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INDEX TO VOLUME LIV

January 1 to June 30, 1921

EXPLANATORY NOTE

Illustrated articles are marked with an asterisk (*), book notices with a dagger (†), and new shop equipment as described in the departments "Shop Equipment News" and "Condensed Clipping Index of Equipment" with a double dagger (‡). Book reviews are listed under the heading "New Publications." Cross references to a particular initial word may apply also to its derivatives. The cross references condense the matter and assist the reader but are not to be regarded as complete or conclusive. So, if there were a reference from "Milling" to "Jigs and Fixtures," and if the searcher failed to find the required article under the latter topic, he should look through the "Milling" entries, or others that the subject might suggest, as he would have done had there been no cross reference. The plural of any given item may not necessarily follow the singular immediately, as the items are listed in alphabetical order. All articles written by any given author are listed directly under his name in the special author's index which starts on page 17. Articles that are not credited to any author may be found under the heading "No author credited," listed under "N" in the Author's Index.

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Metal Cutting Tools.

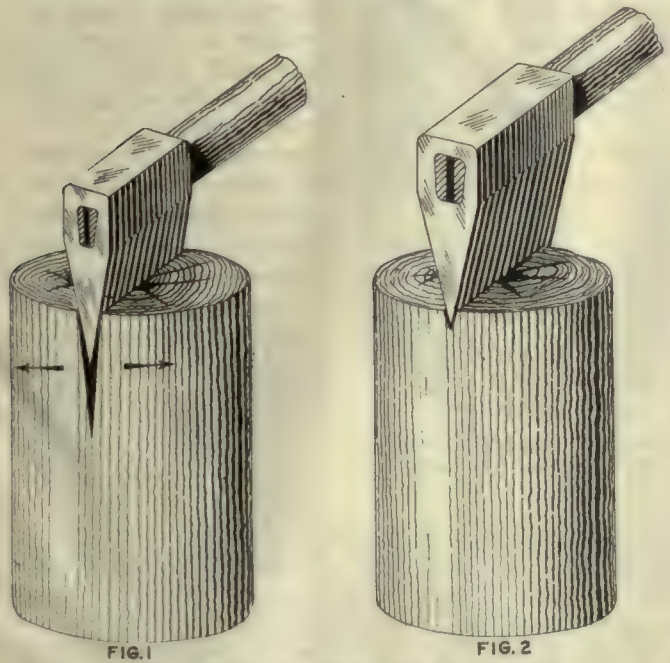
By A.L.DeLeeuw



I. Analogy Between Actions of Razor, Hatchet and Metal Cutting Tools — Formation of Chips — Elementary Considerations in the Construction of Simple Tools

ALL metal cutting tools are essentially knives, very much modified, and sometimes almost unrecognizable, but still, in all essentials of their action and functioning, the same as a pocket knife, a hatchet or a razor. To study the action of a metal cutting tool one should first study the action of the ordinary knife.

The action of a hatchet splitting a log is illustrated in Fig. 1. The hatchet has penetrated a certain distance, and the pressure on the two halves of the log caused by this wedge has made an opening which extends further down than the cutting edge of the hatchet. The log is splitting; and it should be noted that the point where the splitting ends is some distance away from the cutting edge of the hatchet. It is, therefore, not the edge of the hatchet which does the splitting, but the sides which bear against the wood. When the splitting has proceeded so far a dull wedge might be placed in the partially split log, the hatchet



FIGS. 1 AND 2. ACTION OF A HATCHET

might be removed, and the splitting might be finished by pressure on the wedge. This shows that the sharp cutting edge is not needed for the action of splitting. In Fig. 2 is shown the purpose of the cutting edge of the hatchet. In this illustration the hatchet is shown as just entering the wood. The cutting edge of the hatchet has compressed the wood, which allows it to enter a short distance. In entering the bevel sides of

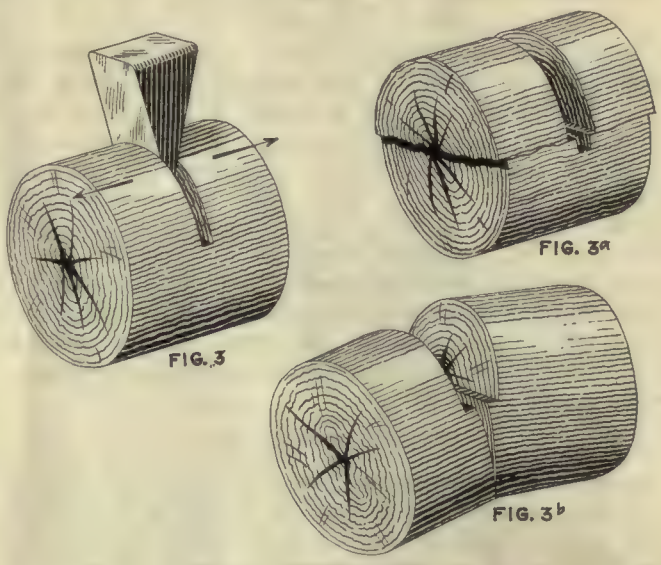


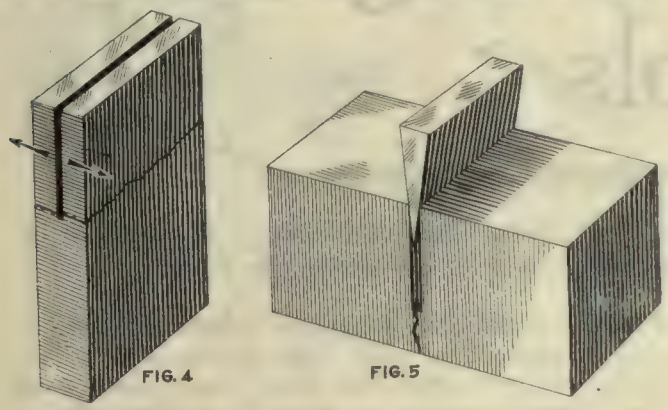
FIG. 3. WEDGE ACTION

the hatchet are forcing the two halves of the log apart. If the blow is not sufficiently hard, or the log is too strong, the only result will be that a little nick or kerf is made in the top of the log; but if sufficient pressure is brought to bear on the hatchet, in other words, if it has been swung with sufficient force, the bevel sides of the hatchet will bring the two sides of the log so far apart that the log splits. From this moment on the cutting edge of the hatchet ceases to work, and all the work is now being done by the sides. The single blow of the hatchet performs two different operations: it compresses the wood, which allows it to enter, and it forces the two halves of the log apart, which makes it split. The two operations are the entering and splitting. It should be noticed that, in this case, the entering is caused by compressing the material, and the splitting by putting the material in tension.

The action of the wedge does not always cause the material to split in the manner illustrated in Fig. 1. If a piece of wood is sawed in, as shown in Fig. 3, and a wedge is driven into the saw-cut, various things

may happen. The top portion of the piece of wood on either side of the saw-cut may be driven out, as shown in Fig. 3a, or it may split, as shown in Fig. 3b, depending on the direction in which the piece of wood has the greater strength.

If we should take a piece of cast iron, of the form as shown in Fig. 4, and make a saw-cut, then drive a wedge into this cut, the piece would probably break somewhat as shown in Fig. 3a; but if it had the form of Fig. 5,



FIGS. 4 AND 5. TYPES OF BREAKS CAUSED BY WEDGE ACTION

it would probably break as shown in Fig. 3b. Again, the nature of the break will depend on the plane of least resistance. A break as shown in Fig. 3b or Fig. 5 would be a break caused by tension; a break as shown in Fig. 3a or Fig. 4, would be a break caused by shear or bending; the probability being that with conditions as shown in Fig. 4 bending would cause the break, and that with the condition shown in Fig. 3a the break would be caused by direct shear. However, it should be noted that the material is first subjected to compression to provide an entrance for the wedge, unless such an entering position had been first provided by making a saw-slot, for instance.

Controlling the Cut

In the illustrations given above, the tool was entirely free, and so was the work. We imagined that a log was set on the ground, and a man swung an axe. If, for some reason or other, the fiber of the log was not straight, the log would split in the direction of the fiber, and the two halves of the log might have plane, or curved, or irregular surfaces; and, furthermore, though the axe might have entered the top of the log exactly on the diameter, the bottom of the log might be divided in an entirely different fashion. There was nothing to guide the axe except its momentum, but there were many causes to make it deviate from its original course. We find this unguided condition of the tool in practically all cases where we use knives, and the only means we have of controlling the nature of the cut when we use a knife is to grasp the knife and the work firmly and depend on our muscle. Where a knife is used for metal cutting the resistance offered by the metal is, as a rule, so great that our muscles are no longer sufficient to guide the tool even approximately. In old lathes the tool was provided with a long handle which was firmly clasped between the arm and the body, or supported under the shoulder, while the left hand would grasp the tool close to the cutting edge and guide the tool point. In this manner light cuts could be taken, provided the operator was skillful, strong, and with steady nerves. But the cuts we take nowadays would make such a manner of guiding the tool utterly impossible; and this brings us to the two chief differences between the ordinary knife, as we use it, and the metal cutting tool.

Metal cutting tools are used almost exclusively in machines; and provision is made in such machines to hold the tool against undesirable movements; or, we might say, the tool is held in a rigid manner. We must not forget, however, that this rigidity is by no means perfect, and that most of the problems of turning, boring, drilling, planing, milling, and so on, are caused by the fact that this rigidity is only approximate. The further the manner of holding the tool departs from absolute rigidity, the greater and more complicated are our problems of machining. The same holds true of holding the work. What we aim to obtain is a positive relation between tool and work, notwithstanding that the tool is moving relative to the work; so that whether the tool or the work lacks rigidity makes no difference—we will have a difficulty on our hands unless the relative rigidity of tool and work are maintained.

Differences Between Metal Cutting Tools and the Knife

The second point in which the metal cutting tool differs from the knife is the angle of the wedge. A razor is ground in such a way that the two sides of the wedge form a very small angle with each other; a pocket-knife has a somewhat greater angle of wedge, a hatchet a still greater angle. But all these tools have a very small angle of wedge as compared to the angle formed by the sides of the wedge of a metal cutting tool. If we should try to sharpen a pencil with a razor, we would soon destroy the delicate edge. Though the material of the razor is hard the amount of material close to the cutting edge is so very small that the resistance encountered in sharpening a pencil is sufficient to break it down. If we should try to cut crosswise through a piece of hardwood with our pocket-knife, hitting it on the back with a hammer to expedite matters, the cutting edge of the pocket-knife would soon break down, though it is much stronger than the razor.

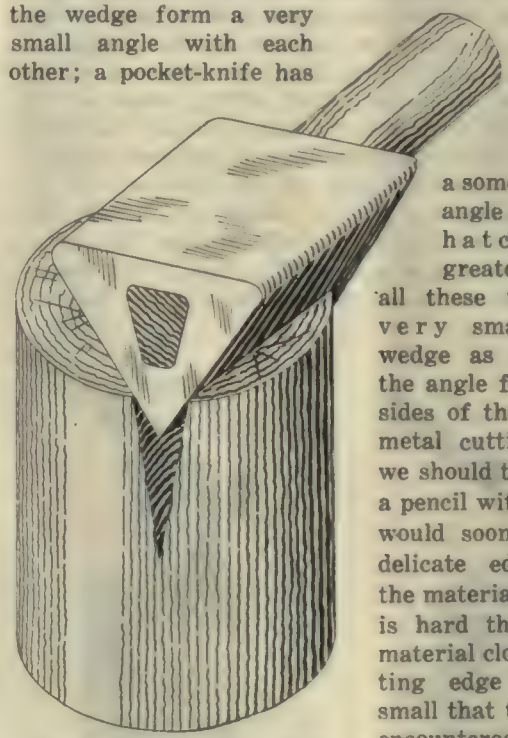


FIG. 6. HATCHET WITH EXTREMELY LARGE WEDGE ANGLE

If we attempt to chop down tenpenny nails with our hatchet, we'll nick the hatchet, though its material is much harder than that of the tenpenny nail and its cutting edge much stronger than that of the pocket-knife. In a tool capable of cutting metal, we need an angle of the wedge so large that it almost approaches

a right angle and, to the casual observer, the tool loses its appearance of a knife. Metal cutting tools are used with wedge angles varying from almost 90 deg. to less than 40 deg. Hatchets and axes may be used with wedge angles of more than 40 deg. So there is a continuous increase in the cutting angle from a knife (or a razor blade which is close to zero) to the heavy roughing lathe tool which is close to 90 deg. The difference in action between the pocket-knife and the heavy lathe tool is merely a matter of degree or amount. Yet one effect may be so large in one tool and so small in the other, and another effect so small in the first tool and so great in the other, that it might seem at first glance as if the two tools were governed by entirely different laws and conditions.

In Fig. 6 a hatchet is shown with a wedge angle somewhat like the angle of a metal cutting tool. It will readily be seen that though such a hatchet would be awkward to handle it would still split wood and do it in the same fashion as an ordinary hatchet.

In Fig. 7 a log is shown clamped down on a solid support, but the tool used to split the log is not guided, and as a result the plane of cleavage still follows that of least resistance. In Fig. 8 the log is again clamped down, but this time the tool is guided. When the tool enters, it may split the log along the plane of least resistance, which is shown by the dotted line, but, as the tool gradually descends, it is bound to cut off everything which is left to the right of the plane *AB;* so that a clean cut will

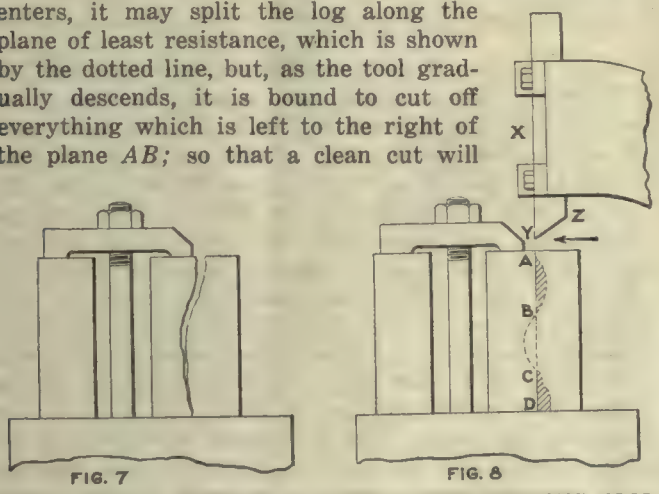


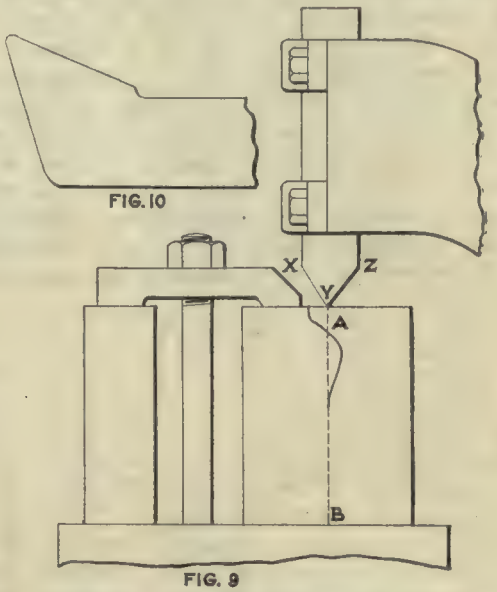
FIG. 7 FIG. 8

FIGS. 7 AND 8. EFFECT OF GUIDING THE CUTTING TOOL

be made wherever the cleavage plane is to the right of *AB*, whereas a hollow remains where the cleavage plane is to the left of *AB*.

In this figure the angle *XYZ* of the tool, the wedge angle, is formed by two planes, one of which, *XY*, is parallel to the plane of movement of the tool. It will also be noticed that as the tool descends, a pressure is brought to bear against *YZ* tending to force the tool to the left. However, our tool is supposed to be rigidly guided, that is, it can move up and down, but in no other direction. Therefore this pressure exerted against *YZ* only forces the tool against the guide but not against the standing part of the log. Of course such a condition never prevails in practice, and we only suppose this condition to exist here in order to separate in our minds the varied phenomena which occur when we cut metal under practical conditions.

In Fig. 9 the log again is clamped and the tool is guided, but this time the plane *XY* of the tool is not parallel to its plane of movement. The point *Y* strikes the point *A* of the log and makes an impression, and the log will begin to split from this point on, either along a straight line *AB* or along some other plane, but in any case starting at *A*. A little later the plane *XY* of the tool bears against the log and as the log cannot move to the left nor the tool to the right the tool can only proceed by crushing the material. In this case the pressure is greater between the standing part of the log and the tool than between the split-off part



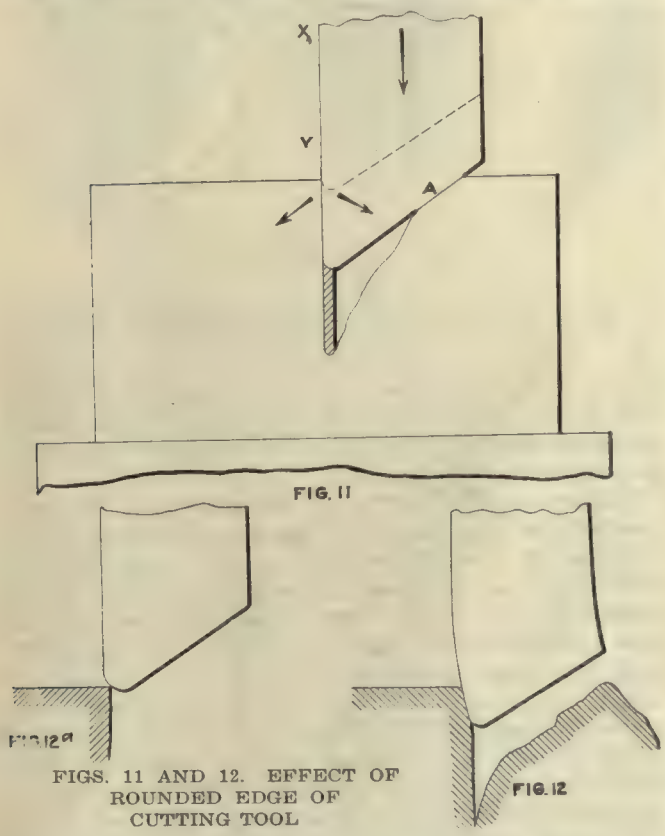
FIGS. 9 AND 10. ACTION AND MAGNIFIED SHAPE OF METAL-CUTTING TOOL

and the tool, and there will be a tendency to force the tool to the right. It is this condition which always exists in metal cutting tools, though not to the extent shown in the illustration.

Referring again to Fig. 8, the tool was shown to be perfectly sharp; that is, two planes, *XY* and *YZ*, came together at *Y* and formed an angle. In reality, two plane surfaces of a piece of metal never form a true angle with each other. Even if there were left only one row of molecules at the joint of these two planes *XY* and *YZ*, these molecules would have *some* size. In other words lines *XY* and *YZ* would not meet in a point, but both would be tangent to a little sphere, or some other body, according to what shape that molecule might have. It hardly need be said that even this condition cannot prevail in practice. The finest grinding wheels would make grooves in both surfaces much deeper than the diameter of one molecule, and even if this were not the case the finest cut would crumble this fine edge until enough material is left to resist the touch. As a matter of fact every metal cutting tool, when viewed under a sufficiently strong magnifying glass, shows a rounded edge and appears like Fig. 10 only not so much so. Most of the precautions we have to take in the construction of metal cutting tools arise from the fact that what we call the cutting edge is really a rounded surface. The other chief element to be considered in the construction of metal cutting tools is the fact that the work is never entirely rigidly held, and that the tool is always more or less free to move in a plane differing from the plane in which it is cutting.

We will first consider in what general manner a rounded edge of the cutting tool affects its action. In Fig. 11 the cutting tool moving in the direction of the arrow is shown splitting off a piece of the material which is supposed to be clamped rigidly. The tool is also rigidly guided. The dotted line shows the position of the tool when the splitting begins. As part

of the rounded edge tends to force the material to the left, and another part tends to force the material to the right, the plane of cleavage will be somewhere to the right of plane *XY* of the tool. The full lines show the tool after it has penetrated a considerable distance into the material. There is some material left (shown in the shaded section) which must be crushed by the tool, and therefore there will be a tendency to bend the tool toward the right. Fig. 11 represents the tool as being caught between two pieces of material. It cannot bend toward the right on account of the heavy mass of material pressing against the tool at *A*, but if the condition were as shown in Fig. 12, where the right-hand material has either moved entirely out of the way or else has been broken up to such an extent that it presses no longer against the tool with considerable force, then the tool will bend as shown in the illustration. It will bend until only a small amount of material has to be crushed, as shown in Fig. 12a, where the point of the tool is shown much enlarged. Under these conditions there is not only a pressure against the point or cutting edge of the tool, but also against plane *XY*.



FIGS. 11 AND 12. EFFECT OF ROUNDED EDGE OF CUTTING TOOL

If the material which is being split here were of a brittle nature, instead of being a log of wood, the movement of the tool against the clamped part of the material and under heavy pressure would wear the back of the tool away and would also wear away part of the cutting edge. In the course of time this cutting edge would have such a small amount of round left, that it would no longer be able to resist the pressure of the material which it must crush, and the edge would break off. It is this condition which compels us to give *clearance* to a metal cutting tool.

Before looking further into this matter, we must now consider what happens if the plane of cleavage, which up to now has always been represented as going from top to bottom, should follow some other direction. Fig. 13 represents this condition. *ABCD* represents a block of wood of which the fiber runs as shown. The block is supposed to be securely clamped and the tool rigidly guided. As soon as the tool has penetrated a short distance it will split off a piece along the line *PQ* and the log will appear as shown in Fig. 13a. After penetrating a short distance further it will again split off a piece along the line P_1Q_1. Penetrating still further, it will now split off a piece P_2Q_2, as shown in Fig. 13b, and so forth. If the fiber of the wood is of a tough nature it may well happen that the pieces which are then split off are still hanging together by a few fibers, and the three pieces which have been split off so far, will appear as shown in Fig. 13c. This is the way in which, generally speaking, a chip is formed when we cut metal.

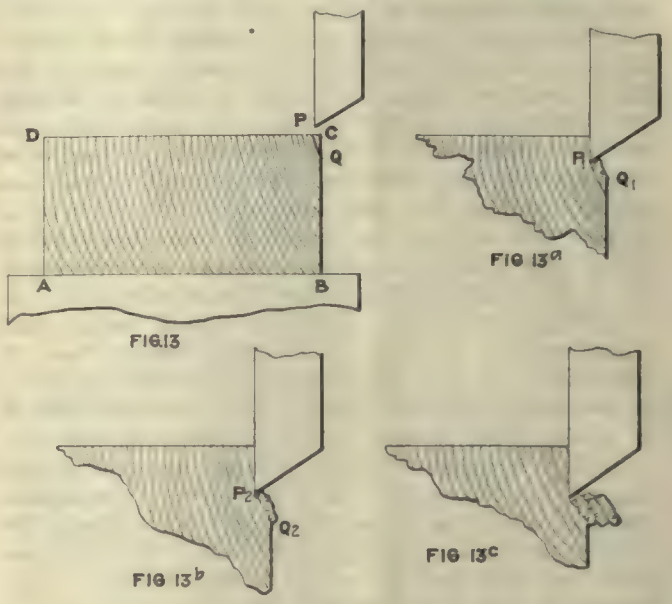


FIG. 13. "CHIP" FORMATION IN CUTTING WOODEN BLOCK

In Fig. 14 a steel plate is shown clamped on the frame of a guillotine shear of which the knife is just touching the work. The downward movement of the knife will deform the plate as shown in Figs. 14a and 14b, and when the depression is down to about one-third of the thickness of the plate, the right-hand portion is completely sheared off from the remainder. If instead of a plate we have a heavy chunk of metal, as shown in Fig. 15, the same thing would happen again provided the machine were strong enough, the tool were strong enough, and sufficient force were exerted on the tool.

A different action would take place if we had a condition such as shown in Fig. 16. Here again a

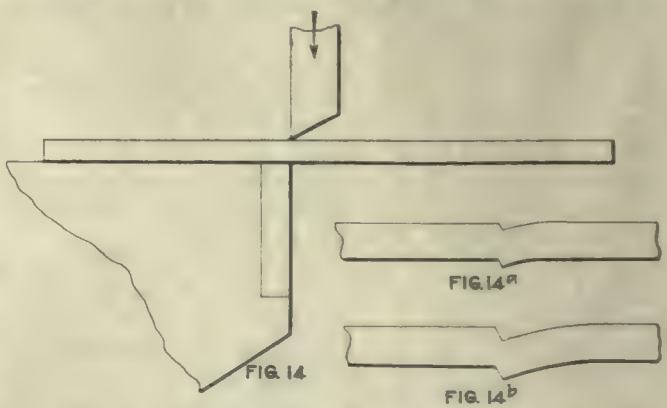
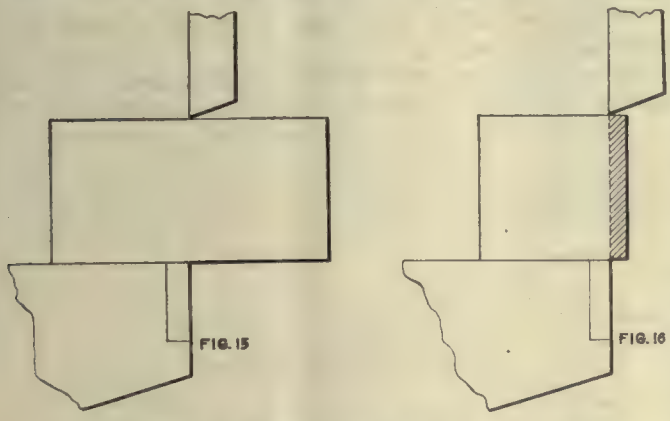


FIG. 14. SHEARING A METAL PLATE

heavy chunk of metal is clamped rigidly to the shear-frame, but that portion of the material which overhangs the frame is rather small (shown in the shaded section).

The shear blade comes down and presses on the work. Due to the fact that the bottom of the shear blade



FIGS. 15 AND 16. SHEARING HEAVY BARS WITH DIFFERENT OVERHANGS

makes an angle with the horizontal plane, the blade must penetrate into the work quite a considerable distance before the maximum pressure is reached. Finally a pressure is reached sufficient to split off a piece of material, after which the shear blade proceeds on its way, gradually exerting a greater and greater pressure on the remaining metal, until a sufficient pressure is reached again to split off another piece of material. It will be seen, therefore, that under the above conditions the entire piece of material is not split off at once, but by fractions. Fig. 17 represents the action of the shear blade and the formation of the chips in an elementary way. Fig. 17a shows the condition after one chip has been formed, Fig. 17b shows two fractions of chips, and Fig. 17c shows three. However, in these illustrations, no account is taken of the fact that the little pieces of metal are compressed before they are split off. They do show, nevertheless, the following features:

First, the final chip is made up of a number of sections.

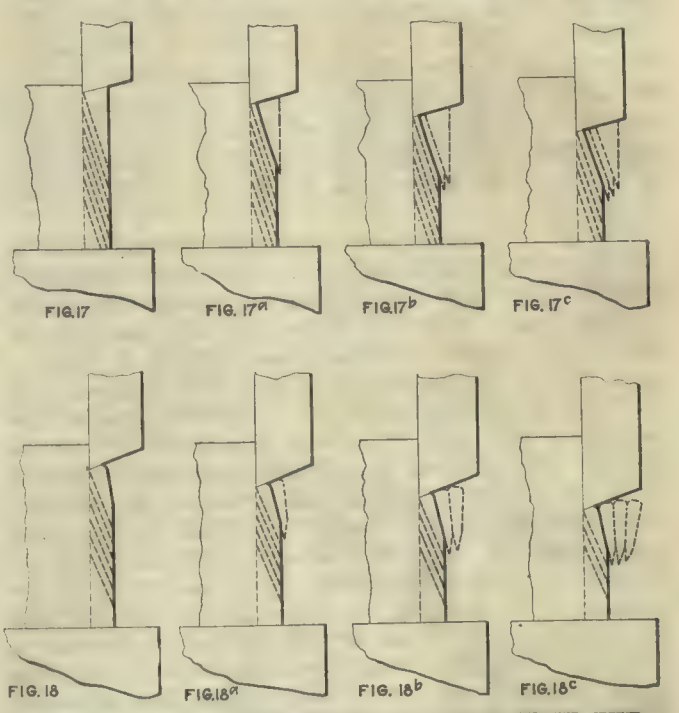
Second, the previous section slides over the next section, when this next section is being formed.

Third, after the sections have been separated from the material, they are compelled to slide along the bottom of the shear blade.

Fourth, the apparent thickness of the chip is not the thickness of the piece of material which is being removed from the main mass, but the length of the line along which the chip is removed from the material.

In Figs. 18, 18a, 18b and 18c, the formation of the chips is again indicated along the same lines as in Fig. 17, except that now the effect of compression is considered. Fig. 18 shows the shear blade in a position after the first section has been removed, and about ready to compress the second section. Fig. 18a shows this second section compressed and about to be split off. It shows the increased width of the top part of that section. Fig. 18b shows two sections alongside of each other, and Fig. 18c shows three sections cut off. Due to the fact that the top part of these individual sections is no longer bordered by two parallel planes, but rather by two planes which converge downward, a succession of these sections will present a curved surface at the top. Furthermore, the broad tops of these sections join each other in a practically continuous surface, whereas the bottom parts which are more knife-like in shape do not join. Again, as the tops of the sections are compelled to move along the bottom of the shear blade under heavy pressure these tops are smoothed down or polished, whereas the bottoms will stand apart and not having been subjected to this sliding motion under pressure the complete chip will present a ragged appearance at the bottom. Particular attention is called to the fact that the natural form of the complete chip will be a curve, regardless of whether the tool is curved or not.

In the foregoing illustrations the plane of cleavage was shown at right angles to the bottom of the tool. This was done merely for the sake of keeping the discussion free from complications. However, there is no reason to expect that the plane of cleavage must be as shown. In Fig. 19 OA is the bottom of the tool, making an angle α with the horizontal line OX. The section $OBCD$ is about to be removed, and the plane of cleavage makes an angle β with the vertical line. If the width of the piece of material to be removed is a, then the length of the line of cleavage, BC, is a cosec β. If the width of the piece to be removed is w, then the section to be sheared off is wa cosec β; and if the compressive strength of the material per unit of area is P, and we may assume that the ultimate shearing strength is $4/5P$, then the pressure required to shear off this section along the line DC is $4/5Pwa$ cosec β. This pressure will not be reached until the tool has compressed the section far enough to cause this amount of pressure in the direction BC or CD, that is, when the line OA has reached the position BQ. The relation of these forces will be considered more in detail in another chapter. Our present aim is to show that a plane of cleavage is formed due to the vertical pressure of the tool, and that the direction of this plane of cleavage is dependent on a number of items. One of the items, we would think, would be the angle of the tool, yet so far this



FIGS. 17 AND 18. FORMATION OF CHIPS WITH THE EFFECT OF COMPRESSION IGNORED IN FIG. 17 AND ALLOWED FOR IN FIG. 18

angle has not appeared in the considerations. However, looking at Fig. 19, we see that the amount of material *OBR* had to be crushed before the section *OBCD* would split off and therefore that the tool had to travel from *O* to *B* before this splitting action occurs. If the angle of the tool had not been α, but if the bottom of the tool had been along the line *OA*, we would still have needed a contact of the tool up to the point *R* before a section would have split off. In other words, the tool would have stood in the direction RB_1 instead of *RB*, and the section split off would have been the section OB_1C_1D, which is a much larger section than we had before. Yet the pressure required to split off this section is no more than that required for *OBCD*. Leaving out of consideration, for the present at least, a number of other items this much is clearly shown: that a change of the angle α affects the amount of metal removed for the same amount of power consumed.

Variation of Pressure

Another point of great importance to be mentioned here is the fact that the pressure required for removal of chips is not uniform but fluctuating. If we leave out of consideration the power required for moving the individual sections of the chip one over another, and also the power required for moving these sections along the bottom of the shear blade, we find that at the beginning of the removal of a section the pressure is zero, gradually climbing up until a maximum pressure for compression is reached. At that moment the splitting off begins which is a shearing action. For some little time this shearing action remains constant, so that the total pressure required is made up of two items—the gradually increasing pressure for compression, plus the constant pressure for shearing. In Fig. 20 the pressure at *A* is zero, at *B* a section has been compressed and is about to be split off; its pressure of compression is at a maximum. Between *B* and *C* there is a combination of pressure of compression on the next section and shear on the previous section, the shear being constant, while the compression fluctuates from zero to a maximum. In diagram 20a the height of the line *AB* above the base line *XY* represents the pressure required for shear, and the zigzag line *CD* represents the fluctuating pressure of compression, so that the total pressure will be represented by the line C_1D_1. This fluctuating pressure alone would account for many of the phenomena we observe in the cutting of metals.

The set of conditions we have pictured ourselves in the foregoing pages is met in the plate planer, a machine tool used for planing or chamfering edges of boiler plates and ship plates. In this machine the plate to be planed is clamped securely to a table, a small portion of the plate overhanging within reach of the tool. A carriage moves on a slideway parallel with the edge of the table. As a rule it is driven by a screw and has arrangements to hold either one or two cutting tools, for cutting either on one stroke or on both forward and backward strokes. The tool is somewhat wider than the work so that all conditions which we presume to exist in shearing off a piece of metal are present in this machine. It is perhaps the simplest type of machine tool, so far as the action of the tool is concerned. Applying what we have found in the foregoing pages to the tool of such a machine, we would construct it along the following lines:

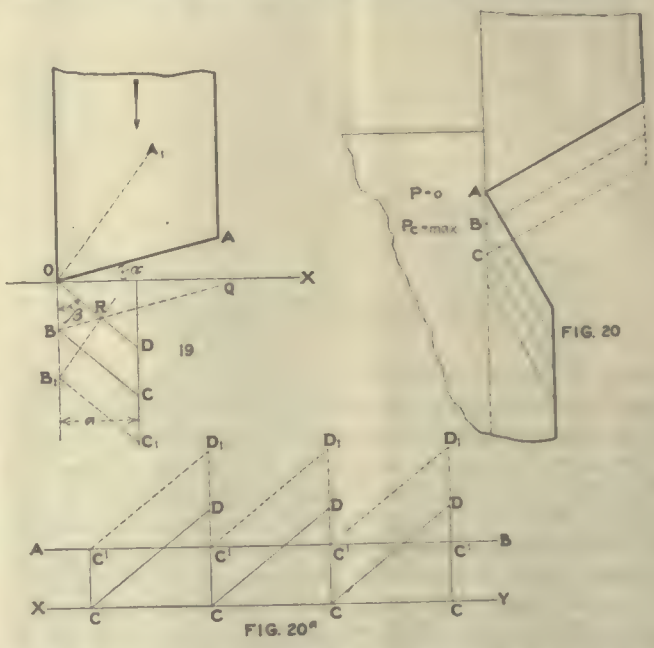
We would give it the greatest possible rake or lip, so as to reduce the amount of power required for cutting.

We would give it the least possible amount of rake or lip, so as to reduce the possibility of the edge crumbling away under the pressure.

We would make the cutting edge as sharp as possible, so as to reduce the backward pressure against the work and the consequent wear on the tool.

We would avoid a sharp edge, so as not to make the extreme edge crumble.

As will be seen two of these requirements are at war with the other two, and this is a condition which



FIGS. 19 AND 20. FORMATION OF PLANE OF CLEAVAGE

we will find all through our efforts to design tools; and, for that matter, through all our efforts to design anything. As in all other attempts at designing the engineer will have to make a compromise.

Referring back to Fig. 18c, it is seen that the sections as they are split off, place themselves in a curve the nature of which depends on a great number of conditions. The conditions shown in Fig. 18c make the curve very flat and running away from the bottom of the tool. If the plane of cleavage were more nearly horizontal, the curve of the chip would be sharper, would be bent upward, and would interfere with the bottom of the tool. This sliding of the chip against the bottom of the tool causes the chip to be burnished as has been remarked before and it also causes the bottom of the tool to wear away and become rough. If we could keep on working with such a tool after it had been worn, the wear would progress to such a point that finally the curvature of the chip would no longer interfere with the bottom of the tool. When that happens, the chip will be rough, but the tool will wear no further, at least at the bottom. This wearing away of the tool at the bottom causes the tool to appear as shown in Fig. 21. The shaded portion has been worn away, and a very small section has been left at the cutting edge. If we could know exactly how the chip will curve, we would be able to construct a tool with a curved surface, so that the chip will never interfere with it. But such a tool would be weak, and not practical. However, here again we can compromise, and grind away part of the material—not enough to weaken the tool too much, and yet enough materially to reduce

the pressure of the chip against the tool. If we should then polish this curved surface we would still further reduce the friction, and in a later chapter it will be shown how this can be done at times to great advantage.

Necessary Properties of Cutting Tools

So far we have considered in an elementary way the general form of a cutting tool, the rake, the clearance and the cutting edge, and we have seen some of the elements which tend to destroy the tool so far as the construction of the tool itself is concerned. There are other elements not yet considered which also have this tendency to cause the tool to break down. One is insufficient rigidity of tool, or work, or both; the other



FIG. 21. SHAPE OF WORN CUTTING TOOL

is the heating of the tool. This latter element is so well recognized that we will consider it first.

Most metal cutting tools are made of hardened steel, and if hardened steel is heated above a given point it loses its hardness and is no longer fit to cut metal. Until the invention of high-speed steel the temperature to which a piece of tool steel could be heated before it lost its hardness was relatively low. This critical point is not so rapidly reached in high-speed steel tools but ultimately high-speed steel loses its hardness, too, if heated sufficiently. For a general consideration of this weakness of tool we need not make a distinction between ordinary tool steel and high-speed steel; both lose their hardness when heated sufficiently. It now remains to be seen why a cutting tool becomes hot when doing work.

A cutting tool does a variety of things when making a chip. In the first place it compresses the metal, that is, it makes the molecules in the metal assume new positions in relation to one another. In the second place it shears off the metal. In the third place it makes the sheared-off sections slide under high pressure over the remaining metal. In the fourth place it compels the sheared-off sections to slide over the face of the tool. All these actions require a certain amount of power, and this power is converted into heat. Part of this heat is carried off by radiation into the surrounding air, part is carried off by the work, another part by the tool, and still another part by the chip. If heat is generated at such a rate that it is carried off as quickly as it is generated the tool will remain at the same temperature. At first the heat is always generated at a more rapid rate than it is carried off, because the temperature of tool, chip, and work is still so low that the surrounding air or surrounding metal does not carry it off very quickly. It should be remembered that the rate of dissipation of heat is proportional to the difference in temperature between the heat giving and the heat carrying mediums. If, for instance, the surrounding air and metal are at 70 deg. F., and the cutting action causes the temperature to rise to 71 deg., then the difference between tool, etc., and the surrounding mediums being only 1 deg., it takes a relatively long time to neutralize this small difference in temperature. But if the tool, etc., should have a temperature of 570 deg., that is, a difference of 500 deg. with the surrounding mediums, then this heat would be carried away very rapidly, and as the temperature drops this rapidity of dissipation would gradually become less and less. At the very first the difference is naturally very small, consequently the rate of dissipation is low; but the rate of addition to the heat is constant, so that the temperature of tool, etc., will increase. However, eventually a temperature is reached where the rate of dissipation of the heat just equals the rate at which additional heat is given to the tool. At that time equilibrium is established. We cannot say beforehand when that time of equilibrium will be reached. This depends entirely on the rate at which the heat is given to the tool and on a number of other things, such as the temperature of the room, the section of the metal, the shape of the chip, the cross-section of the tool, etc. However, we do know that such a condition will exist. If this point of equilibrium is reached before the critical point of the tool steel, that is, before the point where it loses its hardness, then we can go on cutting without danger of softening the tool, but if this point of equilibrium lies above the temperature where the tool is softened, then the equilibrium will never be reached, and the tool will "burn out," as it is called. The moment the tool is softened it ceases to be a cutting tool and it merely rubs under terrific pressure upon the work which increases the heat very rapidly, brings it up to a red-hot condition, and the tool actually oxidizes or "burns out." This burning-out, however, is merely a secondary effect. The real thing that spoils the tool is the loss of hardness. After this point has been reached, the rest follows so quickly that it is very seldom that we will see a tool which is merely softened without having been "burned." The main difference between common tool steel and high-speed steel is the fact that the point of equilibrium is reached much later with high-speed steel than with common tool steel.

The reason why insufficient rigidity of the tool support has a tendency to break the tool down lies in the vibration caused by this condition. As many elements work together to cause this vibration, and as the relation between vibrations and the breaking down of the tool is not apparent at a first glance, we will discuss this matter more fully in a later chapter.

There is, finally, a third element which causes the tool to break down, and this is abrasion. The chip sliding along the work rubs off part of the cutting tool and at last makes the metal near the cutting edge so thin that a piece of the tool breaks off. If we wish to maintain the tool, in other words, if we wish to enable it to do the greatest amount of work before it becomes useless, we must do the following three things:

1. We must minimize the amount of heat accumulated in the tool.
2. We must support the tool as rigidly as possible.
3. We must reduce the amount of friction between the tool and the chip.

How these things can be accomplished will be shown in succeeding chapters.

Trigonometry for Toolmakers

Trigonometric Formulas as Applicable to Daily Practice — Solution of Right and Oblique Triangles—Laying Out Angles and Calculating Chords—Wire Measurement

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IN THE following columns the writer endeavors to explain in a simple manner some of the practical applications of elementary trigonometry. Superfluous matter is excluded and the formulas supplied are simple. No apology is offered for so arranging the article that simple multiplication or division is substituted for the raising of powers and the tedious extraction of roots, believing that the majority of toolmakers would prefer this course.

Remarks on the Use of Tables

No difficulty should be experienced in finding the functions or corresponding angles, if the directions usually incorporated with the tables are closely followed. If no directions are given, look for the number of degrees (if less than 45 deg.) in the top left-hand corner of the book, the name of the functions across the top of the page and the minutes down the left-hand column.

When the angle is greater than 45 deg. find the number of degrees in the bottom right-hand corner, the name of the functions across the bottom of the page and the minutes up the right-hand column. To make doubly sure of using the table correctly it should be remembered that the function of an angle less than 90 deg. is always equal to the corresponding degree-function of the complementary angle, that is:

$$\sin 30^\circ = \cos \text{ of } 90^\circ - 30^\circ = \cos 60^\circ$$
$$\cos 30^\circ = \sin \text{ of } 90^\circ - 30^\circ = \sin 60^\circ$$

and so on through all the functions.

The Solution of Right Triangles

Case I. Given hypotenuse and one side, Fig. 1. Call the hypotenuse and the known side a and b, the unknown side c and the opposite angles A, B and C respectively; then

$$\sin B = \frac{b}{a} = \frac{1.6503}{2.3} = 0.71752 = 45^\circ\ 51' \quad (1)$$

or

$$\text{cosec } B = \frac{a}{b} = \frac{2.3}{1.6503} = 1.3937 = 45^\circ\ 51' \quad (2)$$

Choose the easier form of division:

$$C = 90^\circ - B = 90^\circ - 45^\circ\ 51' = 44^\circ\ 9'. \quad (3)$$

Having found B by means of formula (1) or (2) the third side may be found as follows:

$$c = \text{hyp} \times \cos B = 2.3 \times 0.69654 = 1.60204 \quad (4)$$

The usual formula for the third side, viz.: $c = \sqrt{a^2 - b^2}$, should be used only where the sides of the triangle are small numbers, the powers and roots then being taken from an engineering handbook. (5)

Case II. Given the hypotenuse and one of the acute angles, Fig. 2. Call the hypotenuse and the sides a, b and c and the opposite angles A, B and C; then

$$B = 90^\circ - C = 90^\circ - 44^\circ\ 9' = 45^\circ\ 51' \quad (6)$$
$$c = \text{hyp} \times \sin C = 2.3 \times 0.69654 = 1.60204 \quad (7)$$
$$b = \text{hyp} \times \cos C = 2.3 \times 0.71752 = 1.6503 \quad (8)$$

Case III. Given two sides, neither of which is the hypotenuse, Fig. 3. Call the two sides c and b, the hypotenuse a and the opposite angles A, B and C; then

$$\tan C = \frac{c}{b} = \frac{1.602}{1.6503} = 0.97076 = 44^\circ\ 9' \quad (9)$$

or

$$\cot C = \frac{b}{c} = \frac{1.6503}{1.602} = 1.0301 = 44^\circ\ 9' \quad (10)$$

Choose the easier form of division:

$$B = 90^\circ - C = 90^\circ - 44^\circ\ 9' = 45^\circ\ 51' \quad (11)$$

Having found C from formula (9) or (10), find the hypotenuse a as follows:

$$a = \frac{c}{\sin C} = \frac{1.602}{0.69654} = 2.3 \quad (12)$$

or

$$a = \frac{b}{\cos C} = \frac{1.6503}{0.71752} = 2.3 \quad (13)$$

When the sides are small numbers employ the formula $a = \sqrt{c^2 + b^2}$ for the third side. (14)

Case IV. Given one side (not the hypotenuse) and one of the acute angles, Fig. 4. Call the known side b, the other side c, the hypotenuse a and the opposite angles B, C, A.

$$B = 90^\circ - C = 90^\circ - 44^\circ\ 9' = 45^\circ\ 51' \quad (15)$$
$$c = b \times \tan C = 1.6503 \times 0.97076 = 1.602 \quad (16)$$

or

$$b \times \cot B = 1.6503 \times 0.97076 = 1.602 \quad (17)$$
$$a = \frac{b}{\cos C} = \frac{1.6503}{0.71752} = 2.3 \quad (18)$$

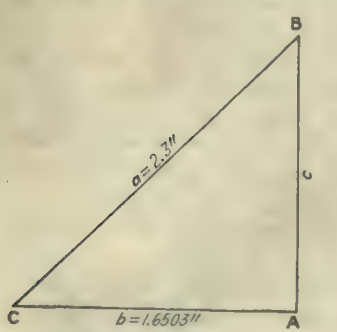


FIG. 1. GIVEN THE HYPOTENUSE AND ONE SIDE (CASE I)

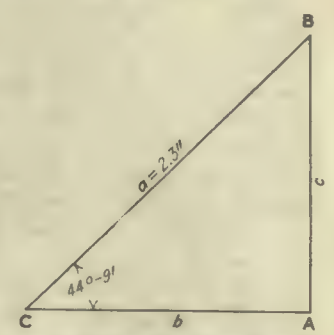


FIG. 2. GIVEN THE HYPOTENUSE AND ONE OF THE ACUTE ANGLES (CASE II)

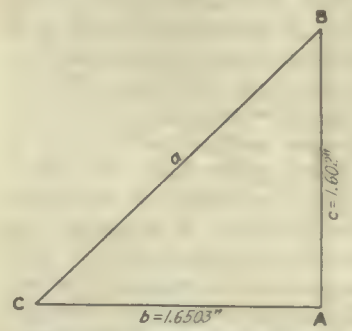


FIG. 3. GIVEN TWO SIDES, NEITHER OF WHICH IS THE HYPOTENUSE (CASE III)

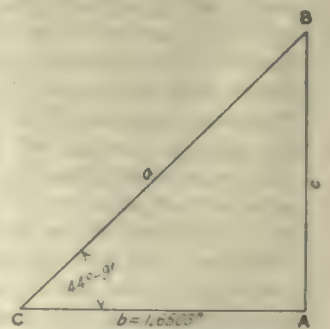


FIG. 4. GIVEN ONE SIDE (NOT THE HYPOTENUSE) AND ONE OF THE ACUTE ANGLES (CASE IV)

or $b \times \text{cosec } B = 1.6503 \times 1.3937 = 2.3.$ (19)

In the general solutions of right triangles a sufficient degree of accuracy will be obtained by working to the nearest minute and as tables of functions to minutes are available no unnecessary work is entailed.

Laying Out Angles Without a Protractor

When the edges of the work are rough and in cases where the protractor cannot be conveniently applied, it is often advantageous to lay out an angle by other means.

If a table of sines is available any of the following methods will suit:

First Method, Fig. 5. From point A draw base line AB and with the dividers set to any convenient radius draw the arc BC. Find the sine of half the given angle and multiply it by double the radius of the arc. With the dividers mark off this distance from point B and strike the chord BD, the included angle α being the angle required. This method is applicable to angles greater or less than 90 degrees.

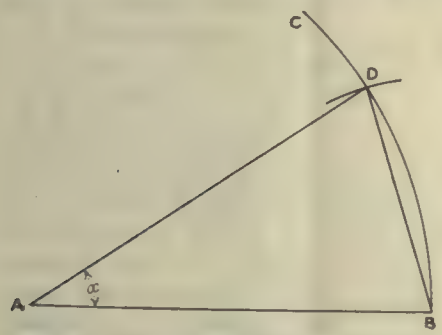


FIG. 5. FIRST METHOD OF LAYING OUT ANGLES WITHOUT A PROTRACTOR

Second Method, Fig. 6. From base line AB draw a semi-circle with the diameter AB any convenient length. Take the sine of the given angle from a table and multiply it by the diameter of the semi-circle. With the dividers set to this dimension strike the chord BC. The included angle α will be the required angle and the triangle included in the semi-circle will always be right-angled with its hypotenuse on the base line AB.

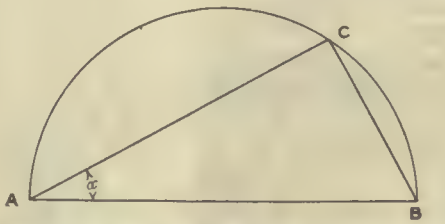


FIG. 6. SECOND METHOD OF LAYING OUT ANGLES WITHOUT A PROTRACTOR

Third Method, Fig. 7. Using a table of tangents. Draw any convenient base length AB. From a table find the tangent of the given angle and multiply it by the base length AB. The resulting dimension will be the length of the perpendicular BC. Join C to A and the included angle α will then be the required angle.

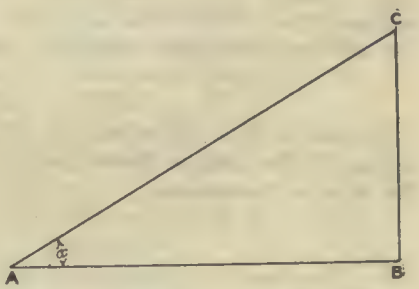


FIG. 7. THIRD METHOD OF LAYING OUT ANGLES WITHOUT A PROTRACTOR

Chord problems may be divided into two general classes, those cases where the circle is divided into equal parts, and cases where the angle is given. When the number of divisions is known, refer to a table of chords and multiply the chord opposite the number of divisions by the diameter of the circle which is to be divided. When the angle is given and the diameter of the circle is known, the chord may be found by multiplying the sine of half the angle by the diameter of the circle.

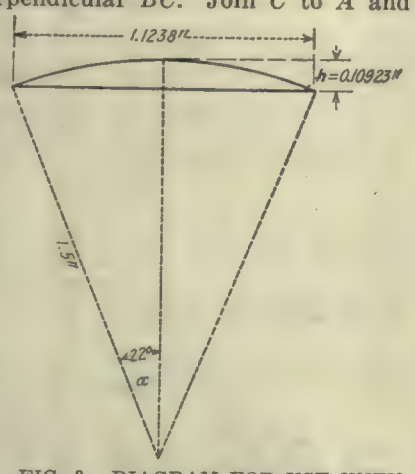


FIG. 8. DIAGRAM FOR USE WITH FORMULAS ON THE SEGMENT OF A CIRCLE

The Segment of a Circle

A large number of problems involving the calculation of the height, chord, or radius of a segment, occur in the work-shop, notably in connection with male and female gages, worm-gear blanks, and corrections for the addendum and chordal width of gear teeth. Necessary formulas are supplied and should be used in conjunction with the diagram, Fig. 8.

Chord and radius given:

$$\sin \alpha = \frac{\frac{1}{2}\text{ chord}}{\text{radius}} = \frac{0.5619}{1.5} = 0.3746 = 22° \quad (20)$$

and

$$\text{versin } \alpha \times \text{radius} = h = 0.07282 \times 1.5 = 0.10923 \quad (21)$$

or

$$(1 - \cos \alpha) \text{ radius} = h = 0.07282 \times 1.5 = 0.10923 \quad (22)$$

Radius and height of segment given:

$$\frac{h}{\text{radius}} = \text{versin} = \frac{0.10923}{1.5} = 0.07282 = 22° \quad (23)$$

or

$$1 - \frac{h}{\text{radius}} = \cos = 1 - \frac{0.10923}{1.5} = 0.92718 = 22° \quad (24)$$

$$\text{rad} \times \sin = \tfrac{1}{2}\text{ chord} = 1.5 \times 0.37461 = 0.5619 \quad (25)$$

Chord and height of segment given:

$$\text{dia. of circle} = \frac{\frac{1}{2}\text{ chord}^2}{h} + h = \frac{0.5619^2}{0.10923} + 0.10923 = 3, \text{ nearly.} \quad (26)$$

Principle of Wire Measurement and Some of Its Applications

The general principles which govern the measurement of angular work by means of wires or disks are briefly outlined. It should be distinctly understood that the one-wire method checks the position of the angle in relation to a predetermined point and does not determine the angular magnitude, this being tested by other means. To test the angle and its position simultaneously, two wires must be used in the angular groove and two

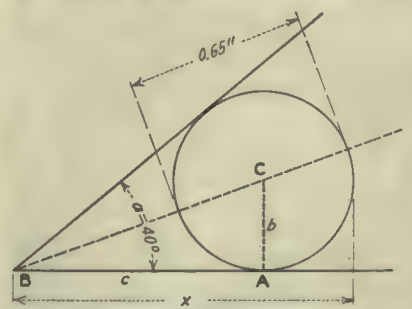


FIG. 9. SIMPLE APPLICATION OF THE WIRE METHOD

wires in conjunction with a sloping side, or two different positions of the same wire adopted.

Figs. 9 and 10 show a simple application of the wire method and how the formula is derived.

A line drawn from point B to the center of the circle bisects the angle α and forms the hypotenuse of the

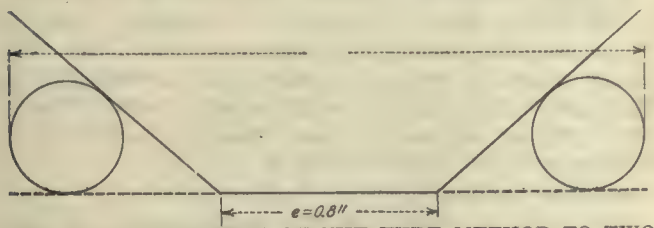


FIG. 10. APPLICATION OF THE WIRE METHOD TO TWO ANGLES OF EQUAL MAGNITUDE

right triangle BCA. The radius of the circle forms the perpendicular of the triangle, hence from the formulas for solving right-angle triangles (case IV):

$$c = b \times \cot \tfrac{1}{2}\alpha = 0.325 \times \cot 20^\circ = 0.325 \times 2.7475 = 0.8929 \quad (27)$$

By adding 1 to the cotangent of the angle and multiplying by the radius, the distance to the outer edge of the wire is calculated:

$$x = (1 + \cot \tfrac{1}{2}\alpha) \text{ rad} = 3.7475 \times 0.325 = 1.2179 \quad (28)$$

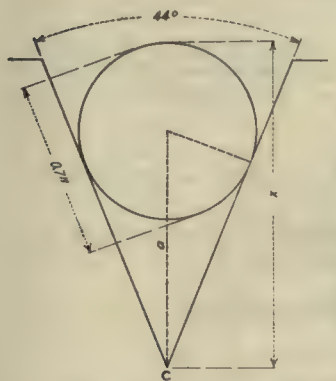


FIG. 11. APPLICATION OF THE WIRE METHOD TO AN ACUTE ANGLE

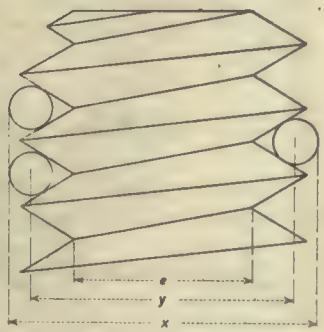


FIG. 12. MEASURING A THREAD BY THE WIRE METHOD

If the work has two angles of equal magnitude, as in Fig. 10, the center to center distance and the overall dimensions are found by doubling the results for one side, or by substituting the diameter for the radius in the previous formulas, which amounts to the same thing.

Hence the center to center distance

$$= (\text{dia} \times \cot \tfrac{1}{2}\alpha) + e = (0.65 \times 2.7475) + 0.8 = 2.58587 \quad (29)$$

The overall distance

$$= e + (1 + \cot \tfrac{1}{2}\alpha) \text{ dia} = 0.8 + (3.7475 \times 0.65) = 3.23587 \quad (30)$$

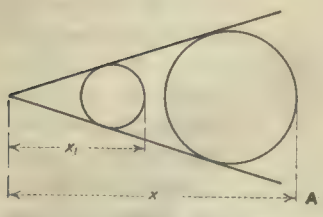


FIG. 13. TESTING THE ANGLE BY THE USE OF TWO WIRES OF DIFFERENT DIAMETERS

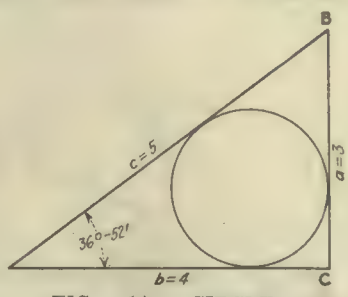


FIG. 14. CIRCLE INSCRIBED IN A RIGHT TRIANGLE

Fig. 11 shows another important application of wire measurement. Reference to the diagram will show that a right triangle is formed which can be solved from the formulas given in case IV.

$$a = \text{rad} \times \text{cosec} \tfrac{1}{2} C = 0.35 \times 2.6695 = 0.9343 \quad (31)$$

By adding 1 to the cosecant of this angle the formula for the overall dimension takes the following form:

$$x = (1 + \text{cosec} \tfrac{1}{2} C) \text{ rad} = 3.6695 \times 0.35'' = 1.2843 \quad (32)$$

Similarly for double angled cases, Fig. 12,

$$y = (\text{dia} \times \text{cosec} \tfrac{1}{2} C) + e \quad (33)$$

$$x = e + (1 + \text{cosec} \tfrac{1}{2} C) \text{ dia} \quad (34)$$

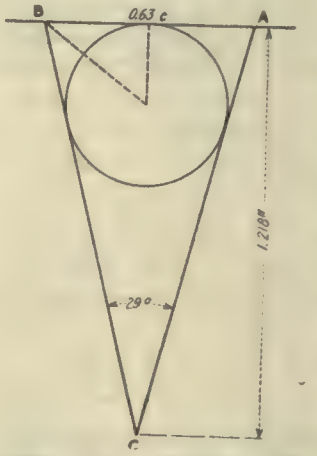


FIG. 15. CIRCLE INSCRIBED IN AN ISOSCELES TRIANGLE

If a test of the angle, Fig. 13, is desired, another wire of larger diameter can be located higher in the groove, using the same formula (No. 32) to obtain the overall dimensions x and x_1. If the second reading of the micrometer corresponds with the figures, then the angle must be correct.

A method of testing the accuracy of an angular space, assuming the angle is correct, is sometimes used when checking tooth gages, screw threads, gages for bevel gear blanks, etc. Formulas to determine the size of the inscribed circle for right and isosceles triangles are given and should be used in conjunction with Figs. 14 and 15.

Circle Inscribed in a Right Triangle

Given an angle and one side (not the hypotenuse).

$$\text{radius} = \frac{\text{side } b}{1 + \cot \tfrac{1}{2} A} = \frac{4}{4.0003} = 1, \text{ nearly.} \quad (35)$$

Given an angle and the hypotenuse,

$$\text{radius} = \frac{\text{hyp.} \times \cos A}{1 + \cot \tfrac{1}{2} A} = \frac{5 \times 0.80003}{1 + 3.0003} = 1, \text{ nearly.} \quad (36)$$

Given three sides,

$$\text{dia (of disk)} = a + b - c = 7 - 5 = 2. \quad (37)$$

Given two sides, a and b,

$$\tan A = \frac{a}{b} = \frac{3}{4} = 36^\circ\ 52' \quad (38)$$

and

$$\text{rad.} = \frac{\text{side } b}{1 + \cot \tfrac{1}{2} A} = \frac{4}{4.0003} = 1, \text{ nearly.} \quad (39)$$

Circle Inscribed in an Isosceles Triangle

Given base c and angle C,

$$\tfrac{1}{2}B = \frac{180 - C}{4} = 37^\circ\ 45'.$$

$$\text{diameter (of disk)} = c \times \tan \tfrac{1}{2} B = 0.63 \times 0.77428 = 0.4878. \quad (40)$$

Given depth and angle C,

$$\text{rad (of disk)} = \frac{\text{depth}}{1 + \text{cosec} \tfrac{1}{2} C} = \frac{1.218}{4.9939} = 0.2439. \quad (41)$$

The Solution of Oblique Triangles

The following formulas for the solution of oblique triangles are so arranged that no negative quantities can be introduced. In cases III and IV it may be found

necessary to obtain the function of an angle greater than 90, but as the solutions are obtained through the medium of the sine, which is positive for all angles up to 180, no trouble will occur. Hence to obtain the sine of an angle greater than 90, take the given angle from 180 and find the sine of the result.

CASE 1. Given the three sides, Fig. 16.

Let c = the longest side of the given triangle,
b = the shortest side,
a = the third side.

Divide the triangle into two right triangles, with bases e and d. Then

$$d - e = \frac{(a+b)\times(a-b)}{c} = \frac{2.7\times 0.1}{1.5} = \frac{0.27}{1.5} = 0.18 \quad (42)$$

$$d = \frac{c+d-e}{2} = \frac{1.5+0.18}{2} = 0.84 \quad (43)$$

$$e = c - d = 1.5 - 0.84 = 0.66 \quad (44)$$

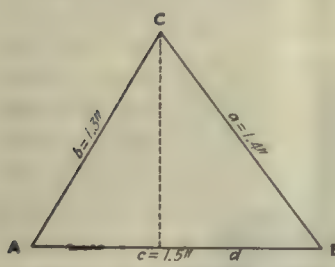


FIG. 16. GIVEN THE THREE SIDES (CASE I)

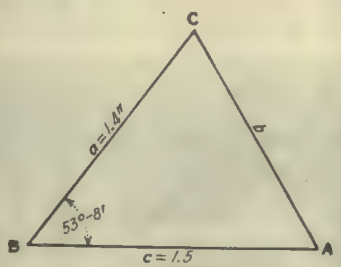


FIG. 17. GIVEN TWO SIDES AND THE INCLUDED ANGLE (CASE II)

Solving for two right triangles,

$$\cos A = \frac{e}{b} = \frac{0.66}{1.3} = 0.50769 = 59^\circ\ 29' \quad (45)$$

$$\cos B = \frac{d}{a} = \frac{0.84}{1.4} = 0.6 = 53^\circ\ 8' \quad (46)$$

$$C = 180^\circ - (A+B) = 180^\circ - 112^\circ\ 37' = 67^\circ\ 23' \quad (47)$$

The above method of solution is simple and the best for general use, but when the sides are very small numbers and a table of squares is available, the following formulas can be used to advantage:

$$\cos A = \frac{b^2+c^2-a^2}{2bc}$$

$$\cos B = \frac{a^2+c^2-b^2}{2ac}$$

$$C = 180 - (A+B)$$

CASE II. Given two sides and the included angle, Fig. 17.

Call the longer known side c, the other side a, the unknown side b and the opposite angles C, A and B. Then

$$\frac{C+A}{2} = 90 - \frac{B}{2} = 90^\circ - 26^\circ\ 34' = 63^\circ\ 26' \quad (48)$$

$$\tan\frac{C-A}{2} = \frac{c-a}{c+a}\tan\frac{C+A}{2} = \frac{1.5-1.4}{1.5+1.4}\times\tan 63^\circ\ 26'$$

$$= 0.03448\times 2 = 0.06896 = 3^\circ\ 57' \quad (49)$$

$$C = \text{sum of (1) and (2)} = 67^\circ\ 23' \quad (50)$$

$$A = 180 - (B+C) = 180^\circ - 120^\circ\ 31' = 59^\circ\ 29' \quad (51)$$

$$b = \frac{c\times\sin B}{\sin C} = \frac{1.5\times 0.80003}{0.9231} = 1.3 \quad (52)$$

CASE III. Given two sides and the angle opposite one of the sides, Fig. 18.

Call the known sides b and c, the third side a and the opposite angles B, C and A.

$$\sin C = \frac{c\times\sin B}{b} = \frac{1.5\times 0.80003}{1.3} = 0.9231 = 67^\circ\ 23' \quad (53)$$

$$A = 180 - (B+C) = 180^\circ - 120^\circ\ 31' = 59^\circ\ 29' \quad (54)$$

$$a = \frac{c\times\sin A}{\sin C} = \frac{1.5\times 0.86148}{0.9231} = 1.4, \text{ nearly.} \quad (55)$$

CASE IV. Given one side and two angles, Fig. 19.

Call the known angles A and B, the third angle C and the opposite sides a, b and c.

Then

$$C = 180 - (A+B) = 67^\circ\ 23' \quad (56)$$

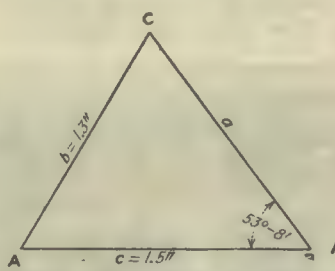


FIG. 18. GIVEN TWO SIDES AND THE ANGLE OPPOSITE ONE OF THE SIDES (CASE III)

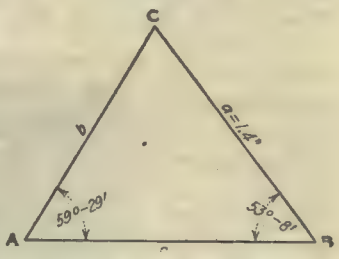


FIG. 19. GIVEN ONE SIDE AND TWO ANGLES (CASE IV)

$$b = \frac{a\times\sin B}{\sin A} = \frac{1.4\times 0.80003}{0.86148} = 1.3 \quad (57)$$

$$c = \frac{a\times\sin C}{\sin A} = \frac{1.4\times 0.9231}{0.86148} = 1.5 \quad (58)$$

Do Things for Employees Who Are Sick

BY FRANK H. WILLIAMS

If there is one time more than another when a person appreciates thoughtfulness on the part of friends, acquaintances and employers, it is when he is ill. During the time that a man is confined to his home or to his bed he is very apt to form a definite opinion as to just who are his friends and who are not. And it is quite possible that he will discover that some of the folks he thought were his best friends fail to call on him or do anything for him.

It is because of this attitude of a sick man toward the world that any kindness shown him during the period of his confinement by his employers will make an everlasting impression upon him.

This being the case, it is interesting to note that the industrial service department of the General Electric Co. at Fort Wayne, Ind., is going out of its way to do things for the employees of the plant who are ill, whether such employees are men or women. One of the good things done by the service department is the distribution of books and magazines among the employees who are laid up. The contributions of books and magazines are secured from well employees and the distribution is supervised by the service department. This plan has met with much appreciation on the part of employees and it is probable that it would work as successfully for other plants.

Boxing Heavy Turret Lathes

By FRED H. COLVIN
Editor, *American Machinist*

ANOTHER contribution to the subject of boxing machinery for long-distance shipment comes through the courtesy of the Gisholt Machine Co., Madison, Wis. This shows how the company solves the problem of boxing heavy turret lathes so as to have its machines reach their destination in good condition and ready to go on the job.

The proper boxing of heavy turret lathes can well be studied, for the principles involved can be applied to a large number of machines of various kinds having similar conditions as to length and weight. The boxing described is that for a Gisholt 24-in. turret lathe, which weighs a little over 7,000 lb., the crate being approximately 11 ft. long, 4 ft. wide and between 5½ and 6 ft. high. In Fig. 1 is shown the machine in the crate, with the men just starting to put on the outside board covering. Fig. 2 shows the crate in outline and gives the dimensions of the various members. The steel tie rods shown are ½ in. in diameter.

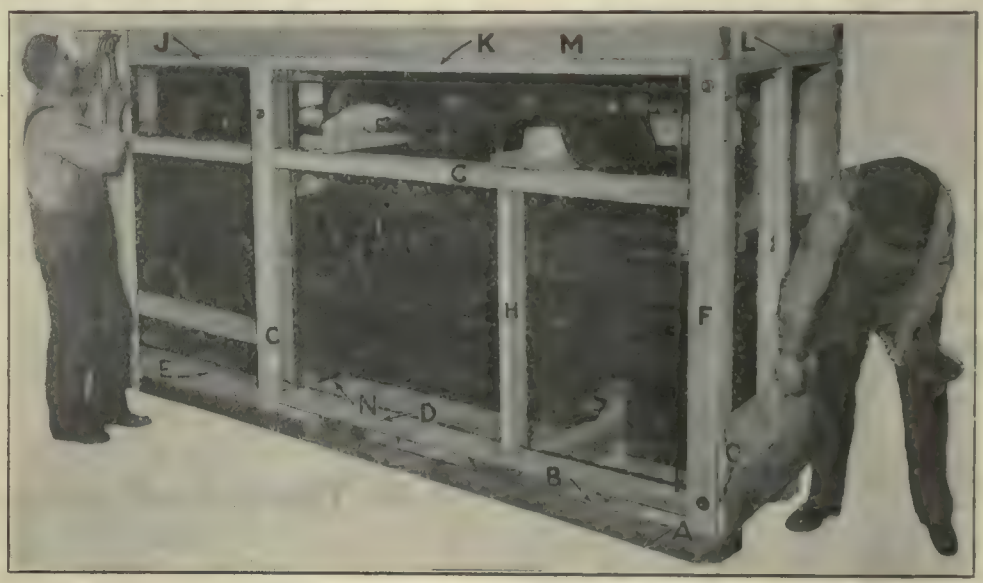


FIG. 1. BOXING A 24-IN. TURRET LATHE

The platform skids *A* in Fig. 1 are 4 x 6 in., one on each side and one in the center. On top of them are the 2 x 10-in. cross-planks *B*, completing the platform. An opening is left in the floor planking for the upright *C*, which is also 4 x 6 in. Then the sills *D* and *E* of 3 x 4-in. lumber are nailed into place and the uprights *H*, corner pieces *F* and side rails *G*, are nailed into place. The side rails are 3 x 4 in. as are the vertical supports *H* and *I*. Other pieces at *J*, *K* and *L* brace the upper ends of the vertical members, after which an upper framework *M*, of 4 x 4-in. stuff is fastened into position.

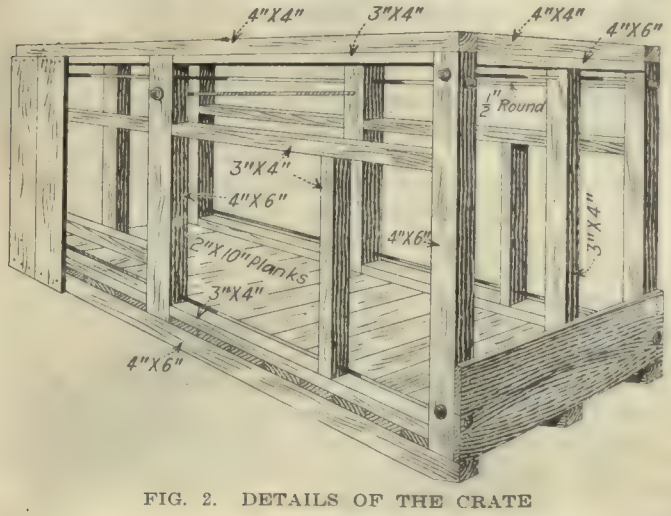


FIG. 2. DETAILS OF THE CRATE



FIG. 3. READY FOR A LONG JOURNEY

A careful study of Fig. 1 will show how the counter-shaft is stowed away over the lathe bed and the way in which the pulleys find a place in the lower left-hand corner. A block *N* holds this point of the bed against side motion, and the location of the ½-in. tie rods are clearly shown.

The outside covering of the box is made of ⅞-in. matched boards 7 in. wide. The way in which these boards are fitted over the nuts on the end of the tie rods is shown at *O*, the end of the board being hollowed out to give room for the nut and still protect it.

On every box for export a waterproof covering known as "keepdry" is placed over the top of the machine and the top covering boards nailed over it. No metal banding strips are used except on small cases or boxes of parts of machines. The nails used vary from 40 d. to 8 d.—both 20 d. and 16 d. coming in between. These are used as called for by the thickness of lumber.

All machines are well slushed with a compound which will stand 110 deg. of heat. It is important that the slushing compound be carefully put on in order to be sure that all of the polished parts are completely covered. It is not so important that the slush be put on thick, as experience has shown that a thin coat is sometimes better than a thick one on account of the lessened liability of the slush to slip off polished surfaces.

Fig. 3 shows six cases of turret lathes being loaded for export. The gross weight of each is 8,450 pounds.

Programs of Apprenticeship and Special Training In Representative Corporations

By J. V. L. Morris



VIII. The United Shoe Machinery Co., Beverly, Mass.

Here is a system of apprentice training that is a departure from the accepted form, in that the boys attend the school and the shop on alternate weeks. The school work is given in co-operation with the public school system. Intensive training for machine hands is also provided.

(Part VII was published in the Dec. 23 issue.)

IN THE plant of the United Shoe Machinery Co. are to be found two distinct types of industrial education and training. On the one hand, there is the Beverly Independent Industrial School, with its special training department provided in the company's plant and now operating in its eleventh year, and on the other, a newly inaugurated intensive training department.

THE CO-OPERATIVE INDUSTRIAL SCHOOL.—Although having its own board of trustees and receiving support in the main from public school funds, the Industrial School is included in this discussion because it functions as the exact counterpart of the corporation apprentice school found in so many plants. The school is conducted on the co-operative half-time principle, one-half of the boys being in the school while the other half is in the training department at the factory. The groups alternate positions each week.

At the present time, there are seventy boys enrolled, thirty-five in each group. The school staff consists of a director, two machinist instructors, a science instructor and a shop foreman. Each machinist instructor devotes all his attention to a single group, accompanying it back and forth as it transfers alternately from school to shop, and he can thus effectively tie up the instruction in the school to the shop problems that arise at the work. The pay given the boy for his twenty-five weeks of shop-work per year is 50 per cent of the standard piece-work price paid regularly in the plant. The remaining 50 per cent is credited to the school fund of the company to defray upkeep and depreciation of the section of the plant turned over to the training department, shown in Fig. 39. Instruction in the school proper, in addition to essential trade training and mathematics, is in applied science, drafting, a class which is shown in Fig. 40, English and citizenship, which subjects have been organized into a teaching program to suit the needs of boys whose interests are primarily industrial. At the start a four-year course was planned, but apparently experience has shown the advisability of transferring to full time at



FIG. 39. CLASS "A" IN THE TRAINING DEPARTMENT



FIG. 40. CLASS "B" AT SCHOOL IN A DRAFTING CLASS

the plant those who have attained efficient production, this occurring usually at the completion of the second year. Owing, however, to state laws relative to the operation of power machinery by minors, graduation to journeyman's grade never takes place until the age of eighteen is reached, no matter how capable the boy may have become.

In the last report published, that for the tenth school year ending in July, 1919, when the war may have still somewhat adversely disturbed conditions by making extraordinary demands for labor, the enrollment according to ages was as follows:

14 to 15 years of age	0
15 " 16 " " "	38
16 " 17 " " "	37
17 " 18 " " "	12
18 " 21 " " "	11
21 " 25 " " "	2
Total for year	100
Average for year	53

The half earnings for the year 1919 were $4,614.47, with a rate per hour paid to the pupil of 11.2 cents, the actual rate earned being 22.4 cents. Dividing the half earnings by the average enrollment for this period (53), we find that the average yearly earnings of each student were $87.06. It should also be noted that, whereas twelve were promoted to full time by completing the course, twenty resigned to enter upon regular production with the course uncompleted, thus suggesting that the institution was being utilized as a kind of vestibule school. Altogether, from the opening of the school on Aug. 2, 1909, to July 20, 1919, the graduates have numbered one hundred, all being in the machinists' trade. It is stated that the last seventeen promoted to full time in the factory, such boys during their first year being transferred about the plant so as to give them general experience, started with a rating of 55

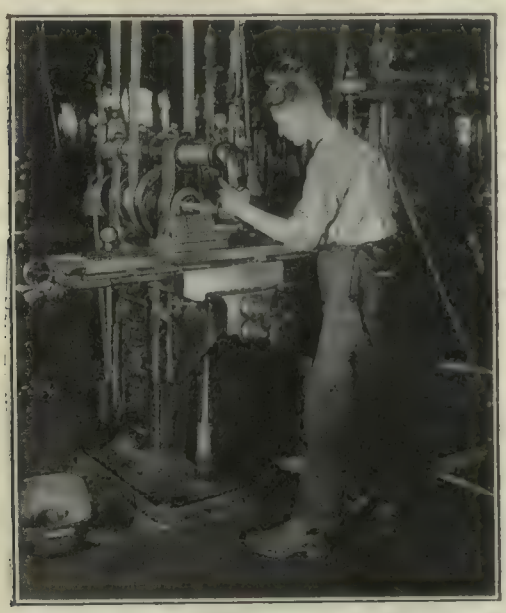


FIG. 41. ON PRODUCTION WORK AFTER GRADUATION FROM THE CO-OPERATIVE INDUSTRIAL SCHOOL

cents an hour. A boy is shown in Fig. 41 working at production in the shop after his graduation from the Industrial School.

INTENSIVE TRAINING.—The intensive training department is newly inaugurated, and to some extent is still in an experimental state. It has a corps of four instructors selected from among the best foremen in the plant



FIG. 42. A RECRUIT UNDER INTENSIVE TRAINING

and a superintendent with a long practical and theoretical experience. The following equipment was being used to capacity to train recruits at the time that this investigation was made: 14 horizontal milling machines, 3 vertical milling machines, 10 four-spindle and single-spindle upright drilling machines, 12 lathes and 2 plain grinding machines. Besides the forty-one men thus provided with machines, the operation of which they were learning, there were twelve additional men receiving bench instruction, making fifty-three in all. In Fig. 42 is shown a view in the intensive training department.

The ordinary period of training is three months, though this is naturally subject to adjustment, as obviously the most skillful would be promoted to regular production whenever a vacancy occurred irrespective of the length of training period. Pay in this department is fixed at fifty cents an hour irrespective of amount of production, and it was stated that those transferred to regular production on a piece-work basis were having no difficulty in maintaining a rate in excess of the minimum fixed for the plant.

ORAL TOPICS

In the main, the instruction is confined to developing the skill necessary to successfully operate the one machine or to perform the bench operations being taught in each case. Supplementary to this, however, either individually or in small groups the superintendent gives oral instruction on the following topics: (1) Plant layout, (2) department location, (3) object of the department and the results expected, (4) company expenses on equipment and maintenance, (5) brief outline of methods of transportation, (6) methods of accounting for work charged to department, (7) brief outline of methods of tooling, (8) application of drawing and operation sheet to work, (9) necessity for interest, accuracy, discipline, and self reliance, (10) necessity for quality first and quantity later, (11) explanation and application of simple tools, such as scale, micrometer, etc., (12) scale and decimal equivalents, (13) hospital, location and purpose, (14) find out natural inclination of new employee. This brief supplementary instruction should materially aid in orienting the recruit in his new environment, and the opportunity offered by the separate training department for providing this instruction is one of the strong recommendations for such a provision.

The Application of Babbitt Metals

Practical Suggestions on Grooving, Alignment, Anchorage and Shrinkage—Results of Casting the Metal When It Is Overheated

By L. D. STAPLIN
Manager Merit Metal Department, Great Western Smelting and Refining Co.

MANY users of babbitt metal feel that it is only necessary to procure a good grade of metal and their bearing troubles will be over. This result does not always follow, as good metal, carelessly applied, means eventual trouble in most cases. For that reason the progressive consumer should make sure that his bearings are made slowly and with careful attention to detail. Because of their added service value, bearings made in this way will return the extra cost of this thoroughness many-fold.

In service, trouble is often occasioned by faulty alignment and grooving. In view of all that has been written on the subject, it seems strange that such should be the case, but it merely proves that bearing makers, as a rule, do not sufficiently realize the importance of these factors and sacrifice durability through lack of attention to them.

How To Do Good Grooving

The rules for good grooving are simple. Groove as little as possible and yet enough to distribute the lubricant evenly on the bearing's surface and particularly on that portion of the surface carrying the load, since an excess of grooving in the latter increases the pressure per unit of contact area.

All grooves should have rounded edges. Experience has taught the writer to look first for sharp corners on the grooves when trying to diagnose bearing trouble. A sharp edge left on a groove, as in Fig. 2, acts as a scraper and destroys the oil film. Round the edges as shown in Fig. 3, and the value of the lubricant is increased and the friction reduced.

When it is necessary to groove the load-carrying part of a two-part bearing, the following method has been found effective: with a boring tool or milling cutter remove the material from both edges of both halves of the bearing except for about half an inch at each end, as shown in Fig. 1, thus making an oil chamber about ½ in. wide and ⅛ in. deep on each side, then, at each end of the lower part only, cut a narrow groove parallel to the ends, connecting the two lengthwise recesses.

Alignment of Bearings

With sufficient patience any average mechanic can align a bearing correctly. It is only a question of willingness to take the necessary time to do a job in which it pays to be thorough. It is not enough to secure proper alignment when the bearing is made and then feel that the job is done. Before the bearing has run too long it should be examined, for in almost all cases readjustment will be found necessary because of unequal wear. If good alignment can be held, the best babbitt metal should be used on important heavy-pressure, high-speed bearings. If not, it is important to use an alloy adapted to the special conditions, having a plastic and yielding body, which will better conform to the contact surface.

Not many years ago the sale of the logging engines made by the largest iron works upon the Northwest Coast was hampered because the crankpin bearings became loose. Almost every known make of good babbitt metal was tried in an effort to find an alloy that would hold the bearings. The fault was so common that loggers objected to buying the engines. By request the writer followed two of the engines into the woods. When Sunday came, the crankpin brasses needed lining. Examination showed the simple fact that the anchors were too shallow to hold, because in service a logging

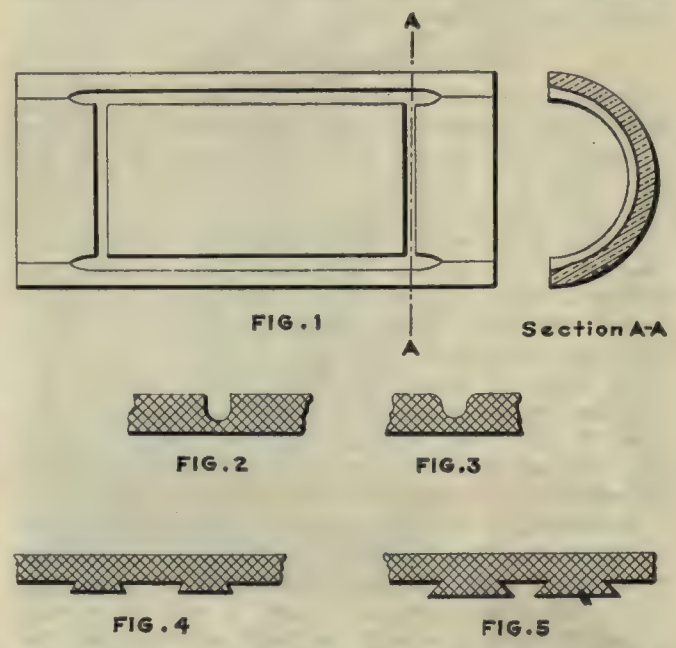


FIG. 1. GROOVING IN LOWER HALF OF TWO-PART BEARING. FIG. 2. GROOVE WITH SHARP EDGES, BAD. FIG. 3. GROOVE WITH ROUNDED EDGES, GOOD. FIG. 4. SHALLOW AND WEAK ANCHORAGE. FIG. 5. GOOD SOLID ANCHORAGE

engine crankpin brass is subject to extreme vibration. By making the anchorage deeper and using a little different style of anchor (see Figs. 4 and 5) the trouble was entirely remedied. The incident shows how simple seemingly serious bearing troubles frequently are. When trying to remedy loose liners, it will pay to examine the anchorage first.

If the service is at all severe, there should be close contact between the container and the liner. Even though the anchorage is right, experience may prove that soldering or tinning is desirable, and this can be done in the following manner, using a solder of 50 per cent tin and 50 per cent lead.

For tinning brass shells the first step is the removal of grease, dirt and other foreign matter from the shells by heating them, being careful not to overheat the material of the shell or the subsequent tinning will be difficult. A good way to remove oxide scale and to produce a good clean surface is to "pickle" the

shells in a bath of water four parts and muriatic acid one part. In obstinate cases the most satisfactory way of preparing the shell for tinning is to machine or grind the surface to insure a clean metallic contact.

After cleaning, the surface is treated with zinc-chloride soldering solution and warmed either by plunging the shell into a quantity of melted babbitt metal or placing it over a fire. In the former case, a portion will adhere to the prepared face and can be spread over the surface later with a small brush, producing a mirror-like coating. In addition to this the hot face of the shell should be rubbed with a stick of solder and then brushed. This will give a good coating of solder on the prepared surface. If the shell is too hot, it will not take the solder well.

Tinning of steel shells may be accomplished in practically the same way, but care must be used in making the surface to be tinned perfectly clean and free from oil of any kind. Tinning of cast-iron shells is difficult ordinarily, but if sufficient care is taken to file the surface bright just before applying the solder, a good coating may be caused to adhere.

How to Prevent Shrinkage

Metals expand on heating and contract on cooling. There is shrinkage in every bearing metal. The hotter the metal when poured the more it expands and the more likely it is to make a lining that may not adhere solid and tight to the backing. This is because of the shrinkage in the metal when it solidifies, which may be sufficient to cause it to pull away from the backing, leaving a space into which the metal can be pressed beneath the load, thus possibly cracking the lining metal and causing it to break.

The commonly given instruction, "Heat mandrel and container whenever possible before casting," is the cause of more poor bearings than any other one common casting direction. It does not make so much difference if a low-grade bearing metal is cast while it is overheated, as its high content of lead prevents much change in structure during the cooling; but if a babbitt metal of the highest grade, such as carries a tin base and considerable content of copper, is cast while overheated, the service value of the metal will be greatly reduced. A good rule to follow where durability is desired, is to cast the metal at the lowest heat at which it will be fluid enough to flow into the bearing at one pour, and against surfaces that have been warmed only enough to remove the chill. If the container or mandrel sizzles when touched with a moistened finger, it is too hot. The more dense and solid the metal's structure, the greater will be its durability, and the foregoing principle, if applied (see Fig. 6), will produce bearings of the best value in density.

To Increase Density

It is desirable to increase the density when casting removable bearings, which may be done by immersing them in cold water as soon as the metal has solidified after casting. In doing this always be careful to immerse the casting from the bottom upward and do it slowly. The spot at which the metal is poured is always the hottest part of the casting and in cooling should enter the water last. This sudden cooling will close up the grain so that under the pressure and load of service it will not "pack" or "give."

Overheating will open the grain or coarsen the structure of babbitt metal. Since "grain" only means the distance between the particles that comprise the metal's structure, it follows that beneath sufficient pressure these particles will be packed together by the weight of the load upon the metal. This makes "clearance" equivalent to the same amount of wear.

This "packing" can be avoided if the metal is dense and solid, as it will be in ratio to its temperature when poured. Necessarily, the babbitt must be made hotter for a large than for a small casting, so heat according to the work in hand and do not be afraid to spoil a couple of castings in learning the lowest heat point. Experimentation in this connection will be repaid many-fold in the time saved in rebabbitting.

A Typical Case of Overheating Trouble

To illustrate a typical case of trouble caused by overheating a high-grade babbitt metal, the following experience will serve: The writer was called to the mill of a sugar manufacturer having trouble with centrifugal bearings. Examination showed that some

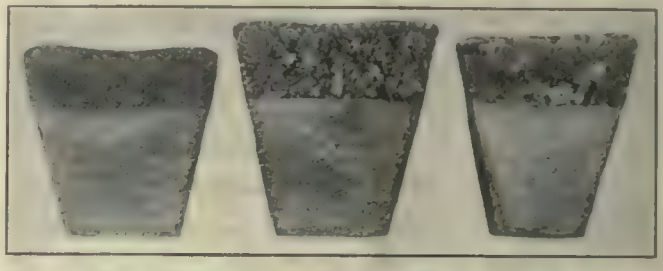


FIG. 6. STRUCTURE OF BABBITT METAL WHEN CAST AT PROPER TEMPERATURE, WHEN SLIGHTLY OVERHEATED AND WHEN GREATLY OVERHEATED

would run a full season and others in the same type of machine and made from the same metal would last only a few days. After running a few days, the metal started to slough out of the bearing. By examining one of these bearings with a glass, the metal was found to contain minute cracks which would enlarge and finally cause the metal to give way under the vibration of service. The cracks were caused by contraction of the metal while cooling, after overheating and casting against a mandrel that was too warm.

If a lead-based, moderate-priced babbitt such as is so widely used for general work is poured when overheated or against an overheated mandrel, the results, as previously explained, are not so serious. Babbitts of this class are not likely to be "ladle spoiled," and to this good point they owe considerable of their popularity. However, overheating will make them brittle and more likely to break, crack or crumble beneath heavy loads and high speeds.

A steel company was testing a certain alloy in its rolls. Two bearings were cast with the metal nearly red when poured. At the end of five days the liner was $\frac{3}{32}$ in. thinner than when the test started. It had packed that much beneath the load. The two bearings were then cast at the proper temperature, and after running for twelve days they were tested and found within a trifle less than $\frac{1}{32}$ in. of their original thickness. It was customary to reline these bearings when the liners had worn to a certain thickness; hence, by casting the metal with care, the company was able to put more tonnage through the rolls that were correctly babbitted, with a saving of time, money and annoyance.

Railroad Blacksmith Machine Equipment

Describing a Small but Interesting Collection of Machines and Tools for Expediting the Work of the Railroad Blacksmith

By J. V. HUNTER
Western Editor, *American Machinist*

A SMALL but interesting collection of machines and tools for expediting the work of the blacksmith is found in the Decatur car shops of the Wabash Railway Co. Here the foreman, H. A. Vahe, has devoted considerable time to analyzing many of the working problems of his men and has devised a number of tools to make their duties less arduous.

Heading the 1¼-in. rivets of draw-bar couplers has been a heavy job to handle with a hammer and so this work is now done by the riveting device shown in Fig. 1. The reader can judge from a study of the double combination of toggle-arms the great power of this riveting press. The power unit is a 16-in. standard air-brake cylinder mounted on one end of a base constructed of steel shapes. The channel and old rails used in this base are actually of insufficient strength for the pressure that is exerted and care must be used that too much pressure is not applied. The heading die is mounted on the end of the plunger sliding through the guide head *A*, Fig. 1. The operation is controlled by a three-way air valve at *B*.

A small portable bending machine is shown in Fig. 2. It has the advantage that it may be pulled from one fire to another when the work of different blacksmiths necessitates their using this device. A 10-in. air cylinder furnishes the pressure and the small dies used are bolted direct to an attachment block on the end of the piston rod. When the illustration was made the machine was set up for bending a number of U-bolts, and the stop-bar *A* for gaging the length of these is seen extending to the right.

A device which employs a heavy pneumatic riveting hammer for cold-heading the button-heads on a ½-in. bar used in a freight car step is shown in Fig. 3. The device is built on a piece of 6-in. channel, mounted vertically in a concrete base. The foot lever *A* at the left, through a combination of levers, operates a pair of clamping jaws at *B* that grip and hold the round bar in place while the cold heading is being done. The foot lever at the right serves to bring the hammer down to the work and holds it in place while the riveting is being done. Air is admitted to the hammer by a trigger on the hammer handle. It will be noted that the hammer is counterweighted by the lever *C*, extending to the rear, so that it automatically raises the hammer to clear the work when the foot-pressure is released. The press shown in Fig. 4 is used for straightening all manner of angles, channels and bent steel parts from cars that come in for repairs. It is a very powerful unit, driven by a 16-x 12-in. air cylinder mounted at *A*. Motion from the piston is transmitted to the ram through the lever B. As originally designed it was

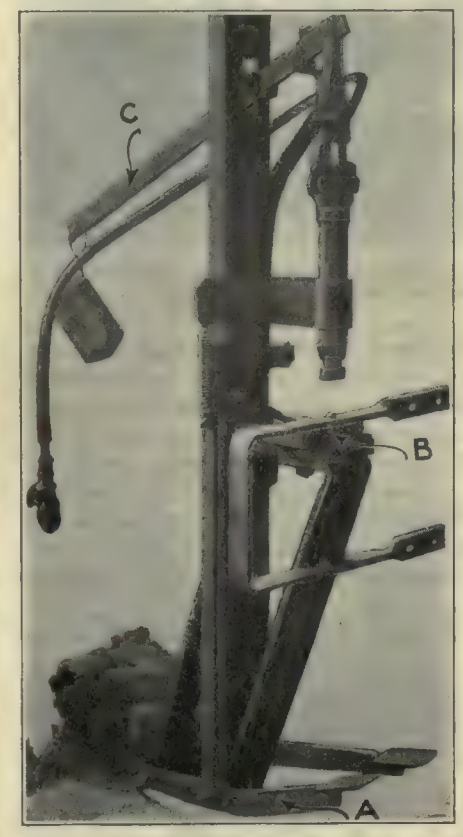


FIG. 3. RIVETING DEVICE FOR COLD HEADING BARS IN CAR STEPS



FIG. 1. HEADING DEVICE FOR COUPLER YOKE RIVETS



FIG. 2. PORTABLE BENDING MACHINE FOR GENERAL SHOP USE

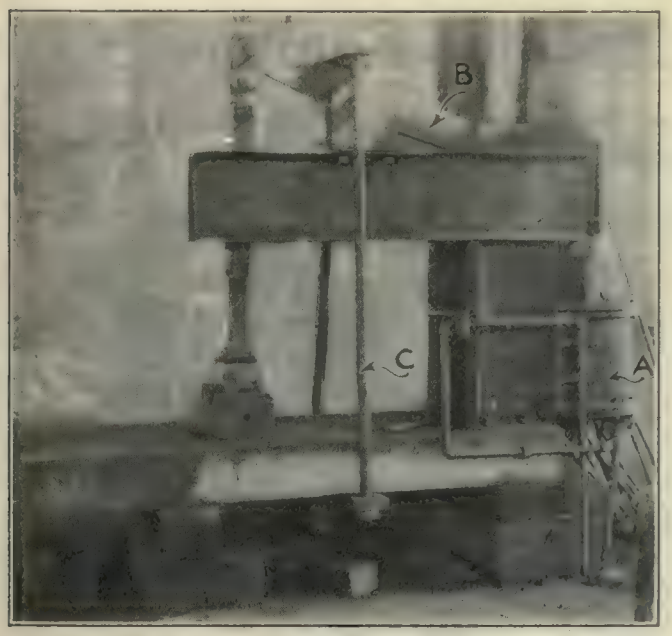


FIG. 4. AIR OPERATED PRESS FOR STRAIGHTENING BENT STEEL SHAPES

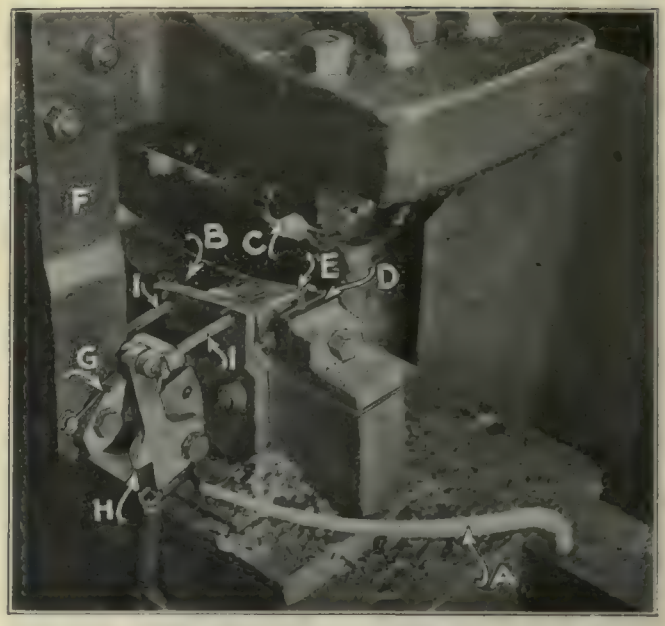


FIG. 5. BRAKE-SHOE KEY-FORMING DIES WITH AUTOMATIC KNOCK-OUT

planned to have the upper channel form a deep throat for the frame so that the machine would have greater range in the size of work. It was found, however, that the pressure was so great that the frame would not stand the thrust, and therefore a couple of tension rods *C* were placed, with bars that pass beneath the bed and over the trunnion on the top of the frame. To show the power of the machine a piece of $\frac{3}{4}$ x $1\frac{3}{4}$-in. bar lying in the V-block was bent, cold, with a single thrust of the ram.

An unusual set of dies for brake-shoe keys is shown in the die-head of the brake-shoe forging machine, Fig. 5. After the piece has been tapered the dies form the key shown at *A* in one stroke, including bending the curved portion, trimming to length and kinking the little hook at the top. The forming is done in the section of the die *B* and the latter two operations are performed by the upper blade *C*, which, after trimming the key to length against the lower shear blade *D*, continues its stroke and bends the right-angle kink over the corner of the die *E*. An automatic kick-out is provided to throw the key out of the die on the up-stroke of the die-head. In making its downward stroke the bar *F* carries the trigger finger *G* beneath the hook of the trip *H*. When it goes up this swings the kick-out toward the right so that the bars *I* knock the formed key out of the die.

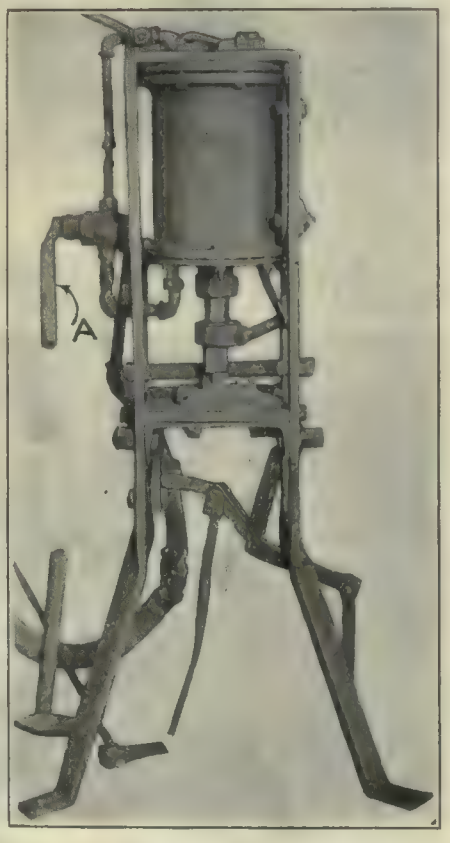


FIG. 6. PRESS FOR HOT-PUNCHING SMALL HOLES

The air-operated punch shown in Fig. 6 is used for hot-punching holes in flat bars or braces. The wreck of what was once intended to be a foot-lever for operating tht air valve still lies beneath the frame and has now been replaced by a hand-lever *A* on the 3-way valve. The frame is constructed with noticeable simplicity as only two long flat bars form both the four legs and the loops over the head of the cylinder. The bed for the die is a short section of channel bolted at its four corners to the frame. The standard plunger end of the air-brake cylinder has been replaced by a head with a packing gland for the piston. This change permits the application of air to the lower end of the cylinder so that power can be developed on the return stroke for stripping the work from the punch.

Beeswax as a Substitute for Thumb Tacks

By B. E. Toole

Did you ever wish that you had a substitute for thumb tacks, especially when working on small drawings and the drafting machine or T-square was bound to ride on the tacks?

The writer had this experience and tried beeswax with good results. The wax was rubbed on the drawing board where the corners of the paper would fall and then the paper laid over it. The corners were then rubbed with a flexible steel scale (a finger nail will do) and sufficient heat generated to soften the wax.

This method of holding paper is extremely handy when the draftsman gets a rush job to do. Instead of removing a drawing from the board to prevent making holes in it by tacking the rush job on top, beeswax may be used.

Early History of Metal Presses*

Probable First "Invention" of Sheet Metal and Press—Description of the Beginning and Growth of the Bliss Company

THE use of sheet metal is quite as eminently respectable in point of great age as is the copper industry recently described to you by Mr. Church. In fact, the origin of the two are co-incident and inter-dependent. The Stone Age furnished the first dies and punches—sharp-edged rocks for cutting or shearing, a hollow in some big boulder combined with a smaller, rounded stone nearly fitting it, were the ancient simple prototypes of our present-day complex cutting and drawing dies and punches. Thus, prior to the discovery of metal, the principles of the tools for working it were at hand.

Oberlin Smith, in his book on "Press Working of Metals" says: "The first man who chanced to dig up a little nugget of native gold or copper, or some other man who found a piece of malleable metal in the ashes of his fire as a result of the accidental smelting of certain ore happening therein, may very probably have pounded it out thinner between two stones, and thus have become the first sheet-metal manufacturer." In this way was probably first produced the material upon which the pressed-metal industry operates. To continue Oberlin Smith's interesting description, "If he then cut it in two by lapping it over the edge of a stone and sliding another down past it, he had invented the first shearing press. If he pushed the end of a sharp-edged cylindrical stone through it into a hole in a stone underneath, he was doing the first punching. If the upper tool was rounded off so as not to cut through, being perhaps a hard-wood stick, he was making a little cup by the process of forming or stamping."

Slow Development of Processes

Naturally, weapons and hollow vessels were the initial wants supplied by this new means. Decades and centuries probably passed in countless primitive experiments involving the acquirement of knowledge of the characteristics of various metals and ways of handling them. If the press operator of today, who tears his hair over the refractory behavior of some particular lot of sheets or the persistance of a set of dies in failing to recognize their plain duty, could but realize that he usually solves in a few minutes or hours problems akin to those that have taken ages to bring to success, he would probably be a little less impatient.

From weapons it was but a step to defensive armor, and here the art of the sheet-metal worker reached a high development. It may be remarked here that in the World War, the pressed-metal industry far more than paralleled the work of the ancient armorer. The steel helmets some of you may have worn were the modern equivalent of the helmets on which Bertrand du Guesquelin and his many famous peers received the cuts and thrusts in which they delighted. Indeed, it was even seriously considered whether breast and back plates might not be added to our war-making equipment. Had this been done we would have seen hundreds of huge machines in the pressed-metal centers of the country, each producing at a single, quiet stroke some piece of armor, to make which in the ancient days would have absorbed many hours, if not days, of the armorer's time. It is well that our defensive armor went no further than helmets. We had enough to do as things were.

Conditions in 19th Century

At the time of the beginning of our concern as Bliss & Mays in 1867, the principles of sheet-metal working were the same as in the middle ages, and comparatively little progress had been made in the details of the tools and machines used. Silversmiths and coppersmiths, as well as the classical village blacksmith, still hammered, punched or drew metal with the aid of tools or implements, improved to be sure, but no great step in advance of the primitive. Horns or forms in vise or anvil had supplanted the lower or larger rock, but, to a large extent the mobile tool was still held by hand.

Metal was "coaxed" more by those early craftsmen than it is today. The limits of drawing or bending, established by experiment and long practice, by which the engineer of today can almost instantly determine the number and extent of steps necessary to achieve a given form, were not then so fully understood as now and the wearying and discouraging "cut and try" method prevailed to a considerable extent.

To give you a picture of the early efforts in drawing metal, we quote here from a letter from the managing director of an old-established metalware concern, describing its initial step (about 1861) in the transition from "pieced ware" to what was then called "French ware"—nothing more than our present seamless or drawn utensils.

"Mr. Tripp (admirably named he was to supervise drop presses) was in charge of the factory. . . . I have often heard him tell of the excitement that was created locally when the first stamped dairy pan was produced and the triumph it was considered.

"There was no engine, the power being furnished by two men who stood behind the drop press and by means of a rope running over a pulley successively lifted the punch or "force" and let it fall upon the sheet of tin plate interposed over the die.

"This crude system proceeded by repeated dropping of the force and the substituting of new forces which extended further into the die than the previous one until the metal was finally coaxed into the shape of a milk pan.

"Afterward a horse was substituted for men to lift the force. Later a steam engine was installed, the buildings extended, new ones erected . . . and a line of stamped, pieced and japanned tinware of creditable proportions for those days was created."

This firm, then Sidney Shepard & Co., had been established in Buffalo some time before ours, in 1836, but prior to the later date previously mentioned, produced only such tinware as could be made by hand—that is, it was made in pieces and seamed and soldered together. The word picture of a notable event in its

*From a paper read before the Brooklyn Engineers' Club, Nov. 18, 1920, by O. P. Hatton, Advertising manager, E. W. Bliss Co., Brooklyn, N. Y.

history gives a very clear idea of the crude, experimental methods then universal.

There were, of course, other simple forms of presses besides drop hammers, which combined the two primitive die members and substituted mechanical means for moving and guiding one of them.

Progress in the pressed-metal industry has been increasingly rapid, as the capacity of sheet metal to stand being squeezed, pressed, drawn, folded and cut into complicated shapes became more fully realized, and as the limits of size and thickness of the metal handled were widened.

The Use of Wood in Freight-Car Construction*

Comparison of Merits of Wood and Steel for Use in Freight-Car Construction—Use of Graded Lumber and Importance of Well-Seasoned Wood

By H. S. SACKETT
Assistant Purchasing Agent, Chicago, Milwaukee and St. Paul Railway Co.

THE fact that over two billion feet of lumber and timber are used annually in the United States for the maintenance of freight equipment and for the construction of new cars, representing an annual outlay for material alone of $50,000,000, is ample evidence of the importance of wood in this big industry.

The first freight cars used for railroad transportation in this country were built of wood and this great natural resource has been an important factor in their construction ever since. In recent years steel has competed with wood, especially in the construction of gondola and other types of open-top cars, but whether this change has been an economical one or not remains a question.

From recent studies made of the subject by disinterested commissions, the indications are that even for open-top cars, wood is still the most economical material. With the growing scarcity of timber, however, and the apparently unlimited supply of steel available, it is probable that this latter material will always be a prominent factor in the construction of cars, and especially so, if some agent is found to reduce materially the present high rate of loss from rust and corrosion.

In the construction of the first cars wood was almost universally used for all parts, except of course the running gear. Within the past decade, however, with the introduction of heavy motive power which spells long and heavy trains, it has been found that wood is no longer capable of withstanding the heavy shocks incident to such operation, and it is generally conceded by all car builders that the freight car of the future must be of steel underframe and steel draft rigging.

This limits the use of wood to unimportant parts of the underframe, such as intermediate sills and crossbeams, and to the superstructure of the car. In the case of open-top cars this means only posts and side and end plank and decking, but in box, stock, and furniture cars, etc., it means siding, lining and roofing.

To take up the question of open-top cars first, statistics gathered by operating officials of some of the larger railway systems seem to indicate that the cost of maintaining steel gondola cars over a period of years is greater than for composite (wooden and steel) cars of the same type. The data[1] collected show that all-steel gondola cars in their twelfth year of service cost over 36 per cent more to maintain than did the composite gondola. Of course, it is probable that during the first five years of its life the steel gondola cost less to maintain, but it is felt that taking the entire twelve years as an average, the cost would be more for the maintenance of the steel than the composite gondola.

It is furthermore interesting to note that but 60 per cent of the composite gondolas in service required repairs, while 72 per cent of the steel gondolas were obliged to be brought to the shops. The actual time that a car is in service and earning money for the road is an important consideration in determining its general utility. It is also interesting to note the conclusions in favor of the composite gondola, which are as follows:

The initial cost of the composite gondola with the present price of steel is less than the all-steel gondola.

The composite type of car costs less to maintain than the steel gondola.

The sides of the composite car do not bulge as do those of the steel car.

The records show that while the composite car costs more to repaint than the steel car, it does not require painting as frequently.

A large portion of the repairs to composite cars can be taken care of at other than steel-car shops.

Certain properties in coal cause corrosion to steel, and wood is not affected by them.

The table shows the annual cost of repairing freight cars since 1908. It will be noted from this table that the cost of repairs per car has increased from $59.30 in 1908 to $80.30 in 1914, an advance of over 35 per cent. This higher cost is due, of course, to a number of factors, but it is felt that no small part of it is due to the use of steel, which requires a greater outlay for material and a higher cost to repair, owing to the fact that it takes longer to make like repairs on a steel car than on a wooden one. It must also be borne in mind that this higher cost is very largely due to the much rougher usage to which freight equipment is now subjected. In recent years the freight business of the railroads has grown enormously, and has necessitated the construction of gravity yards for switching, and the use of fewer switchmen per car handled than in former years. This

ANNUAL COST OF REPAIRING FREIGHT CARS

Year	Number of Freight Cars	Cost of Repairs per Car	Ton-Miles per $1 Repair Cost	1,000 Ton-Miles per Freight Car
1908	2,089,302	$59.30	1,762	104.5
1909	2,073,606	59.70	1,768	105.5
1910	2,135,121	65.60	1,821	119.5
1911	2,117,644	65.10	1,815	117.9
1912	2,140,687	65.50	1,858	121.5
1913	2,209,533	74.70	1,802	134.6
1914	2,263,015	80.30	1,565	125.8

*Presented at the annual meeting, New York, December, 1920, of The American Society of Mechanical Engineers.

[1]Paper by William Queenan, Assistant Superintendent of Shops, C. B. & Q. R.R.

has resulted in severe handling of freight equipment, and is probably responsible to a greater degree than any other factor for the increased cost of repairs in recent years.

In the case of closed-top cars, such as for example stock, box, and furniture cars, there is but little doubt that under present railroading conditions the understructure should be of steel with a wooden superstructure. The steel understructure is required to withstand the shocks of service and to give rigidity and stability to the car, while the wood is desired to give lightness and general utility to the body. Some all-steel box cars are in use today, but their heaviness and the fact that nails and cleats cannot be used in them to brace and hold the lading, are strong factors against the use of this material. It has not met with favor with shippers generally and probably will not as long as wood continues to remain available. No material has yet been discovered which combines the properties of strength, lightness, availability, and ease of working such as is possessed by wood, and until such a material is developed and made available, wood will undoubtedly continue to be universally used for the superstructure of freight cars.

The dead weight of cars is also an important factor in considering the cost of and earnings from freight haul. There is no doubt but what the excessive weight of the all-steel car has been one of the most deterrent factors to its general adoption in freight-car construction, and this fact together with its lack of readily available repair parts and the large expenditure required to equip shops to efficiently handle all-steel equipment, have combined to retard and limit its use.

Graded Lumber in Car Construction

It seems pertinent to say a word at this time as to the grades of material required for the different parts of the body of the car. In the early days when the supply of wood in this country was thought to be inexhaustible, clear grades of wood were generally demanded by the car builders, and in the construction of new cars this is generally the practice at the present time, especially for car roofing and siding—sound-knotted stock being used for decking and lining. Some of the more progressive railroads, however, have gone a step further in recent years and many are now using sound-knotted stock for siding and roofing for repair and maintenance work.

There is no doubt but what such a practice is economical and based on sound judgment, for certainly there is no necessity for using clear material for the repair of many classes of freight equipment, the life of which may not be in excess of seven to ten years. One large railway system which not only constructs its own cars but does repairing on a large scale, has adopted the following practice as to grades:

FOR NEW CARS

Siding	No. 2 Clear and Better Fir
Roofing (double board roof)	No. 2 Clear and Better and Select Common Fir
Roofing (metal-covered)	Select Common Fir
Lining	Select Common Fir
Decking	Select Common Fir

FOR REPAIR WORK

Siding	No. 3 Clear and Select Common Fir
Roofing	Select Common Fir
Lining	No. 1 Common Fir
Decking	No. 1 Common Fir

On this particular railroad the saving on this amended practice amounts to over $500,000 per year, and its economy is apparent.

As far as specifications for end sills, door and side posts, belt rails, etc., are concerned, practice varies widely among the various railroads. Some still insist on oak for such purposes and others have gone to fir and pine. With the rigid steel underframe it is believed the use of soft woods is more justified than ever for posts and belt rail, but unless well protected with steel plates it is believed the use of oak sills is still to be recommended. Oak and other hard woods are becoming more scarce and higher in price each year and it is felt that the general practice very shortly will be pine or fir end sills properly reinforced with steel.

An important feature of car construction which is decidedly in wood's favor, is its general ease of working and adaptability to repair, and this is brought about not only from its qualities which make it easy to cut, saw and shape, but also by its almost universal availability. We have been a wood-using nation for over a century, and artisans familiar with its properties and able to work it are always at hand.

It is also rather curious that the salvage value of wooden cars is greater than that of steel cars, and no one doubts this who has seen the two types of cars in a seriously wrecked condition. The wooden car may be quickly and easily repaired, while the steel car is only rehabilitated at a high cost, or for the most part is fit for the junk pile.

The Importance of Well-Seasoned Wood

Before using wood in the building of freight cars it is vitally important that it be well seasoned. When our grandfathers built a house they expected it to last a century, and it usually did, for they took great care to properly season the wood before putting it to use. In the houses nowadays, however, we use wood almost before it is dry from the saw, and the result is that our American frame houses today are old at fifteen or twenty years and we do not get anywhere near the service out of the wood that we should. Too often today we also see freight cars built of green lumber and timber, with the result that within a few months the bolts are loose, the wood having shrunk away from the original fastenings. This causes rapid deterioration and large timbers often quickly rot, particularly those containing sapwood.

It is safe to say that every railroad in the country should at all times carry on hand an eighteen months' supply of oak and other hard woods and a twelve months' supply of fir, pine and other soft woods. All this material when received should be properly piled for air seasoning, and in the case of cedar material used for important parts, such as car sidings, should be run through the dry kiln just prior to use.

Increasing attention has been given in recent years to the preservative treatment of certain parts of freight cars, and experiments have been made by some of the more important railway systems in the treatment of such items as stock-car decking, side and intermediate sills, roofing, etc. While these experiments have not been conducted for a sufficient length of time to determine actual results, the indications are that the preservative treatment of such car parts as are particularly liable to decay is profitable and will shortly be adopted as standard practice by the more progressive railroads.

Japanning Equipment

Object and Principal Constituents of a Japan — The Baking Process and the Machinery Used—Methods of Recording and Maintaining Proper Temperatures

By C. W. STARKER

JAPANNING is a process very extensively employed for giving a protecting coat and a pleasing appearance to parts made from sheet metal or castings. It is used extensively in the automobile industry as well as upon many small articles, such as typewriters, adding machines, electric motors, etc. The finish may be glossy as in the typewriter, or it may be dull as in the telephone. Black japan is the most commonly used, but different colors are obtainable.

As compared with air-drying finishes, the baking method, in which the articles are coated and then placed in an oven to be baked at temperatures ranging anywhere between 120 and 500 deg. F., results in finishes which are more elastic and durable, besides presenting a better appearance.

The japanning process appears simple enough on the face of it, but it requires careful attention to a number of points in order to secure uniformly good results, and the equipment must be carefully adapted to the individual needs.

The first essential is to have a clear understanding of the nature of the material and the objects to be accomplished. Commercial japans consist of an oxidizing or drying oil, generally linseed, which forms the body of the coating and gives it the required flexibility, and a coloring medium, which in black japan of the higher grades is obtained by the use of asphaltum, and in the cheaper grades by black pitch.

For priming coats carbon black is frequently employed on account of its ability to give a particularly dense coating to the surfaces and to cover the edges of metal parts. Further, we have a solvent for a thinning medium, for which benzine, turpentine or naphtha is used, the object of which is to facilitate the application. In the baking process, or in the preceding drying, these solvents are volatilized.

Special drying materials are sometimes added to the japan to accelerate the process, but, unless they are correctly applied, are apt to be a source of trouble. With modern facilities for baking there is little necessity for their use.

The principal constituents of a japan are, therefore, an oxidizing oil, gums or pitches, a coloring medium and a solvent; and the process taking place in baking is two-fold: namely, a volatilizing of the solvent and an oxidizing of the oil. It is essential to keep this two-fold action in mind as we will see later.

Care in Selecting Ingredients

The object of japanning is to provide a rust and wear-resisting coating. The coat must, therefore, be hard enough to resist scratching and flexible enough to stand reasonable handling and wear. From the standpoint of appearance it must be uniform, free from impurities, and from pitting or burned spots.

The linseed oil is an essential item of the cost as well as of the quality of the japan. An excess of it tends to produce a less glossy but a more durable finish. The cheaper japans, therefore, are apt to be more brilliant, but they give only a thin protecting coat to the metal and are more liable to crack off.

The viscosity or gravity of the japan—that is, the amount of solvent added to it—is next in importance. The proper quantity for each individual brand of japan should be determined by testing samples with varying proportions of japan and solvent. Commercial japans contain about 50 per cent of solvent and it is customary to add between 15 and 40 per cent more to facilitate dipping or spraying in manufacture. Once determined, a standard gravity should be maintained and strictly controlled in manufacture to secure uniform results.

The room temperature should be uniform as this affects the flow of the japan. If the temperature is low less solvent is required and if high the solvent tends to evaporate.

There should be proper facilities for mixing and storing japan, and tanks should be provided which permit the settling (in water) and the drawing off of impurities. Means should be provided for agitating the japan to prevent settling of the heavier ingredients. The air should be free from dust.

Exhaust Fans Important

Because of the combustible nature of the constituents and their tendency to volatilize, tanks must be covered and lights and flames protected. The fumes in spraying must be carried off by exhaust fans and the baking ovens must be ventilated; arranged so as to draw off the heavier vapors near the bottom and the lighter vapors, together with the heated air, near the top.

A careful study of the amount of air required to produce proper oxidizing and to prevent dangerous explosive mixtures is very desirable. Means for controlling the air supply should be provided. Eight to fifteen changes of air per hour are usually figured on in baking. A uniform finish, absence of overheated or insufficiently baked spots, requires that the temperature should be closely controlled and that definite baking times be established according to the requirements of the piece to be japanned, and depending upon the japan as well as upon the thickness and weight of material. These points will be referred to more in detail in discussing different constructions of japanning ovens.

The Baking Process

The ideal baking process would be one in which the metal is heated first and the japan baked, so to say, from the inside out. Present practice does not reach this ideal but approaches it by using a uniform slow heat, indicating that slower heating—that is, a longer baking time and comparatively lower temperature—are preferable to quick baking at high temperature.

Practice varies considerably in this respect. With black japans, temperatures of 300 to 400 deg. F. are ordinarily used, with baking times of three to one and one-half hours. On the other hand, temperatures of 450 to 500 deg. F., with baking periods of 45 to 30 minutes, are employed by many manufacturers to secure

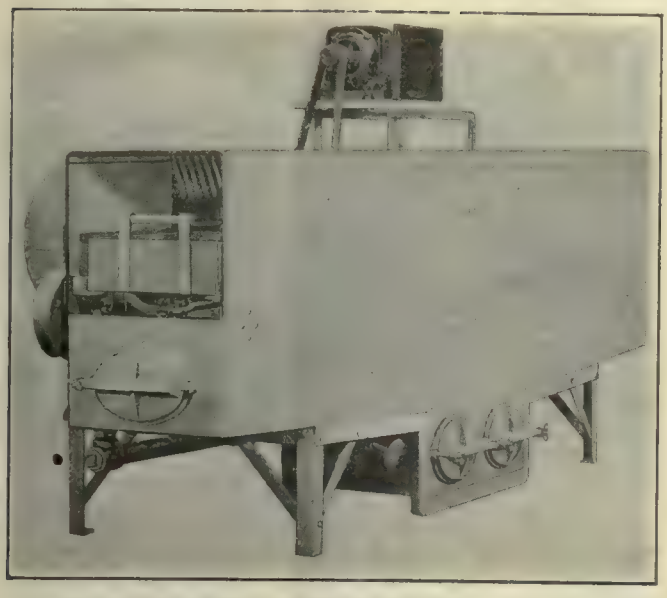


FIG. 1. WASHING MACHINE FOR SMALL PARTS

a maximum of output. White or light colored enamels are particularly sensitive and are baked at lower temperatures to prevent discoloring.

One other point is worth mentioning here: The best japan cannot produce a uniform coating on an unclean or greasy surface, and the cleaning of metal parts before japanning is essential. Particularly is this true when preceding operations have been performed on the punch press, because of the lubricant adhering to the parts. Cleaning by dipping the parts in benzine or washing them with a benzine-soaked cloth by hand is necessarily slow and expensive and the fire risk is also an item to be considered.

With small parts, an automatic washing machine is particularly advisable. One well suited for small punched parts or screw machine parts is shown in Fig.

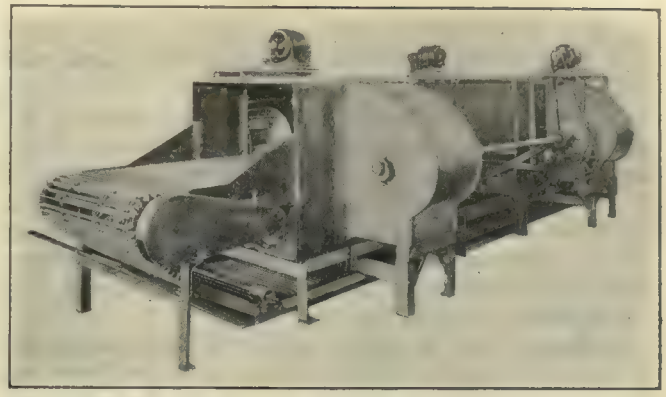
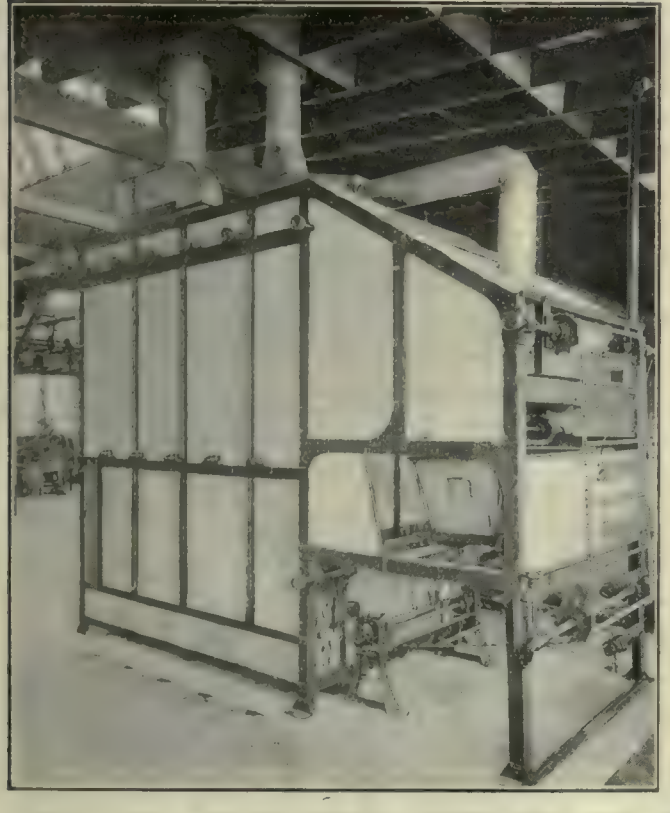
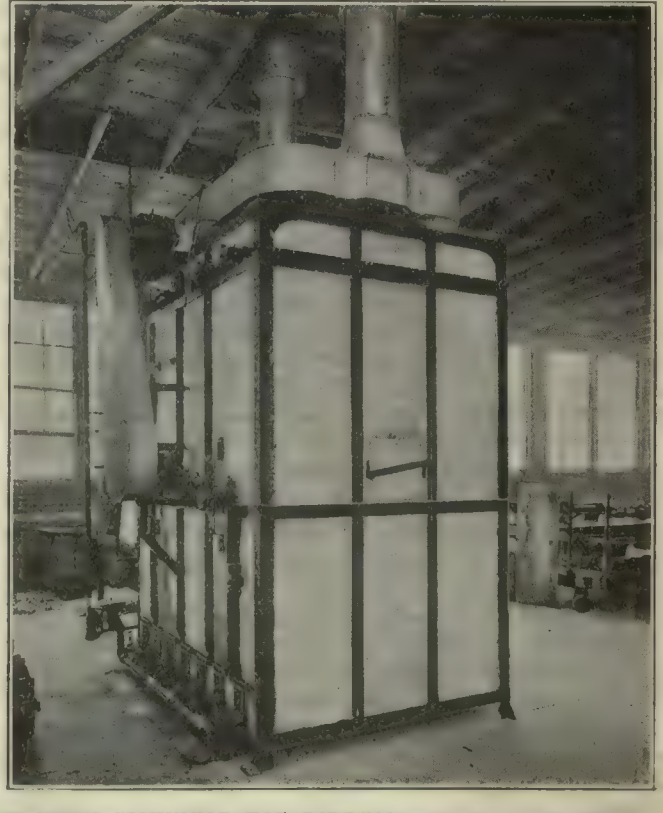


FIG. 2. WASHING MACHINE, WITH CONVEYOR, FOR LARGE WORK

1. The parts are placed in baskets and are pushed first through a washing compartment and then a rinsing compartment; to which may be added, if desirable, a gas-heated drying compartment. Another type of machine suitable for cleaning larger parts, such as automobile fenders, range parts, etc., is shown in Fig. 2. This machine provides a washing and a rinsing compartment in which strong jets of hot cleaning compound are applied from both sides and from below. The parts are moved along on a chain conveyor, the latter, as well as the spraying nozzles, being operated by electric motors. One or two operators on a machine of this type may replace five or six operators cleaning by the hand method.

Cleaning metal surfaces by burning off oil and grease with hot air at approximately 500 deg. F. for 10 to 15 minutes has also been tried with success. Neither of these methods will, of course, improve the surface of the metal itself. If the steel shows imperfections, burns or scratches, they are apt to show up in the finished article, so that where good appearance is desired a metal





FIGS. 3 AND 4. FRONT AND REAR VIEWS OF BAKING OVEN WITH CONVEYOR FOR DIPPING AND PLACING WORK

having a good surface must be selected. With brass it is particularly important to have the parts well cleaned.

The next important item is the size and shape of the oven; this being dependent upon what method is to be used in handling the work. It might be recommended not to decide arbitrarily on a size of oven and then to determine how best to load it, but rather the reverse; that is, decide on the size and shape of truck or conveyor most suitable for the articles to be japanned, and then build the oven around it.

Assuming, for example, that the articles to be japanned are wire wheels or range parts and that we decide on a truck-loading oven, we would select a standard truck, or if necessary, design a special truck in which the various parts can be most economically supported during the baking process. The size of this truck then would determine the inside dimensions of the oven.

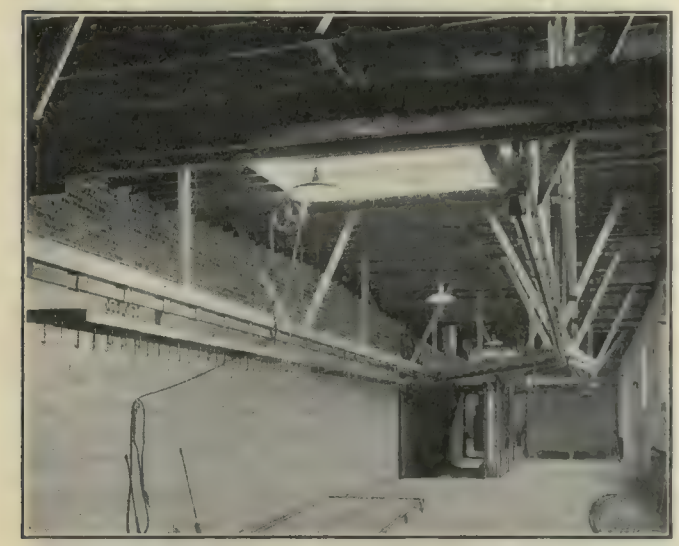


FIG. 5. MONORAIL SYSTEM OF CONVEYOR FOR BAKING OVENS

Where the product is of a varied nature the truck size would be determined by the larger or more important items and shelves or supporting rods would be provided to accommodate the other parts as economically as possible. The aim must be to fill the ovens as completely and uniformly as possible each time.

Parts of different size or weight require different baking times, and this point should be kept in mind so that parts requiring the same baking period may be grouped together in loading the trucks. From this point of view it would seem most economical to have relatively small units of ovens—their number depending on the required total output—or to have large ovens divided into a number of compartments so that the oven space and heat may be used most economically all the time. In operation the aim should be to always have a load in the oven, other trucks being loaded and unloaded in the meantime.

Instead of the truck, the overhead track and, particularly the conveyor, have come into prominence in the last few years. The question of whether a truck or conveyor is most suitable is entirely a matter of handling, depending upon the nature of the work and the general manufacturing plan. This point, therefore, should be considered entirely aside from the oven construction and a decision should be made strictly on the



FIG. 6. REAR VIEW OF OVEN WITH MONORAIL LOADING DEVICE

basis of saving in labor for each individual case. A conveyor is an excellent thing under certain conditions, but may be economically wrong under other circumstances.

The example of installation in other industries should be judged critically and with freedom from the tendency to follow a fad.

A conveyor involves considerable expense and of necessity requires considerable floor space, particularly if the continuous conveyor be selected. In this type of conveyor oven, shown in Figs. 3 and 4, the conveyor travels at a uniform, usually adjustable, speed—say two to three feet per minute—and the oven portion necessarily has to be long enough to give the required baking time. In addition, there must be sufficient conveyor space outside of the oven to permit loading and unloading.

Two or more ovens may be arranged in parallel, or, still better, in series, so that the parts, after passing through the oven for a first coating, may be dipped or sprayed and passed through additional ovens for additional coatings. With the conveyor oven, the so-called intermittent type, the oven may be shorter, as the conveyor stands still during the baking time, and while one portion is in the oven the conveyor is loaded at one end and unloaded at the other end.

An overhead monorail, as shown in Figs. 5 and 6, or a conveyor, as shown in Fig. 7, would be best suited



FIG. 7. THREE BAKING OVENS WITH OVERHEAD CONVEYORS

where it is possible to carry the parts on the conveyor from one department, through the japanning department to another department without taking them off. Where it is necessary to bring the parts into the japanning department on a truck, take the parts off the truck and hang them on the conveyor and, after baking, take them off and put them back on the truck, it is obvious that there will be a great deal of handling and the advantage in the use of a conveyor is questionable.

One advantage of the conveyor in general should not be forgotten; namely, the incentive to the operators to work according to a fixed schedule and have the slower man speed up to keep pace with the faster man. Graphic recording instruments may be provided which show exactly how long the oven has been open, how long the parts were in the oven; how the temperature varied, and how much time was consumed in reloading. Records made by such instruments are shown in Figs. 8 and 9.

Source of Heat

Having decided upon the method of handling, the construction of the oven should be considered in detail. Among the different means of heating, steam is not used extensively, although steam heating coils distributed on the sides of the oven give a good indirect heating effect. When low temperatures are used and fast production is not essential, steam can be applied very satisfactorily.

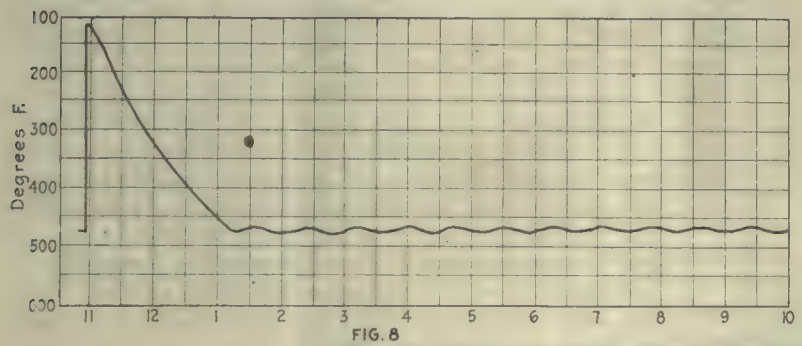


FIG. 8

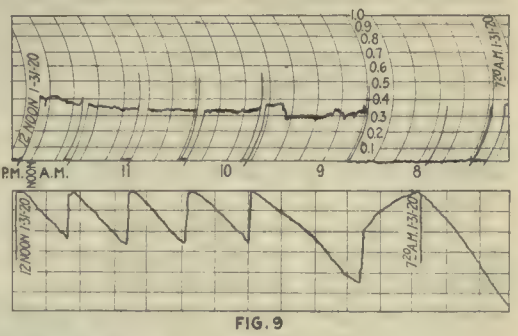


FIG. 9

FIGS. 8 AND 9. CHARTS FROM RECORDING INSTRUMENTS

Gas and electricity are the principal sources of heat. Of the gas ovens, there are two general types: the one using open gas burners installed under the floor of the oven, and the other, the indirectly-heated oven, in which the gas burners are contained in a closed compartment along the lower part of the sides of the oven, and from this compartment flues extend along the sides, from which the heat is radiated. The direct-heated type of oven has been practically superseded by the indirect-heated type; as the former involves a greater fire hazard and also because the latter better provides the uniform heat essential to good results.

Atmospheric pressure is generally sufficient to insure a circulation in the oven but in some cases, as with a battery of several ovens, pressure blowers may be required. The air supplied to the oven should be preheated by having it enter by a pipe passing through the combustion chamber.

The products of combustion should never be allowed to get into the oven. With the direct-heated oven the sulphur and other products of combustion are likely to injure the japanning and the air consumed by the gas burner materially decreases the amount available for the oxidizing process. With a separate combustion chamber, these disadvantages are avoided.

Electrically-heated ovens have come into use to a considerable extent. The question of gas versus electricity for japanning ovens should be decided strictly on a basis of relative merits. Electric heating has the advantage of cleanliness, convenience, and ease of control.

One important item in comparing gas with electricity for heating is the question of cost. There are, unfortunately, so far as the writer can determine, no two installations in which all circumstances are identical except the supply of heat, so that a strict comparison could not be made. Even if full data were available it would be difficult to render a satisfactory judgment as the question of possible shortening of baking time and quality of resulting finish would be subject to differences of opinion. Further, the comparison would be of only local value inasmuch as the relative cost of gas and electricity is variable.

With electric ovens, it is the custom of several manufacturers to make the walls thicker than are the walls of the gas oven, on the theory that the higher cost of electricity warrants the additional expense for the insulating material used in the sides of the oven. This item materially increases the cost of the oven and is cited as an example of the difficulty in making comparisons. From the viewpoint of first cost, it should be noted that electric heaters and control are more expensive than gas burners. On the other hand, the electric heaters take less room so that the oven may be made smaller and the heaters can be distributed on the walls to better advantage.

Frequently the heaters are arranged in two sections: one section supplying the constant heat and the other supplying the peaks occurring after the oven is loaded. After a certain temperature is reached the latter section is cut off automatically and the heat is then maintained by the remaining sections. The maintenance cost is also an item to be considered in the individual case.

From all this, it is apparent that a comparison made merely on a thermal basis, that is, stating that 100 cu.ft. of gas contains 500 or 600 B.t.u. and costs a certain amount, while electricity with 3,412 B.t.u. per kw.-hr. costs so much, does not begin to tell the story and a full analysis of all the points entering into the problem, including incidental advantages, must be made. In calculating the amount of heat energy required, the weight of the conveyor truck should not be neglected as the material in them must be raised in temperature the same as the actual work being japanned. The heat losses in flue gases and air changes are also points of importance and are items which vary for gas and electric ovens.

In recent months the price of artificial gas has taken a decided upward turn, due mainly to the increased price of coal. At the same time, the quality of the gas furnished has, at least in the writer's experience, deteriorated both as to B.t.u. value and purity. On the

other hand, electricity is being produced more economically by the larger generator units installed, by interconnecting different systems, and various other economies. Special low rates for electric power used during the off-peak periods are made, so that in a recent investigation of a typical case the cost of energy for electrically-heated ovens was only a few per cent greater than for gas, and this difference could readily be shown to be offset by the incidental advantages of electrical operation.

The use of electric recording instruments and push-button control is one of the means by which the entire operation of the oven can be visualized graphically, showing just what takes place and where time or heat may be wasted. This feature is an excellent stimulus for most efficient use of the equipment and for uniform quality. It effects an indirect saving which should not be lost sight of. Under present conditions, a saving in labor in almost every case easily overbalances any difference that may exist in the cost of power.

It is a fact that most of the large automobile manufacturers have turned to electrically-heated japanning ovens. Many of them had made exhaustive tests and interesting cost comparisons. They have stated various percentages of increase in production, decrease in rejections on account of poor quality, and saving in floor space, all of which led them to decide upon electric ovens for additional installations. Much as gas has superseded coal, due to its convenience and incidental advantages in spite of the higher cost, so electricity appears to be gradually superseding the gas-heated ovens.

In conclusion a few words should be said in regard to spraying devices, which form an essential part of the equipment of the japanning department. Coating the parts to be japanned by immersion in a vat—so-called dipping—is an inexpensive method and is generally used on plain parts or for first coats, but very often parts are of complicated shapes or have holes and ridges which, if the dipping method were used, would leave marks or streaks of japan and result in an imperfect coating. In all such cases, air-operated spraying guns should be used and spraying booths installed, provided with exhaust fans. The parts to be sprayed may, to advantage, be placed on a turn-table so that they can be sprayed uniformly from all sides.

Knurling Small Pieces in a Vise

By J. A. Raught

The other day while doing some experimenting I found myself in need of some 8/32 fillister-head screws with knurled heads, and not having proper facilities for knurling such small pieces in a lathe I placed the screw head between two 10-in. mill files in a vise and with a wooden mallet drove one file endwise for about ½ in. by striking the blunt end of the file. This produced the desired results in a very short time. I also tried this method on several other small pieces for experiment; including a small wire nail which would be by far too weak to knurl in any other way.

In trying out this stunt a piece of wood should be placed between the vise-jaw and the file that is being driven to prevent spoiling both file and vise.

[Our correspondent sends several samples, all of which show a very good job of knurling. What must have happened to the files is another matter.—Editor.]

Should Jigs and Fixtures Be "Designed"?

By P. A. Fredericks

During the past five years the writer has had experience with two plants using radically different systems of production for jigs and fixtures. In view of the fact that both systems seem to produce results it appears worth while to raise the above question for discussion.

Both plants are doing almost identically the same class of work, namely building a fairly heavy machine tool in quantities sufficient to be classed as production work and therefore requiring to be well tooled up.

In the first plant the jigs, fixtures, etc. are all designed and detailed in the drafting room, down to the last screw. In the second shop the piece to be machined is sent to the pattern shop to have the pattern for the jig built around it and when the casting comes in, the toolmaker works from the blueprint of the part in locating holes, etc., without even a sketch of the jig itself beyond possibly a few scratches to indicate the general plan to be followed.

If one believes either of these shops, the other one must be nearly if not quite crazy to use its present methods; yet having seen both methods used I believe there is something to be said for each.

The plant where the jigs and fixtures are laid out in the drafting room and all the details drawn, has a much better opportunity to analyze the fixture for possible improvements. It is certainly cheaper to build jigs and fixtures from drawings, since the various parts can be routed and some of them worked up by the least expensive men. There is also the possibility of getting out tools in advance for new product where the other plant would be waiting for castings to start building the fixtures around; then, too, the system embodied in drafting room design does not require so much in the way of training employees as does the other system which would scarcely work at all except when there were men available in the toolroom who had been well trained in the particular methods followed in that shop.

However, the plant where the jigs and fixtures are designed and built in the shop will reply that there is much less likelihood of expensive interferences, for when the pattern is built around the piece it is certain that the piece will always go in and come out without trouble. A much smaller drafting force is required which largely offsets the gains the other shop makes in machining the jig parts from drawings. The fact that the men require training is a help rather than a hinderance, for it is more certain that standardized methods of machining and routing of operations will be followed; that the shop has to use the jigs and produce results with them and ought to be best qualified to know what it wants, and finally the fact that jigs or fixtures cannot be built until the castings come in is of no importance, since every wise shop builds an experimental machine and works out the jigs before starting to manufacture.

To the writer it appears to be largely a question of personnel. No doubt either shop would flounder around considerably if it had the system of the other thrust upon it suddenly, but I am strongly of the opinion that the proper place to design tools is in the drafting room and not in the shop. Jigs and fixtures can be successfully made by both methods.

Machining Columbia Rear-Axle Housing

Some Interesting Operations on Drilling, Boring, Reaming, Tapping and Special Machines —Press Work, Assembling and Testing

BY FRED H. COLVIN
Editor, *American Machinist*

THE Columbia type of axle consists of a trussed steel housing which is interesting as a matter of steel forming and machining methods. The complete axle with sections cut away to show internal construction, is shown in Fig. 1, while Fig. 2 shows above, a half housing, and below the housing with the two halves welded together and the tubular ends welded in place. Although not clearly shown, the trussing of the reinforcing ribs around the center opening is an interesting piece of work. The hole is first punched small and the metal drawn inward, after which it is folded back making a double thickness for threading during the tapping operation.

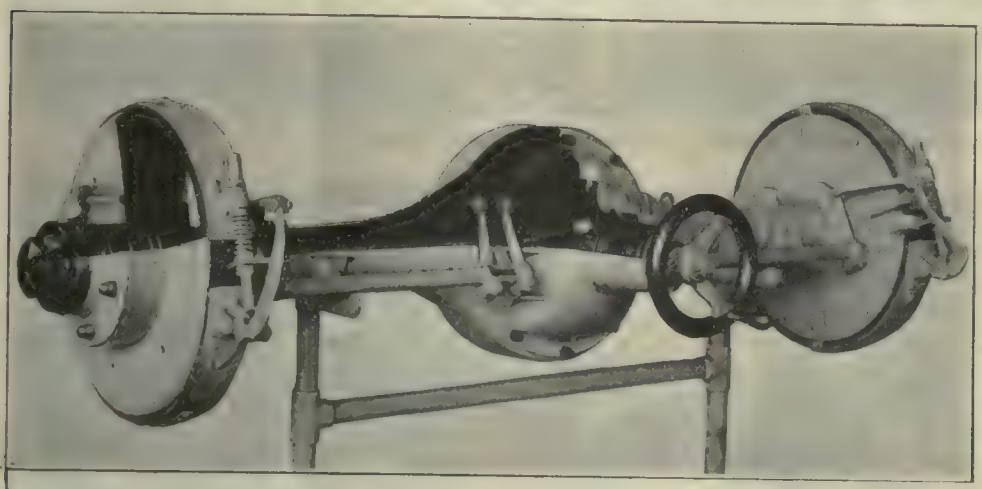


FIG. 1. THE ASSEMBLED REAR AXLE

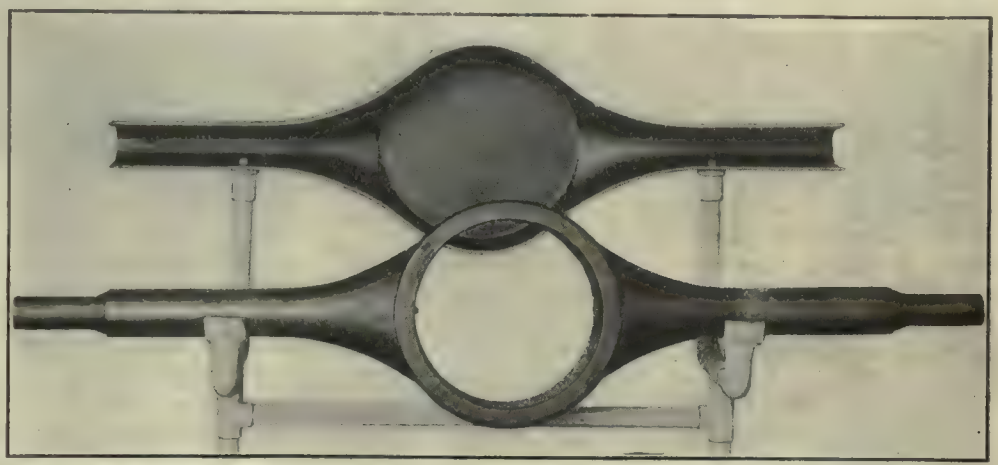


FIG. 2. THE PRESSED STEEL HOUSING

The first operation is to test and straighten the housing in the fixture and under the presses shown in Fig. 3. The tubular ends run on roller rests while the pointers *A* and *B* show how true the ends run as the housing is revolved. If it requires straightening, pressure is applied by the rams *C* and *D*, each of which has an adjustable pressure point, so that the desired deflection can be secured with a constant stroke of the ram.

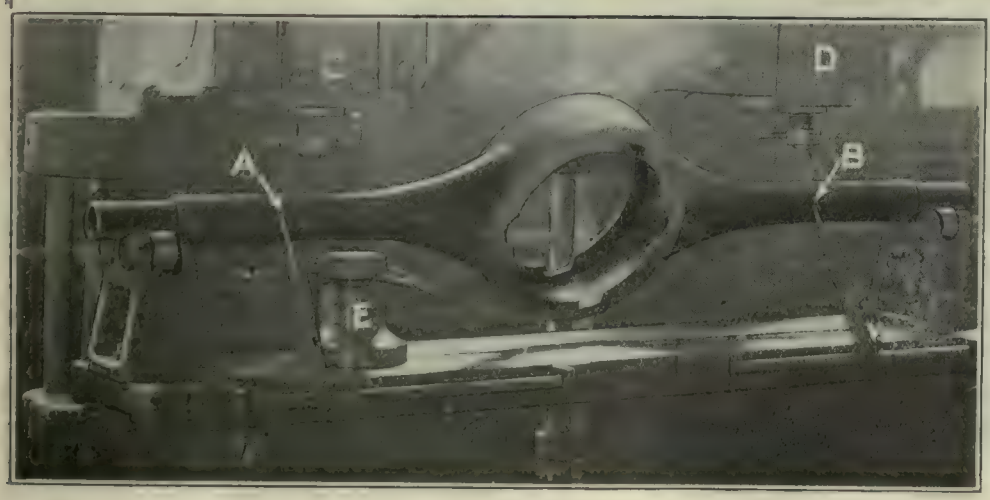


FIG. 3. TESTING AND STRAIGHTENING

When necessary, the substantial screw jack *E* is placed at the desired position to prevent deflection at that point. The inspectors and straighteners become very expert in handling the housings and they are straightened ready for machining at a rapid rate. Next comes the turning of the ends, Fig. 4, both for the spring seat and brake-band housings at *A* and *B*, and for the wheel seats at *C* and *D*. The housings are turned between centers in an engine lathe, a ball bearing dead-cen-

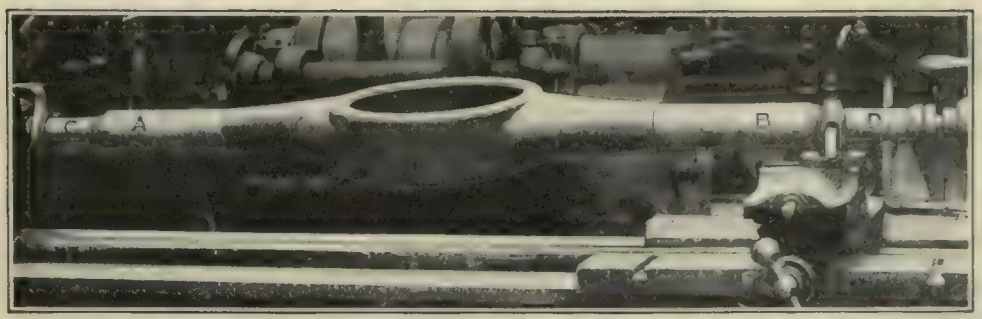


FIG. 4. TURNING THE ENDS

ter being used in the tailstock as shown in the halftone.

The special double-headed facing machine shown in Fig. 5, used for facing the sides for the differential units and the outside cap, is of especial interest. The housings are held against the V-shaped clamps *A* and *B* by means of pneumatically operated plungers operated from cylinders *C* and *D*. Stops are provided at the center, as at *E*, for holding the housing vertically and for taking the thrust of the cutting tool. Two cutting heads are used as shown at *F* and *G*, both being provided with star feeds. It is very necessary to have the housings held properly, so as to be faced by the removal of a minimum of metal as there is very little to spare in most cases.

The drilling and tapping of the housing does not involve any special operations, multiple-spindle drilling machines and the usual types of tools and fixtures being used. The pressing on of the housings which carry the spring pads and the internal and external brake supports is done as shown in Fig. 6. The housing is clamped on a substantial center, as at *A*, by means of a quick-acting strap *B*, while the malleable casting which forms the spring seat is guided by the block *C* so as to insure its being in the proper position. A compact horizontal hydraulic press is used in the usual manner.

This operation practically completes the housing proper and we can pass to the differential housing which carries the driving gears and the differential unit. The differential housing is shown in Fig. 7 being machined in a Gisholt turret lathe, the tooling being of the usual order.

Cross-boring the support for the inner axle bearing is done on the special double-headed machine, shown in Fig. 8. The housing is mounted on the mandrel *A* that squares it with the hole for the driving shaft, which has been bored in the previous operation. The face is clamped against the smooth surface of the fixture by the four straps shown while the dowel pin *B* positions it with regard to the crossholes. The boring bars are large and stiff and are supported in the substantial bushings *C* and *D*, enabling the work to be done in record time.

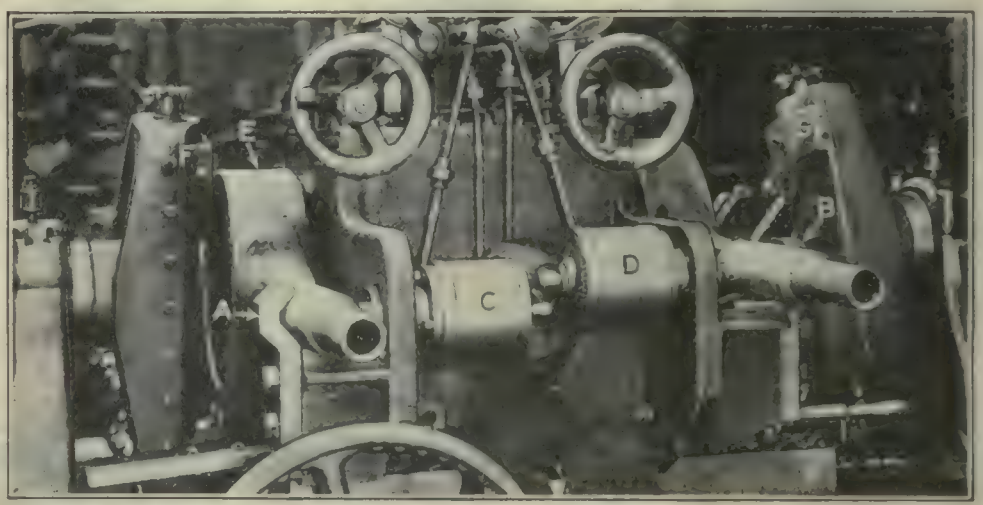


FIG. 5. FACING THE SIDES

The final reaming of the hole to receive the drive shaft bearings is done in the fixture shown in Fig. 9, the job being one of hand reaming in which the power is supplied by the air motor *A*. The work rests in the cradle *B* and is held in position by quick operating cams *C* and *D*. This secures the result of hand reaming without laborious work on the part of the operator. Another application of utilizing motor instead of hand power is shown in Fig. 10, where a similar air motor is used for screwing on the nuts, a friction chuck determining the amount of tension to be given.

This same type of stand is used in assembling the differential units as can be seen in Fig. 11. The quick acting cams allow the changes to be made very rapidly and at the same time the parts are held firmly while being assembled.

Before the business end of the rear axle is assembled to its housing, it is thoroughly

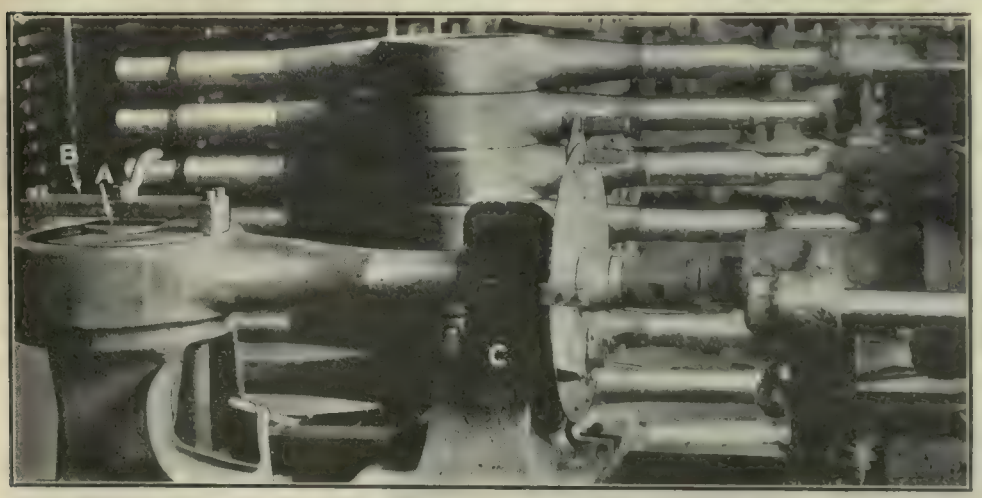


FIG. 6. PRESSING ON BRAKE HOUSINGS

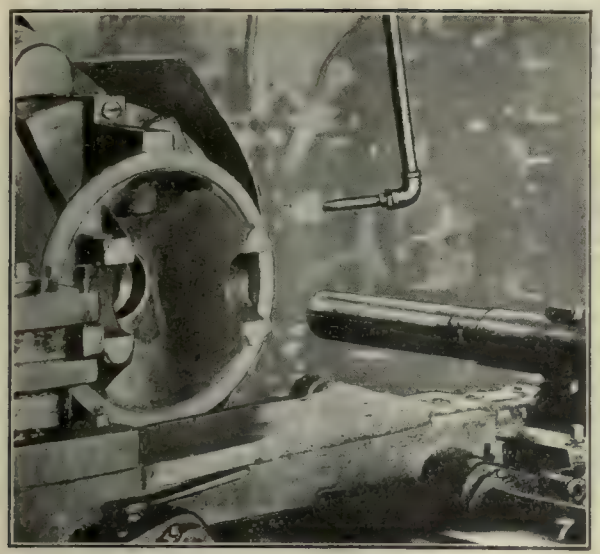


FIG. 7. BORING THE DIFFERENTIAL CASE

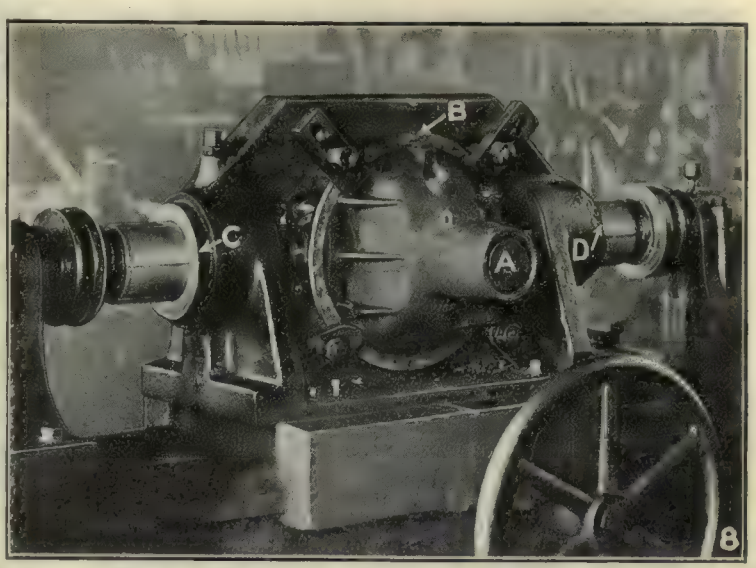


FIG. 8. BORING FOR AXLE BEARINGS

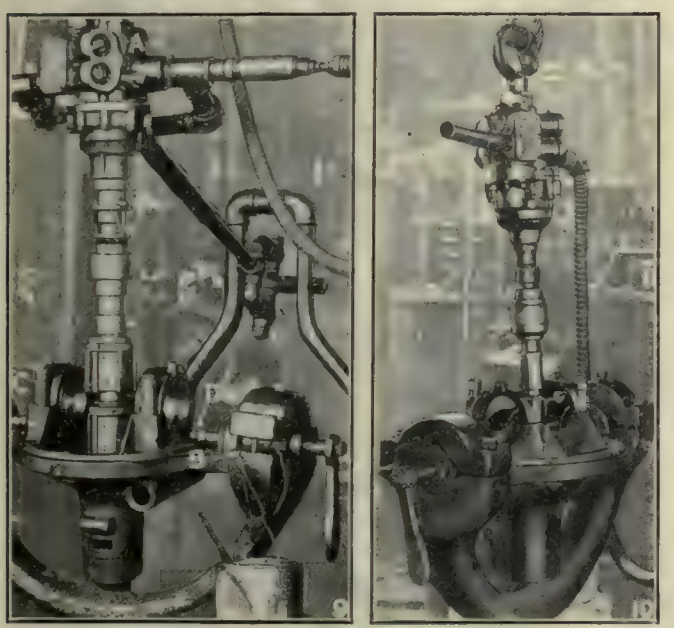


FIG. 9. FINISH REAMING DIFFERENTIAL CASE
FIG. 10. SCREWING ON NUTS BY POWER

tested on the stand shown in Fig. 12. The motor *A* drives the gear unit against the brake which is controlled by the lever *B* and necessary adjustment can be made to eliminate noise or to insure closer alignment. The motor controller is conveniently located at *C* where it is easy for the operator to handle. As will be seen with all the fixtures shown in the Columbia shop, the question of time lost in handling the work in and out of the fixtures has been carefully considered in every case.

Columbia Rear Axle

By Fred H. Colvin
Editor, *American Machinist*

Although the driving member of an automobile rear axle contains but two machining operations it is necessary to have them correctly done and in a reasonable time. Fig. 1 shows the turning operation which reduces the diameter of the axle for a portion of its length; a plain engine lathe with a substantial shallow follow rest being used for this purpose.

The ends of the axle are then splined in a hobbing machine and the piece heat-treated, after which it must be straightened before finishing by grinding.

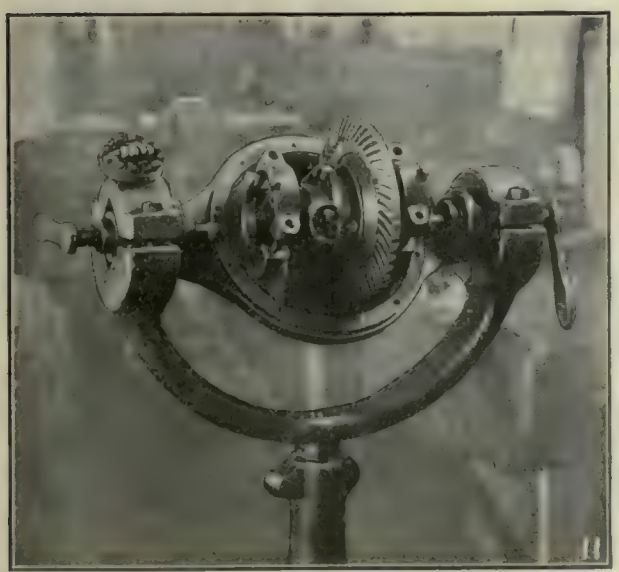


FIG. 11. ASSEMBLING THE DIFFERENTIAL

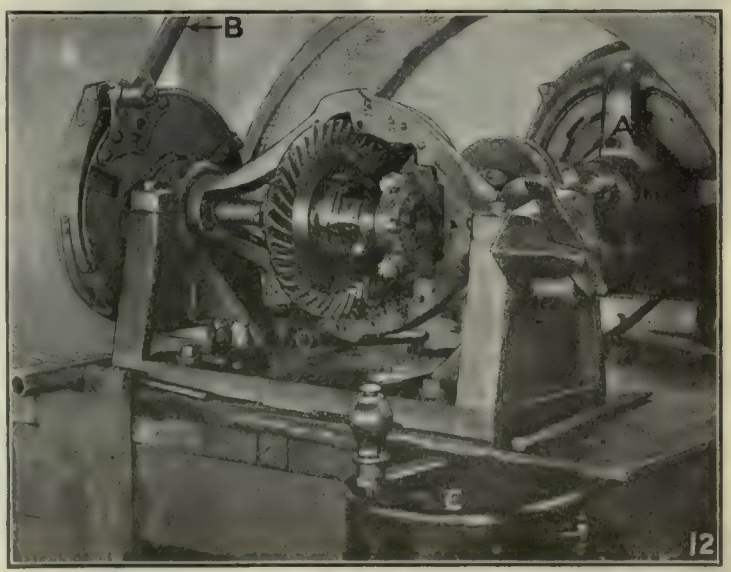


FIG. 12. TESTING THE GEARED UNIT

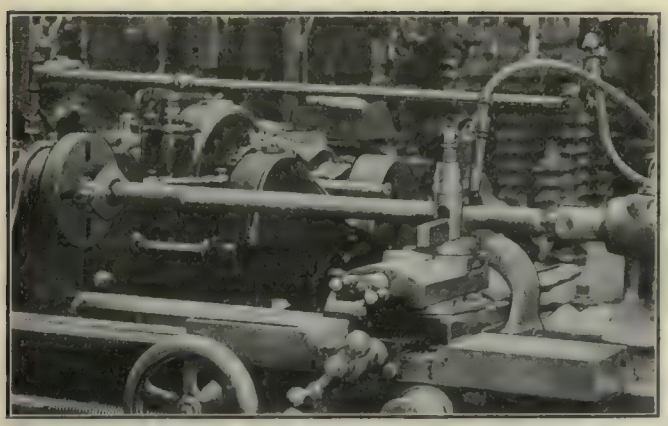


FIG. 1. TURNING AXLES

The straightening process is done very rapidly on a crank press as shown in Fig. 2, the first operation being to determine how much and where the axle runs out of true. For this purpose a pair of centers is hung on the



FIG. 2. STRAIGHTENING AFTER HEAT-TREATING

front of the press, the centers being shown at *A* and *B*. Rotating the axle on these centers allows the operator to mark the high spots, some of the markings being shown on the axle in the press. The press ram carries an adjustable tool C, which can be varied to suit conditions, and an experienced man will take the kinks out of a bent axle very rapidly.



FIG. 3. GRINDING THE ENDS

After straightening the ends the axles are finished by grinding, as shown in Fig. 3, the central portions being left as they come from the turning operation, as the axles float freely inside the axle housing.

Maintenance Work on Aviation Engines

By John Houssman

Ordinarily, from work on rolling-mill machinery to that on jigs and fixtures for aviation motors would be a rather far cry, but under the stress of war and with a few good books one can always do more than that.

The work described herein was done at Fort Sill, Oklahoma, where I was in charge of the drafting office of the engineering department. As the field grew in size, the number of airplanes cared for increased to about one hundred. At first the machines used were 200-hp. Curtiss R-4 planes with V-2-3 type motors. The equipment of our shop was rather limited, but it was made to suffice. Then, too, the engineering department did not always receive the proper support.

Among the first tools made was the fixture, shown in Fig. 1, for testing the alignment of the bearings of the connecting rods of Curtiss motors. It consists of a cast-iron base *A* with four jack-screws *B*, the vertical ones being located from the bore *D* a distance equal to the length of the connecting rod.

With the jig are two clamps *C*, pin *E*, pin *F* and clamp *G*. Clamp *C* is made of spring steel about 3 in. wide.

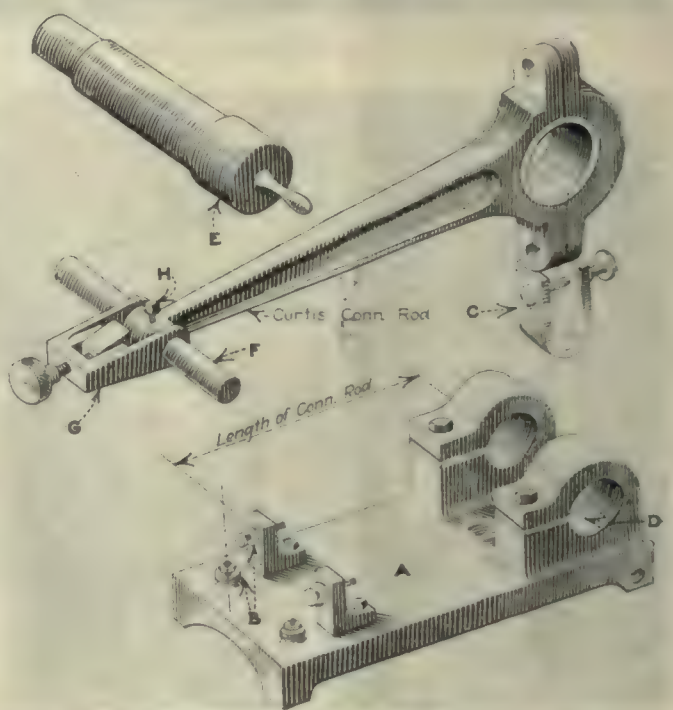


FIG. 1. FIXTURE USED FOR TESTING THE ALIGNMENT OF CONNECTING-ROD BEARINGS OF CURTISS AIRPLANE ENGINES

Uncompressed, it will go over the flange of the bearing and cap and a few turns of the knob clamps the cap on, this method being much quicker than the using of bolts. In the same illustration, *F* is a pin slightly smaller in diameter than the wristpin, but much longer; *G* is a clamp to hold the pin *F* in place in the connecting rod in the same position as the setscrew *H* holds the wristpin. The setscrew is not used while testing, although shown in the illustration. Pin *E* is of the same diameter as the crankpin on the motor shaft, it being made hollow and provided with a handle for convenience. A proper fit in bore *D* was assured by making provision for taking up wear, the saw-kerf being filled with lead, against which the bolts can be tightened.

The connecting rod bearings were lined with bronze-backed babbitt shells. After being scraped, they were tested in the jig for alignment in the following manner. Pin *F* was inserted in place of the wristpin and held by clamp *G*. The connecting-rod was placed on pin *E*, and its cap clamped on by the two clamps *C*. Then, the jackscrews *B* were screwed up against the pin *F*

and locked. Pin *E* was pulled out, the connecting rod turned over and the position of *F* on the screws was noted. Thus, the effect of any misalignment was doubled. In doubtful cases a feeler gage always told the story.

Almost from the start we were short of wristpins and, as new ones were not to be had, it was up to the engineering department to fix up the old ones. Each pin had a liner made from seamless tubing and expanded at both ends to fit the bore, the space thus formed between the pin and the liner receiving oil from the oil duct on the rod—the holes being held in alignment by the setscrews securing the pin in its place.

Investigation showed that the pins were worn about 0.002 in. on the diameter and that the only way to use them again was to expand them. A mandrel with a bulge on it about 0.005 in. greater than the bore of the pins was turned up, and then forced through the

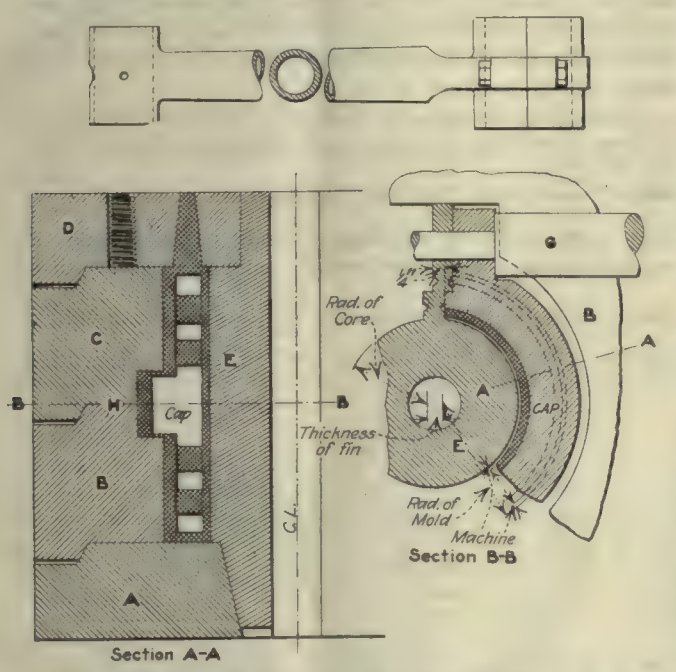


FIG. 2. INNER HISPANO-SUIZA CONNECTING ROD AND MOLD USED FOR BABBITTING IT

heated pins, using an arbor press for the purpose. The liner was destroyed, of course; but a new one was turned out of pipe and riveted in place after the pins were hardened and ground. The heat-treatment gave us quite a bit of trouble. At first the grain in the annealed pins showed very coarse in a break. From Halsey's Hand Book we settled upon heat-treatment *K*, judging temperature by color; and were rewarded by properties very closely resembling those of the old pins.

The expanding process was not entirely satisfactory, however, because it tied up too many motors while the pins were being expanded and because of the poor condition of the ends of the pins due to the action of the press. So it was decided to make new pins, the only material available being cold-drawn steel. The oil cellar was bored out straight in the pin. After carbonizing in cyanide, heat treating and grinding, the liner was pressed in and riveted in the chamfered ends. What the engineering department of the Curtiss plant would have said, I do not know—but we managed to keep the ships flying and had no accident due to changes we made.

One of the nicest jobs we did in making changes on some ships was to move the pilot into the front seat and to mount a machine gun in the rear. Not knowing the center of gravity, we worked about an assumed center of moments, taking care to have the pieces and parts that we moved produce the same total moments as they did before the re-arrangement.

Then came the time when the old machines were pronounced out of date and we received new ones, No. JN-4H with 150-hp. Hispano-Suiza motors.

Connecting rods of the Hispano-Suiza motor differ from those of the Curtiss engine quite radically. The Curtiss motor has two connecting rods working side by side on the same crankpin. In the Hispano-Suiza motor only one connecting rod works on the crankpin; the other has a forked end and works on the first connecting rod, which is babbitted for this purpose on the outside, as well as on the inside. The general shape of the inside rod is shown in Fig. 2.

The mold for babbitting the rods is also shown in Fig. 2. It consists of five main parts; the base *A*, the body halves *B* and *C*, the cover *D* and the core *E*. In use, the core was bolted between the connecting rod and its cap by the bolts *G*, these bolts being carried through the body of the mold to prevent an excess of babbitt from covering up their heads. The fins on the core separate completely the rod and the cap. The reinforcement around the cap and rod fits closely into the recess at the parting of the mold, as can be seen at *H*.

The center hole in core *E* was provided for heating up the assembled jig prior to pouring. After the core and the connecting rod were placed inside the half *B*, they were covered by *C* and *D*, which were then fastened to the base *A* by bolts. The opening around the stem of the rod was stopped with wet clay and each half of the jig was poured separately through the holes provided in cover *D*. The gate holes were made conical, as shown, to facilitate removing the cover, a setscrew in the tapped hole being used for this purpose.

Attention is called to the small grooves on the fins of the core at the point where the babbitt and the steel meet. Without the grooves the babbitt would not run closely into the corners, but the grooves permit it to form slight projections, which can be removed with a few strokes of a file, thus leaving neat joints. The grooves were about $\frac{1}{16}$ in. wide and $\frac{1}{32}$ in. deep.

The jig worked well and the excess of metal fell off after the bearing surfaces and the faces at *H* were machined. A simple fixture for holding the connecting rods while machining the babbitt was also made. It consisted mainly of a pin so located on the faceplate of a lathe that, when the wristpin end of the rod was placed over the pin, the crank end was held in the proper position for turning.

Simple Emollient for Burns

BY HENRY R. BOWMAN

In looking through the valuable booklet, "300 Practical Shop Kinks," in the section on heat-treating, I noticed several first-aid treatments for burns.

A simple and effective pain-killer and blister preventer is the scraped pulp of a potato of the Hibernian, or white, variety applied to the affected part.

An old boss blacksmith I once knew used to carry a "spud" around in his south-west pocket in case of emergency, along with a rabbit's foot and a cut of Navy Plug.



Designing a Wrench for Minimum Angular Movement

By Walter H. Wakefield

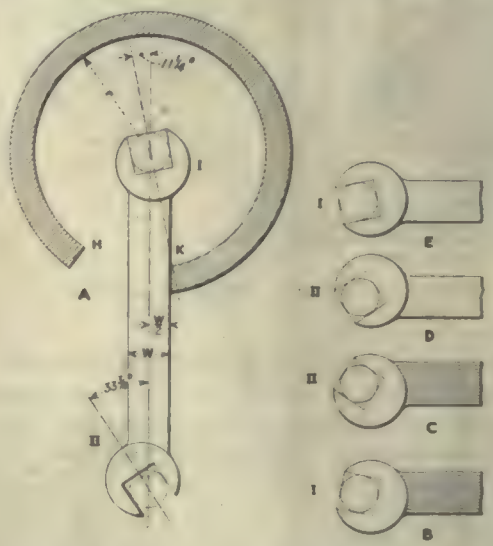
Occasionally a bolt is located in such a position that it can scarcely be turned with the ordinary S-wrenches. In such a case the writer was recently called upon to design a wrench which could be used in the smallest space possible, this condition requiring the least possible angular movement of the wrench as it was manipulated through different positions. It was permissible to have both jaws the same size and of course the wrench could be turned over.

One condition to be reckoned with was the relation between the center line of the handle and the centers of the jaws. Care was taken to have the center line of the handle pass through the centers of the jaws, as shown at *A* in the illustration. Were this not the case the wrench in successive turned positions would really occupy a space greater than its actual width.

Another consideration was that of the angles at which the jaws should be placed with respect to the center line. Reference to the figure will indicate how this was done. The bolt is shown located within a casing having a wrench-receiving opening the sides of which (*H* and *K*) limit the movement of the wrench. Since both jaws I and II fit the head of the bolt and the wrench can be turned over it follows that the jaws can be presented to the bolt in four angular positions. But during these four movements the bolt must be turned through 90 deg., therefore the motion for each position must be through an angle of 22½ deg.

When the wrench is turned over the angular displacement of the jaws in its successive positions is double the angle between the jaw and the center line of the wrench. As the angular position of the jaw is to be advanced 22½ deg. when turned over one jaw (I) is arranged at an angle of 11¼ deg. to the center line. Since two turns of the bolt are made with jaw I before jaw II is brought into play the bolt is 45 deg. from starting position and jaw II should be at an angle of 45 deg. ± 11¼ deg. to the center line. Reference to the diagram will show an advantage to be gained in making this angle 33¾ deg. The shaded and plain handles indicate the two sides of the wrench. Starting as at *A*, the wrench is moved to the left through 22½ deg., when it is turned over and jaw I presented to the bolt as at *B* and moved through another angle of 22½ degrees. Then, without turning the wrench over (because the angle is 33¾ deg.), jaw II is presented as at *C* and the bolt turned through a third angle of 22½ degrees. In the next position, *D*, the wrench is turned over, and after being moved through a fourth angle of 22½ deg., leaves the bolt in the position shown at *E*, which is the same as its position at *A*.

Passing to the general case of a bolt head or nut of *n* sides it will be seen that each sequence of four movements must turn the bolt through an angle of $\frac{360}{n}$. This angle must be divided by four to determine the angle through which the wrench must turn for each of these four positions, that is, $\frac{360}{4n}$. Since one-half of this is to lie on each side of the center line, the offset



THE WRENCH IN ITS SEVERAL POSITIONS

of one jaw will be $\frac{360}{2 \times 4n} = \frac{45}{n}$. The second jaw is offset to the center line an angle equal to one-half the total movement for each sequence $\frac{360}{2n}$ plus or minus the offset of the first jaw, that is $\frac{360}{2n} \pm \frac{45}{n}$. In the case of a hexagonal bolt head or nut, and following the general form shown in Fig. 1, the offsets would be 7½ deg. and 22½ deg.

It is to be noted that as the number of sides of the bolt head or nut increases the angular movement of the wrench for each setting, and hence the limits between which the wrench works, becomes smaller. The angular

movement corresponding to each position of the wrench is $\frac{360°}{4n} = \frac{90°}{n}$.

Letting W represent the width of the handle, H and K the limits of movement and r the distance from the bolt to the limits, the distance between limits will be $\frac{2\pi r}{4n} + W = \frac{\pi r}{2n} + W$.

A Master Wheel and Tire Gage for Railway Shops

By J. H. Vincent

The master wheel and tire gage, illustrated in Fig. 1, was shown recently at the Chicago convention of the American Railway Tool Foremen's Association by William Casson, tool foreman of the Louisville shops of the Louisville & Nashville Ry. This working model is but a very short section of the standard size gage as the overall length of the complete gage is 6 ft. 6¼ in.

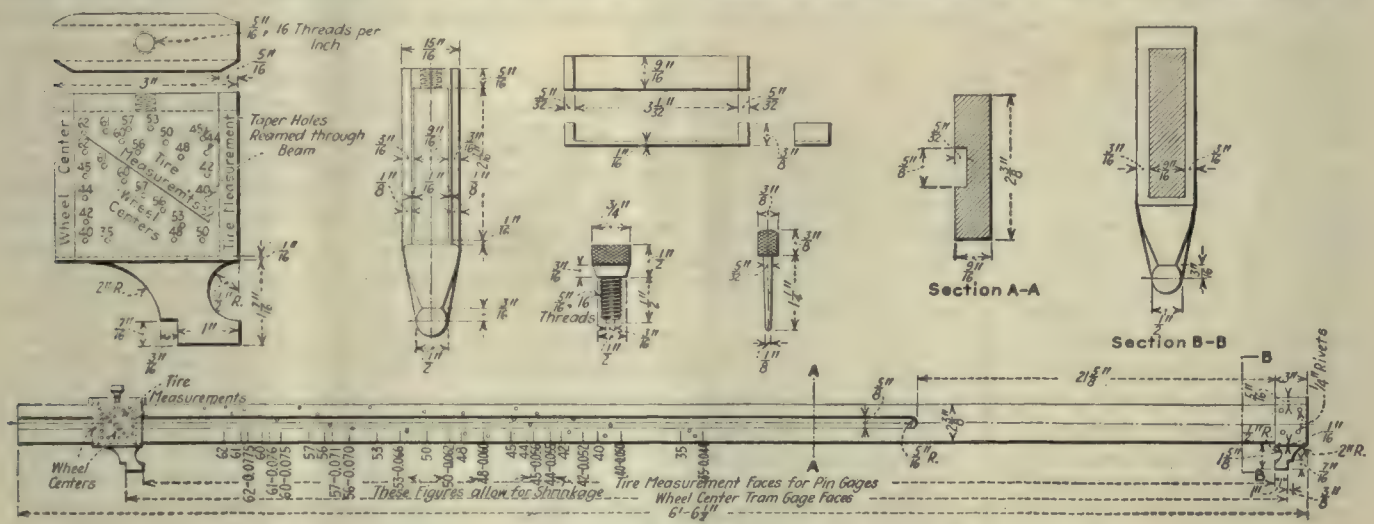


FIG. 2. CONSTRUCTION DETAILS FOR WHEEL AND TIRE MASTER GAGE

This gage is used for checking the calipers and gages used when turning wheels and tires, and does away with the necessity of employing a long steel scale. The complete details of the gage are shown in Fig. 2. It will be noted that dimensions and figures are given on this gage to allow for shrinkage of tires for securing wheel fits and this, in fact, is one of the great advantages attending the use of this master gage, since it obviates the necessity of any special figuring or direction for standardizing the shrinkage allowances.

The removable jaw of the gage slides the full length of the arm and is positioned by means of a taper pin which fits in holes drilled to correspond both in this part and the arm. After once being set in position it can be clamped up by the thumbnut located on its outer edge.

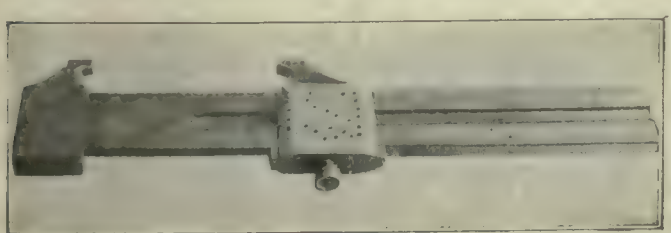


FIG. 1. MODEL OF WHEEL AND TIRE MASTER GAGE FOR RAILWAY SHOPS

Improvised Extension for Small Drills

By David Miller

Referring to the article under the above heading by J. C. Nicholson, on page 930, Vol. 53, of the *American Machinist*, I have used the scheme outlined by him of joining a drill to a piece of drill-rod by means of a closely wound spring, and have found that upon the application of any considerable pressure there is a tendency for the spring to break off at the joint.

If, instead of leaving the abutting ends of drill and rod square, as Mr. Nicholson advises, they are each beveled to an angle of, say, 45 deg., the joint will transmit more power.

A Veteran of Three Wars

By C. E. Kinne

I read with much interest an article under the above title on page 1032, vol. 53, of the *American Machinist*, telling of the discovery of an old lathe at Yonkers, N. Y.

In the shop where I am now employed (the Bagley & Sewall Co., Watertown, N. Y.) there is a 60-in. lathe with the name "William B. Bement & Sons, Industrial Works, Philadelphia, Pa.," cast on the tailstock. The shape and design of the tailstock, compound rest and tool-support, and the triple gears of the headstock, are almost identical with those shown in the illustration of this veteran lathe.

My guess is that the lathe you show was built by Bement & Sons.

Finding Decimal Cube Roots on the Slide Rule

By Henry R. Bowman

The slide-rule text books give rules for the proper scale on which to set a whole number of which the cube root is to be extracted, but they give no rules for setting a decimal number.

I derived the following rule which, as it has been of use to me, may benefit someone else.

$\sqrt[3]{0.1}$ — Right-hand 'K' scale
$\sqrt[3]{0.01}$ — Middle " "
$\sqrt[3]{0.001}$ — Left-hand " "

IN THIS ISSUE

WE PREFACE our paragraphs concerning the contents of this number with a few words on the 1921 dress of the *American Machinist*. The checking column of our contents page has been eliminated to give more space to the titles and short synopses. Bigger type is used for both, making the page more distinctive and the announcements of the editorial contents easier to read. For the heads a bold-face type replaces the light-face hitherto used. So-called newspaper sub-heads replace the italic synopses that have been a part of our general articles. We believe that these changes improve the appearance of the pages and permit an easier and quicker comprehension of what is to be found in the articles. The "What to Read" page has been given the new name, "In This Issue," and its scope has been enlarged to include a forecast of features for coming issues. "Sparks from the World's Industrial Forge" becomes "News Section" with the explanatory sub-heads Industry, Finance and Commerce, and the new head-piece is of one-page instead of two-page width. A 1921 feature of our news section is to be the financial page, the first appearing this week, page 40d.

The first article of the promised series on "Metal Cutting Tools," by A. L. DeLeeuw, opens this issue. It is introductory, yet covers a lot of ground, beginning with the simple tools familiar to all of us—pocket knife, hatchet and razor—showing the analogy between their cutting action and that of metal cutting tools, explaining chip formation, setting forth the necessary properties of cutting tools and specifying what must be done to secure the greatest amount of work before the cutting tool breaks down.

Beginning on page 8, an English correspondent, R. H. Worthy, in "Trigonometry for Toolmakers" supplies simple formulas applicable to the toolmaker's daily work. He shows how to solve right and oblique triangles and how to lay out angles without a protractor; gives formulas for use in connection with the segment of a circle and a circle inscribed in a triangle, and explains the principles of wire measurement.

Another of our short stories on boxing for export appears on page 12. We want our readers to appreciate the importance of having a sturdy case around a machine going overseas and the necessity for careful and thorough slushing of bright parts.

The United Shoe Machinery Co., Beverly, Mass., has a co-operative system of apprentice training that is explained in the eighth installment of J. V. L. Morris' series on "Programs of Apprenticeship and Special Training." An arrangement of alternate weeks in shop and school forms the basis of this system.

L. D. Staplin in "The Application of Babbitt Metals," page 15, gives information on anchorage, shrinkage, alignment and grooving. He tells how to increase the density of removable bearings and of the effects of overheating. He says, "Many users of babbitt metal feel that it is only necessary to procure a good grade of metal and their bearing troubles will be over. This result does not always follow, as good metal carelessly applied, means eventual trouble in most cases."

In these days of much steel construction we are likely to assign our old friend "wood" to a somewhat inferior position. In many cases such procedure is justified, but it is not always so in freight car construction. Data are given by H. S. Sackett in his paper, "The Use of Wood in Freight-Car Construction," which indicate that the use of wood is still more economical than the use of steel even for open-top cars, but that the underframe and draft rigging must be made of steel, on account of long and heavy trains.

Equipment for japanning forms the subject for C. W. Starker's article on page 22. While all of us are accustomed to daily use of japanned articles, many do not know of the rather involved process necessary to produce good japanning and we are glad to afford this opportunity for enlightenment.

Fred Colvin, pages 27 and 29, tells about machining the Columbia rear axle housing and rear axles. Those who are following his automotive articles will be glad to add these two to their files. They are followed, page 30, by a short account by John Houssman concerning maintenance work on aviation engines.

We aren't going to say anything about W. R. Basset's article except that it is good, give you the title, "What to do About Inventories," and mention that it begins on page 40a.

Coming Features

We shall confine this initial announcement of coming features to three series that are to extend over a large part of our 1921 volumes, merely stating in passing that from the present outlook there are to be many meritorious one-part articles and that several of them are to appear in our next issue.

A. L. DeLeeuw's excellent series on "Metal Cutting Tools" will be run in alternate issues, the second installment to appear January 20. You are going to be much pleased with this comprehensive treatise on metal cutting tools.

Beginning with the January 27 number and continuing every other week, there is to be a series by Associate Editor Sheldon of the staff, on "Magnetic Chucks." There is much to be said of magnetic chucks and we think that Sheldon has said a great deal of it, and has said it well and thoroughly.

The other group is by Editor Colvin, under the title "The Foreman and His Job." It embodies suggestions for the foreman who wishes to go up the ladder and for firms that want better shop executives. The first story will appear January 20.

EDITORIALS

Need of Concentration of Product

THE UNPRECEDENTED DEMAND for nearly all machine products, has led us into a maze of uneconomical manufacture. One of the worst features of it is the multiplication of models of machines which has reached an extreme form in the automobile industry.

The great demand for passenger cars and trucks induced many new concerns to enter the field with new models to meet all possible demands of customers. Old concerns added new models to their lists in the endeavor to capture the trade of all classes of purchasers. Many makers now build several models, with 4, 6 and 8 cylinders and different wheelbases to suit all kinds of customers. Each model demands expensive production equipment.

The falling off in demand leaves these companies with a huge capital tied up in tools and fixtures for each model. The investment must be distributed over the output and when this is limited by division among several models, the fixed charges cannot be reduced to an economical figure. The concentration of tools, fixtures and effort on fewer models would make for greater efficiency and lower production costs. Instead of increasing the number of models of cars, the industry should reduce them as rapidly as possible. The example of the Ford business shows what can be done by concentration of effort.

In the days which are ahead of the automobile industry—and we are going to build millions of automobiles in the years to come—economical production will reach a point never before realized. Simplified designs and special machinery will cut costs in many ways. We shall have fewer models and consequently better cars for less money.

This all points to the re-equipment of automobile shops with more efficient machinery. It also means highly specialized machines in some cases. But in any event it means a market for many machine tools as soon as the necessary readjustment can be accomplished.

Deliver Us from All Extremists!

MODERATION in all things is a safe rule of conduct for men, for associations of men and for governments. In the last decade we have had plenty of proof of the soundness of this principle in a negative sort of way. The one big, outstanding recent example of the unwisdom of carrying a policy to extremes is the history of the militaristic policy of the late German empire.

Our own history shows case after case to prove the same contention. Not so very long ago the railroads ran wild in rate matters and roused the people to a pitch of indignation that resulted in the subjection of railroad rates to government control by the Interstate Commerce Commission. The railroad managers paid the penalty of pushing matters to extremes. But far from taking warning from the experience the railroads had just gone through, the Commission promptly swung to the other extreme and starved the transportation systems of the country to a point where their operation by the government became a war-time necessity. The transportation act of 1920 seems to aim at a middle ground and is therefore promising if not perfect.

The passage of the anti-trust acts represents another revolt of the American people against the carrying to extremes of the elimination of business competition. The dissolution of the coal and railroad combines is a result that has been brought strongly to our attention in the last few months.

Organized labor took advantage of the stress of war needs to force the closed shop on many of our industries. As a result we see the rapid spread of the open shop movement over the country.

But have other extremists taken warning from the reverses of their confreres? Most of them have not for we are facing the Sunday Blue Laws agitation of the Lord's Day Alliance, the compulsory metric propaganda of the organizations working for that national calamity, the anti-tobacco crusade, the red radicals and others too numerous to mention.

The worst of it is that any one of the extreme individuals or associations can do an immense amount of harm before public opinion is aroused to the point of action. And even then it may take some little time to squelch a movement that threatens our national safety.

The "let-George-do-it" attitude of the average American isn't going to save us here. Each man of us has to watch himself for symptoms of "extremitis" and at the same time be constantly on the alert to fight every extreme action on the part of others that comes to his notice. Vigilance is the price of security.

Maintaining Standards in the Big Machine-Tool Shops

IN THIS PERIOD OF READJUSTMENT it is gratifying to find many machine-tool building managers with progressive and forward-looking ideas.

Some of the stronger companies are rearranging their plants for progressive manufacturing, replacing the departmental system previously in use. Methods are being improved and everything is being done to lower production costs—except reducing wages. Men are considered the biggest asset and the organization is being maintained. Old and obsolete machines are being sold, for scrap if necessary. When it seems best these will be replaced by the best machines available for the particular kind of work.

Overhead costs in the shape of non-productive labor and unnecessarily complicated cost-keeping systems, are being cut. Records are being simplified. Materials are being studied both from the point of view of cost and of machining properties. In other words the manufacturers realize that direct labor is not over one-third the total cost of doing business and they are not trying to make all the saving in that direction. They are, however, planning on making labor more efficient, and fully expect to do so when quantity production is again possible.

SHOP EQUIPMENT NEWS

SHOP EQUIPMENT NEWS
A weekly review of modern designs and equipment

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

CONDENSED CLIPPING INDEX
A continuous record of modern designs and equipment

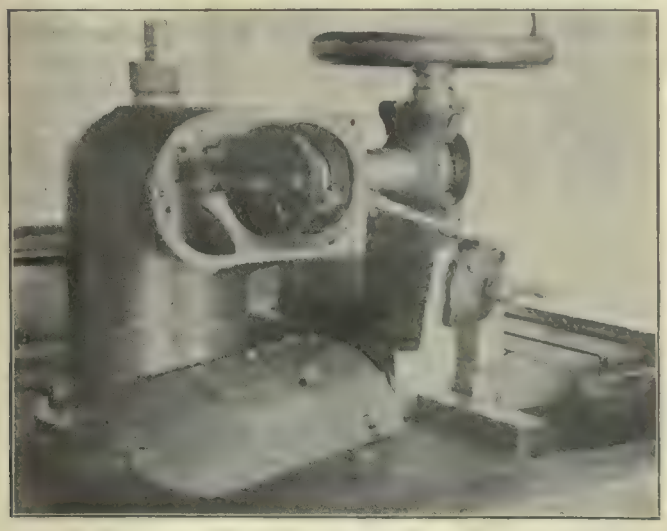
Change in Queen City Shaper

The Queen City Machine Tool Co., Cincinnati, Ohio, has recently made a change in the feed mechanism of its shaper. The illustration shows a view from above the mechanism, the covers being removed so as to show the working parts.

The feeding device consists of two units, the one on the bull-wheel shaft regulating the amount of feed, and the parts on the rail screw the direction in which the table travels. A face cam is mounted on the shaft of the bull wheel, the roller which bears on the cam actuating a pawl engaging a toothed wheel, so that the amount of the feed can be varied. The amount of feed is controlled by the adjusting handle, a stop acting to limit the swing of the arm carrying the roller. Sixteen different rates of feed are provided. When the feed lever is adjusted for zero feed, no running parts are in contact, so that no wear occurs.

The ratchet wheel drives the feed shaft through a friction clutch, incorporated for the sake of safety, so that nothing will be broken in case that the table is run to the end of the travel. The housing carrying the feed mechanism can swing about the shaft carrying the face cam, so as to allow of changing the position of the rail of the shaper. The length of the feed shaft connecting the mechanism with the rail screw is variable for the same reason, it being made of two splined telescoping parts.

The lever on the reverse box is used to start, stop or change the direction of the feed, toothed clutches being used. The feed of the table takes place on the back stroke of the ram. The moving parts are inclosed and run in oil.



PLAN VIEW OF FEED MECHANISM OF QUEEN CITY SHAPER

Scully-Jones Pneumatic Rod Cutting Machine

The illustration shows a pneumatic rod-cutting machine recently placed on the market by Scully-Jones & Co., Chicago, Ill. The machine is intended for use wherever metal rods are to be cut, as in blacksmith shops, bolt factories, and foundry core rooms. It is operated by compressed air, a minimum pressure of 60 lb. per square inch being required. Steam can be used to operate the machine, no change in the mechanism being required.



SCULLY-JONES PNEUMATIC ROD CUTTING MACHINE

The machine is made in two sizes, one to cut rods up to $\frac{3}{4}$ in. in diameter and the other for rods up to $\frac{5}{8}$ in. in diameter.

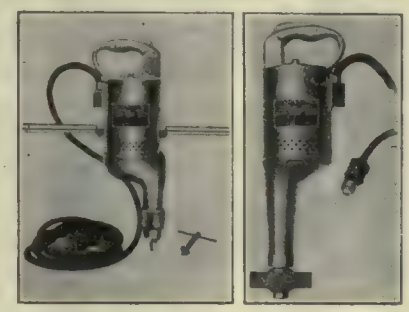
The operator of the machine causes it to actuate by pressing a lever with his knee, thus leaving his hands free. There are no other moving parts that the operator can touch. The shearing cutters are circular, so that when the edges have become dull at one spot, they can be rotated, in this way ten sharp cutting edges are supplied by each cutter.

It is claimed that the air consumption is low, because the travel of the piston in the small machine is only $\frac{1}{2}$ in., while it is $\frac{7}{8}$ in. in the larger machine. The machine may be installed on a permanent bench or on a portable bench on wheels, so that it may be taken to the work.

Wodack Portable Electric Drills and Grinders

The Wodack Electric Tool Corporation, 23 S. Jefferson St., Chicago, Ill., has placed on the market the portable electric drill shown at the left of the illustration. The drill is made in six sizes, the maximum capacities being $\frac{3}{16}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, and $\frac{3}{4}$ in., the $\frac{5}{8}$-in. tool being made in two speeds. The different sizes vary in length from 10 to 17½ in., and in weight from 6 to 16 lb.

The motor is series wound, fan-cooled, and of the universal type, operating on either alternating or direct current. The make-and-break switch is located in the handle, being closed by means of the pressure of the operator's hand. The circuit is automatically broken when the pressure is released, thus stopping the drill as soon as the hole is completed. The case is aluminum. The gears are of chrome-nickel steel and run in an oil-tight compartment. The shafts are mounted in self-oiling S. K. F. ball bearings.



WODACK PORTABLE ELECTRIC DRILL AND GRINDER

A portable grinder, shown at the right, has also been placed on the market, the general features, such as the motor and the control, being the same as used on the drill. The grinder is made in three sizes, to carry wheels 3 x ½ in., 4 x 1 in. or 8 x 1 in. respectively. It is especially intended for smoothing castings, buffing and polishing. The tool, using a 4-in. wheel, runs at 5,000 r.p.m and weighs 13 pounds.

Brownhoist No. 2 Locomotive Crane

The locomotive crane shown in the accompanying illustration has recently been added to the line of the Brown Hoisting Machinery Co., Cleveland, O., as Brownhoist No. 2. In order to meet different working conditions, the crane is made to operate either by steam, by electricity, or by internal combustion motor, and it can be mounted either on a railroad truck, traction wheels, or a creeper truck. It is adapted to use either a grab-bucket, bottom-block, or bottom-dump tub; and it is said that the changes from one to the other can be made in a few minutes. The crane is self propelling and, when mounted on railroad trucks, can be used for switching cars. It is built to handle a one-yard bucket, or hook-loads up to five tons.



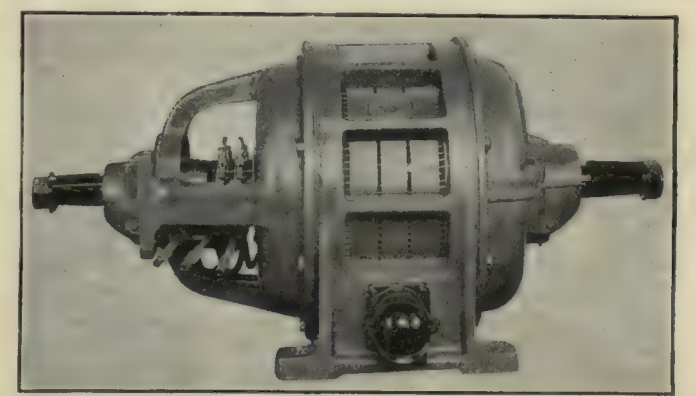
BROWNHOIST NO. 2 LOCOMOTIVE CRANE

General Electric M. T. C. Induction Motor

The General Electric Co., Schenectady, N. Y., has placed on the market a type of alternating current motor for operation on cranes and hoists. It is known as the M. T. C. motor, being intended to take the place of the former M. T. C. and I. T. C. types.

It is, as the illustration shows, generally smaller in diameter and greater in length than motors of the same horsepower of the former designs, thus reducing the flywheel effect of the armature. It is said to have larger shafts and bearings. As to the electrical characteristics, at rated frequency and voltage, it is stated that the maximum stationary torque is twice the running torque. All the motors of 40 hp. and less are rated on a basis of a temperature rise of 90 deg. F. (50 deg. C.) in 30 minutes, and those of 50 hp. and larger of the same rise in 60 minutes.

A resistor has been developed for work with the motor that leaves enough resistance in the rotor circuit,



GENERAL ELECTRIC M. T. C. INDUCTION MOTOR

when the controller is on full, to cause the motor to run at approximately 89 per cent of full-load rated speed when delivering full-load torque. It is stated that the use of the resistor reduces the maximum current demand and protects the motor from abuse, either on the part of the operator or from abnormal working conditions.

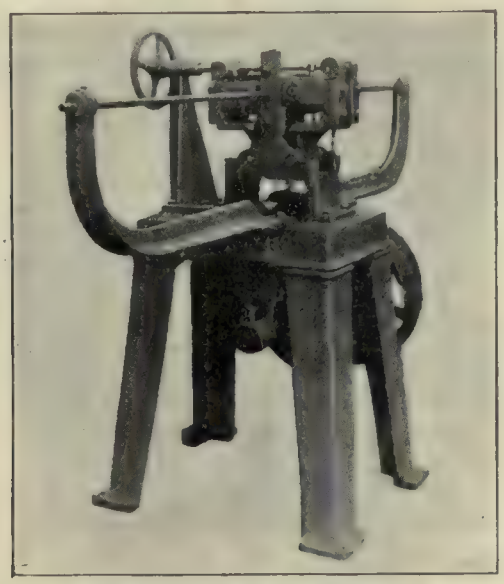
Kane & Roach No. 00 Rotary Straightening Machine

Kane & Roach, Niagara and Shonnard Sts., Syracuse, N. Y., has recently added to its line of straightening machines, the No. 00 rotary straightening machine, intended for handling round stock, either as tubes or as solid bars, in sizes from $\frac{3}{32}$ to $\frac{1}{16}$ in. in diameter. The stock is put into the machine through a tube, to be seen in the foreground in the illustration, and it then passes through the rolls in the center of the machine.

There are two hardened steel rolls, one convex and the

other concave along the periphery, so placed at angles to each other that in turning they revolve the material and also feed it through automatically. It is stated that the stock travels through at a rate of 50 to 75 ft. per minute, and that nearly all material is trued at one pass. A second pass can be used to take out any remaining curvature, if necessary. The handwheel at the side of the machine can be used to adjust the position of the rolls for the diameter of the work.

The machine will straighten stock anywhere from 8 to 10 in. in length up to 25 or 30 ft. long, if necessary,



KANE & ROACH NO. 00 ROTARY STRAIGHTENING MACHINE

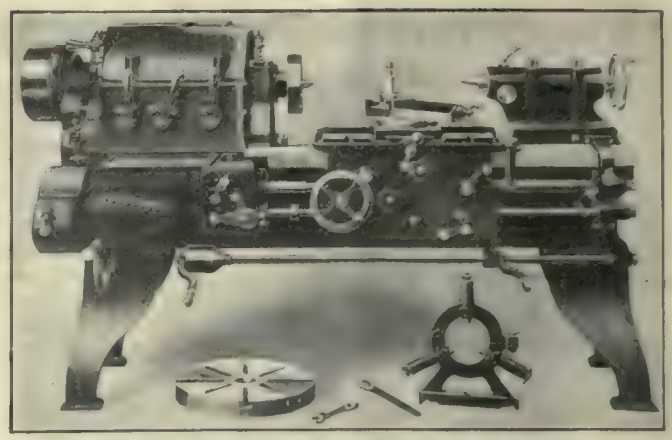
It is said that the machine is simple both in its operation and in its adjustment. It requires a floor space of 24 x 60 in., including the arms that hold the tubing through which the stock to be straightened is fed

Lehmann Geared-Head Engine Lathe

The Lehmann Machine Co., St. Louis, Mo., has added to its line the geared-head engine lathe shown in the illustration. The lathe is made in five sizes, the swings being 14, 16, 18, 22 and 24 in., respectively. It is stated that by using a moderate tooth speed for the gears the machine runs quietly at all times. There are ten heat-treated steel gears in the headstock, arranged to give sixteen spindle speeds in geometrical progression. It is claimed that it is impossible to engage different gear ratios at the same time.

All shafts in the headstock are high-carbon steel and run on ball bearings. Shafts are splined for all sliding members. The shifting parts are operated by rings running in grooves. The spindle is alloy-steel, with hardened bearings that run in bronze boxes. The spindle nose has a bearing surface in front and another behind the threads, both providing bearings for face or chuck plates. The back-gear clutch is secured to the spindle by four splines. The gear ratio is large, so as to permit the use of a high-speed driving shaft. The head forms an oil-tight case that encloses all running parts.

The friction clutches to give forward or reverse motion or to actuate the brake can be operated by levers both on the headstock end of the bed, and on the apron. The clutches run in an oil-bath, the exterior cone being hardened steel and the interior cone cast-iron. The lathes can be furnished in different lengths, and can be



LEHMANN GEARED-HEAD ENGINE LATHE

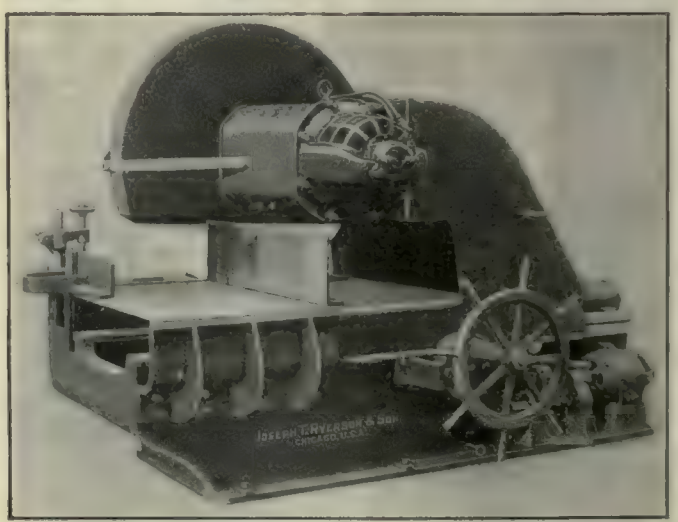
Specifications: Sizes, 14, 16, 18, 22 and 24 in. Maximum distance between centers with 9-foot bed: 16- and 18-in. lathes, 5 ft.; 22- and 24-in., 4 ft. Travel of tailstock spindle, 7½ to 12½ in. Maximum gear ratio: 16- and 18-in. lathes, 57.1:1; 22- and 24-in., 70.6:1. No. of spindle speeds, 16. Range of spindle speeds: 16- and 18-in. lathes, 10.5 to 412 r.p.m.; 22-in., 8.5 to 330 r.p.m.; 24-in., 8 to 310 r.p.m. Feed, 16- and 18-in. lathes: number, 56; range, 2½ to 280 per in. Feed, 22- and 24-in. lathes: number, 63; range 1⅞ to 180 per in. Motor: speed, 1,800 r.p.m.; hp., 3 to 10. Weight: net, 3,450 lb. for 16-in. lathe; 8,200 lb. for 24-in.; boxed for export, 4,120 lb. for 16-in.; 9,000 lb. for 24 in.

arranged for either constant-speed or variable-speed motor drive. Taper attachments and follow rests can be furnished, although steady rests, thread-cutting dials and face plates are standard equipment.

Ryerson High-Speed Friction Saw

A line of friction saws especially designed for the cutting of structural steel is made by Jos. T. Ryerson & Son, Chicago, Ill., being particularly adapted to shops where a large volume of cutting is done. The machine has a heavy cast-iron base of box section, on which the carriage bearing the driving motor is mounted on rollers. The rollers are provided with roller bearings and eccentric pins, so as to provide adjustment for wear.

A large hood covers the saw, one side of it being mounted on hinges to permit of inspection and removal. The saw is made of soft steel, hollow ground on its sides and nicked on the edge to increase friction. It is cooled



RYERSON HIGH-SPEED FRICTION SAW

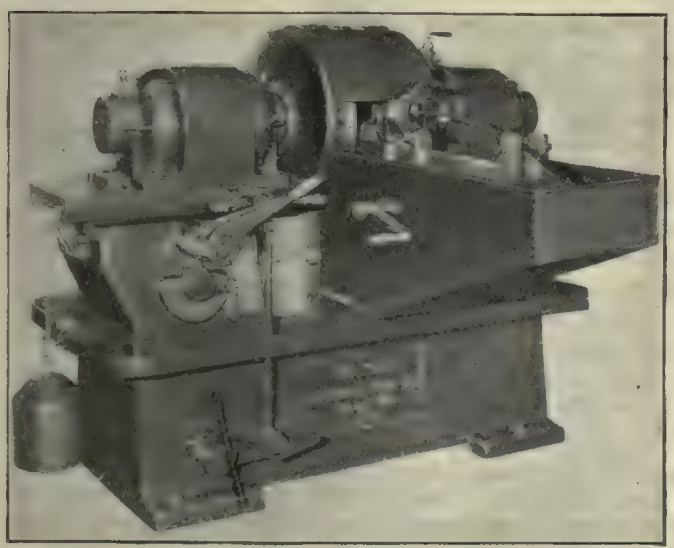
Specifications: Built in four sizes, Nos. 1, 2, 3 and 4. Capacity to cut I-Beams: No. 1, 12 in., 40 lb.; No. 2, 18 in., 65 lb.; No. 3, 24 in., 80 lb.; No. 4, 24 in., 100 lb. Diameter of saw: Nos. 1 and 2, 46 in.; No. 3, 52 in.; No. 4, 56 in. Size of motor, 25 to 120 hp. Height, 6 ft. 3 in. to 7 ft. 5 in. Floor space, 7 ft. 2 in. x 5 ft. 2 in. to 12 ft. 8 in. x 6 ft. 6 in. Weight with power feed; net, 5,740 to 12,650 lb.; boxed for export, 7,300 to 15,450 lb. Export box, 294 to 625 cu.ft.

by jets of water when in operation. The motor is entirely inclosed on the saw end, and the outer end is semi-inclosed to permit ventilation.

The carriage can be moved either by hand or by power. Power feeding is accomplished hydraulically by a cylinder and piston located at the right of the machine. A one-horsepower electric motor drives a gear pump to provide the pressure. A four-way valve gives the operator control of the carriage. In order not to overload the saw motor by too heavy a feed, a relief valve is incorporated in the feed line. The valve operates at a pressure corresponding to the maximum load of the saw motor. The machine can be furnished with a driving motor suited to any current or voltage. It is made in four sizes, Nos. 1 and 2 not being ordinarily equipped with the hydraulic feed.

Badger Disk-Grinding Machine No. 220 for Leaf-Spring Eyes

The double-spindle, disk-grinding machine shown in the illustration has recently been placed on the market by the Badger Tool Co., Beloit, Wis. It is intended for



BADGER DISK-GRINDING MACHINE NO. 220 EQUIPPED FOR GRINDING EYES OF LEAF SPRINGS

the grinding of parallel surfaces, being shown equipped for grinding the eyes of leaf springs.

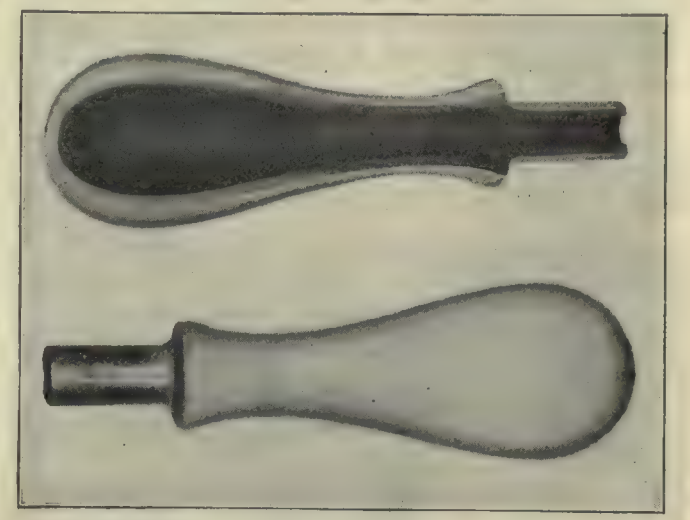
The machine can be furnished with belt drive, but is here shown completely motor driven, each spindle being equipped with a built-in, fully inclosed, 5-hp. motor. The motors slide on ways and drive 16-in. cylinder wheels held in chucks. A ½-hp. motor drives the coolant pump in the rear of the machine. The weight of the machine equipped for spring grinding is 3,800 lb.

When grinding the eyes of springs to length, the attachment shown is used. It consists of a support carrying a sliding carriage to which motion is imparted by means of a rack and a pinion driven by a crank. The eye of the spring rests in a V-block, while adjustable lugs locate the spring and a quick-acting clamp secures it in position.

The two grinding wheels are brought up to stops, and the spring passed back and forth between them. By means of hoods and drip pans the coolant is retained and collected, so that it can be returned to the tank in the rear of the machine.

Rockwood Hollow Pressed Steel Machine Handle

The Rockwood Sprinkler Co., 34 Harlow St., Worcester, Mass., has placed on the market the hollow handle shown in the illustration. The handle is of pressed steel, made by a special process and combines lightness of weight with ample strength to resist any

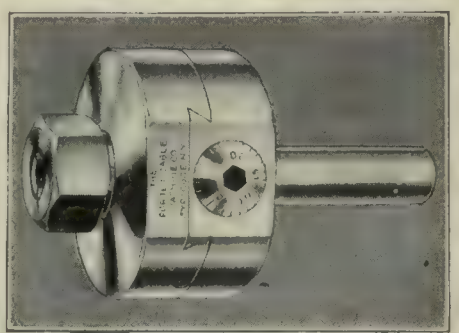


ROCKWOOD HOLLOW PRESSED STEEL MACHINE HANDLE

strain to which such a part might legitimately claimed to be subjected. The handles are made in ten sizes and are especially suitable for the operating levers and handwheels of machine tools and similar machinery.

Porter-Cable "Micro-Adjustable" Boring Head

The illustration shows a boring head recently placed on the market by the Porter-Cable Machine Co., Syracuse, N. Y. The body of the head is provided with a ½-in. shank. To it is gibbed the cross-slide, controlled by an adjusting screw, the head of which is graduated to read in thousandths of an inch. The micro-adjusting screw is at all times entirely enclosed and protected from chips and dirt. It is stated that, because of the ample length of the bearings and the construction of the nut, it is impossible for the screw to bend or bind.



PORTER-CABLE "MICRO-ADJUSTABLE" BORING HEAD

The boring tools are held in a ½-in. draw-in chuck on the cross-slide, thus providing a simple means of changing them. On account of the adjustability it is possible to utilize tools having long lips.

DuBrul Elected General Manager of the National Machine Tool Builders' Association

Ernest F. DuBrul has just been elected general manager of the National Machine Tool Builders' Association, and for the present the headquarters of the Association will be at 817-818 Provident Bank Building, Cincinnati, Ohio.

He started active work in connection with his new office on Jan. 1, 1921.

Mr. DuBrul was born at Cincinnati, Ohio, in 1873, and received his college education at the Notre Dame University, graduating later in Economics at Johns Hopkins University. His business experience was as



ERNEST F. DuBRUL

secretary, vice-president and later president of the Miller, DuBrul & Peters Manufacturing Co., makers of cigarette machinery; also president of the Pyro Clay Products Co., manufacturers of firebrick.

In civic and association work Mr. DuBrul was very active, having served on the Board of the Ohio Mechanics Institute, University of Cincinnati, and the Cincinnati Business Men's Club. He had active service on many committees of the Cincinnati Chamber of Commerce, National Association of Manufacturers and the Refractories Manufacturers' Association. For quite a number of years he was also the commissioner of the National Metal Trades Association.

During the war he was engaged in all of the Liberty Loan and Red Cross campaigns, having also supervision of the southern Ohio district for the training service of the Department of Labor.

Mr. DuBrul has traveled extensively throughout quite a portion of the world, and is a student of all the questions which relate to the development of modern business.

He is an associate member of the American Society of Mechanical Engineers.

British Scientific Societies' Committee Reports Against Compulsory Metrics

The report of the metric committee appointed by the conjoint board of [British] scientific societies to consider the advisability of the compulsory adoption of the metric system in Great Britain was recently made. The co-operating societies are forty-nine in number and include every conceivable interest in science, engineering and manufacturing.

The report is said to be the most comprehensive that has been made. It is comprised in a pamphlet of seventy pages, from which we can give but a few extracts. These, however, we will preface with a quotation from a French correspondent of the committee—M. Lallemand—"than whom," in the words of the committee, "there is no more ardent defender of the metric system." M. Lallemand says: "This is a very delicate matter and one which requires a very long transition period. For us, after a century, this period is not yet closed."

The following comes after the official admission of the French minister of commerce, industry and labor: "I do not consider it worth while to enumerate here the industries and professions which have continued to employ the proscribed standards, but they are still numerous."

These two quotations are an admission of the failure of the metric system to supplant old units in France; they show that country to be still confronted with the confusion of a dual system, and they demonstrate the ignorance of those who believe the change to be easy and represent it as complete in France.

Below are extracts from the report of the committee:

These are instances of recognition by the most ardent decimalists that a decimal division of units is not universally acceptable.

Nothing can get over the immense disadvantage that 10 has only the factors 5 and 2; whereas 12 has 6, 4, 3 and 2.

And, generally speaking, since a very large number of gradations is not usually required, a decimal subdivision of the habitual unit is not often wanted.

For such small trade a binary subdivision of units of measure, as with the avoirdupois pound, and a duodecimal division of the small coinage, as with the shilling and penny, gives the greater flexibility over the very limited range of common operations.

We may conclude that the compulsory adoption of the metric system in Great Britain would not be likely to have the beneficial influence on elementary education that its advocates have claimed for it.

There is no such confusion in British weights and measures.

This is particularly necessary in view of the fact that a country is often labeled as metric on rather slight grounds. Of a state in Central America a British consul reported that the introduction of the metric system created no public difficulty because no one took the slightest notice of it!

Your committee has not been able to obtain any evidence that a change to the metric system in textile manufactures would be of advantage in the process of manufacture.

It would appear that the continuing necessity for additions to and renewals of existing plants must make it impossible for many years to come to insist on the exclusive use of metric units by this [the engineering] trade even should this country generally adopt the metric system.

The deputy warden of the standards has estimated that the cost of new weights and measures for use in retail trade in this country would amount to about two million pounds.

The advocates of the change assert with confidence that there would be, eventually, an enormous saving of time owing to the simplicity of the metric system, but it is noteworthy that no figures seem to have been put forward to substantiate this claim.

Many are attracted by the superficial advantages of the metric system and do not realize the difficulties of a change, especially in retail trade, where a dual system would be impossible and where there does not seem to be any serious desire for a change.

It is by no means clear that any saving in working expenses effected by the adoption of the metric system would not be gained equally by the decimalization of work in British industries, such as has already been adopted in the highly specialized mechanical and textile industries.

To insist upon the replacement of all gas meters within a limited term of years in order that producers and consumers may have the purely theoretical advantage of dealing in cubic meters or liters, instead of in cubic feet or gallons, would, in the opinion of this committee, be absolutely wasteful.

The habit of quoting prices fractionally [in American stock exchanges] seems to be an example of the real advantages of binary as opposed to decimal subdivision.

It does not, moreover, appear to the committee that a good case has been made out for any marked superiority of the metric measures for the purpose of carrying on the ordinary trade of the country.

That the kilogram is not in itself a convenient unit is shown by the preponderating use of the half-kilogram under various names for the small shopping in metric countries. That a purely decimal subdivision of units is not convenient in small trade is equally shown by the habitual division of this half kilogram into halves.

Whatever changes in our system are made it is inevitable that the old sizes and fits should be perpetuated almost indefinitely; moreover, no device of specifying them in the awkward equivalents of new units, or of numbering them in sizes and gages, would be likely to prevent the survival of the old units in common use and parlance.

To require that a so-called three-quarter-inch garden-hose must not, after a certain date be so described, but that it must always be spoken of as a ninteen-millimeter hose seems to be contrary to the principles of sensible reform.

The difficulties which would be introduced into the professions of architecture and civil engineering by a sudden insistence on the metric system are probably greater than those in mechanical engineering.

Finally, to cap the climax, we have the following: *No minority report has been presented because there is no minority on the committee which desires to present a separate report.*

What to Do About Inventories

New Government Tax Ruling That Helps—Balancing the Inventory—What to Do With Valuable Workmen—Use Low Rate Machines to Reduce Overhead

By W. R. BASSET
Miller, Franklin, Basset & Co.

THE formula for business success, "Buy cheap and sell dear," is infallible and delightfully easy to follow when commodity prices are rising. It requires some elaboration and modification when, inadvertently, the manufacturer finds his store rooms full of materials which were bought dear, and which must be sold cheap. Under present conditions there is but one way, that I know, for a manufacturer to make money and that is to "Buy little and sell quick."

Unfortunately that advice is of no value to the man with a big inventory of raw materials, goods in process or finished parts. The best he can do is to take steps to lose as little as possible and to get some consolation from the fact that the size of this year's profits tax won't be a subject to cause him much worry.

That by the way, is a place where the factory owner who faces heavy losses on his inventory can see a gleam of light. For the Government has recently made a tax ruling which offers some relief.

The earlier tax regulations were that for tax purposes inventories should be taken at cost. Then in December, 1917, there was a decision permitting the manufacturer to choose one of two bases. One was to value his inventory at cost. The other basis was that dictated by conservative business practice, which is, cost or market, whichever is lower. Few tax payers it seems, made this change, partly because cost was, as a rule, the lower, and the advantage of the change was not obvious, and partly because the knowledge of the ruling did not get to the public generally in time to let them make the change, had they known of it.

The recent decision allows the tax payer, who has for tax purposes, been pricing his inventories at cost to apply for permission to change to the "cost or market, whichever is lower." The permission to change will be granted where the tax payer can show that the market at the close of 1918 and 1919 was above cost, and that prior to this year he had no real choice. But he must adhere consistently to the new practice in the future.

If, however, it appears that there was an opportunity to take a figure lower than cost because market was lower than cost at the close of 1918 or 1919, the change cannot be made because it will be assumed that there has been a real election to continue upon a cost basis.

This ruling offers many manufacturers the chance to write off the heavy loss on inventories which they have actually sustained. It does not, of course, make the losses exactly acceptable, but it eases matters somewhat not to have to pay taxes on a paper profit which is actually a money loss.

But the manufacturer will get more poignant ecstasy, I realize, if he can learn how to reduce the money loss on his inventory. Fortunately, there are several safeguards which have general application, one or more of which every manufacturer should be able to use with money saving effect. The first rule is, "Get your inventory in balance." That is a profitable rule to follow at all times, for it cuts down the working capital needed and even in normally stable markets, lessens the losses that often come from manufactured parts becoming obsolete. A perpetual inventory record which is carefully checked and which shows maximum and minimum quantities for all parts and materials is the first step toward getting in balance. Without such a record, balance is out of the question.

Inventories out of balance are, I believe, the commonest of management "soft spots." I find the trouble in nearly every plant. What good can it possibly do to have on hand enough of one kind of material to last

three months and only a two weeks' supply of another? If two weeks' supply is sufficient, then why tie up so much money? Of course, I realize that a while back deliveries of some items were hard to get and to be on the safe side, it was advisable to order ahead. No one would criticise that; what I object to is getting the habit and continuing such a dangerous practice in normal times. I even have a certain amount of indulgence for the man, who in a rising market, buys far ahead to make a profit. That is commonly accepted to be "good business judgment," although a brutal realist might call it gambling.

Profits Should Come From Manufacturing

I believe that the source of a manufacturer's profits should properly be from manufacturing—not from speculation. Certainly the unbalanced inventories which are now causing losses are the result of unwise buying for a rise.

But often the lack of balance comes from ignorance of what to buy and when. Balanced buying can only come when the shop is able to plan production based on an accurate estimate of what the sales force can sell. I have described the methods of planning production in a series of articles called "Modern Production Methods" which have appeared in the *American Machinist*.

Briefly, the shop should plan to turn out a predetermined number of machines a week. Knowing just what parts go into the assembly and how long it takes to process each part, it can specify to the purchasing agent the amounts of each kind of material which should be delivered each week. That will prevent over buying. To take care of emergencies, it is, of course, well to carry a stock of raw materials and purchased parts. Maximum and minimum quantities can be set for each, depending upon the reliability and promptness of the supplier, the state of transportation and seasonal needs.

Having set maximum and minimum quantities, do not assume that they are set for ever. They should be reviewed from time to time, for conditions affecting them change. Often it is possible to reduce previously set minimums materially. Such a system of inventory control does not take excessive clerical help to handle. The loss which has accrued in the past few months on a single overstocked item, would likely pay for the cost of installing and maintaining the system for years.

Most machine shops are taking a physical inventory now. Let the executives go over each item carefully and consider the amount on hand in the light of its relation to the amount of others. Let them consider the probable needs of the shop as determined by the sales department's estimate of sales. Let them, if they can, do no guessing as to the future of the market.

Then, on a manufacturing rather than on a speculative basis, let them set high and low limits for the amount to be carried. That will safeguard their future and prevent the danger of immediate over buying, with its consequent gambling risk and tying up of hard-to-get money.

But, of course, these are merely precautions against future over buying. They do not offer immediate relief for the present; and it is right now that losses are being taken. Unfortunately I know of no way to make a profit in a falling market on expensive materials now on hand. But careful judgment indicates a few ways in which the losses can be lessened.

The first thought of the man who is caught in a falling market with large stocks of raw materials, is to sell his raw materials and let some one else hold the bag. Unfortunately that is a procedure which is not open to all for it is only the more staple forms of raw materials such as pig iron and bar stock that can be readily disposed of in this fashion.

And it would be distinctly out of my field to make such a recommendation for it would presuppose that I was able surely to prophesy the future trend of iron and steel products. To sell raw materials in expectation of a decline in price is just as much gambling as to buy heavily in hope of a rise. If, however, a manufacturer has an unduly large inventory of staple raw materials and can find a buyer, it might be good business to reduce his inventories in order to improve his cash position.

As I have said, this drastic method of reducing inventory losses is not always possible. There remain other ways to use up the inventory with a minimum of loss, which tie in rather closely with other management problems.

Take for instance the matter of holding the key men of the organization on the pay roll, when orders for the finished product are non-existent and it seems necessary to shut up shop tight. Being reasonably sure that in a few months at the most, business will be normal, no one wants to have to start in with a brand new force. Many of your employees are of course, merely "hands" who can be replaced. But there are a few highly skilled mechanics, such for instance as gear cutters who would be hard to replace and whom you would like to hold.

The first thought of the executive is to use these high-grade men on repairs to machines and plants. It will pay to look over all belting and machines and see that everything is in tip top shape. Very likely there are rearrangements of machines which would speed up production and lessen the travel of goods in process. You did not care to make these changes when you were rushed with orders because of the interruption which they would have caused to production. Now is a good time to make them. I recently visited the plant of a manufacturer of automotive equipment and there saw several high priced gear men cheerfully doing the work of "hunkies" in moving machines. Incidentally, a surprising order had gone out from the head of the business to the foremen in charge of the repair and maintenance work, not to rush the work. Of course, the workmen were not told of this, but the foreman winked at soldiering and did not push the men, for it was better to have the work cost more than necessary than to have to lay off irreplaceable mechanics.

Good Business in Spare Parts

This same concern, although it has not a single order on its books for machines, is doing a considerable amount of manufacturing. The executives several months ago made a careful analysis of the orders for repair parts which had come in from purchasers of its product in the past two years. They decided, and it has proved rightly, that there would be more likelihood of selling customers repair parts than new machines. So they have kept a number of machines and men busy all through the slump, piling up these parts. And they are selling some every day, thus getting in a little real money. When the present slump is over they will probably not have to make any more repair parts for some time, which will be an advantage when they get back onto their regular production. For their plant is balanced, as to machine equipment, to make complete as-

semblies, and when running on regular output, orders for repair parts are bound to cause a great deal of disorganization and upset to the regular production. Furthermore, when urgent orders for repair parts must be sandwiched into the regular production they cost much more because expensive machine set-ups which might have stood for weeks must be broken down and special set-ups made to take care of a few repair parts.

When the machine shop has been put into good condition and enough repair parts put into stock to take care of several months' need, it may become necessary, in order to hold the nucleus of the organization, to make some finished machine parts to stock. Good judgment can be used in choosing which parts to make so that a minimum of loss may be sustained.

The first consideration is to remember that certain raw materials are more saleable in a pinch than others. Pig iron and bar stock, for example, can nearly always be sold in an emergency for some price. Special castings and forgings are, however, practically unsaleable except as parts of a finished product. Therefore, the wise manager will aim to conserve his stock of readily marketable raw materials, and if he must, work up those special castings and forgings which he has already on hand—not of course, buying more except under unusual conditions.

When the finished parts reach the stockroom they will represent money tied up as material cost, labor cost, and overhead expense. Now, as the whole purpose is to give some of his labor employment, it is apparent that we want to put into the finished stockroom just as much labor cost as possible, tied up to just as little as possible material cost and overhead. Therefore, those parts should be made which are intricate and require a large amount of machining in proportion to the amount of material used. By confining the work to small, highly priced parts, and avoiding the heavy parts such as machine beds and so on, we also cut down the cost of handling the work between operations and are able to lay off a large number of non-productive truckers.

Overhead on Parts

The next point to watch is the amount of overhead expense which we are running up on the parts. Therefore, it is advisable to choose parts which can be done on machines carrying low hourly rates. It may even be well to consider using a tool with a low rate even though a higher rate tool is better adapted to the work.

If these suggestions as to choosing parts of low material cost and high labor cost are followed and the work is done on machine tools with a low hourly rate for overhead, we may find that we have a cost story like this: 1,000 pieces—material cost $200—labor cost $1,500, overhead $1,500. Whereas if we had not chosen the parts carefully we might readily have had for the same labor activity: 1,000 pieces—material cost $1,000, labor cost $1,500, overhead $2,300.

It may be objected that by confining the effort to making a few selected parts we are getting the finished stock inventory badly out of balance. That may seem inconsistent with the emphasis I earlier laid upon need for balance. There I had principally in mind raw materials, although normally all stock should be kept in balance.

My only defense is that I do not believe that any rule governing any phase of management can safely be considered too sacred to break when conditions demand it. It remains true that the inventory which is consistently kept in balance in normal times is a safeguard against excessive loss from obsolescence and a falling market and enables the manufacturer to save considerable sums of money in interest and also in carrying charges.

Summing Up

Let us now briefly sum up the steps which the manufacturer can take to reduce his inventory losses at this time:

1. If he has been taking inventory at cost he can probably get permission from the Government to take cost or market whichever is lower.
2. Get raw material inventory in balance.
3. Set maximum limits for each item to prevent undue buying at this or any future time.
4. Buying should be governed by the needs of the shop.
5. If key men are to be held, put them first at repairing the shop and equipment.
6. If they must be used to manufacture, turn out repair parts.
7. Work up special raw materials like forgings rather than staples like bar stock.
8. Make parts in which the proportion of labor cost to material cost is high.
9. Keep overhead down by using machines having a low hourly rate.

High-Temperature Treatment of High-Speed Steel

"The Relation of the High-Temperature Treatment of High-Speed Steel to Secondary Hardening and Red Hardness," is the subject of Scientific Paper No. 395, recently published by the Bureau of Standards, Washington, D. C. It was written by Howard Scott, assistant physicist. The paper deals with the results of the study of microstructure, hardness, density, magnetic properties and thermal characteristics of a typical high-speed steel as affected by various heat treatments.

For hardening, the specimens were placed in an electrically heated alundum-tube furnace in which charcoal or illuminating gas was burned to prevent excessive oxidation. Light mineral oil was used as the quenching medium. When cracking occurred, the cracks generally followed the contour of the specimen, indicating that they were characteristic of the steel and not due to inclusions.

The following conclusions were drawn from the data derived in the experiment:

1. A high-speed steel susceptible to secondary hardening is partially austenitic when quenched from a temperature high enough to produce this phenomenon.
2. The microstructure of high-speed steels hardened and tempered above 200 deg. C. is similar to that of carbon steels, although the same nomenclature in certain cases is not permissible.
3. The behavior of the physical properties of high-speed steel on heat treatment is analogous to that of hyper-eutectoid carbon steel.
4. The following reasons are given for the use of the high heat treatment: (a) Increase of red hardness; (b) increase of initial hardness; and (c) reduction of brittleness.
5. High-speed steel should preferably be tempered for secondary hardness.



NEWS SECTION

Railroad Situation of 1920

Thomas DeWitt Cuyler, Chairman of the Association of Railway Executives, Reviews the Year's Railroad Situation

This is the record year of American railroad operation. Not only has a larger gross tonnage been moved than ever before, but new records have been established in the amount of transportation got out of each car. Even during the war year of 1918 the highest performance was 494 ton miles per car per day, while for August, 1920, the average was 557, and for September and October, 565.

In the nine full months since the Government turned back the railroads to their owners on March 1 the railroad companies under private operation have:

1. Increased the average movement per freight car per day 6.3 miles—from 22.3 to 28.6 miles.
2. Increased the average load per car 1.7 tons—from 28.3 to 30 tons.
3. Made substantial reduction in the number of unserviceable locomotives.
4. Reduced the accumulation of loaded but unmoved freight cars from 103,237 on March 1, to 21,991 on Dec. 3, of which only 6,386 were detained because of the inability of the railroads to move them.
5. Relocated approximately 180,000 box cars from the East to the West for the movement of farm produce.
6. Relocated approximately 180,000 open-top cars from the West to the East to keep up the production of coal.
7. Moved the third highest coal production in the history of the country.
8. Spent over $500,000,000 extra on improving the maintenance of tracks, bridges, cars and locomotives.
9. Contracted to spend about $250,000,000, largely out of earnings, for additions and betterments to promote the movement of cars.
10. Made arrangements to purchase approximately 50,000 new freight cars, 1,500 new locomotives, and 1,000 new passenger cars.
11. Begun the reconstruction of thousands of old cars.
12. Moved—with a deteriorated plant, under disturbed labor and business conditions—the largest volume of traffic ever known in a single year, with the highest efficiency yet achieved, and with a minimum addition to the value of the property on which the public has to pay a return through rates.

When the railroad companies resumed operation of their properties on March 1 an unusually large number of cars and locomotives were in bad order; the stress of war conditions had compelled their use in a most intensive manner, and the time was at hand when much of the rolling stock was due for thorough repairs; a very small proportion of the cars of any road were on its own lines; equipment was badly distributed with reference to the needs of traffic; there were no stocks of coal left over from the preceding year; a vast amount of grain remained on hand from 1919; and a volume of business was being offered which seemed beyond the ability of the railroads to move.

In addition, railroad labor was in an uneasy and dissatisfied frame of mind. The railroads inherited pending wage demands amounting to approximately $1,180,000,000, and while every effort was made by the railroads to bring the wage questions to a satisfactory conclusion through the U. S. Railroad Labor Board, outlaw strikes developed in April which produced effects wholly disproportionate to the number of men ceasing work.

Commissioner Aitchison's Comment

Interstate Commerce Commissioner Aitchison, who has been in direct charge of car service matters for the Interstate Commerce Commission, has said:

> The condition in the spring of 1920 was more menacing to the domestic welfare of the country than it was in the early winter of 1917 when Federal control was assumed. But the situation was met, squarely and courageously in a business-like way, without political interference or pressure of any character whatsoever, under the orderly processes of law, by privately operated railroads, directed along consistent lines to secure the unity of object and policy which was the end sought in placing the carriers under Federal control during the war.

The annual report of the Interstate Commerce Commission filed with Congress on Dec. 9 states:

> Comparing August, 1920, with August, 1919, the increased mileage had the effect of increasing the car supply 287,694 cars; the increased tonnage per car had the effect of increasing the car supply approximately 104,942 cars.

The railroad companies have manufactured increased transportation capacity, not out of new cars and locomotives, but out of increased efficiency. If the enlarged capacity provided by the companies during the past nine months had had to be produced by new cars and locomotives it would have required the expenditure of approximately $2,000,000,000, a sum of money which would have been permanently added to the property value of the railroads, on which the public would ultimately have to pay a return through rates.

In avoiding the expenditure of this $2,000,000,000 or any substantial portion of it; in increasing the efficient use of our present facilities; and in restoring the orderly flow of commodities, the railroads have made a great contribution toward bringing about more normal economic conditions, and have fully met their responsibilities in this period of national readjustment.

For this result, however, the railroad companies do not take sole credit. The help of shippers in promptly loading and unloading cars — using Sundays and holidays as well as weekdays—and the day-and-night, rain-or-shine work of hundreds of thousands of railroad employees in placing and removing those cars and in keeping them moving when once loaded, are gratefully appreciated.

It is the earnest hope of the railroad companies that this will be a national object lesson in the value of co-operation and will lead shippers, railroad employees, railroad executives and the general public to pull together for an even better showing in 1921.

Higher Rates Not Expected

The statement is being made in various quarters that the railroads will shortly seek a further increase in rates. I know of no movement on the part of the railroads for a general increase in rates, nor do I expect any. It is true that the railroad companies are not yet receiving from the increased rates anything like the 6 per cent return needed. But the railway executives realize that they are trustees of a great public interest in the reduction of railroad operating expenses to the lowest possible figure, and every effort will be made during the coming year to accomplish this by further economies and efficiency.

Private ownership and operation of railroads as a measure of sound public policy rests largely upon its superior efficiency and economy. In my judgment the American railroad companies during the present year have fully justified, and during the coming year will make every effort to continue to justify, the support and confidence which public opinion in gratifying measure has already accorded them.

Business Conditions as the Big Banks See Them

National Bank of Commerce in New York Sees Change for Better in Business Situation

The controlling and outstanding factor today is the relatively small movement of raw materials and manufactured goods even at reduced prices. This is because stocks of goods in the hands of retailers are sufficient to meet the needs of a somewhat lessened demand of the consuming public. Consumers are restricting their buying in part because of some curtailment of their purchasing power, but even more because of a willingness to wait until retail prices reflect the lower levels of primary prices.

Improvement of business activity awaits adjustment of retail prices to a level satisfactory to the public. It is clear that farmers, for example, who consitute the largest single class of consumers and who have already experienced a substantial reduction in the prices of their products, will not renew their buying on anything other than a hand-to-mouth scale until the price of what they buy bears a closer relation to the price of what they have to sell. This necessary readjustment of prices to consumers is now under way and will be expected to make more rapid progress in the future. Its progress will be hastened by the coming into the market of goods which are already being produced on lower cost levels for labor and material.

Sentiment respecting forward conditions, which until lately had been almost uniformly depressed, is now noticeably improving in many directions. This better feeling does not go to the point of optimism, but there is evident a degree of confidence which was previously lacking, in the ability of commerce and industry to meet the future successfully and to conduct business with reasonable profit.

What is now required is courage and respect for fundamental economic principles. Artifical palliatives which are being urged with a view to obviating the difficulties of the adjustment—particularly proposals involving further inflation and cheapening of credit—must be avoided. Such measures, if adopted, could only result in the impairment of the strength of the credit structure and in prolonging and increasing the difficulties of an adjustment which world-wide conditions have made inevitable.

Money Rates

The peak of commercial borrowing may be said definitely to have passed, and from now on there should be a gradual and moderate reduction in the volume of bank loans. The pressure for funds is already less general. The relaxation is, however, spotty in character, varying with the kind of business, and with the requirements in various sections of the country.

The gradual reduction of credit requirements justifies an expectation of moderate easing of rates. Cross currents in the present complex business situation, however, make it impossible to forecast when this may be realized.

The downward price movement, in progress in the case of a few commodities a year ago, and for all important classes of raw materials for many months past, continued without interruption during the month from Nov. 16 to Dec. 15. Even in a period of generally falling prices the future course of the price of each commodity is to be judged by the supply of and the demand for that commodity. At present every commodity must be considered also in relation to the present world-wide situation, the dominant feature of which is lack of purchasing power in Europe.

The progress of the downward price movement to date can be judged by comparison with the highest price reached during the period of abnormal activity following the armistice. Conditions have changed so greatly since 1914, that a uniform return to the prewar price level does not seem probable. At the same time, comparison of present prices with that level is of value, as a measure of the reclines which have taken place.

It should be specifically noted that the price for the nearest available date to the fifteenth of each month was not necessarily the highest price reached. For purposes of comparison, the price is also shown for Jan. 15, 1914.

Commodity	Unit	Highest price for 15th of any month since armistice or since removal of government control: Date	Price	Price on 15th of Dec. 1920	Jan. 1914
Cattle	$ per 100 lb.	Oct. 1919	16.80	9.50	8.60
Coal—					
Anthracite, buckwheat	$ per ton	Dec. 1920	8.00	8.00	2.25
Anthracite, stove	$ per ton	Dec. 1920	8.00	8.00	4.00
Bituminous, Fairmont	$ per ton	Aug. 1920	12.00	4.00	.85
Bituminous, Pittsburgh	$ per ton	Aug. 1920	11.00	3.75	1.30
Copper	c. per lb.	Aug. 1919	22.50	13.75	14.12½
Corn	$ per bu.	May 1920	2.15	.72	.62½
Cotton	c. per lb.	Apr. 1920	41.50	14.75	12.88
Hides—					
Heavy native steers	c. per lb.	Aug. 1919	52	*	17¼
Calfskins	c. per lb.	Aug. 1919	1.00	.15	.21
Hogs	$ per 100 lb.	July 1919	22.10	9.10	8.25
Iron and Steel					
Pig iron	$ per ton	Sept. 1920	48.50	33.00	12.50
Steel billets	$ per ton	July 1920	65.00	†45.00	20.00
Lead	c. per lb.	Mar. 1920	9.37½	4.75	4.10
Petroleum—					
Pennsylvania	$ per bbl.	Dec. 1920	6.10	6.10	2.50
Kansas-Oklahoma	$ per bbl.	Dec. 1920	3.50	3.50	1.03
Rubber—					
Plantation	$ per lb.	Feb. 1919	.56	.17½	.56
Para	$ per lb.	Jan. 1919	.60	.19¼	.73
Silk	$ per lb.	Jan. 1920	16.25	6.20	3.80
Spelter	c. per lb.	Jan. 1920	9.10	5.75	5.10
Sugar	c. per lb.	May 1920	21.57	4.63	3.29
Wheat—					
Spring	$ per bu.	May 1920	3.30	1.61½	.91½
Winter	$ per bu.	May 1920	3.06	2.00	.96½
Wool—					
Ohio fine delaine	$ per lb.	Apr. 1920	2.35	1.12	.56
Ohio ¼ blood	$ per lb.	Aug. 1919	1.20	.45	.39

* Nominal, 20 cents asked.
† Range, $43.50 to $45.00.

National City Bank of Chicago Discusses the Buyers' Strike, Unemployment and Business Honor

The nation is witnessing the most extraordinary buyers' strike ever seen, as the drastic readjustment of merchandise and commodity prices has been brought about primarily by the refusal of the consumer to pay war prices in peace times. The consumer has always been in control of the situation, although he never realized his power until the restriction of credit facilities and the intolerable burden of high living costs made him insist upon thoroughgoing reduction in all lines. This process is putting the country upon a sounder industrial footing and fast eliminating the evils resulting from war time inflation. Average prices have declined in many cases from 25 to 50 per cent below the high level of the war period. This has relieved the credit strain to some extent, although there are still plenty of applicants for nearly every free dollar of credit that the banks have to lend. No one can tell just when the readjustment will be completed, nor what will be the average level for commodities and essential merchandise at that time. Present prices in many cases are still from 50

to 75 per cent above the pre-war level, which, however, no one expects to see restored immediately, if at all. It was fourteen years after the close of the Civil War before the price level of 1861 was restored and economists contend that many years must elapse in this instance before the price level of 1914 can be re-established. Others feel that level can never be restored as production costs the world over are higher and the present scale of living and doing business has changed radically within six years.

It is unfortunate that unemployment is increasing, for in a period of world-wide industrial unrest it is not a good thing to have any considerable portion of the population without anything to do. The indications are that this shifting of labor will go further and that ultimately there will be such a readjustment of wages as shall accord with the new conditions of living and doing business. If it is possible to make the merchandise dollar go further, it is inevitable that sooner or later the wage dollar must purchase more and better service. Should the efficiency of all labor increase in the manner that it has increased in the transportation service, the resultant gain may obviate the necessity of serious wage reductions, for greater efficiency means greater productiveness which is one of the things the country most needs. Workers everywhere are beginning to realize that they must give a better return for the wages received and that the country is facing a condition where there are more workers than jobs. Several important movements have been undertaken to harmonize differences between capital and labor and to secure the kind of co-operation that shall increase the industrial output per unit of worker and make for genuinely better living conditions all around. These negotiations are still in progress and since high experts are concerned in the movement, it is reasonable to expect important developments during the next few months. These reforms would do much to increase national efficiency and promote the welfare of the workers at a time when it is of all things essential to check radicalism and the spread of Bolshevism.

Efforts have been made by some importers to get their banks to refuse payment on irrevocable letters of credit so as to save the American buyers of foreign merchandise from having to take sugar and other commodities purchased abroad several months ago at much higher prices than now prevail. In support of these efforts some importers have set up frivolous claims based upon various pretexts to enable them to violate their contracts. In cases where the seller has lived up to his contract and has kept his part of the agreement, the American buyers ought to pay such claims forthwith. Any other course would cause the greatest confusion and imperil the validity of the irrevocable letter of credit which must be safeguarded at all hazards. An importer can do no greater injury to his country's foreign trade, nor to his own reputation in foreign markets, than to seek to hold up payment of a just debt, because the market went back on him after he had obligated himself to pay a specified price for a certain commodity. An irrevocable letter of credit, if it stands for anything, means instant payment on presentation at maturity. If it is treated in any other way, both the buyer of the goods and the bank that issued the letter of credit are injured irreparably and the American bill is put instantly under suspicion. This issue is clearly defined, for the man who will live up to a bargain only when it is financially advantageous for him to keep his word constitutes a poor normal risk and is a danger to the community. The great London banks on the occasion of the Southern cotton frauds several years ago took losses aggregating several million dollars, paying the claims even after it was known that fraudulent bills of lading had been issued. Victor Murdock, chairman of the Federal Trade Commission, in speaking before the American Specialty Manufacturers Association at Atlantic City the other day said that the first essential factor "entering into confidence in business is inviolability of contract. Our pledge must continue to be our bond if the next few months are not to be a time of even greater difficulties." This is literally true and, fortunately, states the practice of 99 per cent of all right-minded business men.

Steel Business Healthy According to Peoples National Bank of Pittsburgh

December is usually a critical month of the year when inventories are readjusted and final preparations are made for annual settlements. The most prominent feature of the month just closed was the continuation of the downward movement in commodity prices, which has been in progress for more than thirty weeks. Steel was the last of the basic commodities to yield, and while its movement has not gone as far as that in copper, grain, cotton, and wool, it covered much ground in November and December, and 1920 closed with the average price of the chief steel products at the lowest levels of the year.

The steel trade being better organized than some other industries, it has been possible, to some extent, to regulate supply to demand, and at the close of December output was the smallest for many months. Naturally there has been a corresponding reduction in the consumption of coal and coke, and a very decided fall in the prices of these commodities. A noticeable decline in the volume of railroad traffic is also reported in the more important industrial districts, and for the first time, possibly, in more than two years there is idle equipment on some of the roads.

One of the most prominent features of the steel trade during the last quarter of 1920 was the falling off in the amount of unfilled orders on the books of manufacturers. However, the official figures of the Steel Corporation prove that the average monthly increase in orders booked earlier in the year when consumers were convinced that an upward turn had taken place in the industry was larger than the average monthly decrease during the latter part of the year when reaction had set in. It is expected that contracting for delivery during the first quarter of 1921 will appear this month, and if there is an easing in the money market, which is looked for, and if there is a material reduction in labor costs, which is already in progress, an impetus will be given to the steel business.

Already some of the railroads are anticipating their steel rail requirements, and predictions are made that this year will witness a large increase in the steel rail output over previous years.

An encouraging feature of the situation is the manner in which the financial strain of the past month was withstood. There were less adverse consequences than anticipated sixty days ago. While there was an increase in the number of commercial failures during this period, there was none of sufficient magnitude to cause serious disturbance. Credit resources were developed which proved adequate to the occasion.

In the matter of manufactured products the country lives pretty much on a hand-to-mouth basis. In some lines of manufacture there was a material curtailment of output during the last half of 1920. The reaction was not in progress long enough seriously to impair the buying power of consumers, and while a movement described as a "buyer's strike" was witnessed during the past two months, nevertheless considerable inroads must have been made upon stocks of manufactured goods in the hands of retailers. If the expected January reductions are made in retail prices, a revival of buying may be looked for this month, and before supplies can be replenished on a lower-cost basis, the mercantile trade is likely to present a much steadier tone than now appears to be the case.

Review of World Economic Conditions by the National City Bank of New York

The second year following the armistice did not bring the degree of industrial recovery and social recuperation among the peoples of Europe which had been hoped for. Conditions over the greater part of the continent are still in great confusion, and much of it even more distressing than a year ago. There are, however, some signs of progress toward order and better things. The war between Poland and Russia has left deplorable results in the desolation of territory and destitution of great numbers of people, but although there are misgivings in some quarters of

more hostilities on the Russian frontier, for the present peace is established in Europe, except for the trouble that Italy is having with some of her own excessively zealous patriots over the terms of her agreement with Jugoslavia. The consummation of this agreement between the responsible authorities of the two countries may be counted one of the important accomplishments of the year.

Russia

Within Russia the authorities at Moscow now have no armed or organized opposition, and may go ahead in their own way to revive the productive industries of that vast territory. If they can produce a surplus of foodstuffs and of the raw materials which western Europe needs, and deliver them at the coast or any of the country's boundaries, it is not likely that they will be seriously hampered by inability to trade them for the products of other countries. The ambitions of the Bolsheviki to convert the world to their peculiar beliefs will be best served by demonstrating the virtues of their system in practical operations at home.

Austria and the Balkans

Conditions in Austria are desperately bad, due fundamentally to the political severance of Vienna from the territory of which it has been the industrial and commercial, as well as political, center. The immediate problem is to get the population of Vienna through the winter.

Hungary, Rumania, Bulgaria and Jugoslavia are largely agricultural territory and although struggling with treasury deficits, hard times, and insufficient supplies of many kinds have not the more difficult problem of providing for great city populations.

Italy

Italy has quieted her most alarming disorders. The new Labor Board which is to be established will be for the purpose of accomplishing conciliation, but is not revolutionary in character. The treasury is in improved condition as a result of new taxation; the revenues in October are reported as three times those of October, 1919. In the first nine months of 1920 imports decreased 576,000,000 lire and exports increased 1,762,000,000. The note circulation of the Bank of Italy on Oct. 10 was 15,238,000,000 lire, against 14,445,000,000 a year before, and 1,556,000,000 in 1914. With the increased revenues this inflation should cease.

Poland

Poland has been prostrated by the struggle with Russia. The industrial and financial situation is very bad, with the currency depreciated almost to the vanishing point by the enormous issues of the past year. Although the country is normally more than self-supporting in food production it requires importations this year, and needs help to cope with epidemics of disease both among the people and farm animals. Although united in antagonism to Russian bolshevism the people are very much inclined to socialism, and their experiments in the state management of industries have added enormously to the confusion and distress. In a recent lecture at Warsaw Professor Globinski, an economist of standing, stated that the country had 410,000 civil officials and that including the army the burdens of government were overwhelming. He said that the state railways have five times as many employees per kilometer as the roads of western Europe. The change of the land laws at this time is not conducive to increased production.

Czecho-Slovakia

In Czecho-Slovakia the Minister of Finance has recently promised that the budget for the ensuing year will balance, although it is not altogether encouraging that the principal burdens are said to be for social and military projects. Socialism is strong here also, and the chief difficulty with which the industries have to contend at this time is the lack of coal, which is aggravated by schemes for the socialization of the coal industry. The mines were gutted during the war and require large expenditures for development, which are held up pending a determination of what shall be done with the industry. Vienna is mainly dependent on these mines and a shortage of coal is the chief drawback of all Europe.

Germany

Germany is still in an unsettled and agitated state. The crops of 1920 were not good, there is need to import food and raw materials but the exports are insufficient to pay for them. The industries are not working at a rate sufficient to provide for even the needs of the German people, to say nothing of paying indemnities. The revenues of the government are far short of what is required to meet its expenditures, and the deficit is met by printing money, which demoralizes the currency and foreign exchanges and aggravates all the disorders. The railroads, all of which have been taken over by the federal government, are running steadily behind and are a heavy burden on the public treasury. A lack of coal hampers the industries, but in this respect there has been some improvement recently—the most hopeful sign of the year.

Overshadowing every other problem in importance is the question of indemnities. Recent proceedings of the Reparation Commission have afforded ground for expectation that the amount of the indemnities will be definitely fixed, and at a sum which will encourage the German people to energetically undertake the task of payment. At present the situation in Germany is very gloomy, and it affects the entire European and world situation.

In Belgium and France substantial progress in industrial recovery has been made. In Belgium production was back on the whole at about pre-war volume before the present depression came on. France has done much in rebuilding the devastated territory and in getting the crippled industries into operation. Her industrial output has increased, and the adverse balance of trade has been largely reduced. The *Temps* of November 22 gave the value of imports for ten months as 29,784,000,000 francs, against 27,397,000,000 in 1919, and exports as 18,890,000,000, against 7,733,000,000. France shows many evidences of progress, convincing to the world and cheering to her own people. Among them may be mentioned the payment of $150,000,000 to the United States. A new internal loan has been floated recently, to which subscriptions, including certain conversion privileges, aggregate 50,000,000,000 francs, and by the aid of this the government has been able to reduce its indebtedness to the Bank of France to such an extent that the note circulation of this institution is lower than it was a year ago. In France also production of coal is increasing.

Great Britain

Great Britain has passed through a strenuous year, with grave disorders in Ireland and almost equally grave labor problems. The former are more acute at the moment, but the latter are more fundamental. The coal strike was an exceedingly threatening menace, involving as it did a challenge to the government and a covert demand for the nationalization of the coal industry. It was settled, however, with the intelligent co-operation of influential labor leaders, and this is the most reassuring sign in the British industrial situation. The representatives of British labor and British socialism who visited Russia during the year, in every noteworthy instance, reported against the adoption of the Soviet policies by British workingmen.

Despite the difficulties in industry, the revenues of the British treasury have more than met expenditures since the beginning of the fiscal year, April 1, 1920, enabling substantial payments to be made upon indebtedness. The government has stated that by the end of the fiscal year all the war subsidies will be abolished. At the close of 1919 the government announced that the outstanding issue of exchequer currency notes, above cash reserves, would not be permitted to exceed £320,600,000 in the year 1920. This pledge has been observed, the excess on Dec. 1 being £303,854,000, and the percentage of reserve 13.5, against 9.1 at the close of 1919. The gold stock of the Bank of England on Dec. 1 was £124,991,291, against £91,790,369 on that date of 1919. During the eleven months to the end of November the adverse balance in foreign trade was reduced about $600,000,000. In actual accomplishments therefore Great Britain has notably improved her situation during the past year.

We have mentioned above only the countries of Europe which were in-

volved in the war. They all suffered terrible losses in manhood and capital, and are suffering by the disorganization of their industries. The latter source of loss is due in part to the war, but even more to the agitation which seeks to overthrow the existing social order of things.

The effects of this disorganization of Europe are felt throughout the world. Europe was the center of the world's industrial organization, a great market for the products of all other quarters of the globe. The equilibrium which formerly existed in the world's industries is disturbed by the inability of Europe to trade as formerly. The people need clothing, but they cannot buy cotton or wool. They need the metals, copper, lead and zinc, but cannot buy them. They would like to have meats but have not the means of payment.

The spurt of activity which followed the armistice could not be sustained, and has been succeeded by a state of depression in all countries. A cable dispatch from Geneva, Switzerland, the seat of the League of Nations, dated Dec. 22, says:

"From every part of Europe, from old countries and new, and even from Asia, reports arrive of unrest and disturbance, of commercial crises, unemployment and inability to sell products, together with the greatest need of such products."

Lloyd George on the Situation

The Premier of Great Britain, Lloyd George, in a public address recently described the situation as follows, in part:

"Now the first thing we have got to get into our minds is this: The causes are not peculiar to our country. They are something that affects the whole world. It is not an atmospheric depression that affects one degree, one coast, one country; it girdles the earth—the United States of America, Japan, China, India, France, Italy, Germany, as well as the United Kingdom. The whole world is suffering from it. Now it is important when you come to think of remedies to get that fundamental fact into your minds—(hear, hear)—so that we should not run into remedies that may be applicable to one country and not to another.

"For instance, countries with totally different economic systems are suffering alike—protectionist countries, free trade countries, countries with good governments and with bad governments — (laughter) — countries whose governments, in the eyes of Lord Northcliffe, can do no wrong, and countries whose governments, in his lordship's clear eye, can never do right. (Laughter.) They all suffer alike. It is raining on the just and the unjust without stint. And Socialistic countries are suffering just like those wretched individualists are suffering. The working classes are more wretched where the sun of liberty is shining upon them under the ægis of Lenine and Trotzky than they are in this benighted country, where they are locked up in the dungeons of capitalism.

"I got figures from the Board of Trade this afternoon of what we sold to Europe before the war. We sold from this country, most of it our own products, but we got a profit on even what passed through—we sold 246 millions' worth of goods. At present prices, I am told, that would be about 600 millions, probably more.

Europe Bankrupt

"Where is that trade now? Our customers are impoverished, bankrupt. I am not sure about borrowing. The printing press may save you for a time, but you cannot always carry a sack of paper on your backs. That is what is happening in Europe. They cannot get on without it, and when they buy they cannot pay. Have you ever seen the spectacle of a man in rags, down at heels, standing in front of a shop window looking at clothes and boots of the latest fashions? And you say why does he not buy, he is in rags, he needs them, why does he not go in the shop? He cannot pay.

"Europe is standing in front of our shop windows, stocked with the best goods that any land can turn out. And it is in rags and wants to buy. But its pockets are full of paper. It cannot buy. And until a customer is in a condition to trade with you we must admit it. Do not let us work up pretended causes; let us get at realities. Britain has got to work its way back to a full purse, and until it does that nothing that governments can do, nothing that federations can do, and nothing that newspaper articles can do can help us. (Cheers.)

Peace and Hard Work

"What are the remedies? The first is peace. Europe cannot work its way back to prosperity unless it has peace. Europe must work with both hands. (Applause.) She cannot handle the sword and the trowel. I cannot stand those men who are constantly blowing on the embers of the fire. Stamp out those who are going about with petrol tins to start fresh fires." (Applause.)

That speech might have been made as appropriately in the United States. When the truth it sets forth is comprehended all the people will be in better state of mind to set about repairing their fortunes. The first thing is to know that their misfortunes are not due to a conspiracy among grain speculators, or on the cotton exchange, or in Wall Street. All commodities and all markets are involved, and it cannot be supposed that commodities traded in all over the world could be sustained in price in the United States when they were falling everywhere else.

The Union Bank of Canada is issuing from its New York agency, 49 Wall St., a booklet, entitled "A Canadian Plant—Why?" and giving a concise survey of the opportunities Canada offers the American manufacturer.

Railroads Buying in Large Volume

The greatest factor toward stabilizing the iron and steel industry and helping to bring it out of its present chaotic state is the recent buying movement inaugurated by the railroads upon the announcement by the independent steel mills of a rail price cut to the corporation level of $45 for Bessemer and $47 for open-hearth steel rails. With this announcement the Pennsylvania placed an additional order for 100,000 tons and the New York Central one for 75,000 tons for 1921 delivery, both orders going to the independents and involving over $8,000,000. The mills participating are the Bethlehem Steel Co., the Lackawanna Steel Co. and the Midvale Steel and Ordnance Co. The 100,000-ton order previously placed by the Pennsylvania was allocated between the Carnegie Steel Co., and the Illinois Steel Co. The Boston & Maine and Maine Central lines placed orders aggregating over 15,000 tons. At present railroads are being refinanced on a scale never before attempted and heavy buying is expected to take place to fill the accumulated needs of the past few years. The entire rail capacity of the leading interest is booked for the whole of 1921, with the exception of the Birmingham subsidiary, which is booked over the first half only. Thus it will be seen that the all too lean order books of the independents will directly benefit by the orders now pending. Rail orders placed to date for next year's rolling total over 3,000,000 tons, while over 40,000 freight cars have been ordered, and it is expected that contracts for 20,000 more will be entered into shortly. The equipment purchases of the railroads absorb over 30 per cent of the steel output of the country normally, so the extent of the influence of this factor cannot be overestimated.

A Voluntary Wage Reduction

Nine thousand employees of the Pullman car shops in Chicago are willing to accept a reduction of 20 per cent in their wages and they have so notified the management, it was learned.

This action on the part of the men was voluntary, company officials said. They had no idea the men were contemplating such a step until a committee of the workers appeared at the executive office with the statement. The cut is suggested, the committee said, in order to allow the company to make lower bids to attract work in order to prevent a layoff of employees.

Wages at the Pullman shops have increased 100 per cent in the past three years. The average wage now is $6.77. In January, 1918, it was $3.75. Employees were taken into the management of the company's affairs last June.

Failure of the Bank of Barcelona, with deposits estimated at $100,000,000, has made a serious impression in London financial circles. The Spanish Government sent a large sum of money to Barcelona.

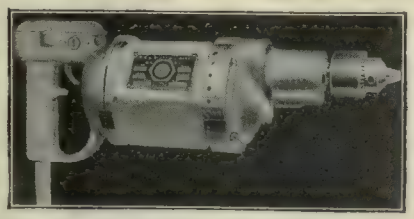
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Drill, Portable, Auto-Body Builder's

Black & Decker Manufacturing Co., 661 Liberty St., Baltimore, Md.

"American Machinist," Dec. 9, 1920.

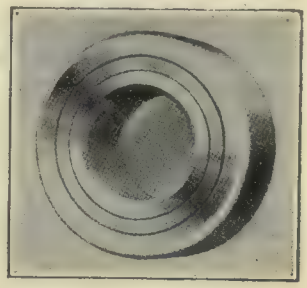


Holes up to $\frac{5}{16}$ in. can be drilled by this lightweight drill. Its housing is of aluminum alloy and its gears are hardened steel. The motor develops $\frac{1}{4}$ hp. and has a no-load speed of 1,480 r. p. m. A pistol-grip handle is furnished, and the control switch is operated by means of a trigger. The drill is equipped with a three-jaw chuck for holding straight-shank drill bits, 15 ft. of duplex electric cable and separable attachment plug. The motor runs on either alternating or direct current and can be supplied for 110, 220, or 32 volts.

Ball Bearing, Self-Adjusting

Langhaar Ball Bearing Co., Aurora, Ind.

"American Machinist," Dec. 9, 1920.



This ball bearing is intended to carry high thrust loads as well as radial loads. The lines of contact of the balls with the races form cones. Spinning and grinding of the balls is said to be largely obviated. The inner race is solid. The outer one is made in two parts. The parts fit together in the manner of jaw clutches, and are fastened by the inserting of pins in holes provided at the joints. The bearing is adaptable to any speed ordinarily used, having proved reliable and satisfactory at speeds as high as 8,000 r.p.m.

Rivet Heater, Electric

Taylor Welder Co., Warren, Ohio

"American Machinist," Dec. 9, 1920.

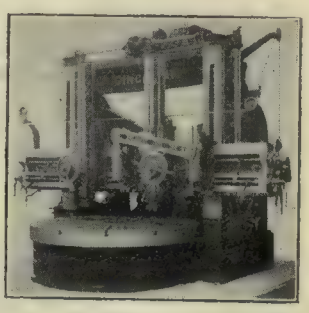


The machine is intended to hold two rivets at a time. A $\frac{3}{4}$ x 4-in. rivet is heated in about 30 seconds. A 6 x 16-in. tray is provided at the front of the machine for holding rivets. It is not necessary to actuate a switch for each rivet, as the circuit is automatically closed when the rivet is placed in position for heating. The machine is equipped with a 15-kw. transformer and a five-step regulator for controlling the current, the power consumption being approximately 18 kw.-hr. per 100 lb. of rivets heated. The extreme height of the machine is 40 in., the dies being 32 in. above the floor. The floor space required is 31 x 18 in. and the weight is about 400 lb.

Attachment, Taper for Cincinnati Boring Mills

Cincinnati Planer Co., Cincinnati, Ohio

"American Machinist," Dec. 9, 1920.



The device, shown on an 8-ft. mill, is intended for use on all sizes of boring mill from 42 in. up to 12 ft. The principal parts are a slanting member or sine bar, sine-bar supports and the sine-bar guide fastened to the ram. In order to provide up and down adjustment to the ram, without loosening the sine bar and thereby changing its position, the face of the ram is machined and fitted with a T-slot equal in length to the vertical travel. The power feed to the ram is disengaged by means of the small handwheel, so that the ram is fed vertically by the slanting bar as the head traverses. The use of the attachment is recommended for angles up to 18 deg.

Defectoscope

Durkee Manufacturing Co., Grasmere, S. I., New York

"American Machinist," Dec. 9, 1920.



This device for the testing of steel magnetically is intended for the examination of commercial steel products, being a means of checking the physical uniformity and structure of the work under examination by determining the variation in magnetic homogeneity along the length of the specimen. It is especially adapted for use in locating defects in steel wire, cables, rods, rails and bars. The cut shows a general view of the defectoscope arranged for testing rails. Accurate results are claimed, as the effects of heat treatment and chemical composition upon magnetic properties are known. The process is, of course, not destructive to the specimens under test.

Oilstone Holder, Self-Cleaning

J. A. Raught, 1006 Grand Ave., Racine, Wis.

"American Machinist," Dec. 9, 1920.



The oilstone holder shown is made of cast aluminum, the surfaces being ground and polished. There are four sharp pegs in the bottom of the holder to prevent it from slipping on the bench. The cover is provided to exclude dirt. The stone rests on four buttons $\frac{1}{4}$ in. high on the bottom of the holder and is prevented from shaking in the holder by four screws in the sides. The stone lies in a bath of oil, thus keeping one side of it soaked. The holder is made in sizes, to hold stones 1 in. thick, 2 in. wide and either 6, 7 or 8 in. long.

Bandsaw, Metal Cutting

Seattle Machine Works, Inc., 37-51 W. Lander St., Seattle, Wash.

"American Machinist," Dec. 9, 1920.



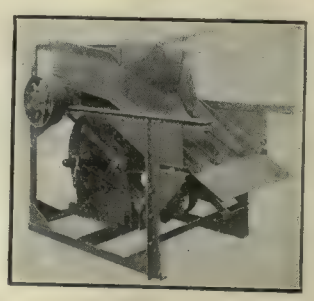
This machine is intended for cutting out solid forged crankshafts, for cutting slots, and for cutting pieces to length. This is accomplished by having the saw cut on both sides of its loop, its motion, of course, being downward on one side and upward on the other.

In order to change the distance between the two cutting portions of the blade, two idlers having horizontal movement are provided, the screws in the slides being connected by means of a chain running on sprockets so that they operate simultaneously. The top wheel is adjusted vertically by means of a hand-wheel, so that the saw can be kept tight for any position of the idlers.

Separator, Chip, Pneumatic

Ideal Concrete Machinery Co., Cincinnati, Ohio

"American Machinist," Dec. 16, 1920.



The separator illustrated is intended chiefly for separating small work, such as screw-machine products, from the chips. The work is placed or discharged into the hopper on the top of the machine, both the hopper and the incline riveted to it being given a compound vibratory motion. When the control gate is opened, the work slides down the incline to an opening. There the blast from the centrifugal blower floats the chips over the opening, while the machined parts drop through into tote pans. The chips continue down the slide and are collected in suitable boxes.

Clip, paste on 3 x 5-in. cards and file as desired

A. S. M. E. Creates Ordnance Section

At a meeting of the council of the American Society of Mechanical Engineers held on Friday, Dec. 10, a petition requesting the formation of an ordnance section of the society was granted, formally establishing this new section along the lines of the other professional sections of the society. The petition for the ordnance section was drawn up at an organization meeting held the preceding afternoon when about thirty men, most of whom were active in the ordnance program of the World War, met in the Engineering Societies Building to put into a definite form the desires of ordnance men and engineers who have had the subject under consideration since 1918.

The chairman of the organization meeting was C. F. Hirshfield, chief of the research department of the Detroit Edison Co., who had been very active in building up this section. A committee of three was appointed by him to nominate officers and to prepare a letter ballot for members to ballot upon officers. The chairman of this committee is Major F. C. Bull, District Claims Board, New York Ordnance District. The other members of the committee are Frederic E. Town, with the Otis Elevator Co., New York, and Ralph G. Macy, construction engineer for Walter Kidde & Co., New York. It was announced that 178 members of the society have already signified their intention of joining the section.

The meeting was thrown open to discussion of what such a section might accomplish. Major Bull interpreted the function of the section as salvaging the knowledge which engineers and manufacturers of ordnance materials had gained in their experience in ordnance production in the War. A number of men present, men who were connected with the ordnance program in one way or another during the war and who are now back in engineering work, related their experiences. Frank B. Gilbreth, president of Frank B. Gilbreth, Inc., Montclair, N. J., was one of those to emphasize the value of making use of the knowledge which these men and many other engineers have gained, applying it to engineering problems and having it ready for any emergency.

Colonel C. L. H. Ruggles, chief of Technical Staff of the Ordnance Department, U. S. A., pointed out that while the Ordnance Department was small and army engineers few in number they were able to handle the technical problems confronting them but needed the support of the engineering societies of the country to secure quantity production.

Colonel James L. Walsh, of Washington, D. C., representing the Army Ordnance Association, offered the co-operation of the Association with its 3,800 members in carrying out any program which the ordnance section may undertake. He urged the closest connection between the two bodies and expressed the opinion that they would work together to attain splendid results.

The general feeling of the meeting was that the new section should be the liaison between technical engineers and manufacturers of ordnance materials, and that it should work toward educating the members of the society and through its members the public as to what are the ordnance requirements in manufacture of ordnance materials and carrying out its program.

American Committee of International Chamber of Commerce Appointed

American participation in the International Chamber of Commerce became fully organized with the appointment of an American committee composed of fifty-seven of the leading business men of the country.

Members of the committee were appointed by Joseph H. Defrees, president of the Chamber of Commerce of the United States. They will take up their work immediately, holding their first meeting in New York on Jan. 6.

The American section is the direct representative of the International Chamber in the United States. It is the point of contact between the membership in this country and the International headquarters in Paris. The American committee will serve in an advisory capacity of the section. In its membership are representatives of the main divisions of the business of the country, chosen with a view of geographical distribution.

The International Chamber was created at Paris last June. In the form of organization adopted each country holding membership has its national bureau as headquarters of its section, its national committee and an administrative commissioner of its own resident at Paris. The American section headquarters began operation in the fall with Lacey C. Zapf as secretary. The American administrative commissioner, Dr. Frederick P. Keppel, has taken up his duties at Paris.

Appointment of the American committee completes the form of organization for this country. Membership of American business organizations, corporations, firms and individuals already has grown to considerable proportions and is increasing steadily.

At its first meeting in New York the committee will take up subjects which the Americans expect to present at the next meeting of the International Chamber in London in June. It will receive a report on this from a special committee consisting of John H. Fahey and Edward A. Filene, of Boston, and Owen D. Young, of New York, all members of the American directorate of the International Chamber. The committee also will consider nominations for American directors for the coming year and will discuss a campaign for obtaining American members.

Automobile Show To Be Held in Mexico in March

Plans for the coming automobile show, which will be held in Mexico City in March, 1921, are progressing rapidly. The secretary of communications and public works has reserved the vacant space in front of the National Theater for this purpose. A temporary structure will be erected, and every distributing agency in Mexico has made arrangements for space in the building.

Acknowledgment of Calendars and Christmas Cards

The *American Machinist* takes this means of acknowledging the receipt of calendars from the following concerns: National Acme Co., American Tool Works Co., Chas. A. Schieren Co. and the New Britain Machine Co. Christmas cards were received from the Norma Co. of America, Black & Decker Manufacturing Co. and R. S. Stokvis & Sons, Inc.

Steel Bookings Said To Be An Optomistic Sign

Declaring that the present business depression is only psychological, Judge Gary, chairman of the United States Steel Corporation, emphasized his point by stating that the daily bookings of the corporation at the present time exceeded the total capacity for its mills at the time of organization. He declared that there was plenty of money in the country and that capitalists are willing to invest in new enterprises just as soon as prices are on "a reasonable, fair and stable basis."

Diesel Engine Used as Dynamo Driver

Members of the San Francisco Chapter of the American Society of Mechanical Engineers last week inspected with great interest the first Diesel engine used to furnish electric power in an office building in San Francisco, when the new power unit in the engine-room of *The Chronicle* building was thrown into operation. The new engine is of the straight Diesel type.

$26,775,000 New York Central Loan Approved

Plans of the New York Central Railroad Co. and a number of its subsidiaries for buying new equipment and making additions and betterments to existing equipment and to way and structures will go forward as the result of the approval on Dec. 23 by the Interstate Commerce Commission of a loan of $26,775,000 to those companies.

Besides the New York Central, the companies which will benefit by the action of the commission are the Michigan Central, the Cleveland, Cincinnati, Chicago & St. Louis, the Cincinnati Northern, the Toledo & Ohio Central, the Zanesville & Western, the Kanawha & Michigan, and the Lake Erie & Western.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Planer, Gear, 48-In., "Sunderland"

J. Parkinson & Son, Shipley, England

"American Machinist" (European Edition), Sept. 11, 1920

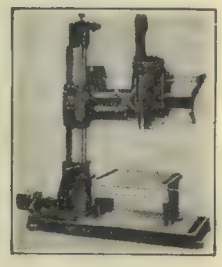


All the Sunderland gear planers for spur and helical gears embody the principle of generation in which the tooth form is developed in the passage of a cutter of rack form in a direction tangential to the pitch circle of the gear being generated, the cutter meanwhile having a reciprocating motion across the face of the gear, during which it acts as a planing tool. This machine will generate gears up to 4 ft. in diameter by 9 in. face and 2 in. circular pitch. It is designed for "double cutting"; that is to say, the machine will operate on two similar blanks mounted on the same arbor.

Drilling Machine, 3-ft. 6-in., Centralized-Control

J. Archdale & Co., Ltd., Birmingham, England

"American Machinist" (European Edition), Sept. 11, 1920

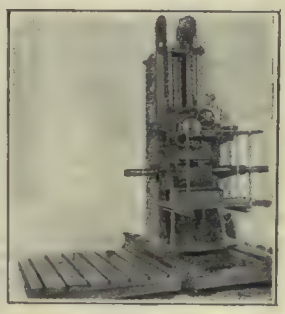


This is a combined sensitive and radial drilling machine. There are nine spindle speeds, from 62 to 760 r.p.m. The drive is by belt. The spindle has a No. 4 Morse taper hole. The spindle is 1⅞ in. in diameter and has a vertical traverse of 12 in. and a horizontal movement of 2 ft. 5 in. The feeds range from 45 to 125 revolutions per inch. The box table is 32 x 27 in., is hinged to the frame and swings clear of the base. The newer features of the machine include a patent saddle and sleeve lock operating simultaneously; thus the arm may be swung and the saddle moved and then both locked with one movement of the lever.

Boring, Drilling and Milling Machine, Horizontal

T. Shanks & Co., Johnstone, England

"American Machinist" (European Edition), Sept. 11, 1920

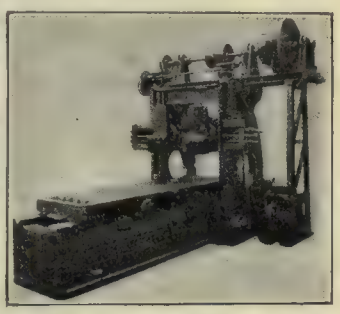


The boring spindle slides vertically on a box-section column, which moves horizontally by rack on a bed. The two slide bars of the bed are set well apart to give stability and the narrow guide obviates binding by cross twist. The main driving motor is mounted on the base of the column and thus travels across the bed with the toolhead. The spindle slide is balanced by weight and has long guiding faces to prevent twisting. The controlling gear introduces several features. First the operator has complete control over the machine movements without moving from the position in which he gets a good view of the work, and, secondly, no two conflicting motions may be put in gear at the same time.

Planer, 8 x 3 x 3-Ft.

Butler Machine Tool, Co., Ltd., Halifax, England

"American Machinist" (European Edition), Sept. 11, 1920

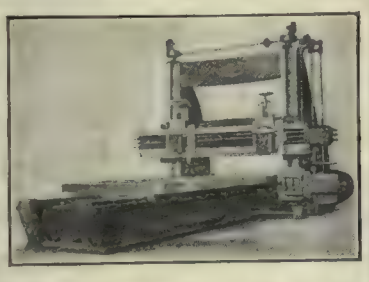


A four-speed countershaft is provided, ball bearings being fitted, and the speed changes are obtained by means of cone pulleys, the belt being lifted from one step to another, a tightening and slackening device enabling the operation to be performed in a few seconds. By this gear a uniform return speed for all speeds of cut is available. To reduce the effect of inertia the reversing pulleys are of aluminum. The drive is by constant-speed motor and belt to the self-contained countershaft. The new features of the machine include an improved cam device for operating the belts.

Planer, High-Speed, Electrically Driven

J. Stirk & Sons, Ltd., Halifax, England

"American Machinist" (European Edition), Sept. 11, 1920

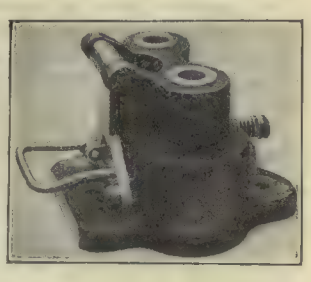


The machine has a 5 x 5 x 16-ft. capacity. The table is 4 ft. 9 in. wide, T-slotted, with troughs at each end for cuttings, etc. Cross-planing can be accomplished by either cross-slide head. The main reversing motor is of 40 hp. at maximum speeds of 500 and 1,000 r.p.m. for cut and return respectively. The table speeds given are from 15 to 240 ft. per minute by means of the gearing in conjunction with the eight-to-one variation of the motor. With the low gear the range is from 15 to 60 ft. per minute cutting, returning at 60 to 120 ft. per minute, these speeds being doubled on the high gear. Weight, 6 tons.

Fixture, Indexing for Milling Machines, Semi-Automatic

B. S. A. Tools, Ltd., Birmingham, England.

"American Machinist" (European Edition), Sept. 11, 1920



The fixture here illustrated is used for milling hexagons, squares, or any number of flats or saw cuts on small components. It consists of two spindles set side by side on which can be screwed suitable collets or chucks for holding the work. By pulling out the handle in the front of the fixture the operator can index the spindles the required amount, this being controlled by the number of notches in the index wheels, which are mounted at the lower ends of the spindles.

Drilling Machine, Sensitive, High-Speed

B. S. A. Tools, Ltd., Birmingham, England

"American Machinist" (European Edition), Sept. 11, 1920



The chief feature is the method of obtaining the speed range, the main shaft driving the countershaft, by means of three-step cone pulleys, and the countershaft driving the drill spindle. Thus three speeds can be obtained by the movement of a belt-shifting lever, while the complete range of six speeds, from 500 to 2,412 r.p.m., may be obtained by movement of the spindle-driving belt in conjunction with a lever operating a jockey-pulley bracket. The machine has ball bearings throughout. Its capacity is the largest drill admitted by the No. 2 Morse bore in the spindle, namely, a ⅞-in. diameter drill. The spindle traverse is 5 in.

Grinding and Point-Thinning Machine, Twist-Drill

W. A. Walber & Co., 38 Victoria St., Westminister, S. W., England

"American Machinist" (European Edition), Sept. 18, 1920.



This machine grinds drills from ¼ in. to 2 in. in diameter, of two-lip form, though by alteration of gearing three- and four-lip drills can be ground. The grinding is automatic. The point-thinning is done by a separate wheel on the main spindle. The machine is self-contained, being driven by fast and loose pulleys. The abrasive wheel carried is 14 in. in diameter by 2 in. by 5 in., and the thinning wheel is 8 in. in diameter by ⅜ in by 1¼ in.

Clip, paste on 3 x 5-in. cards and file as desired

Business Items

A merger has been effected of the American Twist Drill Co. and the Gorham Tool Co., both of Detroit, that will be known as the American Twist Drill and Tool Co. Its capitalization will be increased from $200,000 to $400,000. Heatley Green is president and the active management will be in the hands of L. C. Gorham, formerly general manager of the Gorham Tool Co.

The Chicago Pneumatic Tool Co., New York, announces the resignation of H. L. Dean, formerly manager of the compressor and engine sales division.

The Gilbert & Barker Manufacturing Co., West Springfield, Mass., has announced the following additions to its sales organization: F. E. Mistrot, Waco, Tex.; T. J. Hope, Dallas, Tex.; E. L. Coolbroth, Sr., E. R. Alden, and H. E. Kyburg, Springfield, Mass.; L. K. Draz, Mt. Vernon, N. Y.; and B. L. Heeley, Providence, R. I.

The Calumet Truck Body Corporation, Calumet, Mich., has been organized with $200,000 authorized capital to build what will be known as the Calumet All-Purpose Body for Auto Trucks. The company will be pleased to receive catalogs and prices from manufacturers of malleable and drop-forging parts and fittings used on truck bodies and cabs; also catalogs and prices of tools and shop equipment.

The Bristol Machinery Tool Co., Bristol, Conn., sold its Riverside Ave. plant at auction on Dec. 18. The highest bidder for the plant, except the machinery, was the Wallace Barnes Co. of Bristol, while the Brownell Machine Co. of Providence, R. I., took the latter at $25,000. The plant sale was for $36,500. Owing to conditions of the market the company decided to close out.

Papers filed for record at the office of the town clerk by the G. E. Prentice Manufacturing Co., New Britain, Conn., show an increase in capital stock from $100,000 to $300,000. The notice is signed by G. E. Prentice, A. B. Porter, F. S. Troup and R. C. Legat, a majority of the directors.

The Commercial Camera Co., Providence, R. I., and Rochester, N. Y., announces that effective Jan. 1, 1921, it will change its name to the Photostat Corporation. The purpose of the change in name is simply to more readily identify the name of the company with the name of its products.

The Goulds Manufacturing Co., Seneca Falls, N. Y., manufacturer of pumps, announces the appointment of Edward S. Jenison as acting general sales manager to succeed W. E. Dickey, who retired from business on Jan. 1. Mr. Jenison has been manager of the Philadelphia office for the past five years.

Negotiations are understood to be in progress for the acquisition by the Chelmsford Iron Foundry of the iron and metal yard of A. J. Harris on Tanner St., Lowell, Mass. The purpose is to erect a large foundry on the site in connection with the conduct of an iron and metal yard.

Personals

LEON E. THOMAS, president of the Reading Iron Co., has been elected president of the Eastern Pig Iron Association.

S. DUNCAN BLACK, president of the Black & Decker Manufacturing Co., was recently elected a director of the Automotive Equipment Association.

P. V. BURWELL has been appointed assistant advertising manager of the Black & Decker Manufacturing Co., Baltimore, Md.

ELBERT CLEMENT FISHER, for the past 19 years with Westinghouse, Church, Kerr & Co., Inc., is now connected with Dwight P. Robinson & Co., Inc., with which the former company has become consolidated.

G. A. SCHNEIDER, mechanical engineer with the Standard Steel Car Co., has returned from France and is now located in Chicago.

HERBERT R. CONNOR has discontinued his services with the Phillips Rice Milling Co. and M. Phillips & Co. of San Francisco as chief engineer and has opened an office in San Francisco as consulting mechanical engineer.

Obituary

FREDERICK G. JAHN, inventor of the post-office and bank cancellation machines, died at his home in Brooklyn, N. Y., on Dec. 22. Mr. Jahn was fifty-eight years old.

New Publications

Labor's Crisis. By Sigmund Mendelsohn. One hundred and seventy-one 5 x 7-in. pages, cloth boards. Published by the Macmillan Co., New York.

This volume presents an employer's view of labor problems. It is an analytical treatise of the relations between capital and labor, defining to an appreciable extent their obligations to each other and to the state and offering suggestions toward alleviating the existing unrest of labor. The author's simplicity of style and method of presentation make the book very readable. It is evident that the author has given his subject much thoughtful consideration.

Chapter headings are: Poverty, Its Nature and Effect; Poverty as Related to Labor; Characteristics of Capital and Labor; Labor Not a Commodity; Comparative Value of Physical and Mental Exertion; Depletion and Deterioration of Labor; Labor-Saving Inventions and Labor Supply; the Malthusian Theory as Applied to Labor; Maximum Effort the Foundation of Society; Economic Effect of Curtailed Labor; Can Reduced Hours Advance the Welfare of Labor and Society? Cost of Living Subject to Psychological Influences; Inflated Cost of Living Due to Contraction of Labor; Labor Welfare as Related to Material and Social Welfare; Causes of the Present Labor Ferment; Profit-Sharing as a Basis of Insurance and Pensions; Labor Unrest as a Check Upon Industrial Concentration; Moral Economics as Applied to Labor; Handling of Labor in Small Plants; Labor as it Affects the Wife and the Home; Objections to a Legislated Wage; Housing of the Laborer; Inflation and High Taxes—Their Effect.

The Engineering Draftsman. By E. Rowarth, A. M. I. E. E. Two hundred and forty-five 6 x 9-in. pages, 96 full-page illustrations, cloth cover. Printed in Great Britain at the University Press, Aberdeen, and published in New York by E. P. Dutton & Co., 681 Fifth Avenue.

This book is intended for the use of students already familiar with the elementary principles of mechanical drawing. It provides a course of work corresponding to that of a draftsman during his apprenticeship. Instruction is given by means of illustrations of drawings, explanatory notes being printed below each. In this connection the makeup is very convenient; an illustration appears on the left-hand page and the explanation on the right, both being printed lengthwise on the page so that by turning the book sidewise the former appears over the latter. Sufficient information is given to enable the making of complete working drawings of a steam hammer, hydraulic capstan, hydraulic press, air pump, oil pump, steam-engine governor, lathe, etc. A wide range of the mechanical field is covered.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A firm in The Netherlands operating a shipbuilding wharf and machine factory desires to obtain the representation of manufacturers of machinery of all kinds, especially boat motors. No reference offered. No. 34222.

A manufacturer in Mexico desires to purchase an 18-inch lathe. Quotations should be given c.i.f. El Paso, Tex. Cash to be paid. Reference. No. 34206.

Forthcoming Meetings

The Society of Automotive Engineers will hold its annual meeting on Jan. 11 to 13 inclusive at New York.

A conference of State Manufacturers' Associations, will be held at the Congress Hotel, Chicago, on Jan. 12. Manufacturers, merchants, railway executives and shippers will attend this meeting to protest against the formation of a national board of adjustment said to be demanded by the railroad brotherhoods. The address of the State Manufacturers' Ass'n is 104 South Michigan Ave., Chicago.

The Engineering Institute of Canada will hold its thirty-fifth annual meeting in Toronto, King Edward Hotel, on Feb. 1, 2 and 3.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The Spring Convention of the National Machine-Tool Builders' Association will be held on Thursday and Friday, May 19 and 20, at Hotel Traymore, Atlantic City, N. J. Ernest F. Du Brul, care of the Association, Worcester, Mass., is general manager.

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Md., Baltimore—Bowers & Bartlett, Inc., 1201 South Sharp St., manufacturer of washing machines, C. C. Bowes, Purch. Agt.—gears, small bevel and mitre, worm, wheel and die cast; small aluminum die castings; drop forgings, springs, flat and round; malleable and iron castings; forge gears, and steel stampings.

N. Y., New York (Borough of Bronx)—A. C. Chesley Co., 277 Rider Ave.—equipment for the manufacture of metal doors.

N. Y., Rochester—The Alent Machine Tool Co., 467 St. Paul St., N. Alent, Purch. Agt.—second-hand ammunition lathe.

N. Y., Rochester—The Defender Photo Supply Co., Driving Park Ave., M. E. S. Fowler, Ch. Engr.—small lathe and drill press.

N. Y., Rochester—G. C. Humbert, 301 Cornwall Bldg., jeweler, die sinkers engine with flexible shaft.

Va., Richmond—A. S. Kellam, c/o Richmond Pressed Metal Wks., 6th and Stockton Sts.—medium size lathe, (new or used).

Ill., Chicago—H. H. Hanna Corp., 538 South Dearborn St.—
One 8 in. shear 16 gage capacity.
One press 8 ft.-6 ft. between housings. minimum stroke 10 in.
One press 30 in. to 36 in. bolster 8 in. to 10 in. capacity.
One power brake, same type as Collins 8 ft. 16 in., 16 gage capacity.

Ill., Chicago—G. C. M. Products Co., 3153 Chattanooga Ave.—one power shear 36 in. or larger, (new or used).

Mich., Charlotte—The Hancock Mfg. Co., manufacturer of lubricators—one 250-350-ton embossing press (used, in first class condition).

Mich., Detroit—The Modern Pattern & Machine Co., 123 Monroe Ave.—pattern making equipment, including a 3 x 3 x 7 ft. coke burning core oven.

Mich., Detroit—The Zenith Fdry Co., Miller Ave.—foundry equipment.

O., Cleveland—The Natl. Car Wheel Co., 2120 West 106th St.—24 in. to 36 in. radial drill, (used).

O., Mansfield—The Ideal Electric & Mfg. Co., 153 East 5th St.—several new machine tools.

O., Newark—The Oakoal Co., J. Tracy, Mgr.—tool room equipment.

Wis., Racine—The Western Electric Co.—
1 Kearney & Trecker plain No. 1-B horizontal milling machine.
1 Punch press, straight sided and tie rod construction No. 62 V. & O. or 74½ Bliss.
1 18-in. double disc. grinder.

Wis., Two Rivers—Langer Bros.—garage repair machinery.

Wis., West Allis (Milwaukee P. O.)—The Kearney & Trecker Co., manufacturers of milling machines—1 second-hand horizontal boring, drilling and milling machine with about 6 ft. horizontal and 4 ft. vertical travel.

Minn., Minneapolis—The Spyco Smelting & Refining Co., 307 Syndicate Bldg.—disk machine and shell machines.

Mo., St. Louis—The Eagle Picher Lead Co., Benoist Bldg.—1 second hand 2½ ft. radial drill.

Cal., Los Angeles—The Catholic Bishop of Monterey and Los Angeles, Higgins Bldg.—garage machinery, lathes, drills, etc. Estimated cost, $3,000.

Machinery Wanted

Mass., Boston—The Boston Herald, Tremont St.—new presses, linotype and rotogravure machines.

Mass., West Bridgewater—The West Bridegwater Fdry.—molding machines, sand blast, etc.

Md., Baltimore—The Duraflex Co., 409 Continental Bldg., manufacturers of flooring, etc., J. E. Nachod, Purch. Agt.—

1 rotary or pan type drier, direct fire capacity 500 lb. asbestos fibre per charge, (used).

1 hand or electric operated hoist to run on overhead rail, 1,000 lb. capacity, (used).

30 in. Buhr or Esopus stone water cooled paint mixers and grinders, mixer equipped with agitator blades rather than coffee mill type, (used).

1,000 lb. capacity portable platform scales, (used).

Revolvator or portable 10 x 12 ft. tiering machine, overall lifting capacity 1 ton, (used).

N. J., Newark—Butterworth-Judson Corp., Doremus Ave.—machinery for paranitraniline plant.

Fla., Bartow—The Polk County Record, c/o J. G. Gallemore, Editor—new press, linotype machine, etc.

N. C., Greensboro—The Fuller Lumber Co., Inc., shook splicers and wire tying machines.

Mich., Marquette—E. and G. Wickstrom—monorail crane for garage.

Wis., Fond du Lac—The Latex Tire & Rubber Co., c/o G. Lambright, Mgr., East Scott St.—tire and rubber machinery and additional equipment.

Wis., Janesville—C. V. Kerch, City Engs.—crane for pumping station.

Wis., Milwaukee—The Dept. of Pub. Wks., T. Rodgers, chemist—$15,000 worth of special machinery, to be installed in garbage plant, to determine practicability of making alcohol from garbage.

Wis., Milwaukee—The Thiensville Concrete Products Co., c/o A. Meixner, 1429 22d St.—machinery for making drain and sewer tile of concrete, (new).

Wis., Rice Lake—H. Ashlin and S. M. Nelson—woodworking machinery for the manufacture of sash and doors.

Wis., Reeseville—The Reeseville Canning Co.—canning machinery.

Wis., Neillsville—The Neillsville Auto Co. F. Reinhard, Purch. Agt.—small crane for garage purposes.

FOREIGN

Mexico, Monterrey—The Vidriera Monterrey—small grinding machines to face off cast iron molds.

Metal Working

NEW ENGLAND STATES

Conn., Meriden—The Immick Co., State St., will make alterations to its storehouses, build additions to its blacksmith shop and carpenter shop, and also build a 1 story. 55 x 100 ft. garage. Estimated cost, $30,000.

Mass., Boston—The Kneeland St. Garage, Inc., c/o J. C. Spofford, Archt., 36 Bromfield St., plans to construct a 9 story, 30 x 195 ft. garage, on Hudson and Kneeland Sts. Estimated cost, $800,000.

Mass., Lynn—The General Electric Co., 84 State St., has had plans prepared for the construction of a 4 story, 76 x 125 ft. addition to its plant, for the manufacture of electrical goods. Estimated cost, $175,000.

Mass., Palmer—The Springfield St. Ry. Co., 7 North Main St., Springfield, plans to construct a 1 story machine shop, here, to replace the one which was recently destroyed by fire.

Mass., Pittsfield—The Boston & Albany R.R. Co., South Station, Boston, has awarded the contract for the construction of a 1 story, 60 x 95 ft. machine shop. Estimated cost, $25,000.

Mass., Springfield—Chaplin Realty Co., 374 Main St., plans to construct a 1 story, **51 x 245 ft. garage,** etc., on Pecousic Ave. Estimated cost, $40,000. Private plans.

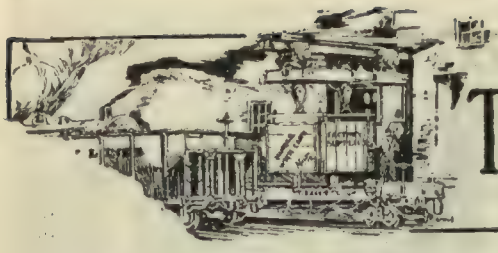
Mass., West Bridgewater—The West Bridgewater Fdry. is building a 50 x 100 ft. iron foundry for the manufacture of iron castings. Estimated cost, $5,000. H. E. Bryant, Supt.

Mass., Worcester—M. Fine, 147 Olean St., is having plans prepared for the construction of a 2 story, 40 x 40 ft. garage on Central St. Estimated cost, $25,000. E. T. Chapin, State Mutual Bldg., Archt.

N. H., Berlin—The Berlin Street Ry. Co. plans to build a 1 story, 50 x 100 ft. addition to its car shop. E. W. Gross, Mgr. Private plans.

R. I., Pawtucket—S. Oziok plans to build a 1 story, 55 x 125 ft. garage and auto repair shop on Main St. Estimated cost, $30,000.

R. I., Providence—The Narragansett Electric Lighting Co., Turks Head Bldg., plans to build a service and storage building on Melrose and Russell Sts. Jenks & Ballou, 1035 Grosvenor Bldg., Archts. and Engrs.



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Year Ago
CINCINNATI		
No. 2 Southern	$44.50	$30.35
Northern Basic	40 00	27.55
Southern Ohio No. 2	42 00	28.55
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	51.26	32.40
Southern No. 2 (Silicon 2.25 to 2.75)	48.26	35.20
BIRMINGHAM		
No. 2 Foundry	40 50	29.25
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25-2.75 sil.	42 50	29.00-30.00
Virginia No. 2	46 25	33.10
Basic	38 25	26.75
Grey Forge	40 25	26.75
CHICAGO		
No. 2 Foundry local	40 00	26.75
No. 2 Foundry, Southern	46.66	28.00
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry	41.96	28.15
Basic	38.00	27.15
Bessemer	38.00	29.35

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Current	New York One Month Ago	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Structural shapes	$3.80	$4 15	$3.47	$3.58	$3.37	$3.58	$3.47
Soft steel bars	3.70	4 15	3.37	3.34	3.27	3.48	3.37
Soft steel bar shapes	3.70	4 15	3.37	3.48	3.27	3.48	3.37
Soft steel bands	4.65	5 50	4.07	6.25	.....	.....	.....
Plates, ¼ to 1 in. thick	4.00	4.15	3.67	3.78	3.57	3.78	3.67

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.25	$2.77
Warehouse, New York	4.75	3.37
Warehouse, Cleveland	3.52	3.27
Warehouse, Chicago	4.12	3.37

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55	5.20	4.57	5.00	6.13
No. 12	3.60	5 25	4.62	5.05	6.18
No. 14	3.65	5 30	4.67	5 10	6.23
No. 16	3.75	5 40	4.77	5.20	6.33
Black					
Nos. 18 and 20	4.20	6 30	5.30	5.60	6.90
Nos. 22 and 24	4.25	6 35	5.35	5.75	6.95
No. 26	4.30	6 40	5.40	5.80	7.00
No. 28	4.35	6 50	5.50	5.90	7.10
Galvanized					
No. 10	4.70	7 05	5.75	6.25	7.25
No. 12	4.80	7 15	5.85	6.35	7.30
No. 14	4.80	7 15	5.85	6.35	7.45
Nos. 18 and 20	5.10	7 40	6.15	6.65	7.75
Nos. 22 and 24	5.25	7 55	6 30	6 80	8.15
No. 26	5.40	7 70	6 45	6.95	8.30
No. 28	5.70	8.00	6.75	7.25	8.60

Acute scarcity in sheets, particularly black, galvanized and No. 16 blue enameled. Automobile sheets are unavailable except in fugitive instances, when prices are 9.45c per lb. for No. 16; 9.50 for Nos. 18 and 20, and 9.55c for Nos. 22 and 24.

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.50	$5.80	$4.84
Flats, square and hexagons, per 100 lb. base	6.00	6.30	5 34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL — Base prices in cents per pound F. O. B. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55
Special Nickel and Alloys			
Malleable nickel ingots	45		
Malleable nickel sheet bars	47		
Hot rolled rods, Grades "A" and "C" (base)	60		
Cold drawn rods, grades "A" and "C" (base)	72		
Copper nickel ingots	42		
Hot rolled copper nickel rods (base)	52		
Manganese nickel hot rolled (base) rods "D" — low manganese	64		
Manganese nickel hot rolled (base) rods "D" — high manganese	67		

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb lots sells as follows, f. o. b. New York: ⅛, 8½c. per lb.; ¼, 8c.; ⅜ to ½, 7½c Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	9.00
Spring steel (light)	10.00	7.00	12.00
Coppered bessemer rods	9.00	8.00	6.75
Hoop steel	4.70	4.04	5.32
Cold-rolled strip steel	9.50	8.25	10.75
Floor plates	6.25	4.00	6.63

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

Steel Inches	Steel Black	Steel Galvanized	Iron Inches	Iron Black	Iron Galvanized
BUTT WELD					
⅜ to 3	54–57½%	41½–44%	⅜	15½–25½%	+1½–11%
			½	19½–29½%	1½–11½%
			¾ to 1¼	24½–34½%	8 –18½%
LAP WELD					
2	47 –50½%	34½–38%	1¼	.....	.....
2½ to 6	50 –53½%	37½–41%	1½	.....	.....
7 to 12	47 –50½%	33½–37%	2	20½–28½%	6½–14½%
13 to 14	37½–41 %		4½ to 6	22½–30½%	9½–17½%
15	35 –38½%		2½ to 4	22½–30½%	9½–17½%
			7 to 12	19½–27½%	6½–14½%
BUTT WELD, EXTRA STRONG PLAIN ENDS					
⅜ to 1¼	52 –55½%	39½–43%	⅜ to 1¼	24½–34½%	9½–19½%
2 to 3	53 –56½%	40½–44%			
LAP WELD, EXTRA STRONG PLAIN ENDS					
2	45 –48½%	33½–37%	1¼	.....	.....
2½ to 4	48 –51½%	36½–40%	1½	.....	.....
4½ to 6	47 –50½%	35½–39%	2	21½–29½%	8½–16½%
7 to 8	43 –46½%	29½–33%	2½ to 4	23½–31½%	11½–19½%
9 to 12	38 –41½%	24½–28%	4½ to 6	22½–30½%	10½–18½%
			7 to 8	14½–22½%	2½–10½%
			9 to 12	9½–17½%	5½–+2½%

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅜ to 3 in. steel butt welded	38%	22%	39%	30%	54%@40%	40½@30 %
2½ to 6 in. steel lap welded	33%	18%	41%	26%	50@40%	37½@27½%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 45%. Cast iron, standard sizes, plus 5%.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	15 00	15.00	22.50
Tin in 5-ton lots	34 25	36.25	56.50
Lead	5 375	5 75	6.25
Zinc	7.00	7.00	7.60
ST. LOUIS			
Lead	6.25	7.25	6.00
Zinc	6.75	6.25	7.15

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

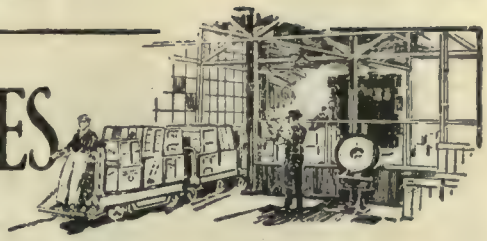
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	22.50	22.50	33.50	24.50	35.50	28.50	36.50
Copper wire (carload lots)	17.00	20.00	30.75	22.00	30.50	25.00	26.00
Brass sheets	20.25	22.25	32.00	25.00	33.00	25.25	28.00
Brass pipe	25.00	25.00	36.00	27.00	39.00	30.00	37.00
Solder (half and half) (case lots)	27.75	27.25	45.00	29.00	41.00	22.50	38 50

Copper sheets quoted above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill, 1000 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	18.25	24.00
New York	18 25	28.00@29 75
Cleveland	23.00	29 00
Chicago	23 25	27 00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f.o.b. mill — less 8% for carload lots 11.50

	Warehouse — In Casks — Current	Warehouse — In Casks — One Year Ago	Warehouse — Broken Lots — Current	Warehouse — Broken Lots — One Year Ago
Cleveland	15.30	12.50	14.70	13.00
New York	14.00	11.50	14.50	12.50
Chicago	14.50	16.50	14.95	16.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	6.25	9.50
Chicago	7.00	9.75
Cleveland	7.50	9.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	*New York — Current	*New York — One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	12.00	17.00	10.00	11.50
Copper, heavy, and wire	11.50	16.00	9.50	11.00
Copper, light, and bottoms	10.00	14.00	9.00	9.50
Lead, heavy	4.00	4.75	4.00	4.50
Lead, tea	3.00	3.75	3.00	3.50
Brass, heavy	7.00	10.50	7.00	10.50
Brass, light	5.50	7.50	5.00	5.50
No. 1 yellow brass turnings	6.50	10.00	5.50	5.50
Zinc	4.50	5.00	3.00	4.50

*These prices nominal because of dull market

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	29.00	26.00	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	28.00	32.00
Chicago	21.00	31.00
Cleveland	25.00	35.00

BABBITT METAL—Warehouse price per pound:

	New York — Current	New York — One Year Ago	Cleveland — Current	Cleveland — One Year Ago	Chicago — Current	Chicago — One Year Ago
Best grade	70.00	90.00	44.00	70.00	43.00	60.00
Commercial	30.00	50.00	16.50	16.50	11.00	13.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York we quote the best two grades, although lower grades may be obtained at from $16 to $20.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York — Current	New York — One Year Ago	Cleveland — Current	Cleveland — One Year Ago	Chicago — Current	Chicago — One Year Ago
Hot pressed square	+$1.25	$1.50	List net	$2.25	+1.15	1.85
Hot pressed hexagon	+ 1.25	1.50	List net	2.25	+1.15	1.85
Cold punched hexagon	+ 1.25	1.50	List net	2.25	+1.15	1.30
Cold punched square	+ 1.25	1.50	List net	2.25	+1.15	1.30

Semi-finished nuts, ⅝ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	50–10%
Chicago	40%	50%
Cleveland	50%	55%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	+10%	50%	20%
Larger and longer up to 1½ in. by 30 in.	Net list	40%	10%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York ..... list Cleveland ..... $2.75 Chicago $1.90

For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York ..... $7.00 Cleveland ..... $4.50 Chicago $5.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	+20%	40%	20%
Larger and longer up to 1 in. by 30 in.	+20%	35%	15%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets — Current	Rivets — One Year Ago	Burs — Current	Burs — One Year Ago
Cleveland	25%	20%	10%	10%
Chicago	net	20%	net	20%
New York	30%	40%	net	20%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	20%	50%	30%
Tinned	20%	50%	30%

Structural, same sizes:
New York ..... $5.73 Chicago ..... $5.73 Pittsburgh $4.50

Boiler, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York ..... $6.00 Chicago ..... $5.83 Pittsburgh $4.60

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	26.00	30.00	31.00
Brass	25.00	27.00	30.00

The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1 c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities from 10-25 lb., extra is 10c.; less than 10 lb., add .15–20c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼-2 in. inclusive in rounds, and ¼-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $8.85 per 100 lbs.

In Cleveland—$10 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	New York — Current	New York — One Year Ago	Cleveland	Chicago
White	13.00@15.00	13.00	15.00	15.00@17.00
Colored mixed	7.00@12.00	9.00–12.00	11.00	11.00@13.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.00	$2.00	$1.75
Philadelphia	2.75	2.75	1.75
Cleveland	4.00	3.00	2.50
Chicago	2.00	2.75	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.50	$3.50	$3.65
Philadelphia	3.65	3.65	3.87
Chicago	3.85	3.85	4.12½

COKE—The following are prices per net ton at ovens, Connellsville:

	January 3	December 27	December 20
Prompt furnace	$6.00@$7.00	$7.00@$7.50	$7.00@$7.50
Prompt foundry	7.00@8.00	8.50@9.00	8.50@9.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

	New York — Current	New York — One Year Ago	Cleveland — Current	Cleveland — One Year Ago	Chicago — Current	Chicago — One Year Ago
Raw in barrels, (5 bbl. lots)	$0.90	$2.15	$1.05	$2.50	$1.01	$2.37
5-gal cans	1.05	2.30	1.30	2.75	1.26	2.57
1-gal cans (6 to case)	1.15	....	....	....	....	....

WHITE AND RED LEAD—Base price per pound:

	Red — Current — Dry	Red — Current — In Oil	Red — One Year Ago — Dry	Red — One Year Ago — In Oil	White — Current — Dry and In Oil	White — One Year Ago — Dry and In Oil
100 lb. keg	14.00	15.50	13.00	14.50	14.00	13.00
25 and 50-lb. kegs	14.25	15.75	13.25	14.75	14.25	13.25
12½-lb. keg	14.50	16.00	13.50	15.00	14.50	13.50
5-lb. cans	17.00	18.50	15.00	16.50	17.00	15.00
1-lb. cans	19.00	20.50	16.00	17.50	19.00	16.00

500 lb. lots less 10% discount. 2,000 lb. lots less 10 4% discount. 10,000 lb. lots less 10-7½% discount.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Morton McI. Dukehart & Co., 641 Light St., will soon award the contract for the construction of a 1 story, 40 x 125 ft. machine shop, which will probably include a foundry. Estimated cost, $30,000. W. H. Emory, Jr., Munsey Bldg., Archt.

N. J., East Orange—The Jephson Scott Body Co., 24 Sterling St., has awarded the contract for the construction of a 2 story, 58 x 63 ft. factory. Estimated cost, $70,000. Noted Dec. 2.

N. J., Orange—I. Blum & Co. plans to construct a 1 story, 57 x 223 ft. garage and store building at 100-102 Main St. Estimated cost, $75,000.

N. J., Orange—The D. & H. Constr. Co. plans to build a 1 story, 55 x 164 ft. garage at 209-211 Main St. Estimated cost, $26,000. Kruger & Siegler, Archts.

N. Y., New York (Borough of Brooklyn)—R. Embers, 209 King St., has awarded the contract for the construction of a 1 story, 60 x 100 ft. foundry on Richards St. Estimated cost, $35,000.

N. Y., New York (Borough of Brooklyn)—J. P. Riorden, 431 West 14th St., New York City, will build a 1 story, 100 x 160 ft. garage at 239 South St. Estimated cost, $40,000.

N. Y., New York (Borough of Brooklyn)—J. Schwartz, c/o M. Hirsh, Archt. and Engr., 26 Court St., will build a 1 story, 135 x 140 ft. garage on Abermarle Rd. near Flatbush Ave. Estimated cost, $50,000.

N. Y., New York (Borough of Brooklyn)—B. Slater, 175 Bay 29th St., will build a 1 story garage on Atlantic Ave. and Clinton Ave. Estimated cost, $60,000. McCarthy & Kelley, 16 Court St., Archts. and Engrs.

N. Y., New York (Borough of Brooklyn)—The Webster Bldg. Co., 290 Saratoga Ave., will build a 1 story, 150 x 200 ft. garage on Myrtle Ave. near McKibbon St. Estimated cost, $75,000.

Pa., Ambridge—The Columbia Steel Shafting Co., Park Bldg., Pittsburgh, is having preliminary plans prepared for the construction of a 1 and 2 story, 600 x 600 ft. factory, here Estimated cost, $1,000,000. I. C. Horn, 1505 Park Bldg., Pittsburgh, Engr.

Pa., Philadelphia—Edelstein & Bernstein, 434 Widener Bldg., have awarded the contract for the construction of a 1 story, 86 x 128 ft. garage. Estimated cost, $30,000.

Pa., Philadelphia—The General Baking Co. is having plans prepared for the construction of a garage on Reed and Percy Sts. Potts Bros. & Cooperson, 129 North 11th St., Archts.

Pa., Philadelphia—The Jump House Wrecking Co., 30th St. below Callowhill St., will build a 1 and 2 story, 20 x 40 ft., 40 x 80 ft., 11 x 30 ft. and 26 x 60 ft. office, storage, garage and repair buildings, on 43d and Woodland Sts.

Pa., Philadelphia—F. A. North, 1306 Chestnut St., is having plans prepared for the construction of a 4 story, 28 x 177 ft. warehouse and garage at 1529 Parrish St. A. W. Barnes, 10 South 18th St., Archt.

Pa., Pittsburgh—The Simons Co., 824 River Ave., manufacturers of beds, will soon award the contract for the construction of a 2 story factory, to cover 23,000 sq.ft. of floor space, on River and Madison Aves. Private plans.

SOUTHERN STATES

Tenn., Etowah—The Louisville & Nashville R.R., Knoxville, plans to rebuild repair shops and machinery department building which was recently destroyed by fire. Estimated loss, $150,000. W. H. Courtney, Ch. Engr.

MIDDLE WEST STATES

Ind., Anderson—The Indiana Tractor & Silo Co. will build a 1 story, 100 x 200 ft. tractor plant. Estimated cost, $60,000.

Mich., Detroit—The Zenith Fdry. Co., Miller Ave., has awarded the contract for the construction of a 1 story, 90 x 200 ft. foundry.

O., Cleveland—The Hill Clutch Co., foot of West 65th St., is building a 1 story, 26 x 42 ft. addition to its factory. Estimated cost, $10,000.

O., Cleveland—M. Purer, 2724 East 53d St., has awarded the contract for the construction of a 1 story, 80 x 120 ft. garage at 796 East 105th St. Estimated cost, $40,000. Noted Dec. 16.

O., Dayton—The Lucas Miner Tool & Production Co., Valley St., plans to remodel and equip a 3 story factory at 427 Valley St. for the manufacture of fire sprinklers. Estimated cost, $25,000.

Wis., Wisconsin Rapids—The Amer. Rotary Engine Co. is having plans prepared for the construction of a 1 story machine shop. Estimated cost, $25,000. J. A. Cohen, Treas. LaSalle Eng. Co., 337 West Madison St., Chicago, Engrs.

WEST OF THE MISSISSIPPI

Minn., Minneapolis—The City is having plans prepared for the construction of a 2 story, 60 x 90 ft. police station to include a 1 story, 34 x 57 ft. repair shop on Bryant Ave., S., and 29th St. Total estimated cost, $100,000. J. F. Walker, Supt. of the Police. Bertrand & Chamberlin, 616 Northwestern Bank Bldg., Archts.

Tex., Amarillo—The Fort Worth & Denver Ry., Denver Record Bldg., Ft. Worth, has authorized the expenditure of $200,000 to improve shops and yards, here, including new machinery, etc. Address F. E. Clarity, Vice-Pres. and Genl. Mgr.

WESTERN STATES

Cal., Los Angeles—The Catholic Bishop of Monterey and Los Angeles, Higgins Bldg., has awarded the contract for the construction of a 1 story, 60 x 176 ft. addition to his garage. Estimated cost, $21,500.

Cal., Los Angeles—The Consolidated Vanadium Co., 1225 Washington Bldg., has awarded the contract for the construction of a 1 story, 50 x 50 ft. factory. W. S. Green, Los Angeles, Engr.

CANADA

Ont., London—The Service Truck Co., Wabash, Ind., plans to build a 1 story, 100 x 300 ft. factory, here. Estimated cost, $100,000.

General Manufacturing

NEW ENGLAND STATES

Conn., New Haven—The Connecticut Sash & Door Co., 451-59 Grand Ave., will build a 4 or 5 story factory to replace the one which was recently destroyed by fire. Estimated cost, $75,000.

Mass., Huntington—The Chapin & Gould Paper Co. has awarded the contract for remodeling its paper plant.

Mass., Pittsfield—The Boston & Albany R.R., South Sta., Boston, plans to construct a 1 story roundhouse at its yards, here, to replace the one which was recently destroyed by fire.

Mass., Southbridge—The Crown Confectionery Co., 89 Main St., plans to construct a 3 story, 50 x 60 ft. candy factory. Estimated cost, $40,000.

R. I., Westerly—The Westerly Textile Co., 41 Main St., plans to build a 2 story addition to its textile plant. Estimated cost, $50,000. C. T. Main, 201 Devonshire St., Boston, Engr.

MIDDLE ATLANTIC STATES

N. J., Newark—The Butterworth—Judson Corp., Doremus Ave., has had plans prepared for the construction of a 3 story paranitraniline plant to replace the one which was recently destroyed by fire. Estimated cost, $180,000.

N. J., Ridgefield—The Continental Paper Box Co., 122 Washington St., Brooklyn, has awarded the contract for the construction of a 100 x 500 ft factory on Grand Ave. and Hale St., here. Estimated cost, $250,000.

SOUTHERN STATES

Fla., Bartow—The Polk County Record, c/o J. G. Gallemore, Editor, will soon award the contract for the construction of a 2 story, 50 x 75 ft. newspaper plant. Estimated cost, $75,000. B. C. Bonfoey, Tampa, Archt.

Fla., Lake Alfred—The Lake Alfred Citrus Growers Assn. has awarded the contract for the construction of a 2 story, 200 x 200 ft. packing house. Estimated cost, $100,000.

Ky., Louisville—G. M. Clark, New Albany, Ind., has awarded the contract for the construction of a 1 story, 95 x 115 ft. building on 21st and Howard Sts. The Natl. Biscuit Co., lessee.

Ky., Louisville—The F. A. Minne factory of the Natl. Candy Co. is having plans prepared for the construction of a 5 story, 135 x 216 ft. factory. Estimated cost, $600,000. D. X. Murphy & Bros., Louisville Trust Bldg., Archts.

MIDDLE WEST STATES

O., Cleveland—The Arnold Woodenware Co., 1369 West 9th St., plans to build a 2 story, 50 x 150 ft. factory on West 53d St. and Detroit Ave. Estimated cost, $100,000. R. H. Ellsworth, Mgr.

O., Cleveland—The City Ice Delivery Co., Cadillac Bldg., plans to build a 1 story, 65 x 140 ft. ice factory and storage room on Saranac Rd. Estimated cost, $75,000. H. D. Morval, Mgr. C. C. Coneby, Cadillac Bldg., Engr. and Archt

O., Sandusky—The Hord Color Products Co., South Columbus Ave., manufacturer of paint, has awarded the contract for the construction of a 1 story factory. Estimated cost, $50,000.

Wis., Fond du Lac—The Latex Tire & Rubber Co., c/o G. Lambright, Mgr., is building a 2 story, 60 x 178 ft. tire factory, on East Scott St. Estimated cost, $40,000. B. E. Mehner, Fond du Lac, Archt. Noted Dec. 30.

Wis., Reeseville—The Reeseville Canning Co. plans to build a 4 story, 60 x 185 ft. canning factory on Main St. Estimated cost, $75,000.

Wis., Thiensville—The Thiensville Concrete Products Co., c/o A. Meixner, 1429 22d St., Milwaukee, plans to build a 1 story addition to its factory.

WEST OF THE MISSISSIPPI

Okla., Oklahoma City—The Amer. Legion is having preliminary plans prepared for the construction of a group of hospital buildings, to include a laundry and garage, etc. Total estimated cost, $2,000,000. C. Needer and M. Jayne, Empress Theatre Bldg., Archts.

Tex., Dallas—The Gulf Refining Co., 315 Sherman St., has awarded the contract for the construction of several 1 and 2 story buildings to cover 40,000 sq.ft. of floor space. Cost between $150,000 and $200,000. Noted Nov. 4.

CANADA

B. C., Kitimat—The Kitimat Pulp & Paper Co. has made application to the Provincial Government of British Columbia for water privileges in connection with the establishment of a proposed pulp and paper mill at Lowe Inlet, Kitimat Arm.

Que., Sorel—M. J. Dansereau will receive bids in January for the construction of a pulp mill, to have a daily capacity of 100 tons of pulp. Estimated cost $500,000.

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Wilmarth & Morman Company's No. 78 Surface Grinding Machine

Designed for Ease of Operation—Two Precision Screws Used for Adjusting Wheel to Cut—Clutch and All Gears Run in Oil

SPECIAL CORRESPONDENCE

THE surface grinding machine herewith illustrated and described has been lately brought out by the Wilmarth & Morman Co., Grand Rapids, Mich., and while it is designed to meet the exacting requirements of precision tool and gage grinding it possesses the essential strength and rigidity necessary for intensive production grinding of a diversified range.

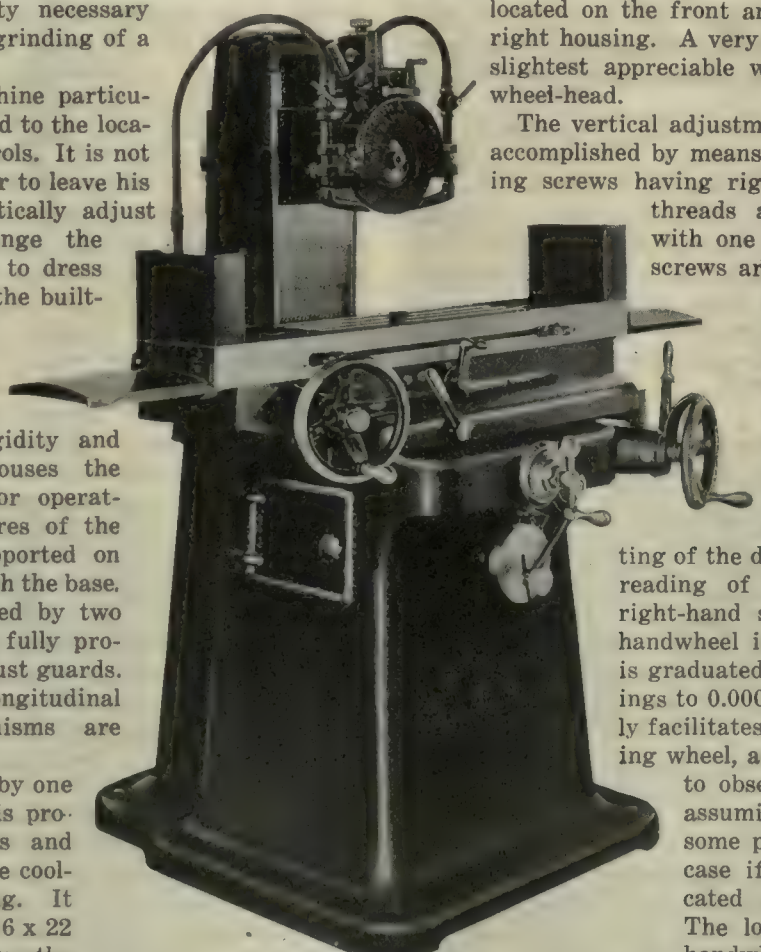
In designing this machine particular attention has been paid to the location of all operating controls. It is not necessary for the operator to leave his working position to vertically adjust the wheel-head, to change the amount of cross-feed, or to dress the grinding wheel with the built-in wheel-truing device.

The base is a one-piece casting of sufficient weight and proportion to insure maximum rigidity and stability. The base houses the mechanisms necessary for operating the automatic features of the machine, which are supported on brackets cast integral with the base.

The saddle is supported by two large V-ways which are fully protected by well designed dust guards. Certain details of the longitudinal and cross-feed mechanisms are housed in the saddle.

The table is supported by one V and one flat way and is provided with dust guards and means for carrying off the coolant used in wet grinding. It has a working surface of 6 x 22 in. and has three T-slots, the center one extending beyond the working surface, thus allowing for the clamping of long work or the use of a magnetic chuck.

The longitudinal travel of the table is automatic in both directions, the reversal being controlled by simple adjustable stop dogs. A convenient lever on the saddle controls the starting and stopping of the table, and provision is made for reversing its direction by hand when so desired.



WILMARTH & MORMAN NO. 78 SURFACE GRINDING MACHINE

The automatic transverse travel of the table, in either direction, is controlled by the lever at the right of the base. Adjustable stops limit the transverse travel, which has a range of feeds from 0.015 to 0.1875 in. per stroke.

The wheel-head travels vertically in square ways located on the front and rear sides of the upright housing. A very sensitive takeup for the slightest appreciable wear is provided on the wheel-head.

The vertical adjustment of the wheel-head is accomplished by means of two precision elevating screws having right- and left-hand Acme threads and working in unison with one another. The elevating screws are mounted in adjustable bronze nuts arranged to compensate for all lost motion in the elevating mechanism. All settling of the head while the wheel is in cut is positively eliminated, thus making possible a dependable, accurate setting of the depth of cut from a direct reading of the handwheel on the right-hand side of the base. This handwheel is of large diameter and is graduated by widely spaced markings to 0.0005 in. Its location greatly facilitates the setting of the grinding wheel, as it permits the operator to observe the setting without assuming an awkward or tiresome position, as would be the case if the handwheel was located on the wheel housing. The location of the elevating handwheel is an exclusive feature of this machine.

The spindle is a crucible-steel forging accurately machined and balanced, and is carried in annular combination radial and end-thrust bearings. These bearings are made exclusively for precision grinding machines and are especially tested for concentricity.

The gear box containing the table-travel gears, and the reversing mechanism, is located in the base of the machine. The clutch (which is made from hardened

chrome nickel steel) and all gears in the gear box run in oil. A train of gears connects the gear box to a spiral rack and pinion for driving the table. All parts subject to wear are protected against dust, grit and coolant by especially designed guards and barriers.

The cross-feed screw receives its motion through a friction drum driven from the gear box. The transverse motion can be set to feed in or out at one end or at both ends of the table stroke as desired. By moving the cross-feed control lever (located on the right of the base) to its neutral position the cross-feed screw is left free for hand manipulation. The amount of cross-feed per stroke of table is regulated by an adjustable driving disk and link motion located on the front of the base. Here is also located a sliding pin for controlling the cross-feed at one end or both ends of the table stroke. The cross-feed screw is carried in a double-row self-aligning ball bearing. Two opposed adjustable bronze nuts make it possible to take up all backlash. The two features noted above permit an extremely free working screw. This machine is regularly furnished for wet grinding. The coolant is piped to both sides of the wheel, which insures complete immersion of the work as it engages and leaves the weel. This is a feature of no small importance in successful wet grinding. The pump-pans and piping (except the spray guards) are built into the machine.

The wheel truing device, including a diamond, is part of the regular equipment. A vise particularly designed for use in surface grinding can be furnished to order. The vise has hardened steel jaws 6 in. wide, 1½ in. deep and opening 3 in. The countershaft is equipped with pressed steel hangers, ring-oiling, self-aligining babbitt bearings and a self-oiling loose pulley.

The machine can be arranged for motor drive but not including motor starting equipment. A 5-hp., 1,200 r.p.m. motor is recommended.

An Inexpensive and Effective "Dope" for Bright Parts

By E. A. Dixie

A very satisfactory "dope" for bright parts of machinery is made by mixing 80 parts of Chinese wood oil and 20 parts of boiled linseed oil. Both these oils dry with comparative rapidity and the composition made in the above-mentioned proportions after a few hours forms a tough film which effectively precludes moisture.

If the composition becomes too viscous to allow it to be spread properly on the goods it should be thinned with turpentine or if this is not available gasoline may be used.

The parts to which the composition is to be applied should be bright and *clean*. Care should be taken that they are not handled with the fingers as they may deposit moisture which will develop into rust spots under the composition after the parts have been treated.

The composition may be applied with a soft camel's hair brush, a piece of waste or a soft sponge. Where large quantities of bright work are to be protected from rusting they may be put in wire baskets and immersed in the composition. The coated goods should be hung up to dry for several hours preferably in a warm dustless room.

The writer has a micrometer which was coated with the above composition shortly after it was bought, new, about 15 years ago. Except for the slight abrasions one would expect to find in a tool of this sort after such a long period of use the tool is as bright as the day it was bought.

Dope of this sort is often applied merely as a temporary protection, and this composition is equally satisfactory for such purpose as it can readily be removed by washing the parts with turpentine, kerosene or gasoline.

What Is a First-Class Machinist?

By J. A. Raught

Mr. McHenry's question on page 858, Vol. 53, of the *American Machinist* as to what constitutes a first-class machinist will, no doubt, elicit many and conflicting opinions; for the possibilities in the matter of varying conceptions of the necessary qualifications are probably greater than in the case of that closely allied question that has been the recent subject of discussion; namely, what is a machine tool?

A first-class machinist is a man less often seen than discussed, and quite likely in such discussion each individual has in mind an ideal workman, a composite of several of his acquaintances, possessing the good points of all of them and the bad points of none.

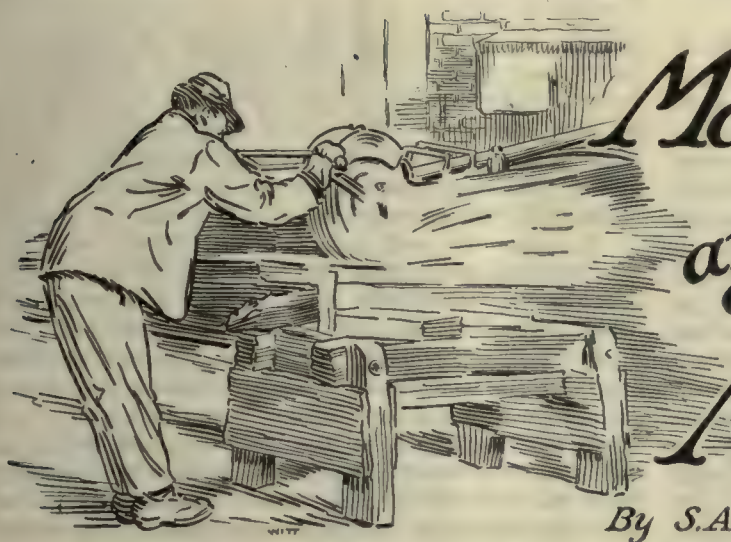
In my opinion a first-class machinist should be proficient and skillful in the manipulation of all the standard machines usually found in the modern small machine shop; which includes the lathe, shaper, planer, drill-press, milling machine, boring mill, etc. He should be able to accomplish well and quickly any job that comes legitimately within the range of such machines; and should any one of them not be available (excepting, perhaps, the lathe) he should be able to perform the operations that are usually allotted to the missing machine in some other way.

He should be proficient in the use of the hammer and cold chisel; file and scraper. He should be able to figure pulley sizes to determine proper speed ratios; also pitches, center-distances, etc., incident to the laying out, turning and finishing of a gear or pair of gears; and, should no milling machine or gear cutter be available, he should be able to lay out tooth forms, make cutting tools, and cut the teeth on shaper or planer.

While it is true that gear cutting is now usually considered a separate trade, it is so closely allied to the machinist's trade that no first-class machinist can afford to be ignorant of its principles.

The first-class machinist must also possess sufficient knowledge of forging and tempering to be able, whenever necessary, to perform these operations without outside aid. He should be able to take the drawings and castings of a machine or fixture and from them construct the finished product. He should be handy with drawing tools himself, and should possess a working knowledge of pattern making and foundry practice. He should be able from study of a broken or defective machine to make the repairs or alterations necessary to puf it in service.

Many readers will doubtless look upon this somewhat formidable array as impossible of accomplishment and will throw up their hands in despair, but I am acquainted with men who are capable of doing all these things and more besides, although few, if any, have acquired their knowledge and proficiency without the aid of good books. To become a really first-class machinist requires not less than eighteen years of constant study and experience.



Manganese Steel and Methods of Machining It

By S. A. Hand, ASSOCIATE EDITOR, AMERICAN MACHINIST

Composition of Manganese Steel—Behavior After Casting — Heat Treatment Required—Grinding the Only Method of Machining

MANGANESE steel, an alloy containing from 12 to 14 per cent of manganese, was first made by Hadfield at Sheffield, England, in 1886. This alloy is produced in a converter much in the same manner as bessemer steel. When the molten pig iron is tapped from the cupola into the converter about 12½ per cent of manganese is added and is practically all used up in cleansing the metal during the converting period. After running the metal into the ladle a charge of 80 per cent ferro-manganese is added.

Differing from the usual practice in steel making, the metal is poured—not into ingot molds—but directly into sand molds made from patterns of the articles wanted.

Manganese steel when cooled slowly is exceedingly hard and brittle. It can only be rolled with great difficulty, so that in ingot form it would be of very little use. It can, however, be forged, but only at a very high heat, and even then the process is exceedingly slow and tedious. And forgings are necessarily rough and the surplus metal is costly to remove, so that casting seems to be the only commercial way in which this alloy can be made to take such shapes as are desired.

When shaken out of the sand, small risers and sprues can be broken from the castings with a hammer or sledge, but if too large to yield to such treatment they can be cut off with a gas torch or by means of the electric arc. Casting, too, has its difficulties, for the shrinkage is great—as much as $\frac{1}{16}$ in. per foot—and the patterns must be made so that unequal strains in cooling will be as small as possible, otherwise the casting will be greatly distorted and may be broken.

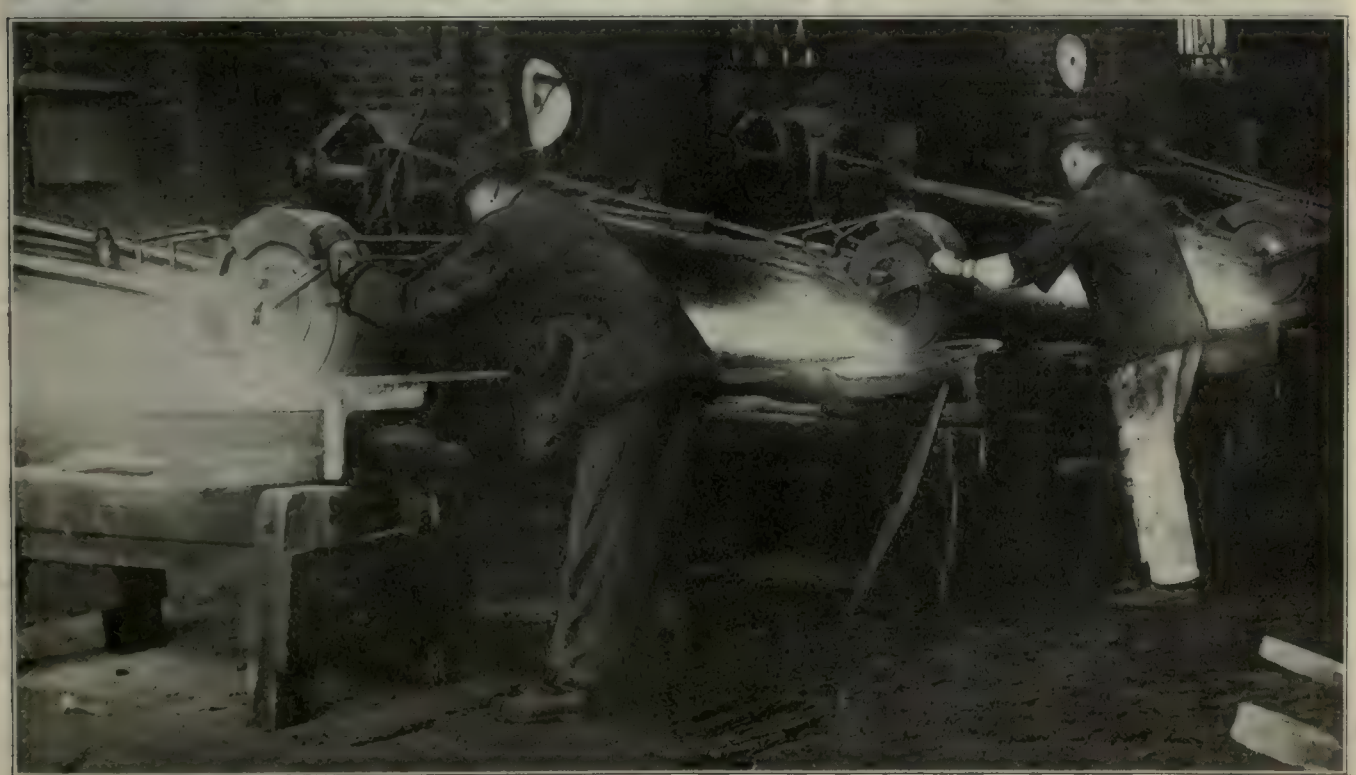


FIG. 1. SNAGGING CASTINGS

In general all holes wanted in the casting must be cored, because it is impossible to drill or bore manganese steel. Where holes must be accurately located provision can be made for drilling them by setting inserts of iron or soft steel in the mold before pouring. Of course, these inserts are necessarily located by coreprints on the pattern and must be larger than the holes wanted, so that any unexpected shrinkage or distortion will still allow the drill to be put through the proper place, leaving enough margin to prevent its touching the casting itself. If, however, the holes are intended to act as bearings for pivots or shafts where the non-wearing qualities of manganese steel are required the object will be defeated as the inserts, after being drilled, will be practically only soft bushings.

As previously stated, manganese steel is exceedingly hard and brittle when cooled slowly, so that before the castings can be put to use they must receive some



FIG. 2. ANGULAR FACE-GRINDING

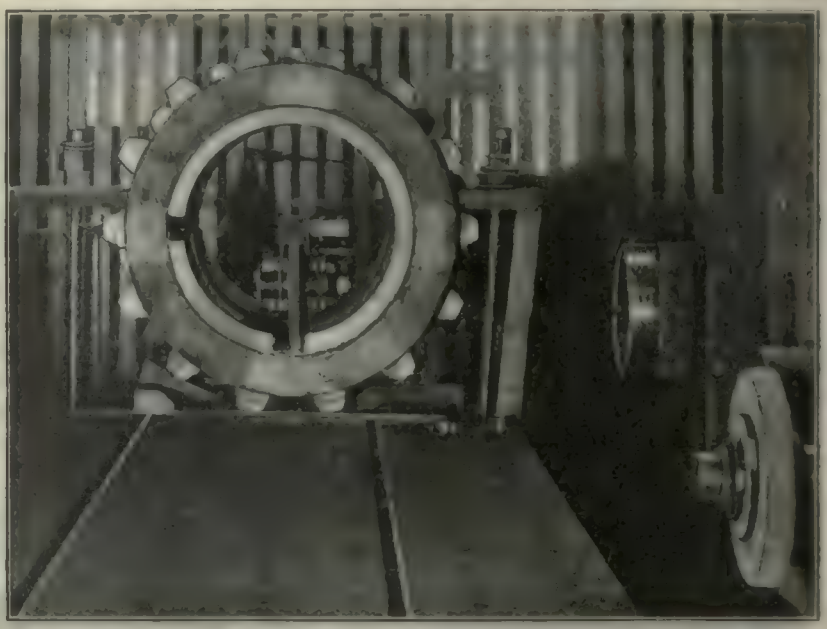


FIG. 3. GRINDING KEYWAYS

treatment for toughening them. This toughening is accomplished by heating them to a white heat, about 1,850 deg. F., and allowing them to soak in the furnace at that temperature from one to two or more days, according to their size. When drawn from the furnace they are quenched in water without previous cooling. This treatment, which would harden steel, results in the castings being tough-hard, in which condition the metal has great resistance to wear due to a peculiar property. The surface will flow under great pressure and in its flow hardens to a great extent and very rapidly, resulting in a hard wearing surface having a ductile backing. A strange thing is that this hard surface is self-renewing, for as soon as a given layer is worn away the next layer, as it becomes surface, at once hardens under the pressure.

Machining Methods

After being heated and quenched the castings are still so hard and tough that they cannot be machined by any of the usual cutting methods, as no tools, either of high-speed steel or stellite, will do the work. The only known method of machining manganese steel is by grinding, and that is both slow and costly—not alone in time but in the terrific consumption of abrasive wheels as well. Hard wheels grind slowly and soft wheels that cut free and fast wear away rapidly, so that the evils to be chosen between are the cost in time versus the cost of the abrasive wheels. This latter is great—greater than would be imagined—for it is the average occurrence for an 18-in. abrasive wheel with 2-in. face to wear away at the rate of one inch of diameter for each hour of use. Then, too, there are other wheel troubles and it seems well-nigh impossible to get two wheels that do not vary from each other in both grade and bond. While this variation might make but a slight difference in general machine-shop use, the punishment the wheels are subjected to in grinding manganese steel makes it very apparent. Some times, of two wheels of the same nominal grade and bond, one will wear away twice as fast as the other. Some idea of the abrasive wheel troubles may be had from the fact that one large manufacturer of wheels keeps an expert practically all the time at a certain manganese steel plant for the sole purpose of investigating and reporting the troubles.

The time and expense of grinding manganese steel could no doubt be materially lessened if wheels could be had that did not vary in grade and bond; if the machines were more rigid and some means could be found to better protect the bearings from grit. In connection with the subject of bearings, it appears that ball bearings stand the punishment better than plain bearings.

Snagging the Castings

Snagging is usually done on either portable or swing grinding machines, as castings small enough to be held in the hands while being snagged are rarely made.

Fig. 1 illustrates some of the swing-frame grinding machines in the cleaning room of the Taylor-Wharton Iron & Steel Co.'s plant, High Bridge, N. J., where the data and illustrations used in preparing this article were obtained. The machines shown have an abundance of power and are suspended from one point, allowing universal movement. The volume of the sparks will give some idea of the amount of punishment the wheels are being subjected to. These sparks, as shown in all

the illustrations, were not faked in making either the photographs or the reproductions, but were recorded on the negatives under actual conditions.

In machining operations the wheels are run at a surface speed of from 5,000 to 6,000 ft. per minute, a feed of from $\frac{1}{4}$ to $\frac{1}{2}$ in. per revolution of the work and a depth of cut from $\frac{1}{64}$ to $\frac{1}{100}$ in., and anyone watching the work being done under these conditions will agree that "This is going some."

Wheels of various grits and grades are used, depending on the class of work being done and on the stiffness of the machine on which they are used. Generally speaking, however, the wheels best suited for grinding manganese steel are from 10 to 24 in grit and from M to T in grade.

Fig. 2 shows a part for a large centrifugal pump being ground. Here, as in most cases, the speed of the work is about 30 ft. per min. It will be seen that the abrasive wheel is being directly driven by a motor mounted on the compound rest of the machine, a flexible coupling being interposed between the motor shaft and the wheel spindle.

Fig. 3 shows finishing one of the two keyways in a shrouded blooming-mill pinion having staggered teeth. The machine in use is of the planer type, though it has no cross-rail. Wheels are mounted on each of the two uprights and are driven by vertical belts from overhead and horizontal belts at or near the wheel level.

In machining the keyways a special attachment is in use consisting of a long tube within which is a shaft driven by a belt from an electric motor. The wheel arbor is mounted horizontally across the end of the tube and power from the shaft to the wheel is transmitted through miter gears. The whole arrangement is pivoted at the rear or driving end and is provided with means for feeding both vertically and horizontally within narrow limits. The function of the machine proper on this job is merely to hold and reciprocate the work, the driving motor and the mounting for the device being located entirely without, and at the rear of, the machine. As the grinding time for each keyway was a little over eight hours, it will be seen that the operation is quite tedious. Incidentally, the hole in this pinion and the small boss surrounding the hole were ground, as were also the shrouds, the latter to the pitch diameter.

The Metric System in Practice

By John A. Grill

Just a word about the metric system. We have several machines (Bronger) built in Europe before the war to the metric system. The machines are all right as far as work goes, but the repairing of them is what "gets our goat," for everything is of an odd size—in fact no size to us.

We make the parts all right, but the American way, "the only way," and make every part that goes with it. It is cheaper and quicker in the long run than to get taps, dies, reamers, drills and other things to make a condemned metric part. We have two that are now almost like machines built in America.

It takes too long to bore a hole or chase a thread, other than by our American standard in inches. The metric system is not of any benefit to an American mechanic—in fact to anybody. Everybody should stand shoulder to shoulder and keep the metric system where it belongs. Me for the inches and feet.

English as She Is Understood

By E. A. Dixie

It's not so much *what* one says as *where* one says it. A statement may be perfectly correct English, or American, perfectly intelligible in one part of the English-speaking world and still be either quite unintelligible or directly misunderstood in some other locality.

My wife and I recently made a trip across the ocean. On the way over she broke the little spring on one side of her glasses, so as soon as we were comfortably settled at the hotel she and I set out to find an optician who could *fix* them. That's where we made a mistake, we should have done something else, but thereby hangs this tale:

Down near the shipping section we spied a sign which read "Optician and Nautical Instrument Maker," so in we went to have the glasses *fixed*.

The store was in the parlor of a dwelling house and as we entered and closed the door the proprietor came in from the back shop. He was a type of man that it would be difficult to find in the United States. Tall and spare, dressed in somber block of ancient cut, he looked just as though he had stepped from between the covers of one of Dickens' books.

Without loss of time, my wife laid the broken glasses on the counter and said:

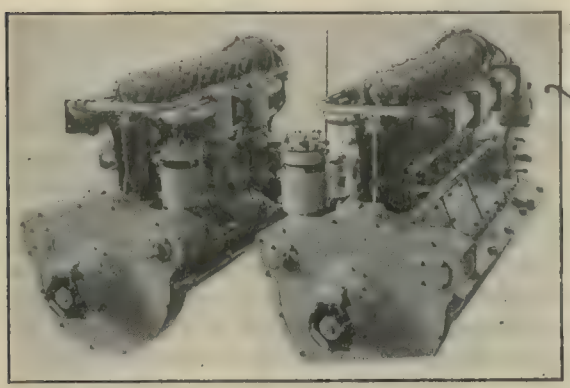
"I have broken my glasses and I would like you to *fix* them."

Old Mortality picked them up, wiggled the little hinge where the broken spring was and solemnly addressed her:

"My dear madam I could not possibly think of *fixing* them, that would be a most unworkman-like thing to do. They are not intended to be *fixed*, that's the reason there is a little hinge on each side of the bridge of the nose. No craftsman who has a reputation to maintain would ever forget himself and his reputation so far as to permit himself to *fix* them. If they were *fixed* they would be rigid, very uncomfortable and unsatisfactory, you remember, no doubt, the old adage about satisfied customers? It is therefore antagonistic to my interests to *fix* them, but I can *repair* them very easily by inserting a new spring. With a new spring correctly set and adjusted they will be quite flexible and as satisfactory as they were when they were new, you remember, no doubt, the old adage about satisfied customers? With a new spring in place they would be perfectly free to adjust themselves to the contour of your nose and would thus be comfortable to wear which they would not be if I were so far to forget my professional reputation as to consent to *fix* them.

"No, madame, I must positively refuse to *fix* your glasses but for the sum of eighteen pence I shall be glad to *repair* them and I can assure you that I shall then number you among the hosts of my satisfied customers, you remember, no doubt, the old adage about satisfied customers? Thank you madame, you can have them by three o'clock, not *fixed* but perfectly *repaired*, comfortable to wear and satisfactory in every way, you remember, no doubt, the old adage about satisfied customers?"

So if any of the readers of the *American Machinist* ever get stranded in England with, for instance, a broken universal joint let them beware of getting it *fixed*.



BUILDING MOTORS ON THE PACIFIC COAST

By Fred H. Colvin
EDITOR-AMERICAN MACHINIST

III. The Principal Operations in Making an Aluminum Alloy Piston—Method of Facing the Inside of the Piston-Pin Boss Differs from Common Practice

THE Hall-Scott motor has an aluminum alloy piston, very similar in design to that used in the Liberty motor. The first operation is to face the skirt and bore the open end, as shown in Fig. 54, on a Jones & Lamson flat turret lathe. The piston is then reversed and held by the open end by an expanding chuck, as shown in Fig. 55. In this operation the piston head is rough turned and faced. Some of the tools are shown in Fig. 56 and the remainder in Fig. 57; a careful study of this tool equipment is worth while.

The piston-pin hole is drilled in the light box-jig shown in Fig. 58, this jig also being used for reaming the hole with the reamer shown. The construction of the fixture is shown more clearly in Fig. 59, where the piston has been removed. This view shows the fork at *A* into which the piston-pin boss fits. This method of locating insures the hole being drilled and reamed in proper relation to the piston-pin bosses.

The method of facing the inside of the piston pin bosses is somewhat unusual and is shown in Figs. 60

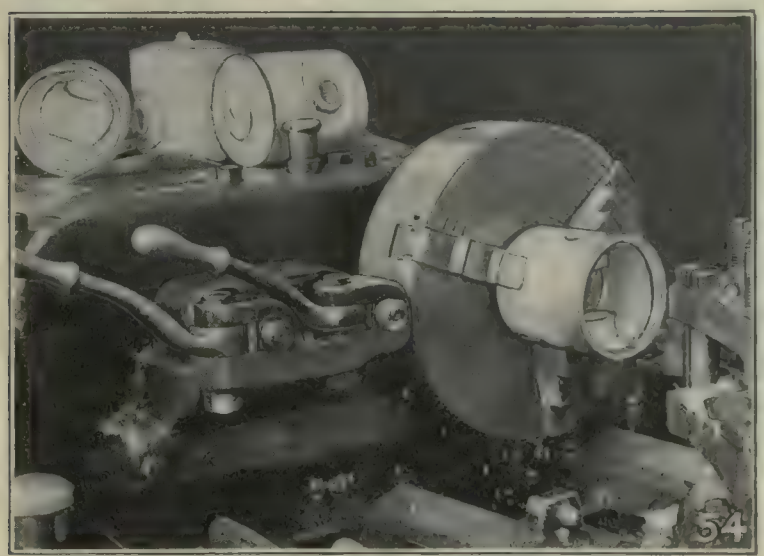


FIG. 54. BORING AND FACING END OF SKIRT

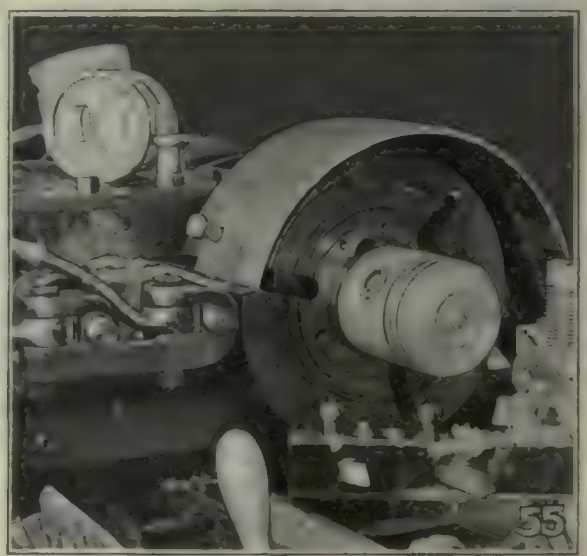


FIG. 55. TURNING AND FACING SOLID END

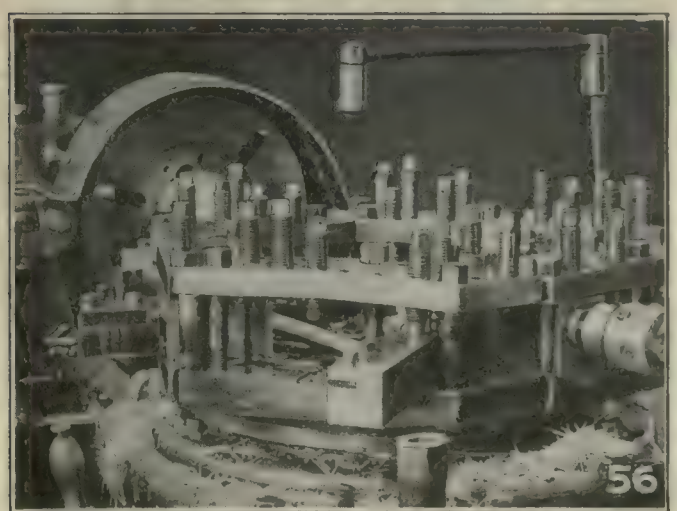


FIG. 56. THE CENTER DRILL AND GROOVING TOOL

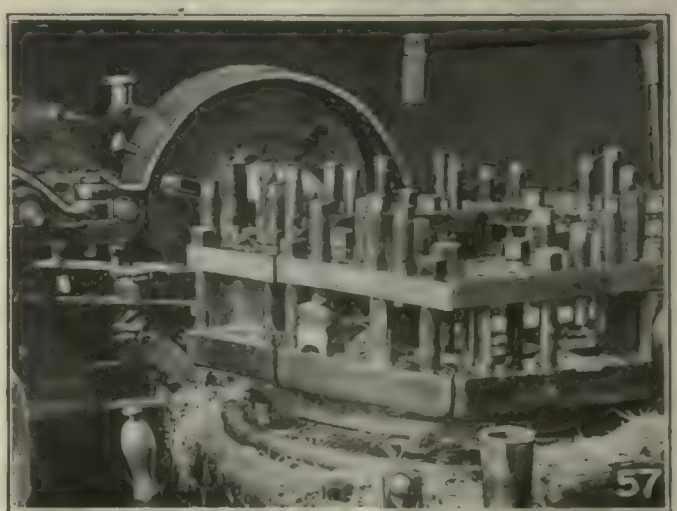


FIG. 57. TURNING AND GROOVING TOOLS

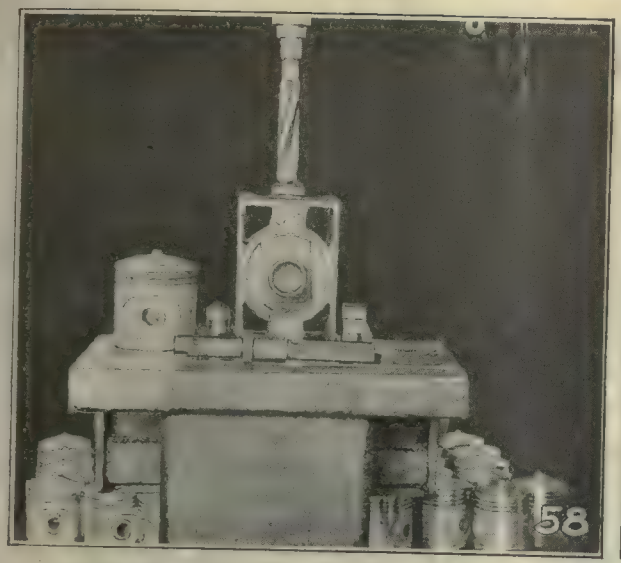


FIG. 58. DRILLING PISTON-PIN HOLE

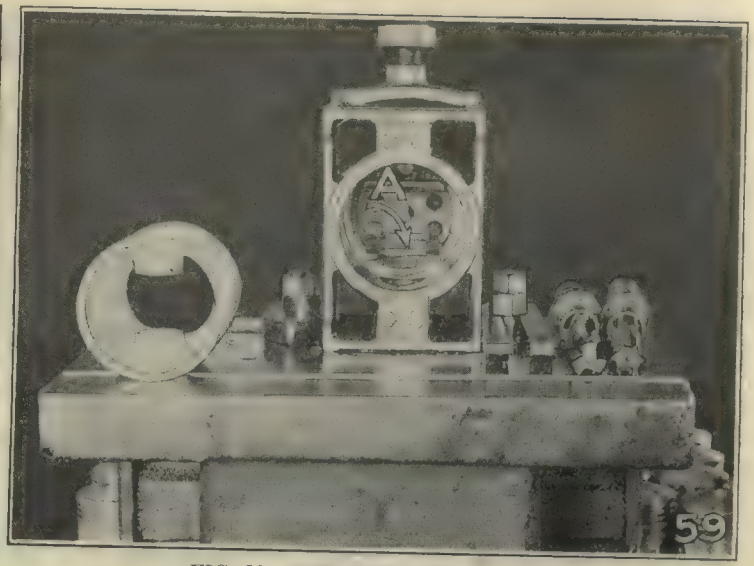


FIG. 59. THE DRILLING FIXTURE

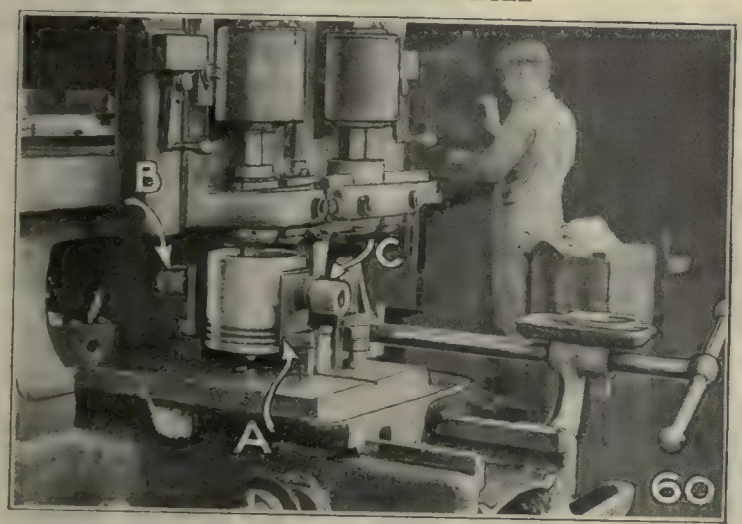


FIG. 60. FACING PISTON BOSSES

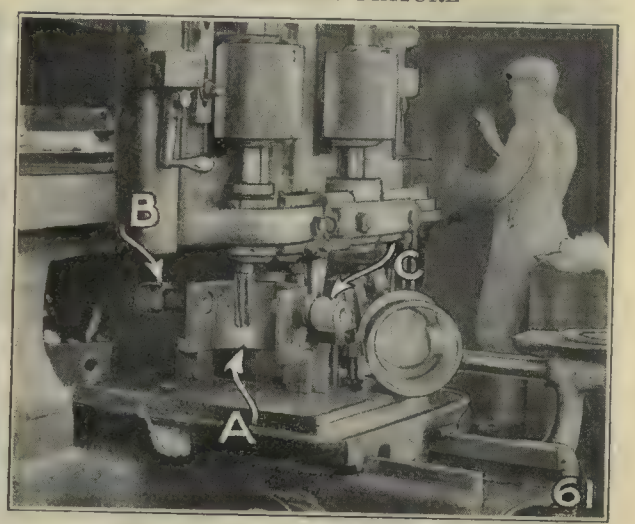


FIG. 61. THE PROFILING FIXTURE

and 61. The piston slips into the fixture *A* and is held by the pins *B* and *C*, which fit into the reamed holes as in Fig. 61. By providing suitable stops it is easy to control the movement of both the table and the milling spindle, making it easy to secure the desired spacing for the upper end of the connecting rod.

Figs. 62 and 63 show the method of slotting the outside end of the piston-pin boss for the piston retainer, which is also similar to Liberty motor practice. The piston fits over the upright *A*, Fig. 63, and is held square by the angle plate *B*. It is then an easy matter to cut the slot at a single passage of the milling cutter.

The final operation is to finish the outside of the piston in the Norton grinding machine shown in Fig. 64, after which it is ready for the assembly department.



FIG. 62. SLOTTING FOR PIN RETAINER



FIG. 63. THE SLOTTING FIXTURE



FIG. 64. FINISHING BY GRINDING

An Apparatus for Delicate Flexure Tests and Some Results of Such Tests*

By W. J. FRANCKE

The apparatus described in this paper was designed to test the thin, tempered strip-steel shims used in flexible couplings. These shims are subjected to bending stresses in operation and the apparatus was therefore designed to measure deflection with the idea that the lowest stress at which any change in proportionality of stress to deformation took place could be used as the limiting stress for loading the shims. To accomplish this result, it became necessary to develop and improve the apparatus so that very delicate and accurate measurements could be made. In making tests, one end of the specimen is held in a vise. The weight causing deflection is applied at the other end. Measurements are made with a magnetized micrometer used in conjunction with an electric contact switch. By the aid of this device and an electric light to signal the moment of contact, readings of deflection may be made with great accuracy. Test results, some of which are included, show properties which may be of value since they indicate that further development will make it possible to determine the quality of the constituents of material. Diagrams plotted from many tests show two significant points below the yield point, the lower one of which may indicate the stress at which crystallin slip begins and which may become valuable in fatigue testing. A point is also developed between the yield point and maximum stress which may be of value in judging malleability and ductility.

IN BENDING a cantilever specimen, the stress is localized, and even if not localized definitely to an individual crystal there is thought to be a better chance of determining at what stress slip first occurs than in any test where the stress is uniformly distributed over the entire cross-section of the specimen. The stress is localized at the fulcrum of the cantilever, in tension at the top and in compression at the bottom, the neutral axis of the beam forming the long leg of a lever of which the short leg is the distance from the neutral axis to the top or bottom of the beam. Since the measurements of deflection are taken at the end of the long leg of the lever, it follows that if measurements of 0.00001 in. can be taken at that point, it may be possible to note movements, due to slip in a crystal, so small as 0.000001 in. at the short end of the lever.

The screw micrometer was chosen for making the measurements because it was at the time the only means available. The development of the magnetic micrometer which is used in making these tests in combination with an electric switch which multiplies the distance between the contact points, so that a light can be turned on and off for a movement of only 0.00001 in. has made this method of measurement so delicate, convenient and practical in its application, that other methods have not been further experimented with.

The apparatus is shown in Fig. 1. It consists of the base bar *A* to which the lever *B* is attached by means of the lead fulcrum *C* which permits movement of the lever without resorting to any form of mechanical hinge in which there might be lost motion to interfere with the accuracy of adjustment. The short end of the lever carries a micrometer which is insulated from it. The long end is adjustable by means of the screws *D* and *D'*.

This unit of the apparatus rests in a slot *E* in the upper vise jaw. It is moveable longitudinally in the slot and may be adjusted up and down by means of the screws *F* and *F'*. When the position of this unit of the apparatus is roughly adjusted with relation to the test specimen *G*, it is clamped rigidly in position by two gib screws one of which is shown at *H*.

The other unit of the apparatus is clamped to that end of the test specimen which projects from the vise. It consists essentially of an electric contact switch made up of two members *I* and *J* insulated from each other at *K* and having platinum contact points at *L*. The lower leg *I* is rigid, the upper leg *J* is made of flat strip steel about 0.003 in. thick, formed channel-shaped to make it rigid except for a short distance at the fulcrum end.

Readings are taken by means of an electric light *M* with a condenser *N* connected in the circuit to reduce arcing at the contact points *L*. The battery is shown at *O* and the application of the weight movements to deflect the specimen, at *P*. The micrometer is equipped with a disk *Q* graduated on its circumference to 0.0001 in. Readings to 0.00001 in. may be made by means of a vernier or by interpolation.

The micrometer is a permanent magnet. When it is screwed downward to take a reading, it picks up the upper leg *J* of the contact switch at a point near the fulcrum, thus multiplying the arcing space between the contact points at the other end of the switch. This multiplication may be carried to an extent where the light goes on and off for a movement of 0.00001 in. at the point where readings are taken. Such pressure as is produced in making the electric contact is made uniform by lowering the magnetically-suspended switch to make the contact instead of pushing it down. When making a test, the specimen is clamped in the vise and the electric switch is clamped to the specimen; then the micrometer is adjusted to zero by means of the fine adjusting screws *D* and *D'*, allowing time for any inequalities in temperature of the specimen and vise to equalize. The test is not begun until the zero reading becomes permanent.

The weights causing the deflections are applied in uniform increments. A reading for deflection is taken for each weight increment and recorded, then all weight is removed and a reading recorded for permanent set. This is repeated to the conclusion of the test.

*Paper read at the twenty-third annual meeting of the American Society for Testing Materials.

Specimens should be prepared by grinding so that a practically flat surface is available for clamping in the vise.

The specimens used in the tests described in this paper were filed up by hand. As they are small, usually less than $\frac{1}{8}$ in. square, this is easily done; but the surface clamped in the vise is apt to be slightly rounded so that the danger of indentations by the vise jaw is increased.

Errors are confined to those in the micrometer itself, to temperature errors and to possible spring in the lever due to forcible and improper adjustment. Micrometer errors are reduced by having the micrometer vertical and weighted. When a specimen is clamped in the vise and the micrometer adjusted to zero, the adjustment may not in all cases remain immediately permanent; some minutes may elapse before it becomes permanent; this temporary error may be due to difference in temperature between the specimen and the vise or to slowness of the lead hinge in adapting itself to a change of shape.

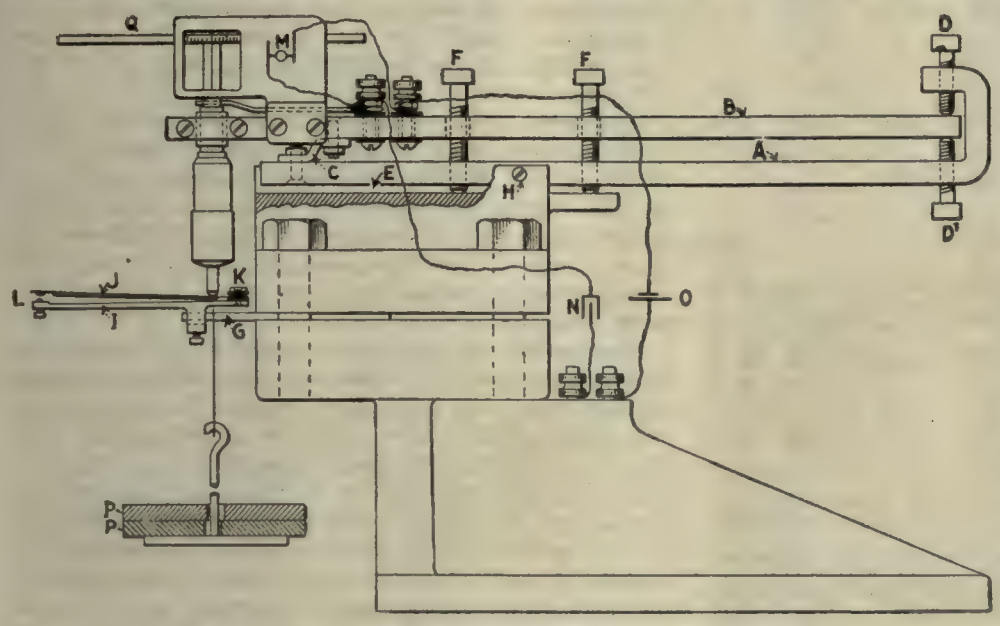


FIG. 1. APPARATUS FOR MEASURING DEFLECTIONS

Another possible source of error is indentation on the lower side of the specimen by the edge of the vise jaw, which would be measured as deflection and therefore cloud the accuracy of results. This matter was called to my attention by Prof. H. F. Moore.

Indentation by the edge of the vise jaw leaves no mark which may be seen with the aid of an ordinary magnifying glass on hard specimens, nor on soft specimens at low stress; on soft specimens at high stress, however, such indentation may be seen without the aid of a magnifying glass in cases where the surface of the specimen is not flat, and indentation shows up on the high spots. It is probable that no indentation takes place in hard specimens and in soft specimens only after permanent bending takes place, and that indentation is negligible in specimens of small section because the total weight employed is too light to cause indentation.

Errors in stress determinations due to using the common formula for flexure beyond the yield point have been neglected.

Differences due to differences in section of the specimen have not been investigated although circular sections, rectangular sections and rectangular sections reduced in area at the fulcrum have been tested.

Nomenclature

It is characteristic of tests made with this apparatus that for nearly all material so far experimented with, six points representing physical changes in the material are developed. The names applied to these points are tentative. In all diagrams they are designated as *F.*, *F. R.*, *Y. Pt.*, *Y. R.*, *P. L.* and *R.* meaning respectively "Fatigue," "Fatigue Range," "Yield Point," "Yield Range," "Plastic Limit," and "Rupture." These terms are defined as follows:

Fatigue is the point where crystals begin to slip or the stress at which failure in the Ferrite constituent is presumed to take place.

Fatigue Range is presumed to indicate the range in which slip in Ferrite continues or the point where failure in Pearlite begins.

Yield Point probably does not record a point where movement first takes place in any crystallin constituent of the material. It is possible that slip in Ferrite crystals has been sporadic up to *F. R.*, taking place in crystals least favorably situated to withstand stress and allowing time for amorphous to harden before other crystals fail. At *F. R.* movement begins to take place in the Pearlite constituent, possibly through slip in Pearlite Ferrite, resulting in increasing deformation of the test specimen as a whole which in turn causes increasingly greater stress to be thrown on the Ferrite crystals which, with diminishing support of the stronger Pearlite, slip in increasing number, slowly at first but in some material soon reaching a point where the slip in many crystals becomes cumulative, time is not allowed for the hardening of the amorphous and a "flow" takes place on many slip planes simultaneously causing the phenomena of the yield point manifested by the drop-of-beam in a tensile testing machine, but not recording a point where failure has first taken place in any crystallin constituent of the material, but recording rather a movement of the amorphous constituent in the slip planes.

Yield Range records the range of this flow, and marks the point where it ceases due to the hardening of amorphous metal in the slip planes permitted by slowing up of the flow due to the gradually decreasing number of large crystals which have now been divided and subdivided by slip, and the exhaustion of the supply of crystals unfavorably situated to resist stress. The material is now presumed to have undergone a complete physical change which began at *F.* with slip in Ferrite Crystals. We are now dealing in a sense with a new material, that is strain hardened steel in which the intergranular amorphous cement has not yet fully hardened and still has some mobility which, however, is probably permitted by a slow movement of the not fully hardened amorphous metal between the subdivided

DATA FOR A SPECIMEN OF MACHINERY STEEL

	Deflection 1	Set 2	Deflection Difference 3	Deflection Difference Minus Basic Deflection = Increase in Deflection per Weight Increment 4	Total Increase in Deflection over the Basic Deflection = Distortion 5	Distortion / Deflection 6	Set / Deflection 7
	0.00058	0.00003	0.00058	0.000073			
	114	10	56	53			
	173	18	59	84		0.00053	
						=	
	232	29	59	83		0.00357	
	297	39	65	143			
F.....	0.00357	0.00053	0.00060	0.000094	0.000530	0.148	0.148
	429	73	72	213		0.00114	
						=	
	499	92	70	193		0.00570	
F.R...	0.00570	0.00112	0.00071	0.000204	0.001140	0.200	0.195
	647	138	77	263			
	729	168	82	313		0.003096	
						=	
	813	200	84	334		0.010190	
	917	241	104	533			
Y.Pt..	0.01019	0.00290	0.00102	0.000513	0.003096	0.303	0.284
	1159	362	140	894			
	1302	439	143	923			
	1505	567	203	1523		0.035583	
						=	
	1738	722	233	1874		0 046700	
	2120	1029	385	3343			
	2770	1608	650	5993			
	3680	2465	910	8594			
Y.R..	0.04670	0 03353	0.00990	0.009393	0.035583	0.762	0.717
	6050	4691	1380	13293		0.074763	
						=	
	7460	5997	1410	13594		0.087400	
P.L...	0 08740	0.07285	0 01280	0.012293	0.074763	0.855	0.833
	10600	9060	1860	18093		0.128843	
						=	
	12700	11098	2100	20494		0.143000	
R....	0.14300	0.12619	0.01600	0.015493	0.128843	0.900	0.882
	0.16800	0.15043	0.02500	0.024493			

$$\text{Basic Deflection} = \frac{\text{Deflection} - \text{Set}}{\text{No. of Weight Increments}} = \frac{0.00357 - 0.00053}{6} = 0.000506 +$$

crystals as distinct from the earlier "flow" due to slip in crystals.

Plastic Limit marks the end of this movement and is comparable with the maximum strength of the material where necking begins in a tensile test.

Rupture is presumed to be comparable with ultimate strength.

The six points noted are characteristic of hypo-eutectoid steel. It has not been shown that all of them would appear in pure iron where there is only one crystallin constituent, or in a eutectoid steel composed of all Pearlite.

There is also some indication that the Yield Point may be absent in tests of some severely strained material in which the crystals have been greatly subdivided by slip and in which the "flow" which causes yielding has taken place before the test is made, especially if the specimen has been subjected to low heat treatment which seems to check the tendency to yield in strained material.

The Yield Point may also be of indefinite or doubtful appearance in alloy steels if the alloy prevents a "flow" from taking place due to chemical combination of the alloy in Cementite or its solution in Ferrite. In these cases the *Y. R.* point is usually more prominent than the yield point.

The data in the table is for a specimen of machinery steel, the section and length being such that a 1-lb. weight increment produces a stress of 2,500 lb. per square inch in extreme fiber. In column No. 1 is recorded the deflection produced by each weight increment and in column No. 2 the permanent set when all weight is removed.

Columns Nos. 1 and 2 are plotted in Fig. 2 beginning at the lower left-hand corner. The "deflection line" shows the deflection caused by each weight increment and the "set line" the permanent set remaining when all weight is removed. The delicate accuracy of the apparatus is shown by the uniformity of the curve, which is constructed by connecting the plotted points by straight lines.

This curve has little practical value. Close examination, however, will show that it is not a straight line even at the beginning; it curves slightly up to *F.*, is almost straight from *F.* to *F. R.*, curves again from *F. R.* to *Y. Pt.* and curves markedly beyond *Y. Pt.* This slight curvature even at low stress is characteristic of practically all material experimented with and it was a persistent search for the reason of this curvature that resulted in the isolation of the point *F.* by the following method of plotting.

In column No. 3 of the table are entered the differences between each deflection reading and the next following one, showing therefore the deflection caused by each weight increment. It is characteristic of this method of testing to have this column of "differences" show groups of readings, each succeeding group indicating where a change has taken place in the material under test.

The end of the first group, point *F.*, is assumed to be the fatigue point for the reason that as far as records of endurance tests have been available for comparison, the stress at this point coincides approximately with the stress at which slip first takes place.

It will be noted that up to this point *F.*, quite a pronounced and fairly regularly increasing permanent set is recorded. This feature of an increasing permanent set taking place at stresses lower than the stress at which slip in crystals may be expected is also characteristic of all material experimented with although the value of it compared with the deflection varies greatly in different materials. It is assumed that this permanent set below *F.* is caused by some movement other than that due to slip and it is ascribed, in the absence of definite knowledge, to movement in amorphous metal.

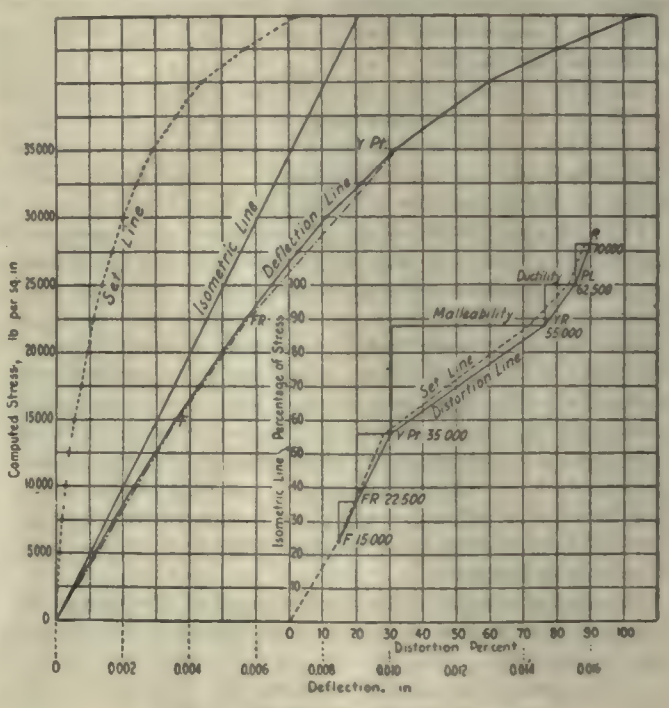


FIG. 2. PERCENTAGE DIAGRAM

With these assumptions, column No. 4 is arrived at by ascribing all movement below *F.* to distortion in amorphous metal and all movement above *F.* to distortion in both amorphous metal and crystallin metal, the word distortion being used to express movement in the constituents of a material as distinct from deformation which is used to express movement in the test specimen as a whole.

If we now deduct the deflection caused by distortion in amorphous metal below *F.* from the total deflection at *F.*, where no crystallin distortion has yet taken place, we may use the remainder, that is the deflection at *F.* minus the set at *F.*, where crystallin distortion is zero, as a basic deflection from which to measure the distortion in constituents above *F.* In this case this basic deflection is: Deflection at *F.*, 0.00357, minus set at *F.*, 0.00053, = 0.00304 and dividing this by the number of weight increments at *F.*, 6, we have the average basic deflection per weight increment, 0.000506+, being the deflection caused by one weight without set and without crystallin distortion, representing therefore theoretically, but only for the purpose of plotting, the deflection of perfectly elastic material at this point.

This basic deflection plotted against uniform weight increments is shown on the diagram as the isometric line.

Column No. 4 shows the remainder, after deducting this basic deflection per weight increment from the "differences" in column No. 3 and therefore the increase in deflection per weight increment, or decrease, in case the basic deflection is greater than the "difference."

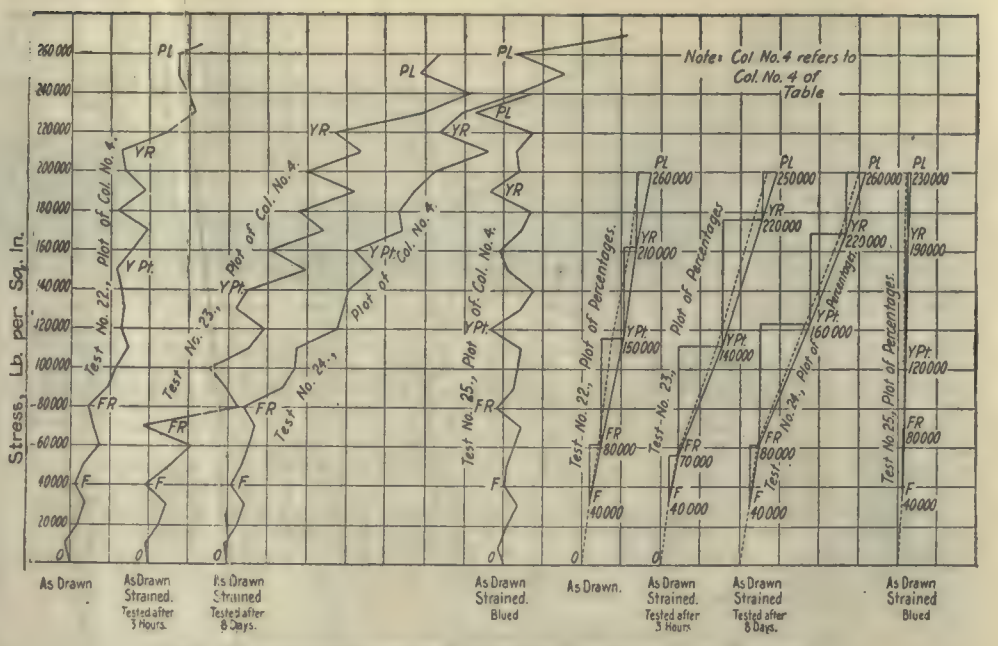


FIG. 4. PATENTED WIRE TESTED IN CIRCULAR SECTION

Column No. 4 is plotted in Fig. 3 in comparison with a stress-deformation diagram which is drawn to no scale and inserted merely to show at what part of the stress-deformation diagram the points *F.*, *F. R.*, *Y. Pt.*, *Y. R.*, *P. L* and *R.* appear.

It will be noted that column No. 4 shows the 6 "groups" more markedly than column No. 3 and that the plotting of column No. 4 brings them out quite clearly. It will be interesting now to look back at the deflection plottings from column No. 1, Fig. 2, and note that the groups are also indicated there, although they are not so clearly defined. The groups often appear so clearly on the data sheets that the plotting of column No. 4 is not necessary in order to locate them.

Diagrams of practical value for comparing different materials cannot be plotted from column No. 4 on account of the long horizontal leg above *Y. Pt.* in ductile material.

In order to get a diagram by means of which materials differing greatly in physical characteristics may be more readily compared with each other, columns Nos. 4 and 2 are plotted on a percentage basis, plotting distortion in percentage of deflection, and set in percentage of deflection. This plotting also makes the distortion graphically comparable with the set. The stress at *P. L.* is taken at 100 per cent. The line of origin for this diagram is the isometric line which is a straight line, being the basic deflection before referred to plotted against uniform weight increments.

Such a diagram is shown in Fig. 2. The distortion line is plotted from column No. 6 showing the total distortion which has taken place

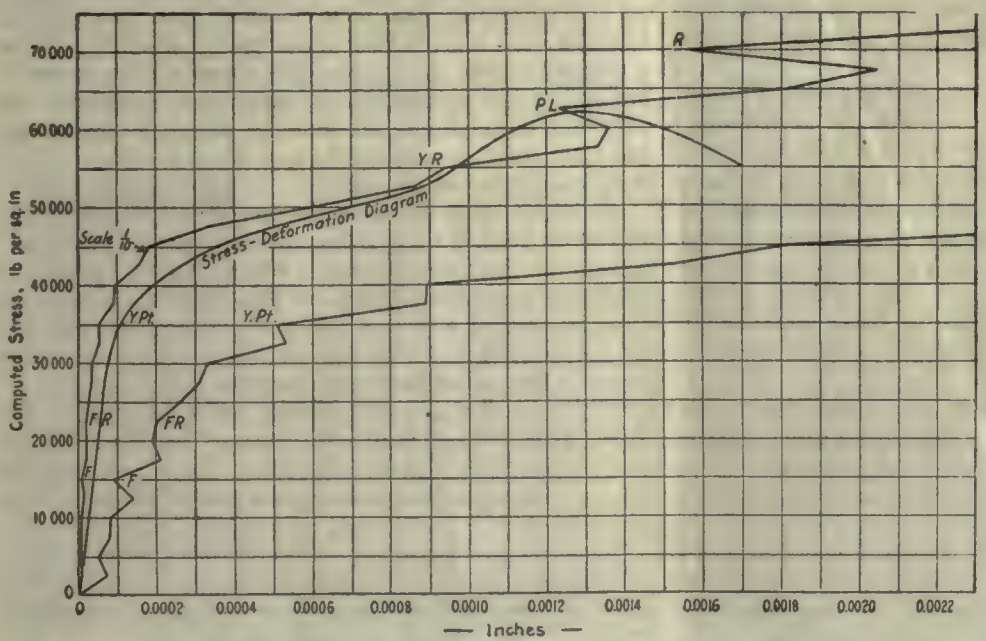


FIG. 3. A COMPARISON OF A PLOT OF COLUMN NO. 4 IN THE TABLE WITH A STRESS-DEFORMATION DIAGRAM

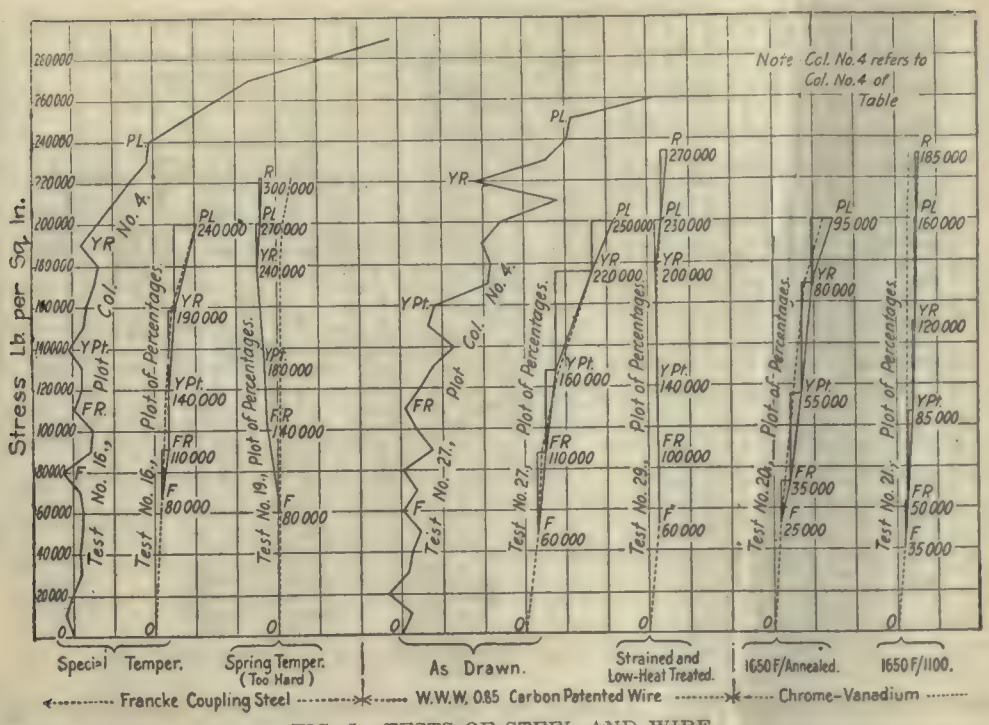


FIG. 5. TESTS OF STEEL AND WIRE

up to each point in percentage of deflection at that point. The set line is plotted in the same manner from column No. 7. Column No. 5 shows the total distortion up to each point.

Below *F.* this diagram shows the percentage of distortion which has taken place before crystallin distortion began, presumably amorphous distortion.

The little triangles on the distortion line show what has taken place between group points and may reasonably be expected to indicate the quality of that constituent of the material which failed during this period. The horizontal leg shows the distortion which has taken place and the vertical leg the stress that caused it.

The triangle above *Y. Pt.* probably registers the "flow" period of material during which there is great mobility of amorphous as distinct from the plastic period between *Y. R.* and *P. L.* where the amorphous metal has become set but is not fully hardened, the flow period representing malleability and the plastic period ductility.

In a similar manner the triangle between *F.* and *F. R.* may indicate the fatigue quality of a material, for a high fatigue point may not necessarily mean high fatigue quality. A material with a high fatigue point may fail rapidly after slip once begins and a material with a lower fatigue point may conceivably stand more reversals of stress if the injury caused by slip is less due to a difference in the nature of the material. Materials from which a large number of reversals of stress may be expected usually show a small triangle above *F.*

Tests on 0.85 carbon patented wire show that aging strained sorbitic steel for 8 days has little effect except to raise the yield point and maximum while the effect of low heat treatment is very marked as shown in tests Nos. 24 and 25, Fig. 4.

A specimen of patented wire strained and low heat-treated for these tests by E. H. Webb, to whom I am indebted for assistance in preparing specimens, is shown in test No. 29, Fig. 5. In this specimen there is no distortion at all up to *Y. R.*, the diagram being practically a straight vertical line from *F.* up, the set line coinciding with the distortion line.

With annealed material, tests may be made up to *F.* as rapidly as readings can be taken and recorded and usually up to *F. R.*, the light promptly becomes steady showing no further deflection. From the yield point up more time is required.

With heat-treated material, usually the deflection caused by each weight comes promptly to a definite rest where readings may be taken. Strained material generally is slow, and waiting for the specimen to come to complete rest would take a considerable time. In the early part of the test, however, there is little difficulty. Strained sorbite is very slow, some tests having taken 5 hours and then the readings were taken before the specimens came to rest. Such material would probably yield very slowly, perhaps for days, for each weight increment. This slow yielding is completely arrested by heating the specimen to about 500 deg. F. for a minute and the diagram plotted from the low heat-treated specimen takes the shape characteristic of the diagram plotted from a quenched-and-tempered spring specimen.

Employees as Associate Editors of the Plant Paper

BY FRANK H. WILLIAMS

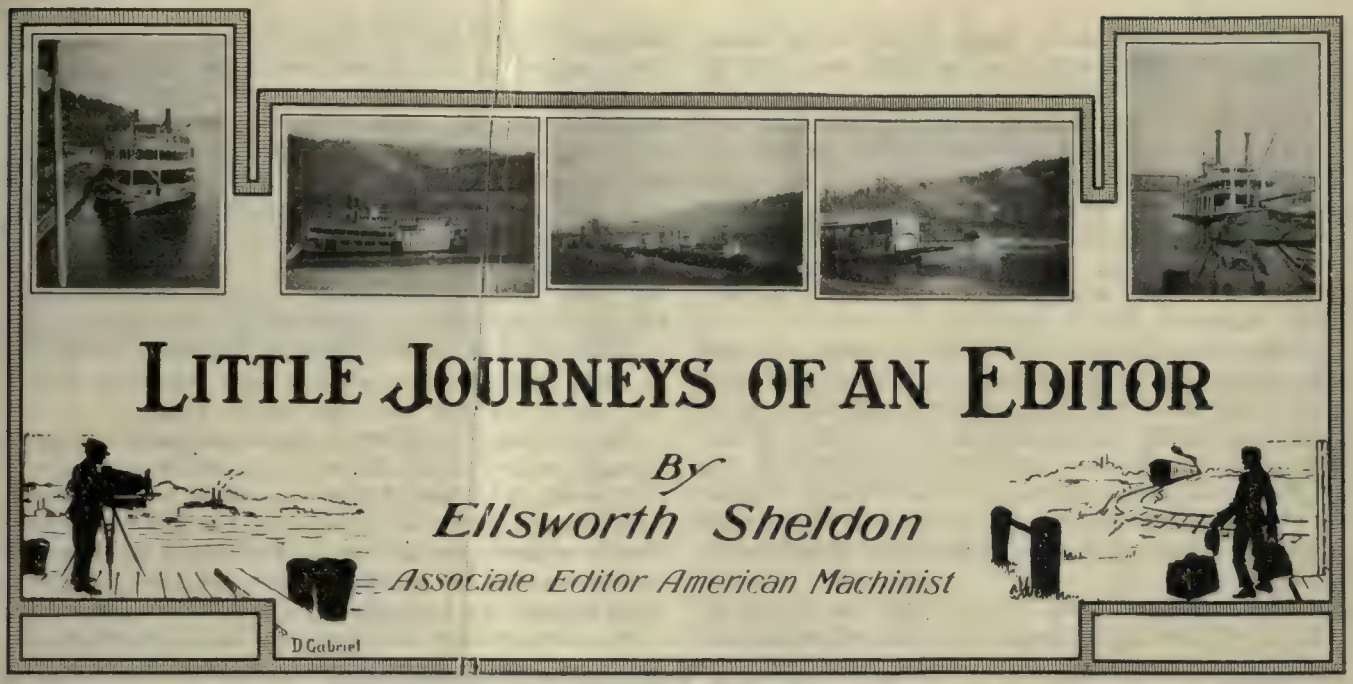
One of the big, outstanding problems faced by every editor of a plant paper is that of getting and holding the interest of the employees in the publication.

Quite often, unless the problem is satisfactorily solved, the employees will hold entirely aloof from the publication and will declare that it is merely another scheme of those "higher up" to try and speed up the workers. But where the interest of the employees is secured and held they quite often feel that the paper is *their* paper and they view it with pride and do everything within their power to help it along.

One of the ways in which the interest of the employees can be secured is by appointing some of them associate editors of the publication. When this is done and when the associate editors are live wires who really do some work and who, by the enthusiasm they put into the proposition arouse the attention of their fellow workers, the paper generally becomes a big success.

Of course the associate editors must be chosen with great care. They must be people who like to see their names and the little items they have written in print and who enjoy the prestige attached to such a position.

Appoint some associate editors for *your* plant paper. It will pay in that it will make the employees feel more as though the paper is *their* paper and less as though it is a form of propaganda coming to them from the executives higher up.



LITTLE JOURNEYS OF AN EDITOR

By
Ellsworth Sheldon
Associate Editor American Machinist

THOUGH the railroads have seriously encroached upon the numbers and prestige of the old river steamboats, Pittsburgh is still an important river port; and although the Rentons have long since ceased to be interested in steamboats, there are other shops to undertake the repairs.

As in the old days, many of the jobs are bigger than the shops that handle them. In such cases the river bank becomes the workshop; the blue sky the roof. Quitting time is when the job is finished and the boat paddles away under her own steam. If the job promises to exceed in point of time the limit of human endurance, the men may work in shifts, going home to sleep; or they may "turn in" in a dry goods box with a coat for a pillow, any time one or more of them can be spared for an hour or two.

Often the roof is not blue, but gray; and inclined to leak. If it leaks too badly sometimes a rude shelter is built of sundry boards and scantlings with tarpaulins thrown over them. If these materials do not happen to be available, why worry? The workmen cannot get any wetter than they already are.

One such job that I saw upon the river bank was the replacing of a defective crankshaft in one of the stern-wheel boats.

The first step is to dismantle the wooden part of the wheel; cutting out the bolts that secure the wooden arms to the iron "flanges" or hubs, upon the shaft and demolishing the "buckets." The boat is then warped up to the river bank, stern first, and a timber crib built up under the shaft.

Lifting the shaft one end at a time by using long timbers for levers, or by means of chain falls suspended from a tripod or a trestle, the crib is built up and the weight gradually transferred until the shaft is clear of its bearings; then the boat is pushed out of the way and the shaft rolled back far enough from the water to enable the workmen to get around it.

Fires of wood are built under the cranks, and a hand pump, set up at the water's edge, is rigged with a hose so that a stream of water may be played upon the shaft to keep it cool or used to extinguish the flames when the crib takes fire. If too much trouble has been experienced in cutting out the bolts from the flanges the wooden arms may be sawed off close to the flanges and, when the shaft has been rolled ashore, fires built around the flanges and the stubs burned out.

The new shaft—a forged billet of steel, hexagon in shape and perhaps 16 in. in diameter across the flats by 20 ft. or more in length, weighing from 7



FIG. 1. LINING THE WHEEL FLANGES ON A NEW SHAFT



FIG. 2. READY TO SHRINK ON THE CRANKS

to 10 tons—has been made ready to receive the cranks and flanges as soon as they are stripped from the old shaft.

Fortunately for the shop that is doing the work (its floor area may not be much over 16 by 18 ft.) the main journals and the shoulders for the cranks have been turned at the mill where the billet was forged. Keyways for the cranks are laid out on opposite ends of the shaft, 90 deg. apart, and cut with chisel and file, the work being done as the shaft lies in its crib on the beach.

To the shop-man who naturally associates keyways with milling machines or planers, such a job with these simple tools would be considered tedious and difficult if not impossible. To these river-men, skilled in the work of making repairs with a minimum of tools and the shop sometimes miles away, it is a simple matter, and when finished is quite as good a job as the average shop-man would produce with all the modern tools at his disposal.

In Fig. 1 is shown such a shaft with the flanges on ready to be lined up. The shaft, as before mentioned, is hexagon; the holes in the hubs of the flanges are also hexagon but are about ⅜ in. larger than the shaft. Long slim taper wedges are driven from both sides of each flange between shaft and hub (the draft of the casting both ways from the center providing the mating taper) until the flange is true and in correct position. This is a job that requires time, skill, and experience, for neither the faces of the hexagon shaft nor the hole in the hub are machined, and the flanges are finally supported on all sides by the wedges, the hub not touching the shaft at all.

If the work of driving the wedges has not been conscientiously done the flanges will wring loose in service under the continuous twist and rack to which they are subjected by the engines. If the radial channels that receive the wooden arms are not in line across the breadth of the wheel, one or two flanges will be doing more than their share of the work and will certainly wring loose.

They will probably wring loose anyway if the operating engineer does not keep his eagle eye upon them and "sock up" any recalcitrant wedge that may have started from its position during the last run. To assist him in keeping tabs on them, wedges, shaft, and flanges are kept painted, usually white, so that if a wedge starts from its position the break in the paint renders it conspicuous.

The bar lying across the tops of the flanges in Fig. 1 is a straightedge, of wood, used to locate the keyways at the proper angle and, later, to line up the flanges. Fig. 2 shows the shaft after the flanges have been wedged up and it has been rolled down the bank to the position occupied by the old shaft to have the cranks shrunk on. One of the cranks may be seen in the fire, and the picture also shows the means by which the heavy cranks are handled.

As at this time it was getting toward night I thought in my innocence that I would come down next morning and see that shaft put back in the boat which was then lying at the bank. So at an earlier hour than I usually get out I wended my way to the scene of activities only to find the place deserted. No shaft; no men; no boat. The job had been completed during the night and the boat had sailed away.

The Monongahela River is made navigable for light-draught boats for a distance of nearly 200 miles above Pittsburgh by means of what are called movable dams. At intervals, depending upon the natural fall of the river, are dams, one section of which may be raised or lowered as occasion requires. When the river is in flood these sections are lowered out of the way and boats have a free passage over the whole navigable length of the river, but in seasons of low water the dams are raised to their normal level, impounding water to the depth of nine feet in the "pools," as the intervals between dams are called. Passage of the dams at such times is by means of locks at one side or other of the river.



FIG. 3. LOWER GATE OF A LOCK PARTLY OPEN



FIG. 4. UPPER GATE, CLOSED, AND MECHANISM FOR OPERATING IT

Figs. 3 and 4 are views of one such lock, taken from the deck of a steamer in the act of locking through. Two gates, in this lock 400 ft. apart, are arranged to roll upon a track laid on the sill of the lock, at right angles to the lock-wall. Recesses in the bank are made to receive them so that they may be withdrawn completely from the entrance of the lock basin to allow the passage of a vessel. When a boat is to enter from above, the lower gate is in place, barring the exit from the basin, while the upper gate is drawn back into the bank. The water in the basin is, of course, at the level of the upper pool.

The boat enters the basin and the upper gate is closed. Smaller pneumatically controlled gates located within conduits in the lock walls allow the water in the basin to fall to the level of the lower pool. The lower gate is then withdrawn and the boat is able to proceed on her way.

Fig. 3 is from the forward deck of a down-river bound steamer, and shows the lower gate partly withdrawn; the last stage of the operation. Fig. 4 is from the after deck of the same steamer and shows a part of the upper gate, which is in closed position, while the water is running out of the basin.

The gate is moved back and forth with the double-



FIG. 5. COMING OUT OF A LOCK

cylinder engine to be seen in the center of the picture. A chain, lying loosely upon the gate, is attached to it at either end, there being sufficient slack in the chain to allow for a turn around the barrel of a winch that projects horizontally from the wall of the recess just above the gate. The winch is, of course, driven by gearing from the engine above it, and the opening or closing of a gate is simply a matter of running the engine one way or the other as required until the gate reaches the limit of its movements. The engine, a very ordinary form of steam engine with Stevenson link reversing gear, is operated by compressed air supplied by a constantly running compressor in the lock house.

Fig. 5 was also taken from the after deck of the same steamer, but at another lock, as the presence of the following steamer would indicate. This view gives a general idea of the arrangement of a lock and also shows a portion of the dam to the right.

The peculiar conditions governing Western river navigation have developed peculiar marine construction, both architectural and mechanical, to meet them. Practically the only means of propulsion is the paddle wheel. Screw boats, both tunnel and open screw, have been and are being experimented with but their success is still in question.

Side-wheel boats have, almost without exception, independently driven wheels instead of two wheels on a single shaft with the engine cranks in the center as in Eastern boats. By far the larger proportion of boats in the upper rivers have a single wheel at the stern and two engines, with cranks at 90 deg. upon opposite ends of the same shaft.

Because of the necessarily shallow draft, weight is a vital consideration and the engines are in consequence made as light as possible consistent with strength Pipes, or sometimes bars of wood, are used for rods that no Eastern designer would think of making of any material but steel; chains, or even ropes, are often used for suspension links on the reversing mechanism; connecting rods (called pitmans in Western river parlance) are of wood, and are often double the length of the rest of the engine.

Cast-iron frames or bedplates are unknown. The reason for this is perhaps as much to make the machine flexible as well as to make it light. Sand bars and shallow places abound in the waterways and boats are often aground and the wringing and twisting of the hull in working the boat over or around such places would soon make trouble for both hull and engine if the latter were rigid. The machines are therefore constructed so that they will almost "work around a corner."

A heavy I-beam or a pair of channels is the nearest approach to a bedplate; this important detail is more often composed of a pair of timbers bolted to the deck in an inclined position and extending out over the stern. Cylinders are cast with a foot to be bolted to the timbers; guides are separate pieces independently attached; and the main bearings are bolted to the inner timber and also to extra timbers designed to take the weight and thrust of the wheel.

Valve movements are almost as diversified as the boats themselves. There is a so-called "standard movement" in which there are four lever-operated poppet valves, but almost every boat has its own peculiar modification. The standard construction involves two pairs of wiper tappets not different in principle from the valve mechanism of the old beam engines, familiar to the eyes of Eastern marine engineers. These tappets receive their motion from eccentrics in the usual manner; sometimes through a Stevenson link, but oftener there is no link and to reverse the engine the hook of one eccentric rod must be lifted off the rocker pin and the other hook put on; the idle link meanwhile swinging to and fro in the air, suspended from a piece of line.

With the standard valve movement the speed of the engine, as easily may be seen, is governed by throttling. If there is a Stevenson link the engineer can "hook 'er up," but that only transfers the control from the main throttle to the admission valves.

As most of the engines have a very long stroke in proportion to their cylinder bore, ratios of 6 to 1 and even 8 to 1 being quite common, control by throttling results in great loss of efficiency; therefore most of the modifications have been made with a view to introducing some form of auxiliary cut-off, many of which are ingenious and some of which are efficient. Upon many of the boats, especially upon those whose engines are fitted with piston- or slide-valves, eccentrics are not used. Instead there is a peculiarly shaped cam and yoke that gives an intermittent movement to the valves that lends itself admirably to the auxiliary cut-off principle.

Because of the excessive length of the connecting rod or pitman, which would involve equally long eccentric rods if the eccentrics or cams were placed on the main shaft, these important parts are not infrequently placed on a short shaft located on the inner timber near the end of the guides and turned by an ingenious crank which derives its movement from the pitman.

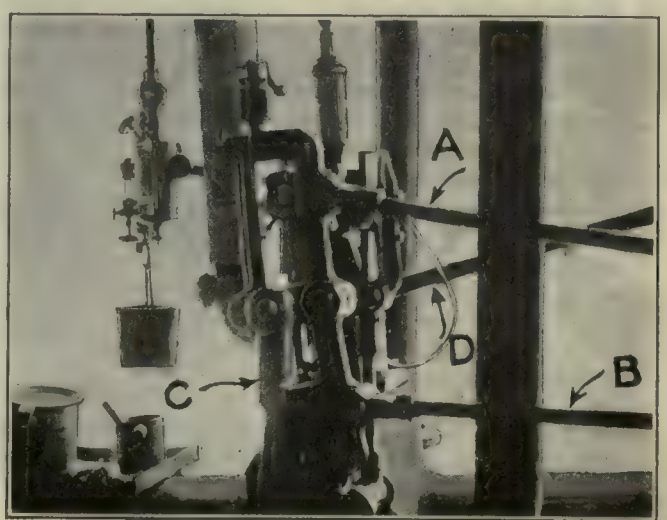


FIG. 6. CORLISS CRAB-CLAW ON A STEAMBOAT ENGINE

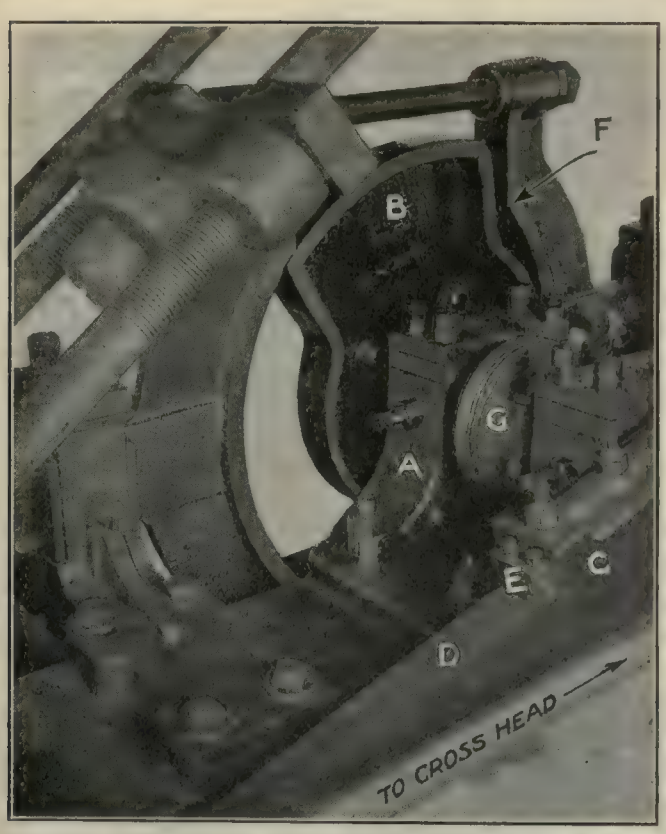


FIG. 7. MAIN CAM AND YOKE WHICH PERFORMS THE FUNCTIONS OF BOTH ECCENTRICS. VIEW FROM OUTBOARD SIDE

On not a few of the boats the cut-off valve takes its movement from a combination of the main valve gear with the movement of the crosshead; and so far as the principle is concerned the resultant is much like that of the well-known Walschaert movement as applied to locomotives.

One engine that I saw which had its valves located about where the throttle ought to be, had four poppet valves, two of which (the admission valves) were lifted by Corliss crab-claws and released by the movement derived from the crosshead. The point of admission and lift of valve were constant but the point of release could be varied at will by the engineer.

This gear is shown in Fig. 6, and though the light conditions were far from favorable for photographic purposes the reader may be able to trace the movement. A Stevenson link attached in the usual manner only to the eccentric rods *A* and *B* (eccentrics were used on this machine) and the reach rod *C* by which it was under control of the reversing lever, moved a rocker arm which in turn lifted the crab-claws alternately. The rod *D* had a reciprocating movement taken from the crosshead and this rod operated the tripping device.

The cam movement heretofore mentioned as being used in place of eccentrics is shown by the pictures, Figs. 7 and 8. These and subsequent pictures show some details of the engines of a large passenger boat—the "Homer Smith"—running out of Pittsburgh. The engines are a pair of tandem compounds with cylinders 16 and 28 in. x 8 ft. stroke.

Fig. 7 was taken from the guard outside the engine room looking toward the center of the room. The engine is at the moment approaching the outboard center in forward motion, and the pitman is therefore rising.

The pedestal *A* is bolted to the inner member of a pair of channel beams that form the bedplate of the engine and its two bearings support the short shaft that has at one end the cam *B* and at the other the rectangular box-shaped part *C*. Through *C* slides the bar *D*; bronze shoes *E*, both on the side shown in the picture and on the other side which is hidden from view, furnishing the bearing surfaces and means to take up wear while allowing the bar to slide freely without shake.

The bar *D* at its outer end (to the left in the picture) is connected by the usual form of crank-connection to a small crankpin which passes horizontally through the wooden pitman (a part of which latter appears in the lower right-hand part of the picture) at a point that just clears the forward end of the guides when the engine is on the back center.[1]

This small crankpin, therefore, travels in an elliptical path, the major axis of which is 8 ft. (equal to the stroke of the engine) and the minor axis about one-third as much (equal to the oscillation of the pitman at this point). The rotary movement of the cam at the point shown in the picture is, therefore, relatively very slow for the reason that the small pin is passing its center with the sliding bar *D* fully extended. When the crank has passed the center and the pitman commences its return stroke the bar *D* slides through the guide *C* until at the moment of passing half stroke the small crankpin is not only very close to *C*, giving a very short leverage, but is moving with the full speed of the main pistons at mid-stroke.

It will be seen from the foregoing that the movement of the cam at the time of contact with the yoke is a very slow one, well suited to the purpose of moving the heavy, and to some extent steam-bound, valves. After the corner of the cam has passed the point *F* on the back part of the yoke, pushing it out of the way and thereby moving the valves, there is no further movement of the latter until the engine reaches the inboard center and the advancing corner of the cam bears against the

[1]To avoid confusion let me explain that the terms "forward" and "back" are relative to the machine; the "forward" end of the engine being the crank end and all parts spoken of as "forward" or "front" therefore being toward the crank. As the boat under discussion is, like most of her contemporaries, a stern-wheeler, these terms are directly opposed to the terms "forward" and "aft," used in a nautical sense.—EDITOR.



FIG. 8. VIEW OF MAIN CAM AND YOKE FROM INBOARD SIDE

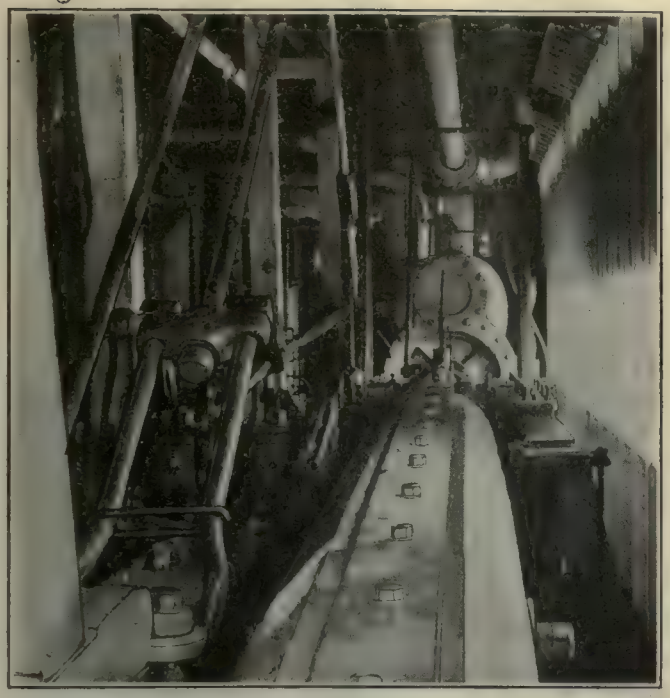


FIG. 9. LOOKING ALONG THE PITMAN TOWARD THE CYLINDERS

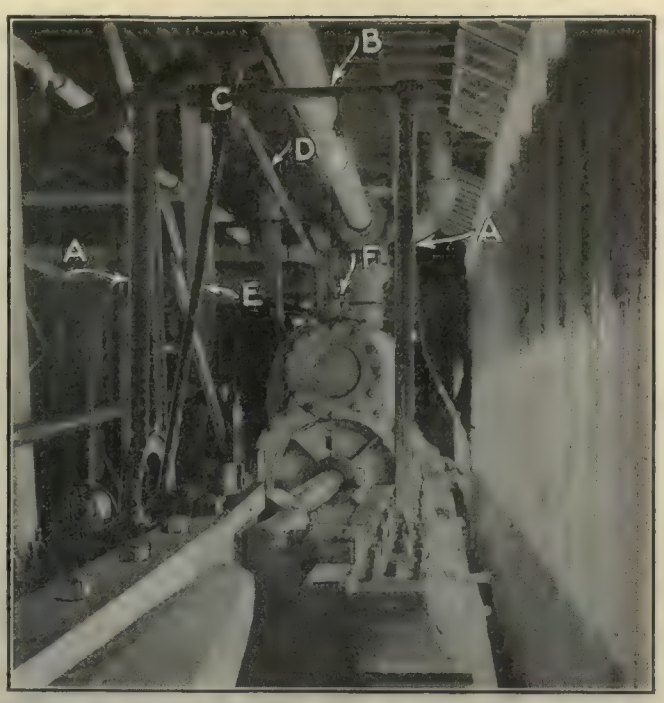


FIG. 10. A NEARER VIEW, SHOWING THE MECHANISM THAT TRIPS THE CUT-OFF

straight portion of the forward half of the yoke corresponding to point *F*, but below the center and on the opposite side of the yoke, ready to move them into position for the outboard stroke.

The movement thus obtained is ideal—for a very slow moving engine. It is quick without being violent; the valves are at rest, wide open, during practically the entire stroke; and the movement takes place at the instant the engine passes the center so that one cam serves to operate the valves for either forward or reverse motion. There is no relative change of position of the parts here shown whether the engine is turning forward or backward; the reversing mechanism does not affect them. Such a movement could not be used to advantage without an auxiliary cut-off, but given that, its only objectionable feature is that it cannot close the exhaust ports quickly enough to give any appreciable compression—not a serious drawback on an engine whose largest piston is 28 in., with a maximum speed of 22 r.p.m.

Fig. 8 shows the cam and yoke from the other side, like letters indicating like parts, giving a better idea of its proportions, and showing how the projecting part of the cam dips in a pan of oil at each revolution. The small eccentric *G*, Fig. 7, was originally intended to operate the cut-off valve, but a change has been made in the movement since putting the boat into commission that transfers that duty to the crosshead as Fig. 9 will show, and the small eccentric is now out of a job.

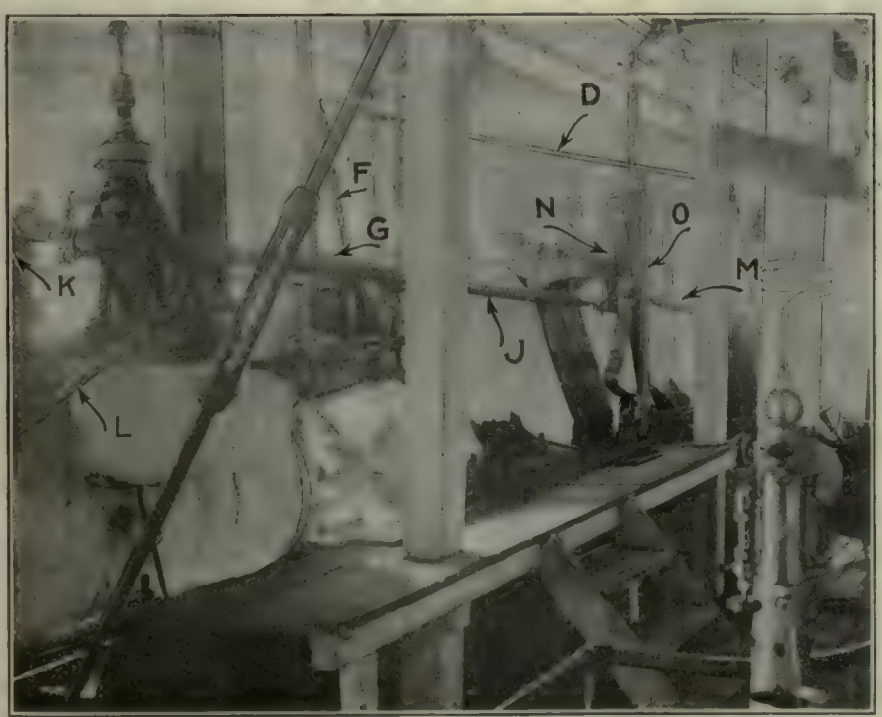


FIG. 11. A GENERAL VIEW OF THE CYLINDERS AND VALVE GEAR OF THE STARBOARD ENGINE, FROM THE OPERATING PLATFORM

Fig. 9 is a view looking into the engine room from the "fantail"—that part of the boat where the wheel is located. The huge timber that apparently fills all the foreground is the "pitman," or connecting rod. It is not as large as it looks, for the foreshortening effect of the lens exaggerates its importance, but even so it is a rather husky stick of timber and several times longer than the rest of the engine. In this picture the details of the cam movement may be traced to better advantage. Figs. 7, 8, 9 and 10 were all made with the engine in the same position.

The picture, Fig. 9, was taken with the camera looking through the opening in the after bulkhead through which the pitman reaches to the crank. Fig. 10 was taken from almost the same point but with a longer focus lens, giving the effect of having been brought nearer to the cylinder. Here

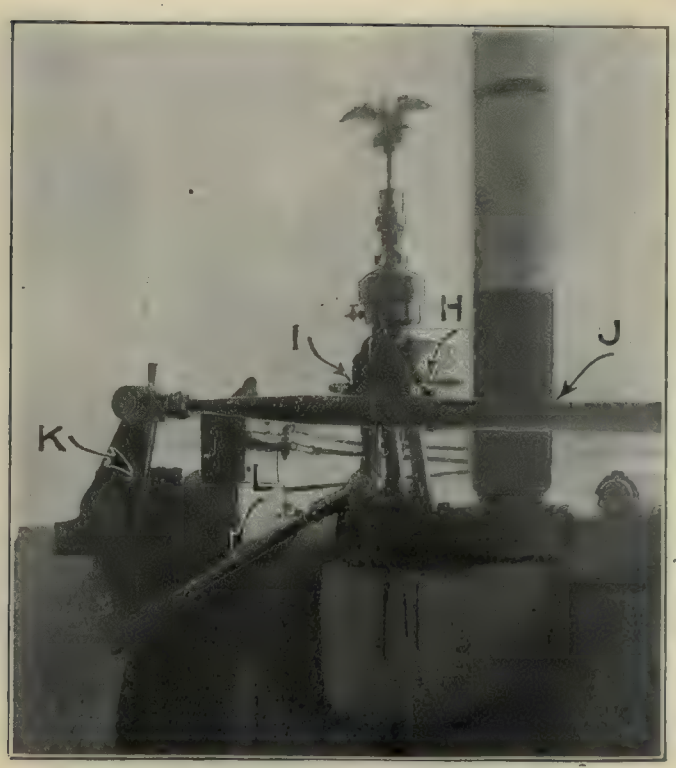


FIG. 12. DETAILS OF HIGH-PRESSURE VALVE GEAR AND CUT-OFF MECHANISM

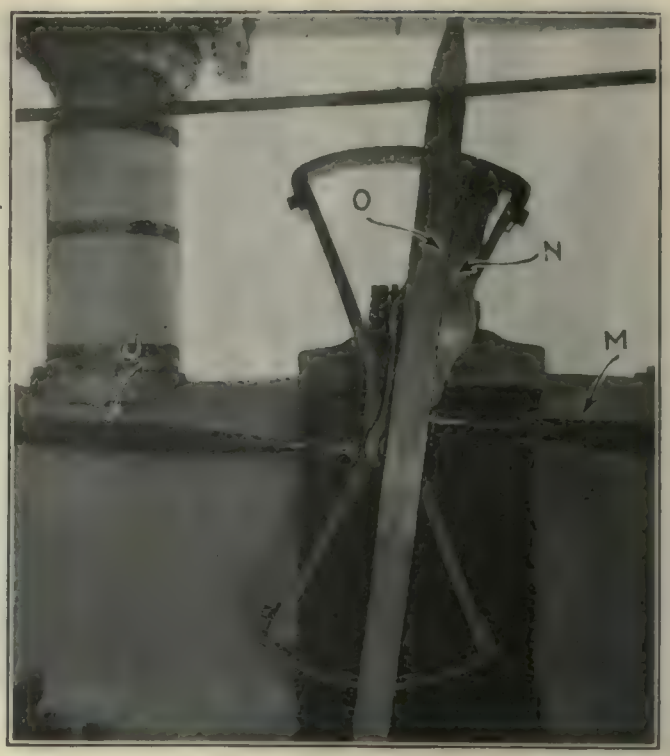


FIG. 13. SIMPLICITY OF THE REVERSING GEAR

may be seen the movement that in conjunction with the main valve movement, operates the cut-off valve. Bolted to the castings that support crosshead guides are two uprights *AA* carrying at their apex the bar *B*. A casting *C* to which is attached the valve-rod *D* swings on the bar, deriving its movement from the crosshead through the rod *E* which is fitted to slide through a bored hole in *C* thus compensating for the varying distance between the bar *B* and the crosshead as the latter moves to and fro.

Rod *D*, Figs. 10 and 11, transmits the motion to the long rock lever *F*, Fig. 11, fulcrumed on the spreaders which separate the high and low pressure cylinders. Upon this rock lever at *G* is a much shorter lever, pivoted at the center, the position of which is always under control of the engineer from the operating platform. From this lever small rods extend to the cut-off release toes, *H* and *I*, Fig. 12, on the valve hood.

The movement is shown more in detail in Fig. 12. *J* is the main valve rod connected to the rocker *K* which moves the high-pressure main valve directly through the stem upon the end of which it (the rocker) is keyed. This valve, as are all the main valves in this engine, is a piston, and is moved by a link and rocker connection to the stem inside the steam-chamber at the center. The excrescence upon the side of the valve-chamber is the body of the cut-off valve.

The short rod *L* moves (every time the main valves move) a double wiper-tappet in the hood of the cut-off valve, and this movement lifts the cut-off valve. Thus

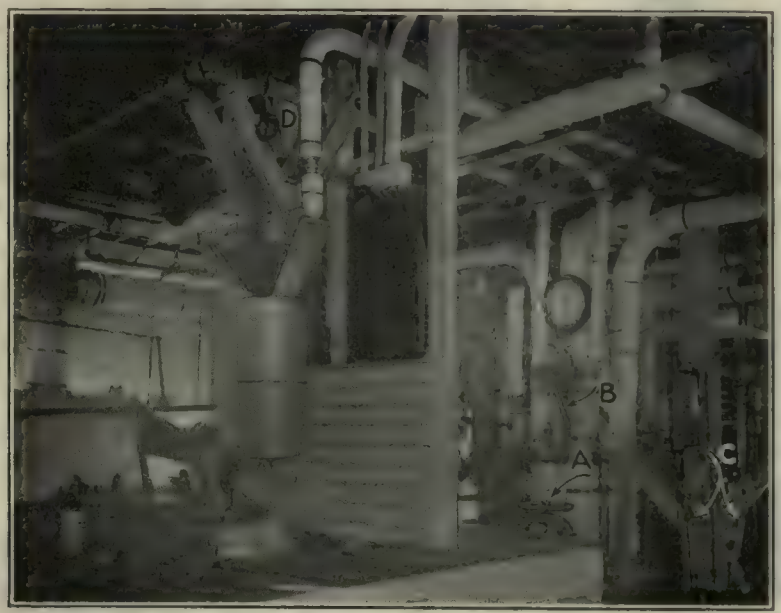


FIG. 14. OPERATING PLATFORM BETWEEN THE ENGINES



FIG. 15. CRANK CONNECTION AND WHEEL

every time the main valve moves in either direction the cut-off valve is opened by one or the other of the release toes and remains open until the moving crosshead, through the somewhat complicated system of levers and rockers, knocks out the release-toe *H* or *I*, depending upon which one happens to be holding up the valve. The bronze eagle shown in Fig. 12 is on the upper end of the valve stem and rises and falls (but does not scream) with every movement.

Reversing Movement Simple

The reversing movement is very simple. The eccentric-rod (or rather cam-rod) *M* is rigidly attached to the large X-shaped yoke which encloses the parts. The link block is also rigidly attached to rod *M*, being a part of the yoke.

I could find no explanation for the above mentioned yoke; it certainly has no function in moving the valves, and if other means of fastening the reach rod from the reversing-engine to the link block had been devised, could as well have been dispensed with.

The lever *N*, seen to better advantage in Fig. 13, is keyed at the center to the low pressure valve stem. It is thus the rocker that moves the low pressure valves, and by reason of the rod *J* being connected by it, it also transmits movement to the high pressure valves. It has still another function; it is made double and the link block slides between its parts so that it is also the reversing link.

O is the reach-rod rigidly attached to the bottom of the X-shaped yoke; so that in reversing, the yoke, the link block, and the eccentric rod *M* all rise together until the block is at the upper end of the link and the link itself oscillates back and forth within the lower part of the yoke instead of the upper part as shown in the picture.

Fig. 14 shows a general view of the operating platform. The throttle is at *A* and the reversing lever at *B*. The two levers shown at *C* are the cut-off controls, and curiously enough are set in opposed positions, so that to shorten the cut-off—to "hook 'er up," as the engineer would say—both levers will be brought toward the center.

The reversing engine is shown at *D*. The lever *B* operates a two-way valve, admitting steam to either end of the reversing engine cylinder and at the same time opens the exhaust ports at the other end. The lever is not connected in any way with the reversing engine, and if the engineer does not use good judgment it is quite possible to slam the piston clean through the head.

Fig. 15 is made from the fan-tail of the boat and shows a part view of the wheel and the crank connections of one engine.

Portable Locomotive-Frame Thermit Welding Outfit

By J. V. Hunter

An excellent portable outfit for conveying the many appurtenances of the thermit welding outfit is found in the Decatur locomotive shops of the Wabash Railway Co.

This outfit is shown in Fig. 1 and shows many of the spare parts carried on it when the welding apparatus proper has been set up for a frame welding job, as shown in Fig. 2.

The wagon is mounted on fairly large wheels so that little difficulty is experienced in running it over uneven flooring. The front axle is pivoted about a king-pin to permit it to be turned in a short radius. The steel



FIG. 1. WAGON FOR CONVEYING THERMIT WELDING OUTFIT

tripod frame on the shelf over the front axle carries the thermit crucible and the latter's cover may be seen resting on it.

The space underneath serves as a place to put miscellaneous tools.

In the center of the wagon is a large locker, the open door of which discloses the stock of plates carried for building molds similar to those shown in Fig. 2. The rear of the wagon is devoted to a couple of bins in



FIG. 2. PART OF WELDING OUTFIT SET UP FOR A FRAME JOB

which are carried the various mold facing and backing-up sands that are required for the construction of a standard thermit mold.

Precise Inspection of Large and Irregular Curves

Only One Long Direct Measurement Required—Heavy Castings Need Not Be Moved About During the Inspection of Curved Surfaces

By ELBERT O. BROWER

When using the method as herein explained for the precise inspection of large and irregular curves, only one of the distances which must be measured directly, is long, while the others ordinarily are comparatively short and easily measured with tools commonly available.

The part to be inspected need not be kept fixed, relative to a surface plate or other reference plane, during the entire time of inspection, and hence it is practicable to interrupt the work of inspection to make additions or corrections and there is no danger that the inspection will be disturbed or time be lost by the accidental changes to which such a fixed set-up is liable.

In the case of a heavy casting which it is difficult to move, it may be practicable to measure its curves without moving the casting at all. In one form of its application the method will indicate clearly the location and amount of any slight lateral bevel in a curved profile and will make it easy to keep a definite record of such inaccuracies.

If a finished templet, perhaps hard all over, is delivered for inspection a couple of buttons may be secured to the templet with C-clamps or other means so that the inspection can be accomplished without any physical change in the templet itself; but it is expedient to put two or more construction holes in the stock and fit pins to them before work on the curves is started. These pins need not be of the same size, but the work is slightly simplified if they are. The holes will facilitate both the machining and the inspection of the curved surface and they will remain available indefinitely for the convenient checking of any part of the profile in the event that a question arises about its condition. In the case of a complex gage such holes may be literally invaluable during construction as means for locating other parts of the device in a desired relation to the curved profile.

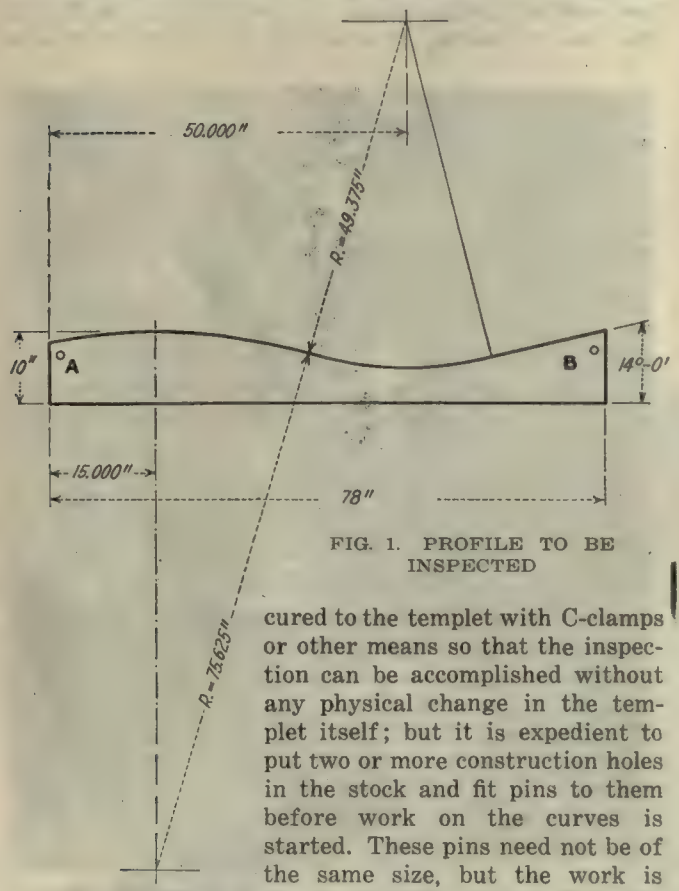


FIG. 1. PROFILE TO BE INSPECTED

To inspect the templet shown in Fig. 1 pins (or buttons) should be located conveniently near the ends as at *A* and *B*. Suppose that both pins have the same diameter of 0.40 in. The distance between the pins, 75.011 in., Fig. 2, should be measured; also the distance 7.3750 in., 6.4694 in. and 1.4482 in. This furnishes data sufficient, when used in conjunction with the dimensions given in Fig. 1, to calculate the distance 73.3570 in. from the center of pin *A* to the point *F* where the center of the convex arc should be and the inclination of this line from the vertical, which is 10 deg. 38 min. 45 sec.

The angle between the center line of the pins and the back of the templet is found by calculation to be 0 deg. 41 min. 30 sec. and the angle *BAF* is found to be 80 deg. 2 min. 45 sec. For the other arc the distance *BG* and the angle *ABG* should be similarly calculated.

The templet should next be placed on edge above a surface plate, Fig. 3, and held at any convenient height and at successively different inclinations in this vertical plane by means of clamps and angle plate. The distance 7.4640 in., 13.7465 in., 12.7150 in. and 19.9340 in. should be measured, finding the crest and trough of each profile with an indicator mounted on a surface gage and transferring these elevations to a height gage, vertical micrometer or size blocks, or using other means for vertical measurement according to the tools available and the degree of precision required. An accidental bevel in the profile will evidently be disclosed by the indicator.

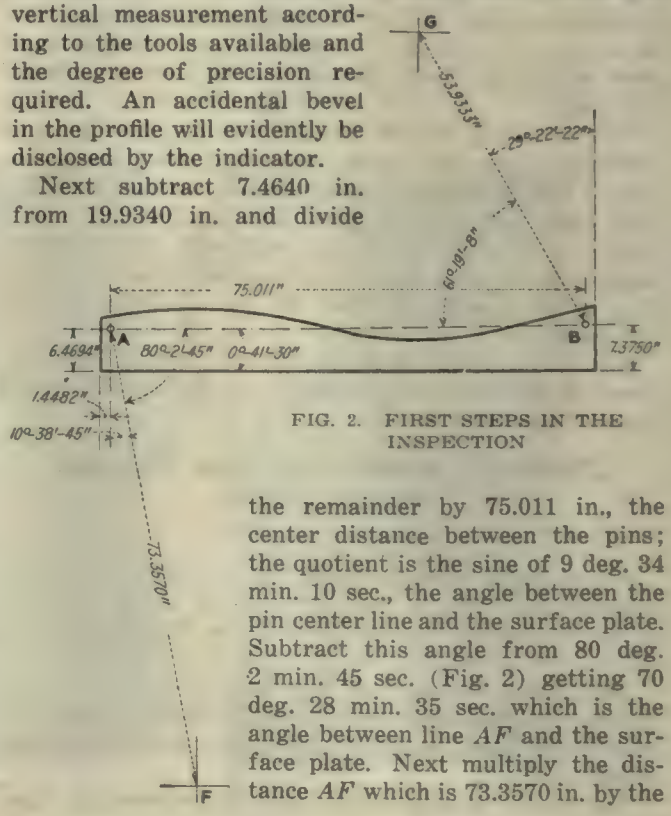


FIG. 2. FIRST STEPS IN THE INSPECTION

Next subtract 7.4640 in. from 19.9340 in. and divide the remainder by 75.011 in., the center distance between the pins; the quotient is the sine of 9 deg. 34 min. 10 sec., the angle between the pin center line and the surface plate. Subtract this angle from 80 deg. 2 min. 45 sec. (Fig. 2) getting 70 deg. 28 min. 35 sec. which is the angle between line *AF* and the surface plate. Next multiply the distance *AF* which is 73.3570 in. by the

TABLE I. ARRANGEMENT OF WORKING DATA

A	B	V	P	D	N	M	L	K	R
7.4640	19.9340	.....	13.7465	(	9° 34′ 10″	70° 28′ 35″	69.1393	75.4218	—0.0032
7.4640	19.9340	.....	12.7150	)	9° 34′ 10″	51° 44′ 58″	42.3544	49.5734	+0.0016
25.4770	8.2165	.....	10.6445	T	13° 18′ 12″	74° 37′ 20″	52.0024	49.5744	+0.0006

sine of 70 deg. 28 min. 35 sec. getting 69.1393 in. and add to this sum the difference between the profile readings at *P* and *A*, Fig. 3, that is, 69.1393 in. + (13.7465 in. — 7.4640 in.) = 75.4218 in. which is less than 75.4250 in. by 0.0032 in. showing that 0.0032 in. too much stock was removed at the point *P*. The value 75.4250 in. is used as the standard for comparison instead of the actual profile radius 75.6250 in. because the indicator touches the upper side of each pin, not the center, it being easier to subtract 0.20 in., the radius of the pin, from 75.6250 in. once and to use this difference for comparison, than to subtract 0.20 in. from each of the different readings taken on the pins.

For the point *Q* of the concave arc the angle 9 deg. 34 min. 10 sec. is subtracted from 61 deg. 19 min. 8 sec., leaving 51 deg. 44 min. 58 sec., and the sine of this angle is multiplied by 53.9333 in. To this product, 42.3544 in., is added the difference between the readings at *B* and *Q*, Fig. 3, that is, 42.3544 in. + (19.9340 in. — 12.7150 in.) = 49.5734 in., which is less than 49.5750 in. by 0.0016 in., showing that 0.0016 in. more stock should have been removed at the point *Q*. The value 49.5750 in. is found by adding the pin radius to the radius of the profile arc in order to avoid as before the changing of the pin readings.

The templet should now be shifted on the angle plate to a new inclination and the preceding operations repeated.

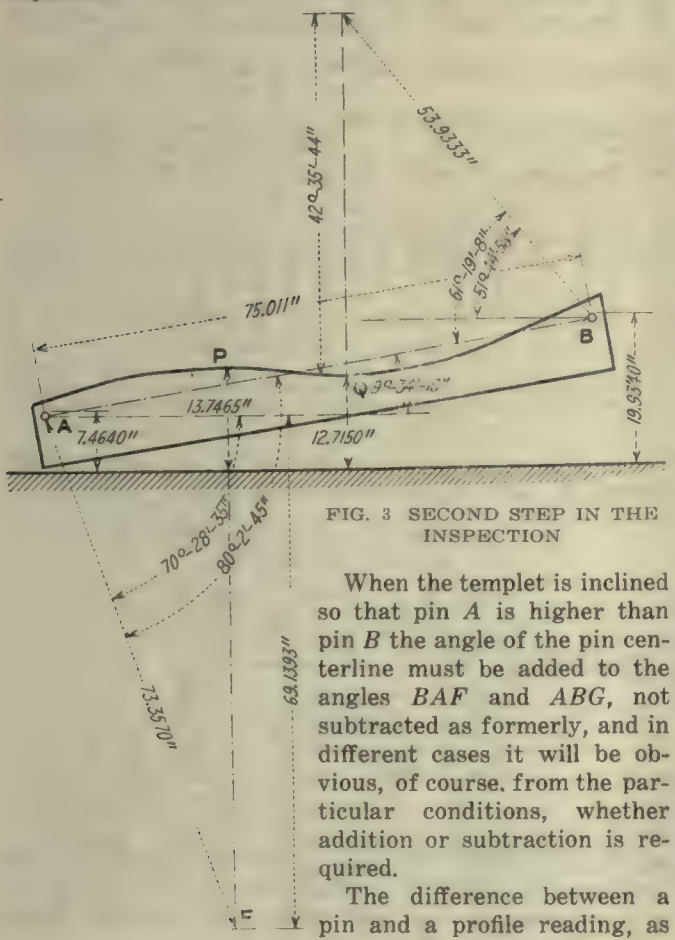


FIG. 3 SECOND STEP IN THE INSPECTION

When the templet is inclined so that pin *A* is higher than pin *B* the angle of the pin centerline must be added to the angles *BAF* and *ABG*, not subtracted as formerly, and in different cases it will be obvious, of course, from the particular conditions, whether addition or subtraction is required.

The difference between a pin and a profile reading, as the difference between 19.9340 in. and 12.7150 in., is sometimes to be added and sometimes to be subtracted from the corresponding product, such as 42.3544 in. in this instance; to be certain which operation is required in any doubtful case both may be performed and of these two results the one which is nearer to the corrected profile radius should be used to get the value of the surplusage.

To determine the position of a straight section of a profile the templet should be shifted on the angle plate until an indicator shows that this straight section is parallel to the surface plate. Then readings on the pins will show the angle of the flat relative to the pin centerline and a reading on the flat will determine the perpendicular distance to the flat from either of the pins.

If the flat is tangent to an arc of the profile the difference between the pin and profile readings follows the same routine of calculation as if the profile reading had been on the arc instead of on its tangent, the resulting surplusage being that of the flat at its point of tangency to the arc. The error, if any, in the angular direction of the flat, when considered with the surplusage at the point of tangency, will show the surplusage at any other point of the flat. Thus, in Fig. 4, if the reading on the tangent, when it is parallel to the surface plate, is 10.6445 in. and the readings on *A* and *B* are 25.4770 in. and 8.2165 in. respectively, $\frac{25.4770 - 8.2165}{75.011}$ equals the sine of 13 deg. 18 min. 12 sec., which angle added to 61 deg. 10 min. 8 sec. (Fig. 2) equals 74 deg. 37 min. 20 sec.; the sine of this angle multiplied by 53.9333 in. equals 52.0024 in., which is greater than 49.5750 in. Therefore, 2.4280 in., the difference between profile reading 10.6445 in. and pin reading 8.2165 in., is subtracted from 52.0024 in., leaving 49.5744 in. which is 0.0006 in. less than the corrected profile radius, showing that 0.0006 in. more stock should have been removed from the flat at the point of tangency. The angle 13 deg. 18 min. 12 sec. added to the angle 0 deg. 41 min. 30 sec. (Fig. 2) equals 13 deg. 59 min. 42 sec., showing that the flat has an angular error of 18 sec. (specification, Fig. 1, calls for 14 deg.) and that the direction of this error is such as to diminish the surplusage of the flat when moving away from the point of tangency. Taking the cotangent of 18 sec. as 11,460 and multiplying it by 0.0006 in., the surplusage at the point of tangency, the product, 6⅞ in., is the distance from the theoretical point of tangency to that point of the flat where the surplusage is zero and beyond this point the surplusage is evidently negative.

While taking measurements at the bench it will be expedient to record the readings in some uniform style allowing space on the original sheet for the addition of some of the calculated values. These notes can be arranged as shown in Table I.

In columns A and B are recorded the readings from the tops of the pins to the surface plate. In the next column is space for notes on accidental bevel in the profile surface. In column P are recorded the profile read-

ings. In column D (designation) may be recorded characters to indicate whether the reading in column P was taken at a trough or crest, a tangent or some special element of the device. Column N contains the angles of the pin centerline with the surface plate. In column M are the sum or difference angles showing the several inclinations of the lines AF and BG. Under L are noted the several products obtained by multiplying the sines of the angles or column M by the distances AF or BG and under K are listed the final sums

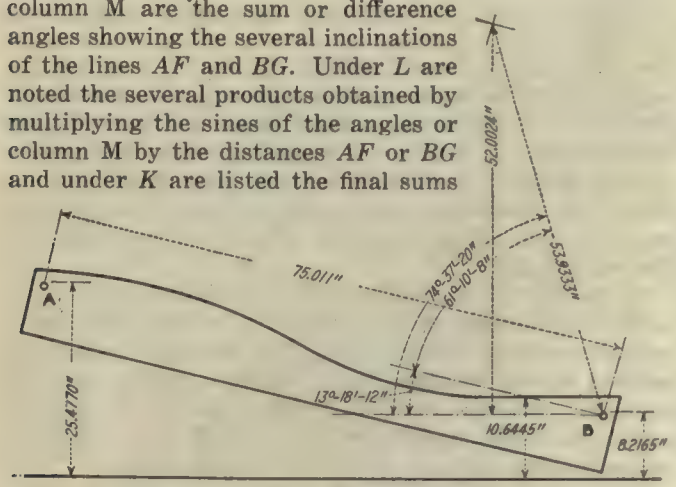


FIG. 4. ARRANGEMENT FOR INSPECTION OF A STRAIGHT SECTION OF A PROFILE

and differences which are to be compared with the corrected profile radii, to get the values of the errors which are recorded in column R.

In a case where the construction pins are of different diameters a convenient way to make allowance for the disparity is to add to each reading on the smaller of the pins a correction equal to the difference in the radii of the pins, the later calculations being made the same as if both pins were actually the diameter of the larger. According to the personality of the workman concerned with the job it may or may not be advisable in such a case to add a column to Table I, so that there will be recorded and preserved both the original and the corrected readings on the smaller pin. Of course all the readings on both pins could be reduced at once to values corresponding to the centers of the pins if such a procedure were preferred by the inspector.

The angles in column L can be conveniently used for laying out the locations of the several readings on a scale drawing, as shown by Fig. 5. With the surplusage values marked on such a drawing the results of the inspection may be seen at a glance.

If a circular arc is delivered for inspection with no mention of the supposed numerical value of the curvature its radius can be calculated and the position of its center determined after three readings have been taken on the curve; and if the arc is only approximately circular, such radius and center may be accepted tentatively while further readings show how closely the entire curve agrees with a true circular arc passing through the three points first measured.

If a templet has no finished edges except a profile surface which is entirely curved, the specification requiring nothing more than that the curves of the profile be in proper relations to each other, the actual or intended position of each center may be quite unknown. If the values of the different radii are known or assumed in such a case two readings on any arc will be sufficient to locate its center relative to the buttons or measuring pins; the several locations thus found after being compared with the profile specifications and possibly adjusted, can be tentatively used as a basis for a thorough inspection of the profile. If one of the radii is unknown three readings on that arc will be required.

After a position for the center of an arc has been accepted tentatively, if later readings show that a different point must be used, the readings which have been taken on the arc, that is, the pin and profile elevations already actually measured, are not lost, of course; only the calculations made from the unsatisfactory center must be discarded. Thus, suppose that a certain arc of a device is required to be of a given radius and in a certain position while actually the curvature and the location of the center are both in error. One complete series of pin and profile elevations can be used to prepare three inspection reports: First, taking the center of the arc in the desired location the resulting surplusage values indicate the discrepancies between the actual curve and the print specifications; second, with the center at a point determined by calculation the surplusage values tell how much the curve deviates from the nearest true circular arc with which it can be compared, the size and position of this perfect arc being definitely known, of course; third, selecting for the center of the arc a new arbitrary point to which other parts of the device can be made to agree by possible alterations, the surplusage values show where and to what extent stock must be removed from the profile in order to salvage the device.

Suppose that readings have been taken at three points, P_1, P_2 and P_3 on an arc of unknown radius R. Let p_1 represent the reading at P_1, that is, the distance of P_1 from the reference plane and let a_1 and b_1 represent the distances from the reference plane to the CENTERS of the measuring pins A and B respectively. Similarly let p_2, a_2 and b_2 represent the profile and pin readings for the second point P_2 of the arc, etc. In order to condense the formula let $N_1 = \sin^{-1}\frac{(a_1 - b_1)}{AB}$; and similarly let $\sin N_2 = \frac{(a_2 - b_2)}{AB}$, having regard for all the signs. Also let $N_{12} = N_1 - N_2$ and let $N_{23} =$

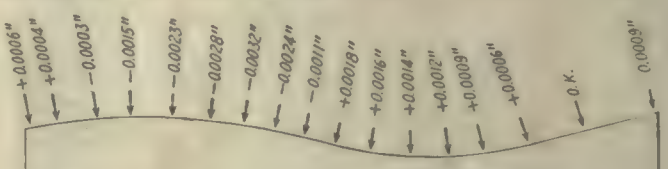


FIG. 5. DIAGRAM SHOWING ERRORS IN PROFILE

$N_2 - N_3$, regarding the signs of N_1, N_2 and N_3 but calling N_{12} and N_{23} positive in all cases. Then $R =$

$$\frac{(p_1 - a_1)\operatorname{cosec} N_{12} + (p_3 - a_3)\operatorname{cosec} N_{23}}{\tan \tfrac{1}{2} N_{12} + \tan \tfrac{1}{2} N_{23}} - \frac{(p_2 - a_2)(\cot N_{12} + \cot N_{23})}{\tan \tfrac{1}{2} N_{12} + \tan \tfrac{1}{2} N_{23}}$$

Referring to Fig. 6 it will be seen that

$$(p_1 - a_1)\operatorname{cosec} N_{12} = UW$$
$$(p_3 - a_3)\operatorname{cosec} N_{23} = AZ$$
$$(p_2 - a_2)(\cot N_{12} + \cot N_{23}) = HW + YZ$$

and
$$AZ + UW - HW - YZ = UV$$
$$= R(\tan P_2FU + \tan P_2FV),$$

which shows the derivation of the formula. Regardless of the positions of the pins A and B the formula will hold true if the signs of the several terms are properly regarded, a negative value of R resulting when

the concavity of the arc is directed away from the reference plane.

As the orientation of any actual arc will be already otherwise manifested the sign of R is immaterial, hence the formula may be written also as follows:

$$R = \frac{(a_1 - p_1)\ \text{cosec}\ N_{12} + (a_3 - p_3)\ \text{cosec}\ N_{23}}{\tan \tfrac{1}{2} N_{12} + \tan \tfrac{1}{2} N_{23}} - \frac{(a_2 - p_2)\ (\cot N_{12} + \cot N_{23})}{\tan \tfrac{1}{2} N_{12} + \tan \tfrac{1}{2} N_{23}}$$

and either expression may be used in any particular case though the one may be preferred which would

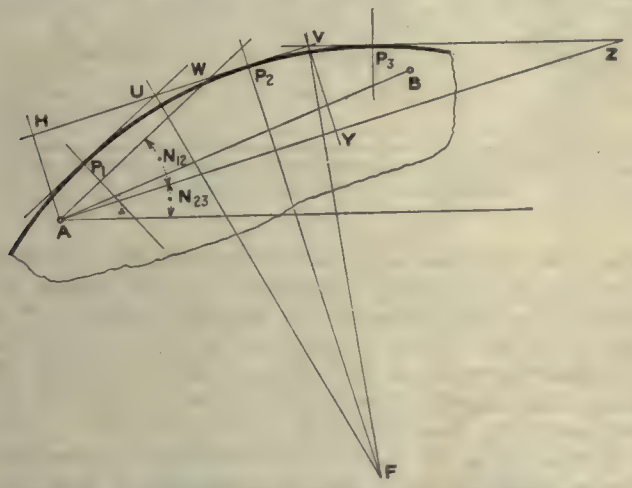


FIG. 6. DIAGRAM FOR DERIVATION OF FORMULA FOR RADIUS

make a majority of the pin and profile differences positive.

After thus finding the radius of an arc, in order to determine the position of its center F relative to the pins A and B, find the angle M_2, Fig. 7, such that $\cot M_2 = \frac{(R + a_1 - p_1)\ \text{cosec}\ N_{12}}{R + a_2 - p_2} - \cot N_{12}$. Then the angle $BAF = M_2 - N_2$, regarding all the signs, the angle BAF being greater than 90 deg., of course, when its cotangent is negative, and the distance $AF = (R + a_2 - p_2)\ \text{cosec}\ M_2$. The center of the arc is now located in the manner which is requisite in order to proceed with further inspection of the arc by the tangent method.

For a derivation of the formulas, it is seen that M_2 is the angle EAF and that it corresponds to the angle which would be recorded in column M of Table I, in line with the readings for the profile point P_2 if the center location were already known and that N_2 is the angle EAB.

$$\cot EAF = \frac{AS}{FS} = \frac{AE - SE}{FS} = \frac{AT\ \text{cosec}\ N_{12} - FS \cot N_{12}}{FS} = \frac{AT\ \text{cosec}\ N_{12}}{FS} - \cot N_{12}$$

and as $AT = R + a_1 - p_1$
and $FS = R + a_2 - p_2$

the relation $\cot M_2 = \frac{(R + a_1 - p_1)\ \text{cosec}\ N_{12}}{R + a_2 - p_2} - \cot N_{12}$ is shown.

By transposing the above slightly we get:

$$\cot M_2 = \frac{R + a_1 - p_1 - (R + a_2 - p_2) \cos N_{12}}{(R + a_2 - p_2) \sin N_{12}}$$

which may be preferable sometimes because the involved quantities are smaller numerically.

In these formulas for finding the radius of an arc and locating its center it has been assumed that all the pin readings have been corrected to correspond with imaginary readings at the centers of the pins. With pins of the same radius, as 0.2000 in., instead of subtracting this amount from each pin reading, if this same 0.2000 in. were added to each profile reading, it will be seen that the correct value of R would result from the formula whether the pin radius correction were applied to the pin readings or to the profile readings. But suppose that neither the pin nor the profile readings are corrected for the amount of the pin radius. It will be evident that the evaluation of the formula will give a radius which is 0.2000 in. greater than the actual radius, and that in any case the difference between the calculated radius and the actual one will always be equal to the pin radius exactly, though the direction of the difference will depend jointly upon whether the arc is measured with its convexity toward or away from the reference plane and whether the pin readings are taken on the sides of the pins which are nearest to or farthest from the reference plane. Without troubling to be certain whether the actual radius is greater or less than the calculated one this value may be used in the second formula with the uncorrected profile and pin readings to find the location of the common center of both arcs and after the center is located in this manner the direction of the error will be unmistakable.

If a case requires nothing more than to determine the radius of a single arc which is assumed to be truly circular it may sometimes be accomplished conveniently

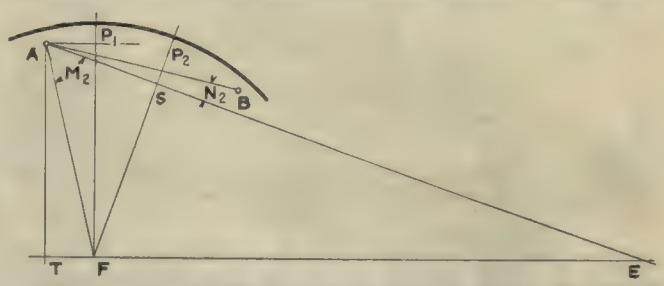


FIG. 7. TO DETERMINE POSITION OF THE CENTER AFTER HAVING FOUND THE RADIUS

by placing two buttons of equal size in contact with the arc and measuring the distance between the buttons and the lateral location of the crest of the curve. A certain common type of sine bar could be handily used for an arc of corresponding length, the center distance of its pins being already known.

Referring to Fig. 8, the distance H between the trough of the concave arc and the straight edge T is measured with a plug gage L and the size blocks J or in some other satisfactory manner and the distance K between the buttons is measured by some method dependent upon the tools available. With the diameter of each button denoted by d and the required radius by R,

$$R = \tfrac{1}{2}\left[\frac{(K + d)^2}{4\ (H - d)} + H\right].$$

The derivation of this formula is as follows:

In the similar triangles ACB and BCD

$$AC : BC = BC : CD$$

or $$AC = \frac{\overline{BC}^2}{CD}.$$

Now $DE = \frac{1}{2}d$, $CG = \frac{1}{2}d$

and $CD = GE - ED - CG.$

Therefore $CD = H - d.$

Also $BC = \frac{1}{2}(K + d).$

Therefore $$AC = \frac{\frac{1}{4}(K+d)^2}{H-d} = \frac{(K+d)^2}{4(H-d)}.$$

Now $AF = \frac{1}{2}d = CG.$

Therefore $AC = FG.$

Also $R = \frac{1}{2}(FG + GE),$

that is, $R = \frac{1}{2}(AC + H)$

and finally $$R = \frac{1}{2}\left[\frac{(K+d)^2}{4(H-d)} + H\right].$$

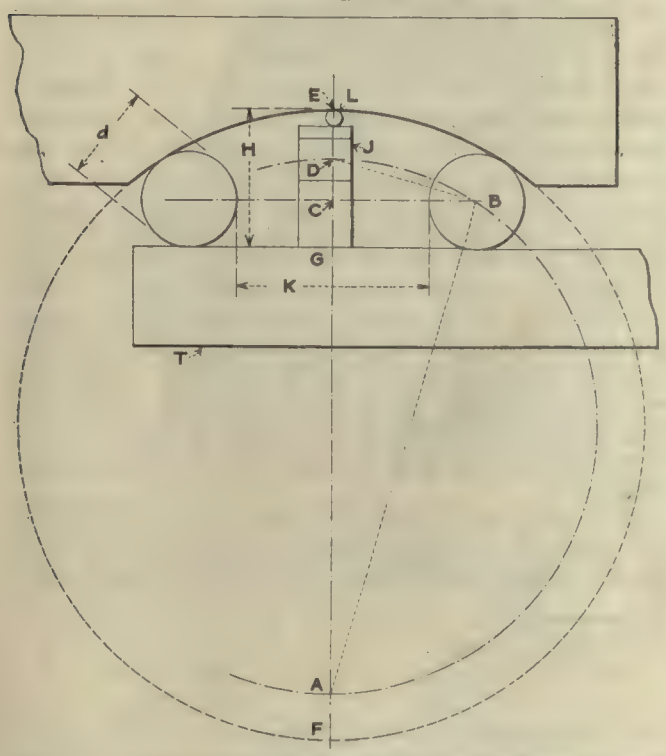


FIG. 8. DIAGRAM FOR DERIVATION OF FORMULA FOR RADIUS OF A SINGLE CONCAVE CIRCULAR ARC

For a convex arc the known dimensions may be denoted as shown in Fig. 9 and the formula becomes:

$$R = \frac{1}{2}\left[\frac{(M-d)}{4(d-J)} - J\right].$$

The derivation of the formula is analogous to that of the previous one.

If the buttons cannot be conveniently clamped to a surface plate or otherwise held at an appropriate distance apart it may be well to clamp the buttons to the templet itself, in which case it is necessary merely that the two buttons be located equidistant from the arc in order to determine the radius with a minimum of calculation. In this case it will be advisable to arrange the formula for dimensions taken from the CENTERS of the buttons as sohwn in Fig. 10. The formula is:

$$R = \frac{1}{2}\left[\frac{N}{4(T-S)} + T + S\right]$$

and it will be clear that either of the quantities T or S will be negative if the space corresponding to the dimension is on the convex side of the primary arc.

When using trigonometrical tables the labor of interpolation is naturally to be avoided as much as possible; in fact, it is generally better to have a table unnecessarily large than to be obliged to use one which is inconveniently small. It is commonly expedient to

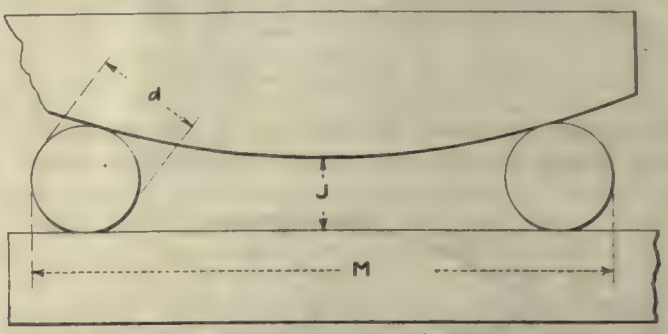


FIG. 9. METHOD OF MEASURING TO FIND RADIUS OF A SINGLE CONVEX CIRCULAR ARC

extend the decimals of a calculation somewhat further than might be strictly warranted by the degree of precision actually attained in the construction of a gage or in the means for checking it, hence it may be of interest to mention Bauschinger & Peter's table of logarithmic sines and tangents to every second (G. E. Stechert & Co., New York).

As the numerical value of the distance between the centers of the pins is to be used repeatedly as a divisor, if the calculator is not familiar with logarithms he should use the reciprocal of this value as a multiplier. Let AB represent the value of the distance between the pin centers. When the decimal equivalent of $1/AB$ has been found by division or from a table, it should be added to itself repeatedly so as to get a small multiplication table such as shown in Table II, which will both save labor and tend to avoid some of the chances

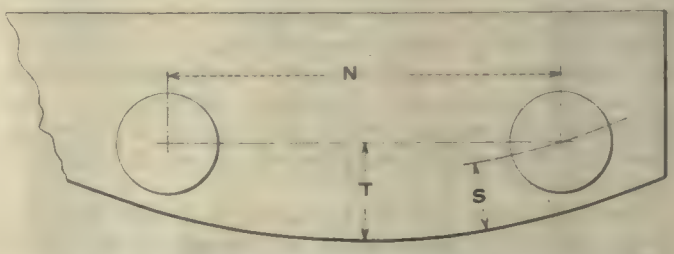


FIG. 10. MEASURING TO FIND RADIUS OF A SINGLE CONVEX CIRCULAR ARC WITH BUTTONS CLAMPED TO THE TEMPLET

for errors to intrude. If an adding machine of suitable type is available it may be worth while to extend such a table to 100 times $1/AB$.

It will be noted that for each individual measurement of a point on a curve nothing is required in the way of calculation more difficult than addition, subtraction and multiplication and in comparison with a method of curve measurement which necessitates either division or the extraction of square root, certain advantages of the tangent method for the inexperienced calculator will be appreciated.

TABLE II. MULTIPLICATION TABLE FOR CONSTANTS

1	0.0133314
2	0.0266628
3	0.0399942
4	0.0533256
5	0.0666570
6	0.0799884
7	0.0933198
8	0.1066512
9	0.1199826
10	0.1333140

The calculations may be checked by working to a point P on the profile from both pins; or if a more rigid check is desired three pins may be used instead of two,

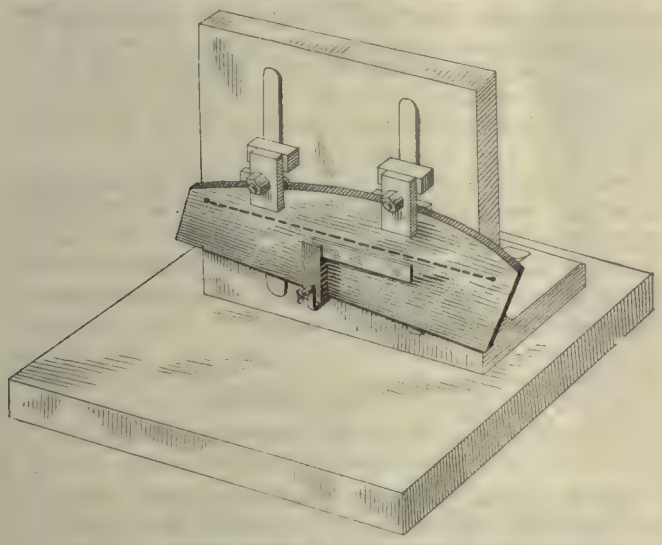


FIG. 11. FIRST STEP IN MEASURING DISTANCE BETWEEN PIN CENTERS

the third pin being located midway between the end pins in which case the condition of the profile at any point P would be found from the end pins and this result checked by using the middle pin and one of the end pins. Of course four pins could be used, two at each end of a profile, to permit different pairs of pins to be used independently for the most rigid checks on all the measurements and calculations involved in machining a profile and locating parts of a gage in proper relation to it, but in the case of a mere templet, after the locations of the two pins have been carefully determined, it may not be worth while to check any of the later calculations. If the curves are reasonably smooth and the readings are not too far apart any single error in measurement or calculation will be disclosed by an abrupt variation in the results in column R and the uncertainty of such an occurrence is quickly and conclusively settled by taking a second reading near the point in question.

The number of readings to be taken on any particular curve will naturally be regulated in the main by the character and prevalence of its errors. If the curve has been finished by hand operations or is otherwise liable to erratic variations, about the only course to be followed is to take readings on the curve at convenient points and to continue the routine until the results leave no serious uncertainty; but if there is some warrant for presuming that the curve is a very good approximation to a circular arc it may be well to inspect this property of the curve first and afterward to take only a few readings by the tangent method to determine the position of the curve relative to other curves of the profile or other parts of the device. By fixing two pins or temporary lugs about as far apart as half the length of the arc and then sliding the arc along these points, with a stationary indicator touching the arc not too near either of the lugs, it may be possible to ascertain with practical surety that the arc is truly circular within the desired tolerance if such actually is the case, but unless the arc is smooth and true the test is likely to afford only negative results.

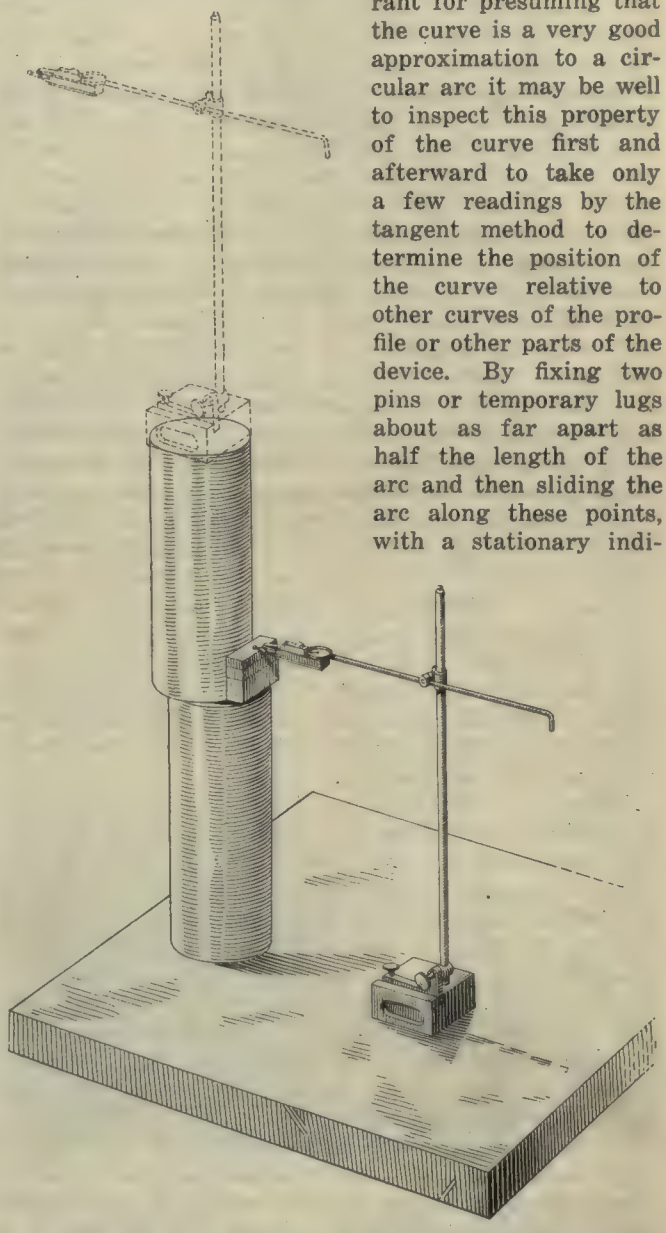


FIG. 13. THE USE OF SIZE BLOCKS AND INDICATOR IN MEASURING DISTANCE BETWEEN PIN CENTERS

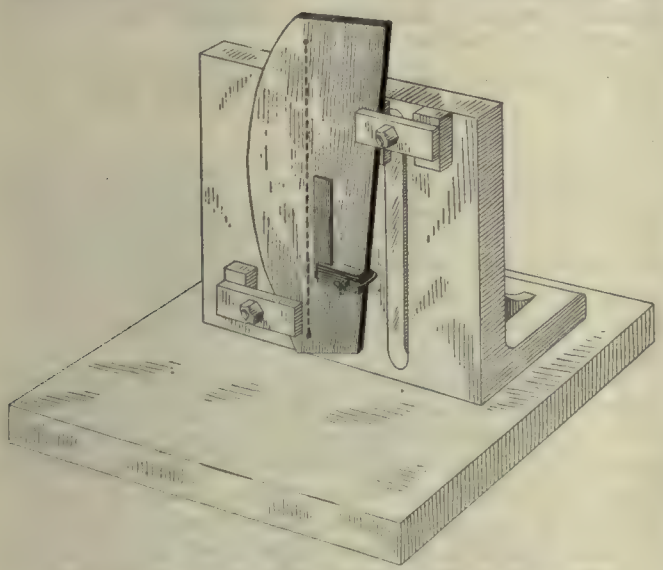


FIG. 12. SECOND STEP IN MEASURING DISTANCE BETWEEN PIN CENTERS

As it is plainly a difficult matter to determine with certainty and precision the distance between two pins or buttons which are comparatively far apart, a word of warning may be allowed regarding the dubious value of the micrometer or vernier caliper in such cases in contrast to the dependable results which are secured with indicator and size blocks. If pins are a foot or more apart it is most difficult to judge the character of the "touch" when using an ordinary outside micrometer. Without asserting that it is impossible in such a case to reduce the probable error of a reading to less

than one one-thousandth, the manifest uncertainty in the touch should disbar the use of such a tool if it is desired to keep the error within this limit.

If a templet is clamped to an angle plate resting on a surface plate as indicated in Fig. 11 an ordinary square may be clamped to the templet and the templet and square adjusted until one edge of the square is parallel to the line of centers of the construction pins. While keeping the square fixed to the templet, if the templet is held vertically, Fig. 12, an indicator on the second blade of the square will show when the pin centerline is vertical and then measurements from the pins to the surface plate made with indicator and size blocks are both precise and reliable. As a moderate error in the vertical direction of the pin centerline would cause merely a negligible error in the measurements the operation of getting the pins in vertical alignment may be done hastily with only moderate pains.

If there is available—as there should be in every tool shop—a size block large enough laterally to permit a surface gage to be placed upon it, the combination may be used as indicated in Fig. 13. In this manner with careful handling the surface gage can be moved from the top of the block to the surface plate and back, thus comparing the height of the pin above the block with the height of the Johansson blocks above the surface plate. While inspecting a long tool the writer has used a surface gage in this manner on a pile of three steel size blocks with the indicator in operation at a height of more than four feet above the surface plate. In this instance it was necessary to minimize vibration by placing a rubber block under each pad of the surface plate but with such concession the results were entirely satisfactory.

When it is desirable to stretch available facilities to reach a high button it is clearly sufficient to reach the lower edge of that button and in doing this a couple of inches of the height can be saved by using the indicator upside down (with a mirror to assist when reading the dial) in which case the Johansson blocks would be arranged with the ball of the indicator functioning on the under side of the topmost of the blocks.

In passing, it is tempting to emphasize the convenience and usefulness of such size blocks in general tool inspection work and to express the opinion that any inspector who has once used them would be most unwilling to do without them. If available tools cannot reach between the pins of a curve inspection job it may be practicable to place one or more buttons in line between the pins and measure the total distance in sections. Such a procedure should not make trouble if the part is light.

If the curves belong to a device which is so heavy as to be moved only with difficulty the dependability of the indicator and size blocks method may even warrant the expedient of placing the heavy tool in a position such that the pin centerline is roughly vertical, placing by the side of the heavy part a surface plate supported by adjustable jacks and then moving the surface plate until its surface is perpendicular to the pin centerline. In some cases it may be advisable to clamp an angle plate to the heavy part, to clamp a second angle plate to the first and to adjust these until a surface is perpendicular to the pin centerline.

At the present stage of toolroom practice it is probably very seldom that an occasion arises when it is desired to inspect with considerable precision a curve which was not intended to be an arc of a circle, with an exception perhaps, in the case of the involute.

It would be possible of course to inspect any curve by placing a cylindrical plug or a spherical ball in contact successively with different points of the curve if means are available for determining the several positions of the convex plug or ball, but, except in the case of a circular arc, the incidental calculations would be apt to stagger anyone but a thoroughly experienced computer, so that the tangent method is to be preferred in the case of any irregular curve.

The tangent method is applicable to an involute of a circle, commonly termed simply an involute. The calculation required is not too seriously troublesome and the formulas appropriate for an inspection of the involute may be derived along the same general lines as followed for the arc of a circle.

Precision Gages

By H. W. Bearce

U. S. Bureau of Standards

In the article by M. E. Kanek under the above title on page 884, Vol. 53, of the *American Machinist*, a list of recommended sizes is given which it seems to me is open to objection.

First, of the 30 sizes given, 22 are so thin as to be at present not commercially practicable. It has been found by experience that a block of about 0.05 in. thickness is as thin as can at present be produced commercially. It is, of course, a simple matter to make blocks as thin as desired; but to make them with plane and parallel surfaces, and keep them in that condition, is quite another matter.

Another point that might well be raised is the advantage of the 1, 2, 4, 8 series recommended by Mr. Kanek over the more usual 1, 2, 3, 5 series. The two are of equal value as far as making up combinations is concerned.

Sets of less than 81 blocks are, of course, already in use.

The usual sizes of the 34-block set are as follows:

0.10025			0.10050			0.10075		
0.101	0.102	0.103	0.104	0.105	0.106	0.107	0.108	0.109
0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19
0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1.	2.	3.	4.					

If, for any reason, the above sizes are unsatisfactory, the following is suggested as containing a somewhat smaller number of blocks and at the same time as being commercially feasible.

0.0501	0.0502	0.0503	0.0504	0.0505	0.0506	0.0507	0.0508	0.0509	
0.50	0.051	0.052	0.053	0.054	0.055	0.056	0.057	0.058	0.059
0.11	0.12	0.13	0.15						
0.1	0.2	0.3	0.5						
1	2.	3.	4.						

The above series makes a total of 31 blocks. This number could be reduced to 26 by omitting the 0.054, 0.056, 0.057, 0.058 and 0.059, and to 21 blocks by omitting the 0.0504, 0.0506, 0.0507, 0.0508 and 0.0509. Such a reduction, however, is not advisable as it would greatly increase the number of blocks required to make up certain sizes.

Mr. Kanek's statement in regard to lack of agreement among scientists as to the wave length of light appears to be a rather weak attempt to discredit the optical method of testing. Until the art of manufacturing precision gage blocks is much further advanced than at present, no one need concern himself greatly about inaccuracies in the wave length of so-called monochromatic light from the usual sources such as the helium tube or the sodium flame.

Special Railroad Machine-Forging Tools

Description of Dies Used for Forging Locomotive Grease Cups, Universal-Joint Jaws, Connecting Rods, Valve Handles, Boiler-Flue Beading Tools, Etc.

By J. V. HUNTER
Western Editor, *American Machinist*

A CONSIDERABLE degree of success has been obtained in tooling the different forging machines of the locomotive blacksmith shop of the Wabash Railway Co. at Decatur, Ill. A forging-machine die with few complications is shown in Fig. 1; it is used for forging the blank *A*, from which locomotive grease-cups are machined. The forging is made from round bar and the stock is gathered in the upper pass of the die where it is upset while still retaining its roundness. In the lower pass *B* the material is further upset, formed to a hexagonal section and, at the same time, the point *C* of the header squeezes the major portion of the stock from the center of the blank. This leaves the hollow center shown in the forging and saves the time of drilling it out during the subsequent machining operations.

Forging Universal-Joint Jaws

The universal-joint jaw shown at *A*, Fig. 2, is a good example of light, intricate machine forging. It should be noted that the shank is pierced with a square hole which adds one forging operation. In working out this forging the stock is first necked down in pass *B* leaving the material which later forms the forging in the section inclosed by the dies. This necking-down operation insures that all stock required for the forging will remain in the die and prevent any slipping back through the grips. The outer end of the stock thus gathered is then flattened by gripping between the dies in the pass *C*.

The next two passes are practically identical, rough-forging the jaws first in the bottom pass *D* and then finishing them in the middle pass *E*. The header *F* is for the pass *E* and is somewhat similar to that used for the bottom pass, which was not available when the photographs were taken. The hole through the shank is punched in the top pass *G* by the square punching header *H*. The necking-down operation which has previously been mentioned provides a small section of the same area as the square-hole punch so that when this punch has made its stroke the finished portion is free from the bar. The greatest forging strain on the dies comes where the bar has been necked down, and it will be noted that an insert *I* of special forging-die steel extends through both dies at this section.

Forging a Bell-Ringer Connecting Rod

The Bell-ringer connecting rod *A*, Fig. 3, has a small pair of jaws that are made by a different method. The side of only one of the dies for this operation is shown. Three passes are required, starting with the gathering

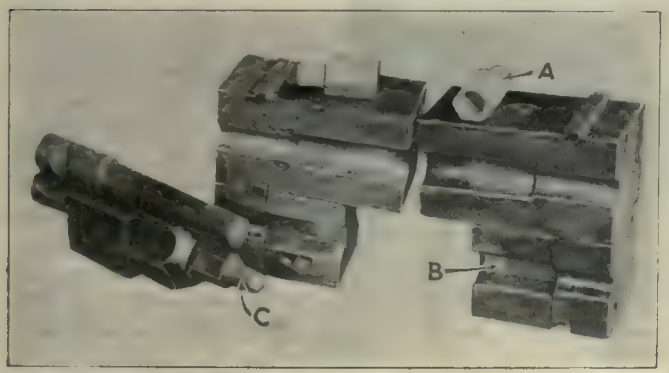


FIG. 1. BLANKS FOR LOCOMOTIVE GREASE CUPS FORGED IN TWO PASSES

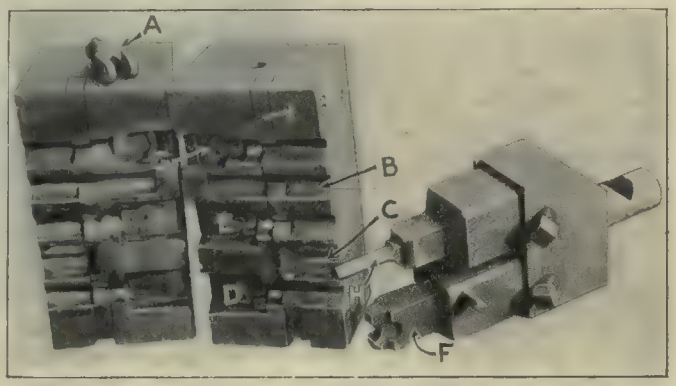


FIG. 2. FIVE-PASS DIES FOR FORGING UNIVERSAL JOINT JAWS

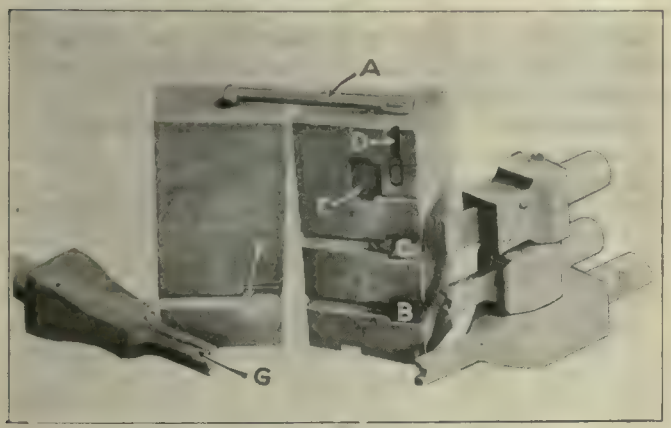


FIG. 3. FORGING DIES FOR BELL-RINGER CONNECTING ROD

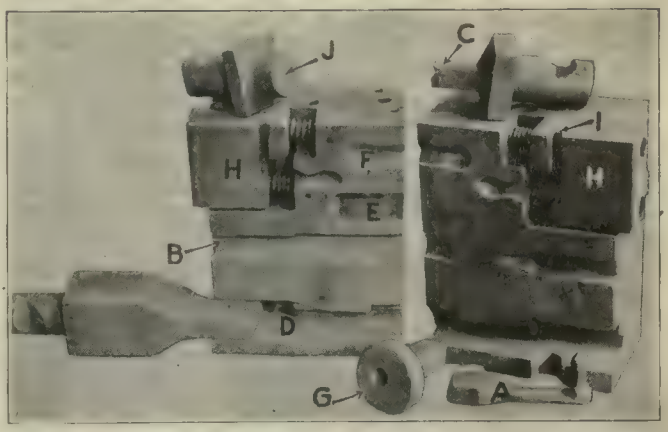


FIG. 4. DIFFICULT VALVE HANDLE FORGING MADE IN HEADING AND SLIP DIES

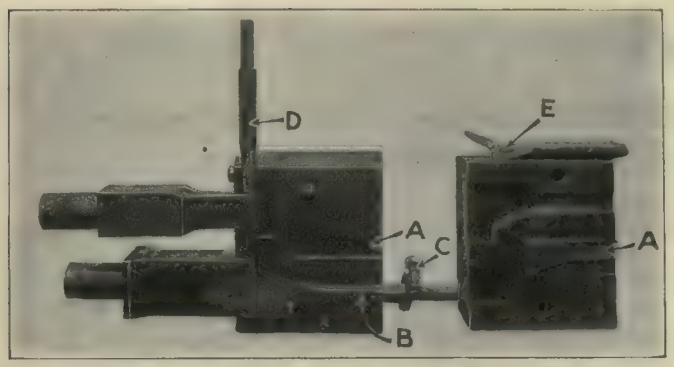


FIG. 5. DIES FOR BOILER-FLUE BEADING TOOL FORGINGS

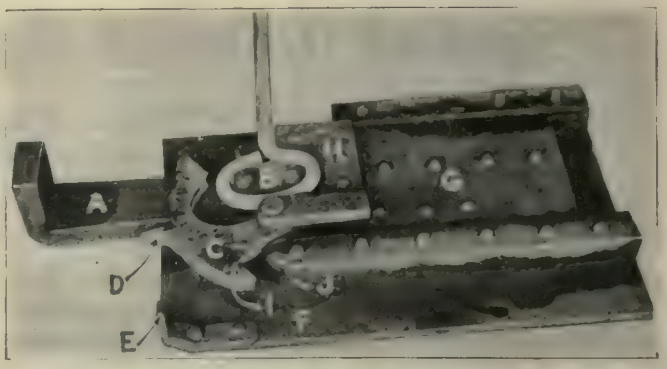


FIG. 6. WING DIE FOR BENDING LOOP HANDLES

of the stock in the lower pass *B*. The jaws are shaped further in the pass *C* and are then held in a vertical position in the pass *D* while the top header punches out the stock from between the jaws, carrying it through into the space *E*. The other side of the die blocks is used for the single pass required to form the other end of this forging. This is a simple upsetting operation in the pass *F*, using the header *G*.

An exceptionally difficult piece to accomplish on a forging machine is the valve handle shown at *A*, Fig. 4. The hub or shaft end of the handle is the first portion upset and the stock for this is worked partly to shape by an upsetting operation in the pass *B* using the header *C*. This end is then inserted in the bottom pass *D* where the header shown forges it to its final form exclusive of flash trimming operations. It will be noted that the rear end of the dies (where they adjoin in the illustration) shows an enlargement of this pass back of the grip which serves to provide for a tong-hold. The formation of the handle end shows great ingenuity as this is a difficult shape to forge in this manner. Its end is first worked down to small section by several gripping blows in the pass *E* and then shaped up in the same manner in the pass *I*. Originally an attempt was made to give a right-angle bend in a form bolted to the top of the dies, but the gripping blow of the machine was found to be so severe that the end would snap off. This end is now bent by hand, inserting it in the stake *G* held in an anvil. The final forging operation is performed in the slip-die section *H* with the handle held in a vertical position in the groove *I*, the bent portion for the handle lying in the impression that will be noted. The header *J* pushes in the two slip-die sections, thus upsetting and forming the base of the handle.

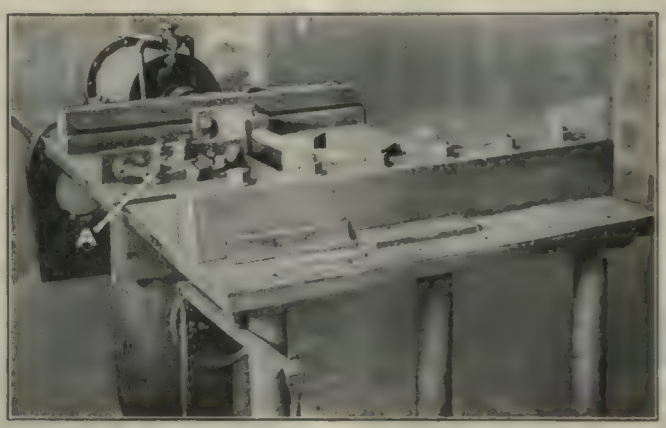


FIG. 7. AIR-CYLINDER BENDING PRESS AND SPECIAL DIES

A number of railroad shops have lately been devising improved methods for the production of boiler-flue beading tools, and in this shop is found a well-developed method of forging these. The chisel stock is first cut to length and the shank turned before these go to the blacksmith shop. The dies for the work are shown in Fig. 5. The first operation is to flatten out the end in the center pass *A*, which is merely a squeezing operation. Unfortunately the die at the right has been turned upside down and is a little confusing.

The first flattening operation leaves the end so that it is in good shape for the forming operation in the bottom pass *B* that forms the tool as shown. An end view of same is shown at *C*. For the final operation the piece is held vertically in the position *D* while the header of the top pass trims off the flash, leaving the tool as shown at *E* ready for finishing in the toolroom. A peculiar form of wing or folding die is shown in Fig. 6. This die is used for forming the handle of stoking bars, one of which is shown lying in the die. The male part of the die *A* carries the core *B* around which the handle is formed. When this part is withdrawn to the extended limit of its stroke the wing section *C* is thrown back so that the horn *D* comes against the stop *E* rivited to the base-plate *F* of the sliding section. The sliding section *G* operates in guides made by riveting bars to the base-plate, and on its forward end carries the female section *H* for forming one side of the handle, together with the hinged section *C*. The heated end of the bar is laid across the dies and when these close the center core *B* catches it, pushing it into the curve of *H* until, as the sliding section retreats under pressure, the swinging arm *C* swings around, forming the end of the rod around the center core. The forward movement of the die head is arrested at the same time that the horn *I* comes in contact with the end of the slide *J*, which causes the wing to force in the end of the handle with a final firm pressure.

Another pair of plain dies that operate on the well-known toggle-arm principle is shown lying at *A* on the bed of the homemade bending press shown in Fig. 7. This press is of interest because it was made in the shop and consists of a heavy air cylinder together with sliding and stationary heads, all mounted on a heavy base casting.

Attention is also called to the V-block bending dies in use on the machine and particularly the peculiar form of the male V-block which is mounted in a special socket holder. This holder is made so that by means of spacing or filling washers, the male V-block may be easily adjusted for different thicknesses of stock.

Convenient Shipping Crate Diagram for Machinery

SPECIAL CORRESPONDENCE

A good method of crating machinery, of showing exactly what material is required and the way in which it is put together, is shown in the accompanying diagram. This is the practice of the Blanchard Machine Co., Cambridge, Mass., the diagram having been arranged by the superintendent, Winfield W. Blake. The machine shown is a 16-in. high power vertical surface grinding machine.

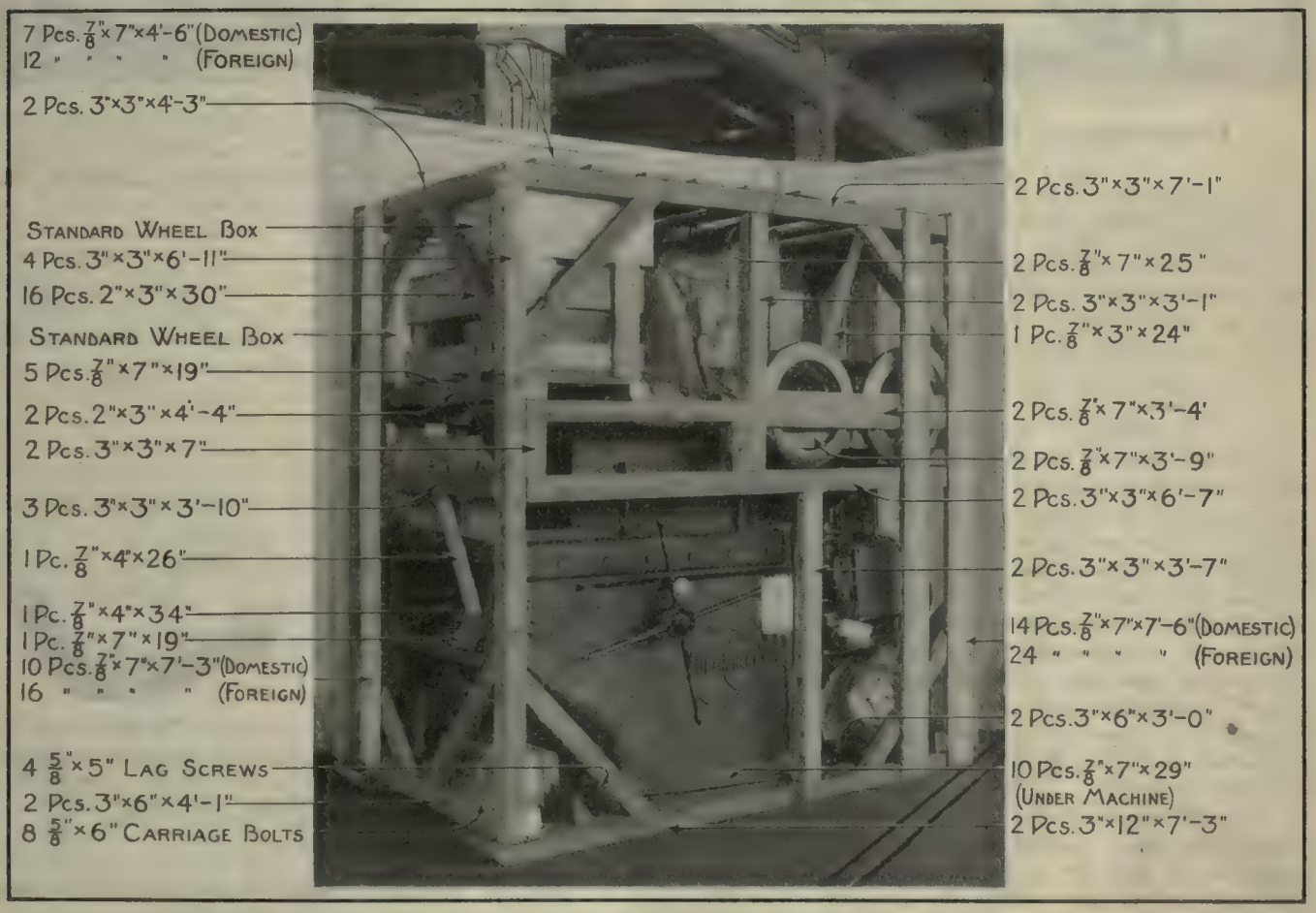


DIAGRAM OF CRATE CONSTRUCTION AND LUMBER USED

A copy of this diagram goes to the lumber merchant together with the instructions that "all frames, braces and skids are to be of spruce and all 7/8 in. stock is to be of North Carolina roofers." This diagram enables the lumberman to send stock which will cut up economically to the lengths shown and so secure the necessary pieces of lumber with the least possible waste.

It will be noted that there are three references to domestic and foreign shipments. The additional number of pieces shows what is required to make it a complete box, such as is used for foreign shipment.

Such a diagram can be readily made for almost any type of machine and forms a simple yet comprehensive record of the kind and amount of material required, as well as the way in which the crate is built up. This method seems particularly useful in comparatively small shops where standard machines are built, so that it has a wide field of useful application.

Computing the Depth of Keyway in Gear and Pulley Hubs

BY HENRY R. BOWMAN

I have noticed several articles in the *American Machinist* in regard to finding the depth of keyways in pulley and gear hubs, but they involve the use of tables which are apt to be mislaid when required for use.

The following rule is simple and easily memorized:

$$X = \sqrt{\left(\frac{D}{2} + \frac{W}{2}\right)\left(\frac{D}{2} - \frac{W}{2}\right)} + \frac{D}{2} + \frac{b}{2} + .002$$

X = the required distance from the bottom of the keyway to the opposite side of the bore of the hub.
D = diameter of bore.
W = width of key.
b = thickness of key.
0.002 = clearance.

Extracting Small Slivers of Steel

BY J. A. RAUGHT

I suppose every machinist has his way of removing steel slivers. In most cases they are likely to locate them first with the eye, then proceed with the scriber, knife blade, or some other similar implement.

The method I use I think is superior to others: Get a safety razor blade—one that is clean and quite sharp; scrape the part quite hard once or twice where the sliver seems to be, and then examine the edge of the blade where, most likely, you will find the sliver.



Generating a Parabolic Reflector

By L. J. Voorhees

Some time ago I was confronted with the problem of experimentally making a number of small, accurate, parabolic, thin metal reflectors of various depths and the method finally adopted facilitated this difficult job to such an extent that I believe it will be of interest to others, and perhaps can be used to construct other sheet metal articles of a similar nature.

The method previously used was to geometrically construct a parabola on the drafting board by the use of a large number of ordinates with their respective mathematical dimensions. These were then transferred to a sheet of thin metal and a line drawn through the points of intersection was the parabolic curve which formed the outline of the templet from which the reflector was later constructed. In using this method a number of unavoidable errors or inaccuracies were incorporated which were objectionable in the finished reflector. Also the method was slow, difficult and expensive and even when considerable care was used in constructing the templet the inherent inaccuracies were objectionably noticeable in the beam of light projected by the reflector made from it.

The aim was to find a method that would overcome these objections, require very little of a draftsman's time and be easy for a toolmaker to follow. This was accomplished by generating the parabolic templet. I will describe how this was done but will not give the geometric reasons for taking each step, as they are obvious.

A piece of well seasoned, hard maple, somewhat larger than the diameter of the finished reflector, was placed in a three-jaw, universal, bench lathe chuck and the end turned down to provide a more positive grip for the chuck-jaws, as shown in Fig. 1. The piece was then removed and the turned end placed in the chuck and firmly gripped. The part outside of the chuck was then turned to the exact diameter the finished reflector was to be. The end was then pointed until it formed a cone. The length of the cone indirectly determined the depth of the reflector. I will explain this after the next step. The positions of the chuck-jaws were marked on the block so that after being removed it could be put back in the same concentric position. It was then removed and placed in a milling machine vise in such a position that a thin saw would cut the slot *ed*. This slot was cut about 0.025 in. wide being started exactly in the center between the points *a* and *b* and continued parallel to the side *cb* until it reached the base of the cone at *e* exactly in its center. Care was taken to cut just to the base of the cone and no further. I would like to emphasize the fact that the slot *ed* is exactly parallel to the

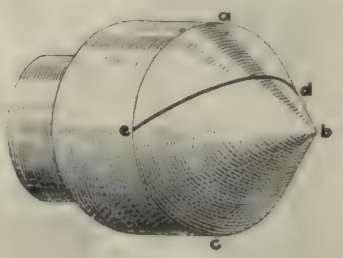


FIG. 1

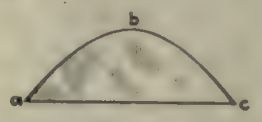


FIG. 2

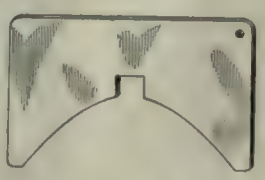


FIG. 3

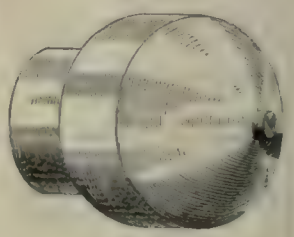


FIG. 4

FIG. 1. HARD MAPLE BLOCK IN WHICH THE MALE TEMPLET WAS MADE. FIG. 2. THE MALE TEMPLET, FINISHED EXCEPT FOR FILING THE BEVEL. FIG. 3. FEMALE TEMPLET. FIG. 4. THE SPINNING BLOCK

side *cb* of the cone and where the slot touches the base of the cone it lies exactly in its center line.

I will now explain how the dimensions of the cone are determined. As already stated the diameter of the base of the cone will be the diameter of the finished reflector. The depth of the slot *ed* will be the depth of the reflector. As the depth of this slot is one-half the length of either of the sides *ab* or *bc* then the depth of the reflector will be one-half the length of either side of the cone.

With this cone we generated the parabolic templet in the following manner. A piece of sheet metal with at least one straight side was fitted tightly into the slot *ed* with the straight side lying against the bottom of the slot. A line was scribed on the metal along the edge of the slot; the metal was removed and the edge trimmed off so that when it was put back in the slot just a small amount protruded the whole length of the slot. Then the piece of wood, with the sheet metal still in the slot, was inserted in the lathe chuck in its original position. The lathe was started and while the block slowly rotated the metal that protruded from the slot was carefully removed with a fine file. When the edge

of the inserted sheet metal exactly conformed to the contour of the cone it was removed from the slot. This completed the male templet.

When the templet is generated with a cone having an included angle of less than 90 deg. in its apex the templet, when viewed from the side, as shown in Fig. 2, will have an edge that bevels toward the back at *b*, and toward the front at *a* and *c*. The direction of the bevel at *b* should be reversed by filing down the edge that is high, so that it bevels toward the same side throughout its entire length.

In order to make a block over which to spin the reflector it was necessary to have a female templet or gage Fig. 3. This was made by cutting out a piece of sheet metal and accurately fitting it to the male templet. A piece of seasoned hard maple was then turned to fit the female templet and the reflector was spun over this block, suitably trimmed and silvered. The finished spinning block is shown in Fig. 4.

In making the female gage the difficulties are very much lessened if the metal used is several thousandths thicker than that used in the male gage. In fitting them together a piece of plate glass to lay them on makes the matching much easier. The two templets can be placed together on the glass and then be held up to the light, glass and all, or the glass can be clamped so it extends over the edge of the bench. When used in this position a light should be placed under it.

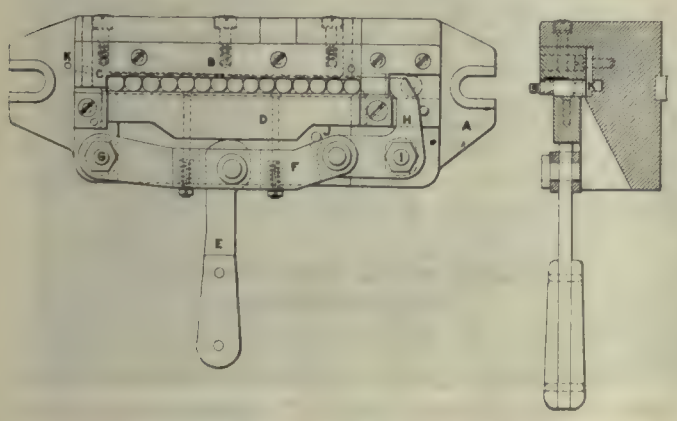
It was found that parabolic templets constructed in this manner were more accurate than required for these thin, drawn, sheet-metal reflectors, and that reflectors made from these templets were more accurate than when made the old way and that this improvement was especially evident in the concentration of the beam of light reflected.

Multiple Fixture for Milling

BY FRED S. WOODEAD

The illustration herewith shows a good quick-action fixture for holding a number of pieces for simultaneous operation on the milling machine. It is designed to reduce the time of unloading and reloading as much as possible.

The base *A* of cast iron, has screwed and dowelled to it the stationary jaw *B*, of hardened steel. This jaw has an angular projection at *C* that serves as a stop to resist the thrust of the milling cutter. The moveable jaw D, also of hardened steel, is operated by the cam lever *E*, the latter having its fulcrum in the link *F*, which in turn is pivoted at *G* upon a stud fixed in the base.



FIXTURE FOR MULTIPLE MILLING

The opposite end of the link *F* is attached to a bent lever or bell-crank *H*, pivoted upon the stud *I*, also fixed in the base, and the opposite end of the bell-crank *H* exerts a longitudinal thrust upon the work, holding it firmly against the stop *C;* thus clamping the work in two directions at a single movement of the handle.

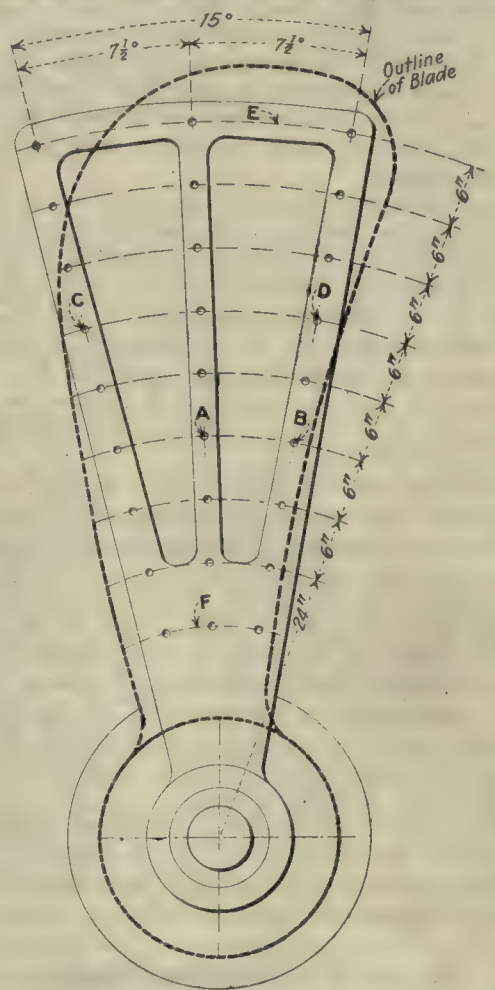
Tension springs attached to the movable jaw *B*, and having a bearing upon the first link *F*, tend to throw the fixture open as soon as the pressure of the cam lever is released. A pin at *J* limits the movement of the links when the jaws are opened.

A raising block is provided at *K* upon which the work rests, and other blocks of the same shape but of different thickness may be supplied to suit the dimensions of any work that may fall within the range of the fixture.

Measuring Propeller Blades

BY JAMES MCINTOSH

Referring to an article on page 706, Vol. 53, of the *American Machinist* under the above title, I have to say that the *modus operandi* evidenced by the description



DEVICE FOR MEASURING PITCH OF PROPELLER BLADES

given will never indicate the "pitch," as I know it; that is, the distance the boat will advance per revolution of the propellor (slip being neglected).

I inclose a sketch of a device that is used in Scotland and by its use it is a simple job to find the pitch without calculation. Assume a frame incorporating three rows of holes drilled on radial lines 7½ deg. apart, the first holes starting at some point say 18 in. from the center of the propeller hub and the other holes

say 6 in. apart; the holes so spaced will indicate the pitch at every foot in diameter.

The angle between the arms of the pitchometer frame is in this instance 7½ deg., the included angle being 15 deg. This gives $\frac{1}{48}$ and $\frac{1}{24}$ of the whole circumference. As we have decided to use the above fractions of the circumference, the reading bar must be graduated to read ¼ in. = 12 in. and ½ in. = 12 in. respectively so the scales will indicate $\frac{1}{48}$ and $\frac{1}{24}$ part of the pitch; thus the pitch values at any point may be read direct. Assume the pitch at *A*, *B* is desired. The holes being 7½ deg. or $\frac{1}{48}$ part of the circumference, apart, we must use the ¼ in. = 12 in. graduations on the reading bar to get the pitch in feet beween the points *S*, *A* and *B*. It is also obvious that if we take the pitch at *C D* the holes being 15 deg., or $\frac{1}{24}$ of the circumference, apart, we must use the ½ in. = 12 in. graduations on the reading bar.

The frame is often made of wood for lightness and is fitted with a series of holes as indicated to fit bushings that are unusually long to keep the reading bar (say a ⅜-in. steel rod) square with the plate or frame. The top of the bushings should be all the same height and the rod should have a long fine point to strike the face of the blade so as to give a true reading.

It is usual to use the propeller nut to pinch the frame against the hub and bring it square with the center line of the shaft.

Suppose we insert the rod graduated ¼ in. = 12 in. in hole *A* and the reading is 8 graduations, and after transforming the rod to hole *B* the reading is twenty-four graduations, the difference being 24 — 8 = 16 ft. or the pitch of the blade between points *A* and *B*. Considering the points *C* and *D:* if the pitch is uniform, the difference in rod reading will be double due to the points being 15 deg. apart, and it is obvious we must use the graduation ½ in. = 12 in. which should also indicate 16-ft. pitch.

By using the holes at both 7½ and 15 deg. we may detect a blade that has an increasing pitch from leading edge to trailing edge or where the pitch increases from root to point of blade as at *E* and *F*, etc. To use the rod along the radial lines of holes we may determine if the face is at right angles to the center line of the propeller shaft or if it is thrown back to aid in driving the water more directly astern. If the pitch is square the rod reading will be the same in each radial hole; if it is thrown back (usual for high speed boats) the amount is the difference of the reading, using the radial lines of holes.

[The author of the article in question states that in the use of the word "pitch" he intended it to mean the relative squareness of the blades with the shaft and not the helical pitch or lead.—EDITOR.]

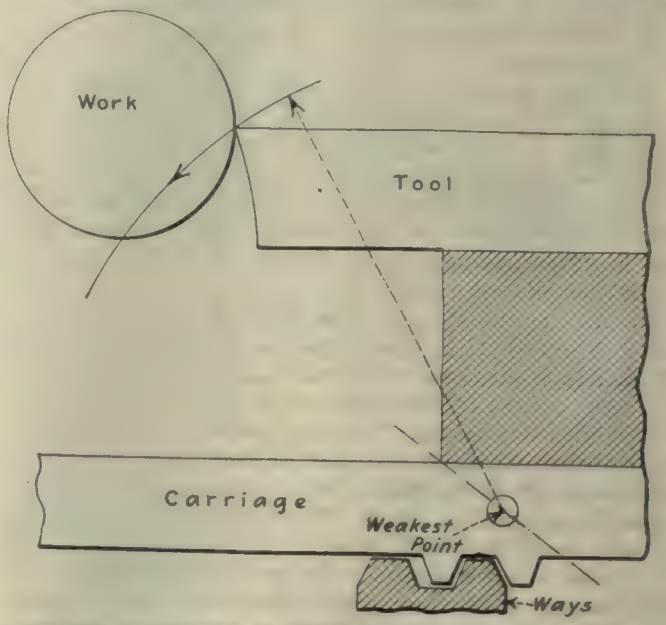
Know Why You Do Things

BY A. W. FORBES

On page 883, Vol. 53, of *American Machinist*, L. S. Watson asks my reasons for placing a lathe tool below center. I am not a machinist, and Mr. Watson can probably get a more satisfactory answer from a specialist in machine-shop practice, but in connection with my electrical work I have found it necessary to know something about lathe work.

One of the reasons, a condition which I have repeatedly met, is shown by the appended sketch. Details of construction have been omitted, and the lathe design so distorted as to illustrate the principle. This shows a tool of massive proportions, rigidly mounted, and a carriage relatively weak. As the chip exerts a pressure downward on the tool the carriage bends forward on the arc shown, so that the tool digs in, giving an unsatisfactory finish.

When this trouble develops there are several easy remedies. One is to use a weaker tool, so that the tool



SHOWING ACTION OF TOOL UNDER PRESSURE OF CUT

will bend away from the work as much as the carriage bends forward. The sketch shows that it must bend away many times as much as the carriage bends forward. I have also used spring tools for this purpose. Usually the best remedy is to lower the tool till the digging in stops, the point being easily found by trial.

In the great majority of cases the motion of the tool is away from the work when placed on center, so trouble does not develop.

[In the original article upon this subject, published on page 612, Mr. Forbes advances the idea that the cutting point of a lathe tool should be below the level of the center line of the lathe. Being contrary to the training and observation of thirty-five years of experience the proposition was new and somewhat startling to us; but as we reflected, old theories are being upset, old practices discarded every day; why not this one? Our opinion is that, however, in putting the idea into practice, insurmountable obstacles to good work in the way of faulty clearance angles and negative top rake would be ecountered and that any advantage that might accrue in the way pointed out by Mr. Forbes would be far more than offset by the introduction of complications due to backlash of the crossfeed screw and nut. We still believe that we would prefer to set the point of a lathe tool, not on the center-line but above it. Can any of our readers show us our error?—EDITOR.]

Position and Help-Wanted Advertisements

BY JOHN MARK MAY

In the article "Getting the Right Man Through the Help Wanted Columns," by A. W. Forbes, on p. 892 of the *American Machinist*, there is one paragraph about

which I would like to ask the question, Who is to blame? The paragraph referred to is the one that makes mention of a blind advertisement from which a good number of replies were received, not one of which showed that the writer had any of the qualifications called for and not one of which the advertiser considered worth a reply.

Is it not a fact that many of the advertisements for help ask for a higher grade man than they expect to get or pay for? The writer feels sure that some of them do.

In one case that came under my observation an advertiser made the remark that he was advertising for first-class toolmakers, not that he wanted them but that by so doing he would be likely to get replies from handy men and fairly good machinists, both of which he did want. Now I ask the question: Has there not been so much of this kind of advertising done that at the present time those who are looking for help and those who are looking for jobs are adopting as their regular practice a certain discount on the words of the advertiser and the words of those who answer the ads?

I realize that one of the faults that humanity is heir to is the individual's inability to avoid rating his own talents somewhat higher than he would the same qualities when in the possession of another person, but is it not time that we should all say just what we mean—*especially when we put it in print?* Then the man looking for a job will not answer an advertisement that calls for qualities that he knows he cannot produce, but will answer only those that ask for knowledge and experience which he possesses.

Then he who answers an advertisement can reasonably expect a reply, for inasmuch as fifty applications might be received when only ten men were wanted the advertiser would feel that all of the applicants had responded to his request truthfully and in good faith and that all of them were at least entitled to a reply.

Some Experiences in Selling Machine Tools

By Lambert G. Neff

Sales Engineer, S. A. Potter Tool and Machine Works, N. Y.

I never claimed to be a salesman. It was my job to be humped over a drafting board, designing and detailing machines which our manufacturing department would occasionally criticize.



BENCH LATHE MOUNTED ON THE BACK OF AN AUTOMOBILE FOR DISPLAY PURPOSES

I was busy "sharpening my pencils," as our office boy would put it, when the war started, and my Uncle Samuel reminded me that I was a reservist. After a period in training camp, my business for a year and a half was to be a high-flyer and to teach others to do likewise. It was a case of "there may never be a tomorrow for us, so let's go the limit today." I am telling you all this so that you may understand how it was that, after all the excitement of the war times, I could not come back to the tameness of the drawing board. I told this to the boss when I got back and he said, "I could get out then." I thought at first that I was no longer to draw down that little salary that came in so handy, but he didn't mean what I thought. He said he meant that if I had gall enough to go up in the air, I could use it to land some business for the firm.

It looked like a cinch at first. I knew our product and had seen it built and inspected; and I was convinced that it was the best machine on the market. But for some reason or other, people either didn't want to see me, didn't want to buy anything or were not so sure that our machine was the best. Such a statement by one upon whom I called sometimes led to a little argument.

Now I am like the Allies, I do not want to fight unless I have to. So it occurred to me that I might be able to avoid an argument by taking the foreman to the machine and proving my assertions to him. I did take hold of some foremen and bring them to our shop or to some other shops in their neighborhood where our machines were being used; and in nearly every case where I managed to do so, I made the sale. But I could not drag the fellows along who would not come out. That was my problem.

Since the foremen would not come to our shop, I began to carry the lathe with me. No, I am not saying that I carried the whole machine around in my pocket; but I did take the headstock spindle and the grinding attachment and show them around. But people then wanted to see the whole machine. One day the boss had his limousine standing in front of the factory and I asked him if he would permit me to take a little ride in it for a while, as I had a special call to make. He said, "Go ahead." Of course, I did not tell him or did he ask me where I was going; but he was not pleased when I stayed away with the car most all the day. You see, a certain manufacturing company, which was a prospective customer, is about thirty miles from our shop. The foreman there told me that it was too far to come to our place, so I brought the machine out to them. The order I got was worth the trip ten times over.

The next thing was to get a flivver and fix up a case in the back of the car with one of our lathes in it, as the accompanying photograph shows. I got acquainted with all the fine roads and all the bad ones from New York to Chicago, and then some. I know mud in many varieties. Some folks were nice to me and some weren't. Some came out to look and some wouldn't. There are not many metal-working concerns from New York to Chicago along the main roads that have not seen my flivver and my lathe. I told some of my friends that I'd be back soon again; but if any of them read this, I want to tell them that when I got to Chicago I had so many people to call on that I'm there yet.

IN THIS ISSUE

A DESCRIPTION of the No. 78 surface grinding machine, lately brought out by the Wilmarth & Morman Co., has been given the privilege of opening this number. Features mentioned are the use of two precision screws for adjusting the wheel to the cut, the piping of coolant to both sides of the wheel and the running of clutch and gears in oil.

On this page last week we promised for this issue several one-part articles of merit. The first of these, beginning on page 43, is by Associate Editor Hand, telling of the composition of manganese steel, its behavior after casting and the heat treatment required. The chief virtue of manganese steel is its ability to resist wear. It flows under sufficient pressure and in its flow hardens to a great extent and very rapidly, resulting in a hard wearing surface having a ductile backing. Manganese steel is so exceedingly hard and tough that tool steel will not touch it. The article explains the methods used to machine it and recounts some of the difficulties met.

Fred Colvin continues to draw from his store of data gathered on the Pacific coast. The aluminum alloy piston of the Hall-Scott motor is the subject of the third installment of his series on building motors on the Pacific coast, page 46. He explains the principal operations in making the pistons and presents ample and excellent photographic evidence to back his statments.

The second of the promised one-part articles, page 48, is by W. J. Francke who describes an apparatus for delicate flexure tests and sets forth some results of such tests. Perhaps it is best to use Mr. Francke's own words to show you the "why" of his apparatus and to indicate what you are going to get out of the paper. "The apparatus was designed to test the thin, tempered strip-steel shims used in flexible couplings. These shims are subjected to bending stresses in operation and the apparatus was therefore designed to measure deflection with the idea that the lowest stress at which any change in proportionality of stress to deformation took place could be used as the limiting stress for loading the shims. To accomplish this result, it became necessary to develop and improve the apparatus so that very delicate and accurate measurements could be made." A good technical treatise.

You will feel repaid if you will make the "little journey" with Associate Editor Sheldon this week. He will take you to Pittsburgh, not to interest yourself in steel or smoke or anything else quite so serious, but to go with him down to the river bank to watch engine repairs to a stern-wheeler; to take a trip up the Monongahela, the while examining its locks; and finally to observe some of the extraordinary practices in engine design which are exemplified on the interesting river craft that are designed to meet peculiar conditions.

Elbert O. Brower very thoroughly explains, page 60, a method for the precise inspection of large and irregular curves, by which long arcs of large radii and irregular curves can be inspected in their relations to other working surfaces by taking a series of independent readings at various points along the curves. Only one of the distances which must be measured directly is long, while the others are comparatively short and easily measured with tools commonly available and understood.

"Special Railroad Machine Forging Tools" is the title of a two-page railroad article by Western Editor Hunter, page 67. The railroads are making every effort to get their equipment into good shape, they are employing up-to-date methods in repair and manufacture and they favor the interchange of ideas on shop practice. Such articles as this one on forging dies are going to play a big part in railroad shop efficiency.

Some weeks ago a contributor said several things not altogether complimentary to the average help-wanted advertisement. That started the ball rolling and it hasn't stopped. It seems that many have had somewhat unsatisfactory experiences in answering and composing help-wanted ads. There is a letter on this subject in our section devoted to ideas from practical men, page 70. The same section contains several other short articles that many will appreciate.

Don't overlook "Conditions as the Big Banks See Them," page 80d. In these days of doubt it is well worth anyone's time to keep in touch with the opinions of the big bankers, a large part of whose business depends upon their ability to see ahead.

Coming Features

Last week we announced the series on "Metal Cutting Tools" by A. L. DeLeeuw, and that on "The Foreman and His Job" by Fred Colvin. We just want to remind you now that Colvin's series will start on Jan. 20; that the same issue will contain the second of DeLeeuw's articles, and that both groups should be read from the very beginning.

Beside the two series mentioned there is to appear next week the thirteenth part of W. R. Basset's "Modern Production Methods," devoted to departmentalizing the overhead expense. Productive and contributory departments are defined, incorrect methods of departmentalizing are considered and examples of expense analysis are given.

There are also to be next week several one-part articles that you will hardly class as ordinary. The industrial co-operative course of the high school, Lansing, Mich., is to be explained by E. M. Hall, Lansing's director of vocational education; another apprentice system, that of a railroad shop school, will be treated by J. V. Hunter; and there will be a treatise on the supervision of correspondence by John T. Bartlett.

EDITORIALS

Machinery for Motor Shops

THE future of the automobile industry presents many interesting problems to the machine-tool builder. And these problems are not only interesting—they are vital.

The opinion of those who have studied the situation carefully is that we have probably reached the limit of expansion in automobile building for some years to come. This does not mean that the number of automobiles built is likely to be less, especially after the present readjustment gets things back to normal conditions. It does mean, however, that there are likely to be fewer builders of automobiles and that those who survive must adopt newer, better and more economical methods of machining. It also means that the shops which build the bulk of our automobiles must re-equip in the near future.

This brings up the problem not so much of new machinery as of what kind of machinery? With fewer shops building automobiles greater production per shop must be the rule. This means machinery especially adapted for the work rather than what we usually term standard machines. Will the new equipment be strictly single purpose machines—highly developed semi-automatic, multiple spindle machines, perhaps of the station type—more simple semi-automatic machines with a single work spindle, or hand operated machines of the special turret type? Each has its advocates with convincing arguments—until you hear the other fellow.

The decisions should not and will not be made offhand. They must consider first cost, not only of the machines but of the tools, and interest on the investment. The life of the machine as determined by wearing out in service or by obsolescence is another big factor.

The cost of upkeep—of tooling for different jobs—or of idle time while tools are being ground and reset, must also be carefully considered. The likelihood of lost time from breakdown, or derangement of parts, is an important item. It often looms large in the case of heavy investment in a single machine or a group of machines and may throw the weight of argument in favor of the simpler machines.

The accuracy required is also a determining factor in many cases. The more intricate and the more automatic the machine, the more difficult it usually is to maintain extreme accuracy. The spring of parts frequently due to hard spots in casting can, as as rule, be best taken care of by a skilled operator on a hand machine. And, when we count losses due to stoppages, rejection of parts and other causes, the hand turret machine with a skilled operator is a real competitor.

Where the part is to be finished by grinding, as is becoming more and more common, the need for extreme machining accuracy decreases and acts in favor of the semi-automatic of either type.

But whatever our individual opinion may be, there are many problems to be encountered and solved before the re-equipment of our automobile shops is completed. Millions of dollars worth of new and improved equipment must be installed. Those who are alive to the situation will secure the orders.

Expensive Economy

THE desire to make a "showing" frequently leads us to practice uneconomical methods. The attempt to keep inventories to the lowest possible limit has two sides. Following this plan has led to added expense in many instances.

With the curtailing of automobile buying, many of the builders took drastic measures to reduce the stock on hand and keep the inventory down. Orders for springs, bodies and parts were cancelled where it was possible, or the delivery delayed, to the discomfiture of the parts makers.

In a number of cases, orders exceeded the pessimistic expectation, and parts had to be secured in a hurry. In one instance several carloads of bodies had to be shipped by express, which is no small item of expense when shipments of several hundred miles are involved as in this case. It would have been unnecessary, but for the bugbear of too large an inventory to look well on the balance sheet.

A somewhat different phase of the evil is to be found in the service stations of several makes of automobiles. The stock of spare parts is extremely low in many cases and customers have to wait for service at a time when they should be served well and promptly. The making of spare parts would help to keep the factories going, would help to hold the shop organizations together. And good service to customers is sure to have its effect on next year's sales. Too much economy is sometimes expensive.

The slackening of business, the slump in orders, and the readjustment had to come. You cannot tear the world up by the roots, destroy millions of lives and billions of property without paying the penalty. But it is a great mistake to be too fearful of the future. The world will go on and business will get back to normal. And the sooner we get rid of fear the sooner this will come.

Nothing will help it more than to begin buying what we need in a normal way. As Horace Greeley said years ago regarding the resumption of specie payment, "the way to resume is to resume." The best way to get business back to normal is to begin to buy the things we need when the price is fair, without waiting for them to reach a possible lower price. Such careful buying will induce sellers to make a fair price. But as long as there is no buying many feel that the price does not matter.

This is a good time to show appreciation of fair treatment under the stress of excessive demands. You can do this by placing orders with concerns whose advance in prices but kept pace with their costs. Let those who profiteered learn that fair play and a square deal pay in the long run.

The first thing is to realize fully that business is coming back, that it *must* come back. Then that each must do his share to hasten its coming by acting and buying in a way as near to normal as circumstances will permit. This will be real economy in the end.

SHOP EQUIPMENT NEWS

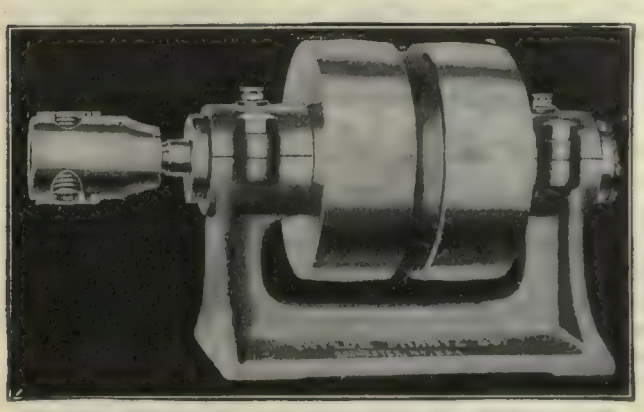
SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and • equipment •

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs • and equipment •

Taylor-Shantz Bench Tapping Machine

The illustration shows a horizontal-spindle, bench tapping machine placed on the market by the Taylor-Shantz Co., 478-86 St. Paul St., Rochester, N. Y. The machine has a capacity up to ⅞-in. taps. When the work is pressed against the tap, the spindle turns in the direction necessary to cut the thread; but when it is pulled away, the direction of rotation is reversed, so as to withdraw the tap. The reversal is accomplished by means of a leather-faced friction disk between the pulleys. The cushioning action of the disk is said to minimize the danger of tap breakage.

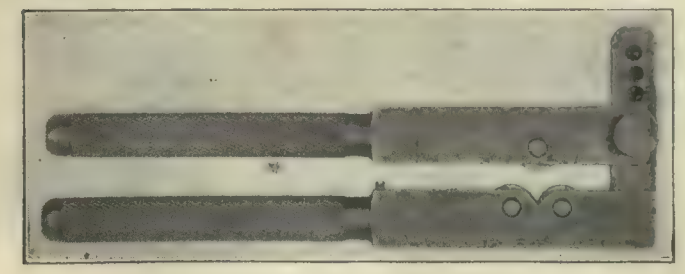


TAYLOR-SHANTZ BENCH TAPPING MACHINE
Specifications: Maximum capacity of chuck, 21/64 in. Pulleys, 5 x 1¼ in. Length of spindle and chuck, 12¼ in. Size of base, 7⅝ in. x 5 in. Total height, 6½ in. Weight, 21 lb.

The machine can be driven directly from the lineshaft by an open and a crossed belt, no countershaft being necessary. It is equipped with a Jacob's chuck.

A. D. Hand-Knurling Tool

The illustration shows the hand-knurling tool recently placed on the market by the A. D. Knurling Tool Co., 120 E. 128th St., New York City. The tool is made in three sizes. The No. 2 size handles work from ⅛ to 1¼ in. in diameter. It is ½ x 2½ x 6½ in. in size and weighs about one pound.



A. D. HAND-KNURLING TOOL

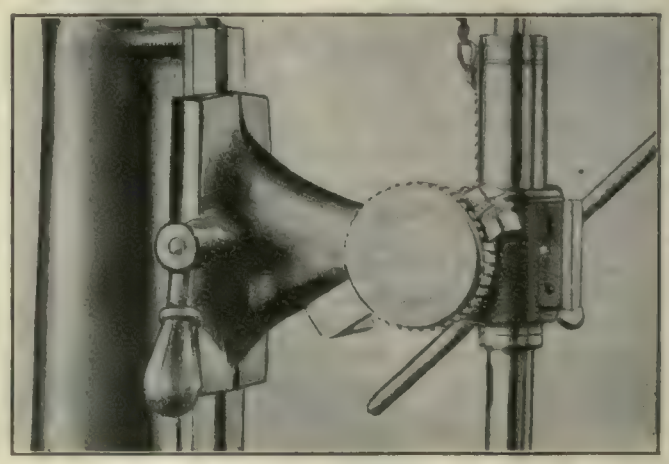
The tool is intended to be held in the hand, the work being rotated between centers or in a chuck. It can be used on work held in a drilling machine spindle, or turned by hand about work held in a vise, in the same manner as a die would be turned about it for cutting threads.

The work is held between three knurls, the distance between the jaws carrying them being adjustable. Usually the knurls are held against the rod or tube being knurled by gripping the two handles. It is stated that non-circular work, as elliptical, hexagon or even square stock, can be knurled in this way. However, a bolt can be inserted, so as to hold the jaws in position. In case that it is desired to keep the tool properly set when doing work that is rough or has a variable diameter, pieces of spring wire about 7 in. long can be inserted in the ends of the handles and fastened together by means of a ring, thus providing a spring clamping device.

Martian Drill Protector

The F-S Machine Specialties, Inc., 171 Washington St., Newark, N. J., has recently placed on the market the Martian drill protector shown attached to the head of a drilling machine in the accompanying illustration. It is intended for use on sensitive drilling machines when using drills ½ in. in diameter or smaller. It is stated that the device prevents the breakage of small drills when they pass through the under side of the work, because it keeps the rate of feed the same as when cutting through the solid metal.

The device must be set for the depth of hole to be

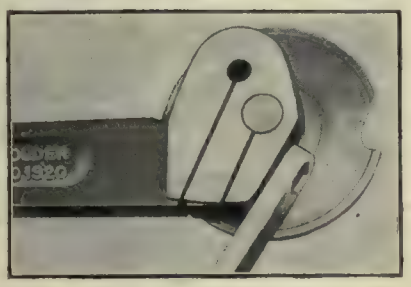


MARTIAN DRILL PROTECTOR IN PLACE

drilled. When the drill breaks through, the operator continues to feed as before until a positive stop is reached, the drill then being through the work. The action of the protector prevents the drill from advancing too rapidly, thus keeping it from seizing. When drilling holes to depth, the device will provide a positive stop, being set by means of the worm.

Smith Cutting-Off Tool

The R. G. Smith Tool and Manufacturing Co., 315 Market St., Newark, N. J., has placed on the market the cutting-off tool shown in the illustration. The tool is intended for use with the spring toolholder made by the same company and described in the *American Machinist* on page 694, Vol. 53. It is circular in form, being held by a shank on one side of the center. The thickness of the cutting edge gradually decreases around the circumference. To sharpen the tool, it is necessary to grind only the top of the cutting edge, the proper clearance being thus maintained. It is said that the available cutting edge occupies over 300 deg. of the circumference of the tool. The tool is said to be particularly adapted to use on automatic screw machines and turret lathes.

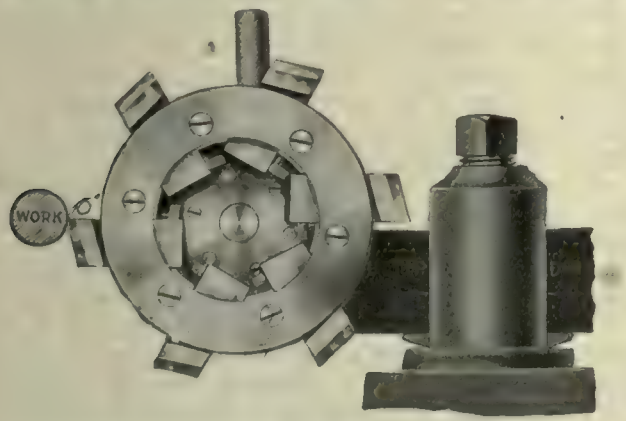


SMITH CUTTING-OFF TOOL

Cruban "Multiplex" Threading Tool

The illustration shows the "multiplex" threading tool recently brought out by the Cruban Machine and Steel Corporation, 63 Duane St., New York, N. Y. It is intended for the quantity production of externally threaded parts. Six cutters or knives are carried in a ring or turret capable of rotation about a horizontal shaft held in a bearing at the end of the shank. The shank can be mounted in the toolpost of a lathe or on a block on the cross-slide. The cutters are ordinarily set for depth only once for a job or for a number of parts. One complete revolution of the turret should be sufficient to cut any thread up to No. 12 pitch without disturbing the position of the cross-slide, a point claimed to increase the speed of production.

The cutters should be set so that each cuts slightly deeper than the preceding one, the last finishing the thread. When starting the cut, the first tool is in the cutting position, as shown. At the end of the cut the pin or handle on the top of the bearing is pulled by hand, thus disengaging the tool from the work. The feed is then reversed to bring the tools to the starting point. To start the next cut, the operator again pulls the handle, thus putting the next tool in the cutting position. This action is continued until the thread is finished. It is claimed that manipulation of the cross-slide is eliminated and the possibility of gouging of the tool diminished.



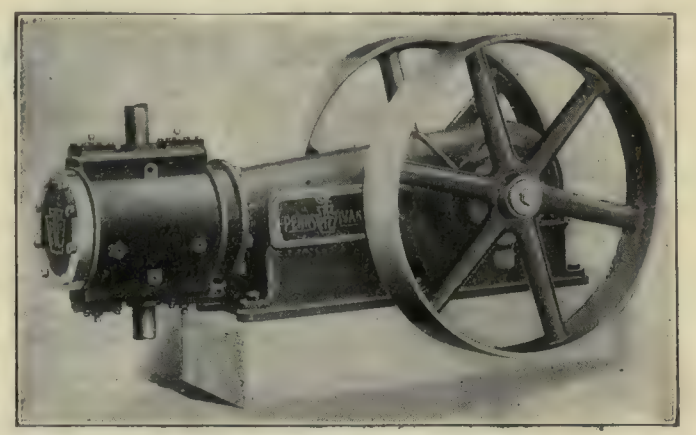
CRUBAN "MULTIPLEX" THREADING TOOL

Each cutter is provided with a micrometer adjustment for depth of cut, and is held in position by locking screws. They can be removed for grinding. Either chasers or cutters of high-speed or of carbon steel can be furnished. The shank is $\frac{5}{8}$ x $1\frac{3}{8}$ x $4\frac{3}{4}$ in. in size and can be furnished either straight or with a left-hand offset.

Pennsylvania Air Compressors and Vacuum Pumps

The Pennsylvania Pump and Compressor Co., Easton, Pa., has placed on the market air compressors and vacuum pumps of similar construction, the illustration showing an air compressor. The vacuum pumps have, of course, greater cylinder diameters than the air compressors for the same length of stroke. The positions of the valves are also reversed, the discharge being at the top of the compressor and at the bottom of the pump.

The mechanism is completely inclosed, so as to exclude dirt, and splash lubrication is used for the driving parts. It is claimed that the oil does not work into the air cylinder, although only one stuffing box is used, because of a baffle plate and because the crosshead, which has bored guides, nearly shuts off the oil chamber. A float gage indicates the level of the oil in the basin.

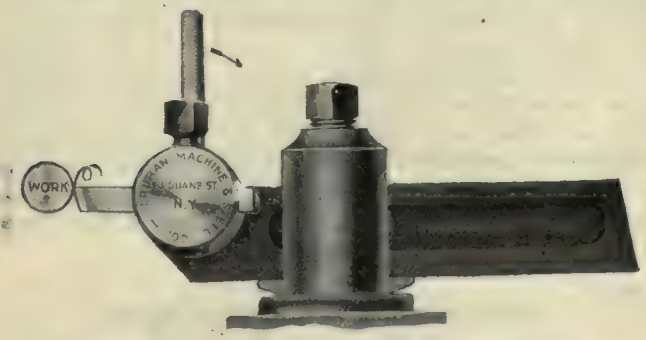


PENNSYLVANIA AIR COMPRESSOR

The crankshaft is forged steel and operates in removable bronze bearings. The box at each end of the connecting rod is solid, the eye at the crank end being slipped over the crank and the adjusting gibs and wedges then put in place. The flywheels are each made in one piece and mounted on the tapered ends of the crankshaft, being secured by keys and washers held by bolts. Ring plate valves are used; and they are so guided on the outside that it is stated that they cannot cock when in operation. The machine can be furnished integral with an engine for steam drive, a balanced piston valve being used for the steam engine.

Cruban "Rapid" Threading Tool

The Cruban Machine and Steel Corporation, 63 Duane St., New York, N. Y., has recently placed on the market a tool and toolholder, shown in the illustration, for external threading. The device consists of a shank held in the toolpost of a lathe in the usual manner and carrying a small cylinder, in one end of which is inserted the tool, while a small handle is carried on the other



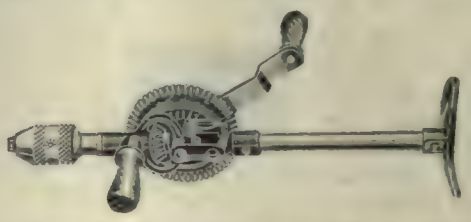
CRUBAN "RAPID" EXTERNAL THREADING TOOL

end. The cylinder can be rotated slightly in the shank, so that the tool can be swung up out of the cutting position when desired.

When starting or cutting a thread the tool is in the position shown. At the end of the cut the tool is lifted about 45 deg. by pulling back on the handle. The feed is then reversed and the toolslide fed in by hand for the next cut while the carriage is traversing. In this way the machine can be kept running continuously and it is not necessary either to withdraw the toolslide before reversing the feed, or to disengage the feed nut. The tool can be provided with either straight or left-hand off-set shank. A wrench and a high-speed toolbit are furnished with the device. The tool is made in three sizes, taking toolbits $\frac{1}{4}$, $\frac{5}{16}$ and $\frac{3}{8}$ in. in size, respectively. The smallest holder is $\frac{3}{4}$ x $\frac{7}{8}$ x 5 in. in size, and the largest $\frac{5}{8}$ x $1\frac{3}{8}$ x 7 in.

Consolidated Three-Jaw Breast-Drill Chuck

The Consolidated Tool Works, Inc., 261 Broadway, New York, N. Y., has recently placed on the market a three-jaw chuck. It is intended for use with the breast drills made by the same concern, to replace the



CONSOLIDATED THREE-JAW BREAST-DRILL CHUCK

two-jaw chuck formerly used, being shown with the drill in the accompanying illustration. The chuck is made of steel. It has no springs and is said to be simple, strong and positive in action.

Shop and Trade Conditions in Europe

By E. A. DIXIE

A LOT of bunk has recently been printed in American and foreign papers about the resumption of work and return to pre-war conditions in the shops of Belgium, England and Germany. I have just returned from a European trip and beside my own observations offer the combined testimony of a number of engineers with whom I talked and who had been in many shops which I did not visit.

One of the stipulations of the peace treaty was that Germany should return the machine tools which she had looted from the shops of the various Allies. The manner in which this has been carried out in a number of shops in Belgium affords a notable example of the much-advertised German efficiency. As I remember it this stipulation required that the Germans return similar tools but did not specify that they should return exactly the same ones. In several shops in Antwerp and in numbers of others throughout Belgium the Germans returned the identical tools which they took away. Some of them, I was told, had evidently been used during their stay in Germany, but so far as inquiry could elicit they had been kept in good running order.

Loss of Belgian Skilled Mechanics

However, the return of the tools was of little use. The thousands of skilled Belgian pre-war mechanics could not be returned. I am familiar with the Belgian mechanics of pre-war days; not only were they highly skilled but they were exceptionally industrious. Men of this type seem to have entirely disappeared and in their places are a discontented lot of near-bolsheviks who would rather talk than work.

In the ship-building centers of Germany things are in very bad shape, according to my informant, who is chief designer of machinery in one of the largest of our American shipyards. Practically all the ships the Germans build fall in one way or another into the hands of the Allies. This being the case the men have little interest in their work and consequently do just as little as they possibly can.

Labor Conditions in One German Shipyard

One visit was to a big yard in the north of Germany where ever since the signing of the treaty the men have alternately been finishing and setting on fire one of the largest ships which has so far been built. In this yard the work is carried on under the direction of a sort of soviet of 100 men selected by the workers. The managing director can not on any pretext go into the yard. He attempted to do so recently and was set upon and nearly killed by the men. He used this as an excuse for refusing to show my friend around the yard, as he dared not show himself for fear of causing a riot. He further told my friend that the men had even forced their way into his private office recently and that one of them had on that occasion struck him with a chair. He could not attend to his regular duties as chief of such a plant as all his time was taken up by endless argument and pow-wows with the heads of the yard soviet. The men, he said, seem to have gone crazy; no

sooner has he arrived at an agreement regarding some phase of their work with the heads of the soviet and they have gone into the yard to explain the details to the men than like as not a riot will break loose with perhaps the killing and maiming of several men. Half an hour after the dead and wounded have been removed the yard will perhaps be again normal.

The United States Blamed for Everything

In Germany, France, Belgium and England much of the blame for the adverse conditions is placed squarely on the shoulders of America. In Germany they say that President Wilson betrayed them. They assert that they were an unconquered people who laid down their arms on the strength of the promise of an honorable and just peace, that Wilson lied to them and that the American nation has cheated them. It is impossible to get them to see it differently; they still believe that they were set upon by England and her allies, and they just as firmly believe that they could and would have won the war if they had not listened to the siren song of Wilson's fourteen points.

Goods in Germany from the German viewpoint are very dear; from the American viewpoint with the exchange as it is they are very cheap. There are of course no large stocks of anything, but to give an example of relative pre- and post-war values the following will serve.

A certain small tool which before the war cost 15 marks a dozen, say $3.50, now sells for 60 marks a dozen. At the time when my informant bought these goods for export to South America the mark was worth just one cent. So while from the German viewpoint these goods cost four times as much (for one must remember that in Germany a mark is still nominally accepted a mark), from the American point of view they cost about one-sixth of what they did before the war.

Conditions in England Are Bad

In England things are in bad shape. With the connivance of the government the trade unions are riding the country to death. They have been coddled and given in to until their executives seem to believe that all they have to do is ask for more and still more. For this reason it is almost impossible to let a contract at a fixed price. In England all mechanics belong to unions; they can't get jobs unless they do. The unions have placed all sorts of restrictions on the activities of their members. Two examples will serve to illustrate.

A lathe hand had a certain piece to attach to the faceplate of his lathe. After taking the faceplate off the spindle and applying the piece to it, it occurred to him that by drilling two bolt holes in the faceplate the piece could be easily and securely attached. There was an idle drill press near but he had to wait till he could find a drill-press hand to drill the holes for him; his union rules prohibited him from drilling them himself.

The catch on my wife's handbag was out of order and I was referred to a nearby machine shop to have it repaired. Before reaching the shop I decided that a small sheet brass hook pivoted on one side and embracing both parts of the bag frame would make a satisfactory repair.

I explained to the foreman just what I wanted and made a sketch so that he would thoroughly understand. To my surprise he said he had no man who could do the job.

"It's a simple job of bending, drilling and filing; any one of those bench hands over there can do it easily," said I.

"I do not mean that they *cannot* do it but that they *will not;* they are not allowed by *their union* to do such a job," he replied.

"That's easily remedied," said I. "If you will hire me with the use of a vise and the tools I will do the job myself."

"I can't do that either," said he. "If I were to allow you to use a vise or tools the whole bunch would walk out." He handed me back the bag.

The "Shop Steward's" Job

In the shops they have a personality called a "shop steward," appointed by the men and recognized by the ministry of labor. His job is not, as one might suppose, the preparation of food for the men; it is, however, to a great extent the keeping of the bread out of the proprietor's mouth. In other words he is a sort of shop *in*efficiency man whose job seems to be to determine how little a man shall do and see that he doesn't do more.

A case in point:

The proprietor of a shop making automobile transmissions and differentials was so convinced he could make crankshafts at a profit that he ordered two high-priced crankshaft grinding machines from the United States. The guaranteed production of these machines was a crankshaft of a certain type every 30 minutes. The first crankshaft was got out in eight hours; likewise the second, and this was the time set by the shop steward, as I am given to understand. The proprietor of the shop then sent to the London agents of the grinding machine company, requesting them to send a demonstrator to instruct his men.

On his arrival the demonstrator went out into the shop to one of the machines and made some inquiries of the operator, who instead of replying asked him who in H—— he was. To which he responded that he was the demonstrator come to show him how to get out a crankshaft every 30 min., and took off his coat to make a start. As he did so the operator reached for his own coat and began putting it on. The foreman then came and asked the demonstrator to go to the office. Here the proprietor told him he better not bother about the demonstration as he did not wish to have the men go out on strike. The demonstrator stuck to his ground that he had come to see that his machine made good and suggested that he go away but return in the evening with the night shift, who would not know him. Arrangements were also made that half a dozen crankshafts were to be at the machine ready for him to grind.

He returned in the evening, finished the first shaft in less than the specified time and the whole six in an average time of 24 min. each. Just as he was taking the last shaft out of the machine one of the men came over and asked him if he didn't think he was turning out too much work.

The demonstration was, however, of no avail so far as increasing production and the proprietor was obliged to sell the machines as second hand.

Adverse Attitude of Older Mechanics to Union

One of the peculiar features of this union domination is the adverse attitude of the older and more skilled mechanics toward it. On the trains, on steamers and other places outside the shops and out of hearing of shop stewards and other union members I conversed with many union men. Without a single exception the

older men were opposed to the union policy of restricting output and standardizing wages, and over 75 per cent were in favor of some form of piecework, which is absolutely banned by the British trade unions. When asked why they did not legislate within the union in support of their views they all said that the unions were run by a large majority of young men who were always ready to listen to the mouthings of the labor agitators and that to even appear to disapprove of accepted union methods would likely cost them their jobs as the union members in the shops where they worked would make things so uncomfortable for them that they would be obliged to leave. The union would then see that they did not get other jobs until they changed their views.

Animosity Toward Unionism

Conditions such as these, which have even made many members of the unions dissatisfied with the way they are run, have naturally invited the antagonism of those outside the unions, against whom the union activities have been directed. This has resulted in strong anti-union feeling, which now permeates all classes in England.

The average Briton is somewhat slow to anger, but when thoroughly aroused it does not usually pay to rag him further. One of two things is sure to be the outcome of this strife: If the unions succeed the nation will be ridden to death and she will lose her foreign trade. If she loses that she is done. However, the other alternative is what is most likely to take place: England will eventually "get her mad up." When she does she will fall upon the unions and smite them. When she does this mechanics will be paid according to the quantity and quality of their work and not according to the strength of the union to which they belong; England will then regain her foreign trade and gradually re-establish her credit as the great manufacturing nation she has been.

Balancing Grinding Wheels

By W. Burr Bennett

The following is not intended to be a treatise on balancing but rather a few points that the writer has learned for himself about the balancing of grinding machines with especial reference to the common snagging grinding machine having a wheel mounted on each end of the arbor, and to disk-grinding machines of the same construction. As a starter the writer would suggest that you go to your stockroom and pick out a wheel, say 14 in. in diameter with a 2-in. face, mount it on an arbor and put it on the balancing ways; you will probably be surprised at the amount of unbalance.

Of course it is easy to calculate what trouble this condition of static unbalance will cause to the wheel when mounted on the spindle of the machine. First of all it represents an unbalanced mass revolving in a plane of its own and is going to make the grinding stand and the work vibrate badly even with a small amount of unbalance and a good heavy machine. This condition is shown in Fig. 1.

Now consider the case, where two wheels are mounted on the respective ends of the spindle, each one being out of balance on a static test, a condition as shown in Fig. 2. It is this condition that causes the worst trouble as the wheels and spindle try to move as shown in Fig. 3 with high resultant stresses, and even the heaviest grinding stand will vibrate.

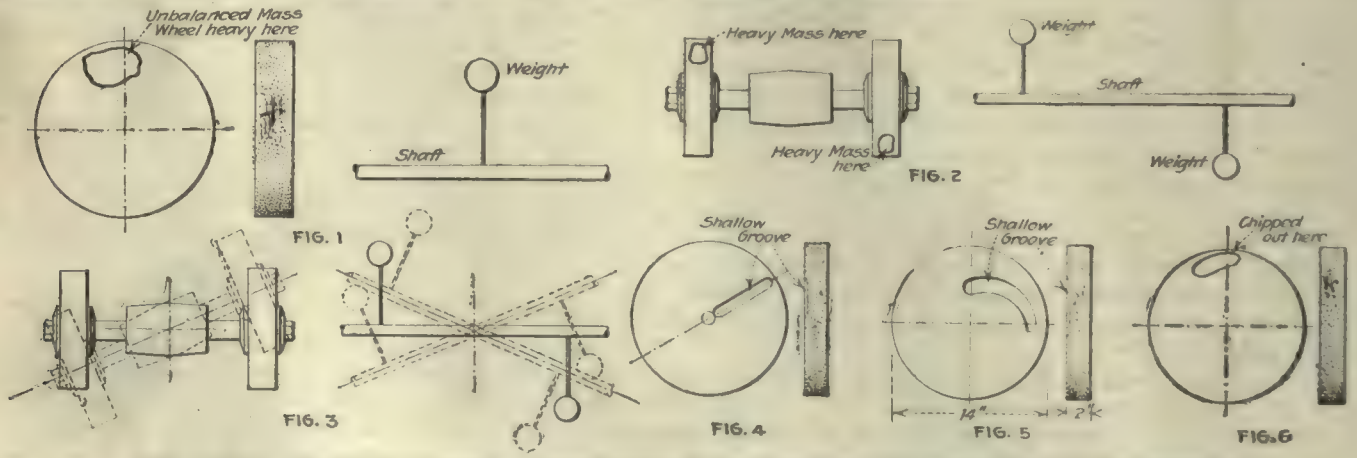
A Remedy

As this is a condition that the maker of the machines can hardly provide against, it is up to the shop man to correct his own trouble in this respect. Further, it could hardly be expected that the maker of the wheel could spend his time and money to get a very fine balance. It would perhaps be apt at this point to remind the reader that this condition of unbalance in the wheel is due to the varying density of the mass and is a condition typical of any structure of this sort.

To correct the trouble the writer took each wheel separately to the balancing stand and with a good hard diamond pointed chisel chipped away a little material from the side of the wheel in the form of a shallow groove running radially from the center of the wheel as per Fig. 4. However, in some cases it was not possible to chip a groove radially with the center of the wheel as the unbalanced mass seemed to lie in a spiral path, Fig. 5.

In other cases the heavy mass was localized and lay near the rim of the wheel, Fig. 6. This procedure takes a lot of time and can only be done by an experienced and reliable man. The cutting must be done with gentle blows to avoid fracturing the wheel, and no sharp corners must remain as a starting point for fractures.

The reader will perhaps question the effect as the wheel diameter is reduced by wear. This makes no appreciable difference if the chipped recesses are kept very shallow and actually executed at the unbalanced mass part of the wheel.



FIGS. 1 TO 6. SHOWING UNEQUAL DISTRIBUTION OF WEIGHT AND METHODS OF CORRECTION

Reminiscences of An Old-School Machinist

By R. Thomas Huntington

The apprentice boy in a locomotive shop in the early 60's could not well complain of a lack of variety in his work, though in after years and with a knowledge of modern machine shop equipment he might justly bemoan the fate that had decreed for him aching muscles and cramped and bruised fingers on jobs that the boys of a later day may contemplate in comparative comfort from the top of a high stool, while a machine is doing the work.

In a previous letter I have described some of the difficulties with which the early apprentice was obliged to contend in getting out work on a lathe; this time I will endeavor to tell you how he did planer work.

Surfacing Valve-Seats on a Locomotive

The valve seats on the cylinder of a locomotive built by the Norris Locomotive Works was a flat surface about 9 x 12 in., if I remember the dimensions correctly, and within its boundaries were three long, narrow, rectangular port openings. The surface had to be perfectly flat and smoothly finished; there must be no grooves, scratches, hollow spots, or other imperfections by which steam could find its way under the valve.

It would *now* be a very simple matter with the help of the cranemen to mount a pair of locomotive cylinders on the platen of a huge planer, line them up, and plane off both valve-seats at once, smooth and true; leaving but little, if any, work for the file and scrapers. *Then* there were few planers big enough for such a job and the work was generally brought to the scraper stage by a combination of hammer and chisel, brute strength, and skill.

The job would be started with a cape chisel by cutting a series of narrow grooves across the surface leaving about ½ in. of metal between the grooves to be taken out with a flat chisel. There was nothing but the eye of the worker to guide him in this preliminary operation and it was essential to have the grooves all pretty nearly of the same depth; just deep enough to get under the scale of the casting and to avoid digging holes in the iron that would necessitate lowering the whole surface to match them.

Fitting the Ports to a Templet

After the scraping had been done to the satisfaction of the foreman the ports had to be filed out to fit a templet. These ports were three in number; a narrow one near either end and a wider one in the middle, reaching nearly across the seat. The edges had to be made perfectly straight and smooth, and so sharp as to cut paper. One of the difficulties of the chisel and file method of finishing the valve-seat was to avoid crumbling this edge, which must be carefully guarded against, for a slight nick or indentation would permit steam to pass through into cylinder or exhaust port at the wrong time.

When the ports had been properly fitted to the templet, the whole surface was lapped; using for the purpose a flat plate and a very limited quantity of fine emery.

Though the fitting of a valve-seat was a job for an expert mechanic, no fundamental truth was ever more clearly recognized in the early days than that the supply of skilled men for future service depended upon the faithfulness and care with which the boys were educated, and it was considered to be an important part of the foreman's duties to make experts out of the apprentices. To be sure, an apprentice-boy would not be expected to surface a valve-seat the first time he tried his hand at it; but after he had demonstrated his ability to produce flat surfaces upon other and less important work he would be given this work to do under the supervision of a journeyman, and if he were the right kind of a boy it would not be long before he was himself as capable as his instructor.

Speaking of chipping and filing flat surfaces brings to mind the remark of a "Pennsylvania Dutch" shopmate of mine, who, upon being requested by the foreman to take about an inch off the bottom of a certain pillow-block casting, said "Mine Gott! He dinks I am a blaner."

Making Cast-Iron Balls by Hand

Another example of skillful hand work was displayed in the making of the cast-iron ball check valves that were placed in the suction pipe from tender to boiler pump. There was one man who made all these balls, and he did it by taking first a cube of cast iron and filing off all the corners until he had a polyhedron with approximately equal facets. Again increasing the number of facets by taking off the remaining corners, being careful to keep all of the many sides as nearly equal as possible his piece gradually assumed the form of a ball; finally becoming so nearly round as to hold water in the valve when turned to any position. I never saw him do any work on these balls in a lathe.

This same man was considered the best screw-maker in the shop. He could catch the right pitch for any given number of threads per inch at the first trial and very seldom made a wabbly or "drunken" thread.

A Predecessor of "Armistice Day"

All hands were sitting around on benches and boxes eating their dinners one noon near the close of the Civil War when word was brought in of the fall of Richmond, Va. Whistles were blown and bells were rung all over the city. Orders soon came from the office, closing the works for the afternoon. Our big bell, the deep tones of which could be heard for more than a mile, joined in the clangor, and Mr. Norris conceived the idea of attaching the bell-rope to the crosshead of a nearby donkey-pump and letting it ring all the afternoon. This scheme worked fine; so fine indeed, that exasperated citizens in the neighborhood carried a complaint to the Provost Marshal, and that functionary sent an orderly to stop the noise.

At the close of the war, our shop had nearly completed an order from the Union Pacific Railroad for locomotives, and had under construction a batch of twenty-five for the U. S. Government to be used in war service; but as a large portion of our business had come from the South, and as prospects for future business from that quarter were not very bright it was not long after this that Mr. Norris decided to close the plant and sell the real estate and tools.

Some of the older employees were pensioned. I remember one man in particular who had been in the employ of the Norrises for over twenty-five years. This man had turned all the cylinder heads, both inside and out, for such parts were highly polished in those days. He had also turned the wristpins which were cast in place in the crosshead.

This job required the casting to be centered over the pin and the line of centers must be accurately square with the planed surfaces and with the tapered hole for the piston-rod. The crosshead would be mounted in the lathe, a hickory handle placed in the piston-rod socket, and the piece oscillated back and forth as far as the tool would allow.

The tool used has a peculiarly curved nose, something like a "gooseneck" tool, and that reached part way over the pin. It would, of course, finish but little more than half-way around the circumference of the pin, and, after one cut had been taken the crosshead must be reversed in the lathe so that the remaining surface could be reached. Several cuts were necessary to finish a pin and the job required a deal of skill and special knowledge to do well.

This man felt so badly about the closing that for a long time thereafter he would make trips almost daily to the now silent and deserted shop where he would stand before his old lathe and weep silent but bitter tears of regret. So far as I am aware he was the only man who had ever worked on this particular lathe.

Upon the closing of the shop Mr. Norris gave me a fine "recommendation" (which I still have, and highly prize) and thus ended my apprenticeship. Sometime I will tell you some of my later experiences.

A Pair of Old Pulleys

By B. Shell

In reference to the pair of old pulleys illustrated on page 1161, Vol. 53, of *American Machinist*, it occurred to me that the groove in the tight pulley was used to retain in position a brake block with which the machine could quickly be brought to a stop after the belt was shifted.

[An ingenious suggestion; but would not the groove have been located on the other side of the belt?—Editor.]

By James Tate

Mr. Bennett's article on page 1161, Vol. 53, of *American Machinist* as to the use of the V-groove on the tight pulley reminded me that I once saw the same idea used in an Ulster shop. A small round belt ran in the V-groove, which was deep enough and the belt small enough, so that the larger belt rode over it with no trouble. The small belt drove a little magneto, used to generate current for various testing purposes. This may not have been the purpose of the groove on the pulleys that came under Mr. Bennett's notice, but it seems, at least, as reasonable a solution as any.

By J. A. Raught

In reply to W. Burr Bennett on page 1161, Vol. 53, of *American Machinist*, I think I am making a safe guess in saying that the pulleys in question came from a cotton loom.

Some years ago I went through several cotton mills the machinery in which had been sold to a junk dealer, and upon each loom was a tight and loose pulley identical with those described by Mr. Bennett excepting that the spokes were "S" shaped. The V-groove on one edge of the tight pulley seemed to be quite common, though, as they showed no wear, I could not see for what purpose they were used.

Acme Threads in Motor-Jack Bushings

By Henry Armstrong

Replying to Mr. Schwartz's inquiry on page 1082, Vol. 53, of *American Machinist* concerning clearances, tolerances, etc., which we used on Acme threads, I will state that the point I wished to bring out in my article on page 397 of the same volume was the saving effected by the changes made on length and clearance of taps. However, Mr. Schwartz brings up some interesting points in regard to tolerances, etc., and I think that I can furnish some further information, as requested.

The screws which we used to fit the Acme bushings were cut on a Landis threading machine and were fairly accurate when measured in accordance with the data published in the "American Machinist Handbook" except that the stock used was from 0.010 to 0.015 in. small, and as the threading operation threw up a burr, we used to grind this off on the side of a large disk grinding machine, the workman revolving the screw with his hands and finishing the operation very quickly and satisfactorily.

As the taps were made full size with a plus tolerance of 0.002 in. this gave us a clearance between the top of screw thread and bottom of tapped hole in bushing of from 0.005 to 0.010 in. which we found sufficient.

Regarding side clearance: we made the taps in accordance with the "American Machinist Handbook" on the width of thread measurement; that is about 0.163 in. at the widest part of the tooth. The first tap cut pretty close to this size and, of course, the screw would not fit as it was about the same width as the tap. However, the pressure exerted by the workman on the second tap made this tap cut more on the bottom side of thread as it went through the bushing. We cut some of the bushings in two and found that the thread space was from 0.010 to 0.015 in. wider than the width of thread on the tap, so that we had plenty of clearance on the sides.

The hole in bushing was made about 0.530 in. in diameter. This is larger than the U. S. Government standard but by making it this size we reduced tap breakage although we did not get a full depth of thread. However, when these bushings were put under severe test, invariably some other part of the jack broke before the bushing showed signs of weakness; proving that the depth of thread was enough for our purpose. I would not recommend that this practice be adopted for all purposes, as for some work a full thread is necessary for safety.

We made two screws, one slightly oversized and the other slightly undersized for measuring purposes. It should be understood that we were trying to get a large production at a small cost and could not afford the cost of great accuracy.

To sum up: we had from 0.005 to 0.010 in. clearance between the top of screw thread and the bottom of the bushing thread, and from 0.005 to 0.0075 in. on each side of the screw thread when the screw was in place in the bushing.

The dimensions and tolerances for the Acme thread should be decided by the A. S. M. E., as there is no reliable data to be found on this subject. The "American Machinist Handbook" gives dimensions of screws and taps but it will be found that the screw and nut made in accordance with this table will not fit, as the dimensions of the touching surfaces are the same.



NEWS SECTION

Activities of Engineering Council and Engineering Societies Service Bureau Transferred to American Engineering Council

Beginning Jan. 3, the transfer of the activities of Engineering Council and the Engineering Societies Service (Employment) Bureau has been made to American Engineering Council.

The American Engineering Council now has an office in Washington at the McLachlen Building, 10th and G Sts., with A. C. Oliphant as acting assistant secretary in charge. This office is available for the member societies of the Engineering Council.

The Engineering Societies Service Bureau is being maintained in the Engineering Societies Building, 29 West 39th St., New York City, with Walter V. Brown in charge.

Pending the development of a more permanent organization which may direct this very important activity of the American Engineering Council and which has had such a close relationship with the secretarial responsibilities of the member societies of the Federated American Engineering Societies, the secretaries of the American Institute of Mining and Metallurgical Engineers and the American Society of Mechanical Engineers and the American Institute of Electrical Engineers have been requested to act as a Committee on Management to conduct the service bureau until such time as a permanent organization under the American Engineering Council can be effected.

The Committee on Procedure of the Executive Board of the American Engineering Council, voting to take over the employment service, specified that the applicants should be arranged in two groups; first, those who are members of member societies of the Federated American Engineering Societies, and, second, all others.

As a means of communicating with the secretaries of the member societies of the Federated American Engineering Societies, a bulletin listing positions open will be issued regularly. The first of these bulletins will be sent very shortly.

The following committees of former Engineering Council have been invited to act as committees of the American Engineering Council:

Classification and Compensation of Engineers; Co-operation with American Institute of Architects; National Board for Jurisdictional Awards in Building Industry; National Service Department; New York State Government Reorganization; Patents Committee; Payment for Estimating; Russian-American Committee; Types of Government Contracts.

Smoot-Reavis Resolution Passes

The Smoot-Reavis resolution providing for a survey of the executive departments of the Federal government has become a law without the signature of the President. A joint congressional committee will be organized under the bill. It is expected that Senator Smoot, of Utah, will head the committee. The bill provides for the employment of a representative of the committee to take charge of the immediate direction of the survey which is to be made.

Problems Facing U. S. Exporter

"American manufacturers and producers enter the new year facing a serious situation in export trade," says W. L. Saunders, chairman of the board, Ingersoll-Rand Co., in the *New York Commercial*. "This is made more serious by the fact that certain fundamental things which govern foreign trade between countries are not understood or are looked upon as matters of opinion rather than matters of fact, as for instance:

(1) Under present conditions the only way to rectify permanently the great difference in exchange between certain European countries and the United States is to either sell Europe less or buy more from Europe. It is out of the question to talk about payment in gold, because there is not gold enough in the world for this purpose. If I want to buy your hat and you sell it to me for $5, I must either give you gold or a gold note worth $5, or I must give you $5 worth of work or I must give you a pair of shoes worth $5. Failing in any one of these you may tide the situation over for a certain length of time by giving me credit. Now, Europe has not gold or gold notes to give us. They cannot liquidate their huge debts in services. If we give them credit it only puts off the final payment, so that the one and only thing left is goods. In this matter there is no difference between two individuals and two corporations, governments or individuals in foreign countries. The principles are the same.

(2) The reason why there is such a wide difference in exchange is that Europe is on a paper, not a gold, basis. This situation is hopeless, so far as any attempt might be made to rectify it within a reasonable term of years.

(3) Because of the depressed conditions in Europe, and the large issue of paper money, living conditions, prices of commodities and of labor are lower there than they were before the war. The inevitable result of this is the production of goods over there can be made at lower costs than in the United States—so much lower in fact that America's export trade is threatened as it never was before. There are many things now made in America the cost of which is greater than the selling price of the same thing made in certain countries of Europe. This situation is not growing better, but worse. The immediate remedy may be an extension of credits, but the cure can only be effected by either buying more from Europe, which means also selling less, or, which is still better, establishing American works in Europe, making there the same things we make here and in this way holding our trade with foreign countries through a proportion of our capital invested there instead of at home."

P. & H. Employees Hold Annual Xmas Party

The fourth annual Christmas party of the employees of Pawling & Harnischfeger Co., crane and hoist builders, Milwaukee, was held on Dec. 21, at Riverview Roller Rink. Because of the fact that the majority of the 1,100 employees have been connected with P. & H. for long periods of service, ranging from 10 to 20 years, this was an unusually happy Yuletide affair.

Business Conditions as the Big Banks of the Country See Them

National Bank of the Republic, of Chicago, Sees Early Recovery of Business

Despite the great amount of pessimism which one hears today, it is doubtful if most people realize the extent of the deflation through which business has passed during the past twelve months. Deflation in this instance has been essentially one of commodity markets, although naturally preceded and accompanied by a liquidation of the stock markets in the process of discounting the reduced earning power of corporations generally. The familiar symptoms of industrial curtailment, unemployment, almost complete lack of forward buying on the part of retailers and wholesalers, slow collections and the failure of inexperienced, undercapitalized and grossly over-extended concerns have all been present. But the spectacle of large failures, of temporarily embarrassed concerns forced to the wall, of the widespread withdrawal of deposits by the timid from the banks of the country has not, and undoubtedly will not, be witnessed in this instance, thanks to the massing of the financial resources of the country back of the elastic Federal Reserve System.

Little Drop in Commodities Where Labor Cost Is High

While certain articles of commerce have receded very little, others have dropped to a point very close to their level in January, 1915, as for instance hides, rubber, coarse grades of wool, coffee, copper, spelter, tin and antimony, several of which, incidentally, are now even lower than before the war. The significant fact is that raw materials have suffered relatively the greatest amount of depreciation. An even closer inspection warrants the statement that the resistance to declines in the case of any commodity or manufactured article has been in direct relation to the amount of labor represented in its finished state. The conclusion is inescapable that price inflation has come about largely through the immediate agency of inflated labor costs. This fact in itself militates against any expectation that prices will all descend to the pre-war level, or that those already there will remain.

Most Employers Against Wage Reductions

It might be said parenthetically that while grossly inefficient workmen, or so-called skilled workers who owe their employment in that capacity to the erstwhile labor shortage, and who are skilled in only one mechanical process, will undoubtedly be replaced gradually, employers of labor generally are opposed to wage reductions except where they are temporarily an alternative to a complete shut-down, or where the lowered cost of living warrants such reductions. The manual workers of the country have in the past four years gained a standard of living which it is for the best interests of the country to perpetuate. This of course implies real wages, or command over goods, as opposed to money wages. Although the latter may decline, a contemporary and parallel decline in the cost of living will maintain those real wages. It should not be overlooked, also, that there is a large class of people in the country, dependent upon salaries which have advanced comparatively little during the war, whose purchasing power is increasing with the general decline in prices.

Replenishment of Supplies Necessary Soon

While it may be said that the worst of the business decline has probably been seen, it is probable also that some time must elapse before commodities again become adjusted in their true relation to one another. But experience has shown that any voluntary and prolonged curtailment in the output of essential goods has produced scarcity and high prices eventually, since the public continues to consume. Just how much of a supply of goods is in the hands of the consumer, due to the extravagance engendered by wage levels which in very many cases had advanced far more rapidly than essential living costs, is a matter for conjecture. But replenishment, sooner or later, will become imperative. While curtailment of industrial output will exist while there is still a surplus of high-priced goods unliquidated, there are other branches of activity which may well demand attention.

Failure of the Much-Advertised Building Boom

The much-advertised building boom came to little because of the restrictive influence of tight money and the lively expectation of lower building costs. While there is possibly an oversupply of commercial office space and industrial building for the time being, housing is still greatly in arrears. Finally, the railroads, which have been much neglected during past years, demand increased facilities. It is significant that although the roads have increased the average loading of cars and have speeded up their movement, congestion has only disappeared with the curtailment of industrial operations. The country paid a great price for insufficient transportation facilities during the war—how great a price will only be known when the history of that conflict is written.

Italian Discount and Trust Co. Tells of Industrial Disturbances in Italy

The industrial disturbance in the metallurgical trades of Italy has been brought to a close. Work has been resumed everywhere. It is now possible to present a true picture of the entire situation, which was brought about by a small minority of noisy and extreme radicals. The great mass of Italian workers—right-thinking, hard-working, substantial citizens—kept their heads and refused to be led astray by leaders who did not have the real interests of the workers at heart.

Causes of Trouble

The causes leading up to the trouble may be plainly stated, thus:

The workers in the metal industries demanded more wages, claiming that what they received was not sufficient to meet their living expenses. The manufacturers refused to accede to these demands, on the ground that the condition of the industry did not yield profits sufficient to pay higher wages at that time—it being pointed out to the workers, also, that constant jumps in wages did not bring any relief into the situation in that these wage increases tended only to make commodity costs mount still higher. The workers considered this reply calmly, folded their arms, and refused to work. Realizing the impossibility of going on without workers, the manufacturers closed their plants. The men refused to leave, thus becoming the masters in practically all of the engineering establishments in Italy.

The workers then demanded the right of a certain voice in the management and a participation in the profits, maintaining that industrial peace could be secured only by their possessing a guarantee that they were not being exploited for the benefit of capital, they agreeing at the same time to bring about an increase in production.

Workers' "Control" in Management

At this point the Italian government stepped in and passed a law whereby the workers were allowed a certain "control" in the management of the factories and a participation in the profits—the basic motive of this action being that if the workers were given the opportunity of collaborating with the management in the internal affairs of the factories, they would come to know that there is a limit beyond which it is not safe to go without jeopardizing the entire industrial structure, and

that this joining of capital and labor would tend to operate beneficially on economic conditions and the national well-being.

The new law is now in force. And it is hoped, and believed, that a satisfactory and lasting peace will thereby be obtained, together with increased production and greater general prosperity.

Peoples National Bank of Pittsburgh Discusses Influence of Foreign Trade on Our Domestic Situation

Developments in our foreign trade will have much to do with the domestic situation. Among serious-minded people there is a feeling that in this year, 1921 the commercial nations of the world will enter a new era, and more courageously face the problems of the future. During the past two years affairs have drifted. The inevitable reaction from war to peace affected statesmen responsible for the conduct of nations as well as individuals. New standards of international relations were suggested and experimented with; old standards of individual initiative and self-reliance temporarily fell into disuse.

This was not an unnatural development of four years of self-abnegation on the part of the individual; of a surrender of his long-cherished personal rights, in his home as well as in his counting-room; of a merger of national interests into international—at least among the Allies—and of general submission, almost without questioning, to newly-created authorities, to whom the new conditions were as alien as they were to those who submitted. The only thing which did not change during and after the war was human nature. This is now reasserting itself as the world enters the secondary stage of reaction. It has been strikingly manifested in the Geneva meetings of the Assembly of the League of Nations, in the gradual annulment of war-time rules and regulations affecting business in the United States, and in individuals who have been held in restraint thereby during the past four years.

Policy To Be Adopted in Relation to Credit Advances Important

A matter of vital importance in its bearing upon the future of the United States will be the policy adopted in relation to credit advances for the development of our external trade. Shall the major exports of capital represented by goods and additional credit advances be to the most favored commercial nations (which are at present our largest debtors), or to backward nations whose exploitation—using the word in its best sense—promises richer returns in the more or less distant future?

It was once declared by a certain great captain of industry who fell into grave difficulties: "My creditors cannot afford to let me fail; I owe them too much!" That in a nutshell is the position of the United States toward our national debtors, and of Great Britain toward her national debtors. The problem of the future will be the "nursing" of these debtors, and this alternative is likely to present itself: to supplement our credits to Europe with additional advances, thereby enabling the nationals which have long experience and training in dealing with countries less advanced commercially to recoup themselves, or for ourselves to compete strenuously with our European debtor nations in the development of the markets of the backward countries of the Orient, Asia, Africa and South America.

The popular theory is that we must strain every effort to retain our fortuitous gains made while England, France, Germany, Italy, and Belgium were at grips for five years, and add thereto. Furthermore, that we must expand our merchant marine, carrying our imports as well as our exports in our own vessels acquired at such extravagant cost during the war and since the armistice.

An Unpopular Theory

It is at least permissible to consider what for the moment may be an unpopular theory, namely: to cultivate what is best within our own national boundaries and the boundaries of our contiguous neighbors, and leave to old hands at the business the long-practiced job of cultivating the backward countries, and to assist these "journeymen" in such work (who are at the same time so greatly in debt to us) by making them further advances of credits.

The people of the United States are the largest per capita consumers in the world today and they have not reached the limit in this respect. In the prime essentials (the production of foodsuffs and of the materials which enter into the provision of shelter) we still have a surplus. To a considerable extent the so-called backward countries which before the war were being supplied with capital for their development by the leading European nations contain the potentialities for excess food production which is imperatively needed by their financial creditors.

As the world gradually recovers ground lost during the war, the task of England, France and Germany in regaining their lost trade in commercially backward countries will become easier physically and financially, than the task of the United States in competing with them in these pre-war markets. World trade consists in an exchange of things, not, as too many persons seem to think, in an exchange of goods by one nation for the gold and silver of another. The nations whose economic necessities, financial as well as commercial, are greatest will make the largest sacrifices in order to retrieve and maintain outside markets.

Europe Doubling Her Sales to the U. S., Especially in Manufactures and Manufacturing Material

What are the articles with which Europe has doubled her exports to the United States? Our trade figures, says a statement by The National City Bank of New York, show for the ten months for which records are now available just twice as much in value of merchandise imported from Europe as in the corresponding months of 1919 and four times as much as in the same months of 1918. The value of merchandise imported from Europe in the ten months ending with October was $1,078,000,000 against $543,000,000 in the same months of 1919 and $272,000,000 in the same months of 1918. Our chief imports from Europe, prior to the war, were manufactures and especially luxuries and certain manufacturing materials which the European countries had brought from their colonies to their own ports before re-shipping them to the United States. During the war, however, the colonies found it more convenient to ship their merchandise direct to the U. S. and as to the manufactures which we were accustomed to draw from Europe, it was scarcely expected that her factories would be able to so quickly resume the outturn of any considerable surplus.

In both of these lines, however, the return to pre-war conditions has been rapid. Most of our manufactures imported are drawn from Europe, and manufactures show in the imports for the ten months ending with October, 1920, a total of $1,460,000,000 over $844,000,000 in the same months of last year, while manufacturing material shows in the ten months of 1920 $1,600,000,000 against $1,324,000,000 in the same months of 1919.

In raw manufacturing material, Europe is rapidly returning to her pre-war custom of accumulating the products of her colonies at her own ports before sending them to the United States. Of Egyptian cotton, Great Britain has this year sent us $10,000,000 worth against $5,000,000 in the corresponding months of last year; of india rubber, $34,000,000 worth against $16,000,000 in the same months of 1919, and only $4,000,000 in the corresponding months of 1918, while Netherlands has sent us nearly $4,000,000 of rubber from her East Indian colonies as against a quarter of a million one year ago and nothing two years ago. Of pig tin, Great Britain has sent us $13,000,000 worth as against $8,000,000 in the same months of the preceding year.

Exports of Automobiles in 1920 Far Exceed All Records

Exports of passenger automobiles from the United States for the year 1920 far surpass all records, says the National Bank of Commerce in New York, in the January number of its magazine, *Commerce Monthly*. In the first ten months 112,376 were sent abroad as compared with 67,145 in 1919,

the highest previous year, and 28,306 in the fiscal year ending June 30, 1914, the highest prewar year.

"Shipments to all parts of the world showed remarkable gains, the numbers sent to the United Kingdom and British India being especially noteworthy," it is pointed out. "These sales have not only benefited American industry but the widespread use of these cars will also facilitate the development of further trade in American automobiles, accessories and parts."

The largest exports were to the following countries: United Kingdom, 18,154 cars; British India, 10,848; Canada, 7,369; British South Africa, 5,510; Cuba, 5,286; New Zealand, 5,099; Brazil, 4,968; Sweden, 4,887; Dutch East Indies, 3,439; Argentina, 3,372; Uruguay, 3,287; Norway, 3,000.

U. S. Trade With Spain Grows

American exports to Spain increased 240 per cent from 1914 to 1919, from $30,000,000 in 1914 to $102,000,000 in 1919. The displacement of Germany, and also, in some part, of England and France, in the Spanish market largely explains this great favorable American trade growth, according to Trade Commissioner Arthur Young, in a report entitled "Spanish Finance and Trade," just published by the Bureau of Foreign and Domestic Commerce of the Department of Commerce.

"Spain, like the United States, changed from a debtor to a creditor nation as a result of the war," the report says. "The geographical position of the country and its great natural wealth made possible the supplying of the war needs of the belligerents on an important scale. The total trade balance in favor of Spain from the beginning of the war to the close of 1919, was approximately 4,000,000,000 pesetas ($772,000,000 at nominal par of exchange). This strengthened the financial situation in the country in a remarkable manner. It is a striking fact that Spain granted a credit to the United States of 250,000,000 pesetas, of which 155,000,000 were actually utilized.

"The meagerness of economic information about Spain available to American interests has not been in keeping with the growing importance of that country," states the Bureau of Foreign and Domestic Commerce in calling attention to the report which it says was prepared to fill the existing gap in its information service. The report describes the principal features of the financial system of Spain, with special reference to the effects of the war upon the economic activities of the country. Particular attention is given to the growth of more direct financial and commercial relations with the United States. The policies adopted by the principal European countries in their trade with Spain with respect to the establishment of branch banks, the granting of credit, the promoting of sales, and the investment of capital are likewise discussed. The report is known as Special Agents Series No. 202, "Spanish Finance and Trade."

Business Conditions in England

Conditions in Machine-Tool Market Are Generally Bad—Textile Machine and Locomotive Industries Good—Situation of Great Britain—Unemployment Insurance

By Our London Correspondent

London, Dec. 23, 1920.

The industrial and economic storm has undoubtedly commenced but despite the rumblings and more definite warnings of trouble that have for some months been recorded in these columns, a large section of the community has found itself unprepared for trouble. Whatever the direction in which one looks it is difficult to see light breaking through. Still it must be recorded with satisfaction that the electrical power-station engineer strike has again been postponed and that the strike half promised in the engineering industry will not take place yet awhile, for the claim for an advance of 6d. an hour for time workers and equivalent increases for day workers has been dropped for a period of six months. This postponement followed many conferences between representatives of employers and employees.

Meanwhile a joint committee may consider "the adjustment of wages on the basis of fluctuations in trade," though in the past this basis has usually been rejected by the unions concerned. The claim for an advance was made on the ground of increased cost of living. This is admitted. It is some seven or eight months since any increase in engineering wages rates was effected and in the interval the cost of living, however estimated, has certainly gone up considerably. Now, for the first time for many months, the cost of living, based on average retail prices of all commodities taken into account, is reported by the ministry of labor to show a decline, being 169 per cent over that of July, 1914, against 176 per cent last month. The decline may be described as due to reduction in the price of sugar and clothing. It is wholesale, not retail, prices that have been steadily or sharply reduced. But with the lapse of time some amelioration of the retail position may be expected.

Raw Material Prices

Prices of raw materials for engineering products have been falling, but the effect is not particularly marked on the cost of the finished machine. Firms are now able to quote definite prices and, subject to the usual strike clauses, delivery dates.

The machine-tool industry is not of course in the position of the motor industry in that, so far as the writer is aware, no firms have had to close down completely. The present state of the motor trade, now notorious, ought to provide a warning to those journalists who, presumably under suggestion, asserted a few weeks ago that the industry was at least in a relatively strong position. It is foolish to bluff when the facts are clearly known.

As to machine tools, observation on recent journeys indicates that while conditions steadily become more difficult in Yorkshire, and indeed everywhere, Manchester is in a better position than Birmingham, Coventry and also London, where the engineering industry, as a whole, is in large part a war product; a number of small firms having arisen who, after war demands had been satisfied, devoted themselves in minor ways to the motor trade and are suffering the same troubles. In machine tools, while drilling machines have been in some demand, the market for milling machines and turret lathes, to take only two types of tools, has faded.

One well-known Lancashire firm, though still very well occupied has not received an order of note for the last three months. While half-time working is not uncommon one old-established firm, for the first time in its existence, has but two working days to the week.

Small Tools

The small-tool side of the business can hardly claim to be in a better position. At a recent auction in London some 1,100 end mills went for £28. The twist-drill trade, like the milling-cutter trade, is largely concerned in price-maintenance associations. Branded twist drills have been thrown on the market by auction and bought by dealers at prices which readily enable them to undersell the original makers.

Textile Machine Industry

As we have stated previously, the textile-machinery industry in Lancashire still find good employment by reason of orders from abroad; in fact, not very long ago deliveries promised on inquiry were stated in years. The locomotive side of engineering is also satisfactorily engaged, although in one center there is some measure of unemployment, due apparently to shortage of skilled iron foundry workers. Indeed, according to the last available figures—a considerable rise has occurred since their issue—for the Lancashire and Cheshire district in engineering nearly 7,000 names, including laborers, were on the register as unemployed; while 588 vacancies had been notified, 547 of them being in connection with molding.

Motor Industry

Turning again to the motor industry, it is reported that a Manchester firm has suspended 1,100 workers for a month, and that a Southport firm has shut down for a fortnight. One large factory farther south has shut down indefinitely. Nevertheless, the condition of engineering generally seems to be better than that of the cotton or wool industry and, regarding the Yorkshire trade, the anomoly was recently

noted of production at the rate of 40 per cent of normal being accompanied by an increase on wage rates of 20 per cent.

Situation Gloomy

When will the storm reach its height or rather when will any sunshine be visible is naturally the question on which opinions are offered. A fortnight ago the turn of the year was often suggested; now that opinion is held by no more people than those who hold the view that the crisis will last four or five years—for such an opinion has been expressed. Next April or so has at the moment the largest number of votes, apparently on the principle that "in the spring the young men's fancy lightly turns to thoughts of—say machine tools." At the moment it is probable that another six months will be required to get us through the worst. The government, accused of waste in expenditure, is replying by permitting the continuance of the half-timer and ordering local education authorities not to incur new expenditures. But the day-education continuation act will undoubtedly be brought into operation in London, where the education officials have high ambitions and apparently need not trouble about cost.

Unemployment Insurance Act

Great Britain has just brought into operation an unemployment insurance act which gives the unemployed 15s. a week. To meet the crisis—a mean estimate gives three-quarters of a million persons unemployed — the qualifying period is to be suspended temporarily. Then, apart from the £6,000,000 to be spent on arterial roads, a committee will have the disposal of £3,000,000, out of which grants can be made toward the cost of labor on local schemes—except roads and housing—for the relief of unemployment, this fund being available up to the extent of 30 per cent of the labor cost mentioned.

Getting Ex-Service Men Into Unions

Again, the building trades, which are notoriously some 65,000 workers down in numbers as compared with the pre-war period and which have at the lowest estimate 10 years full work ahead, are to be bribed to accept 50,000 ex-service men through the trade unions concerned within the next three years, £5 a head being paid for their training, with other guarantees to be given regarding time lost owing to bad weather. Thus half-wage rates will be paid for the first 22 hours lost in a week, and three-quarter rates for any time lost in excess of 22 hours, while if a whole week is lost owing to the weather conditions the man will be paid as if he had worked 27½ hours. In addition, this particular industry is to provide a supplementary scheme of unemployment insurance to increase the unemployment benefit, the training grants being, it is suggested, a nucleus for such a fund. The trade unions generally, it should be explained may work the unemployment-insurance scheme, provided that from their own funds they add one-third the benefit.

No one regards the proposals as affording a remedy for unemployment—the nightmare of the British working man—and it has been left to Lloyd George, the prime minister, to suggest emigration to the colonies. So much for "the land fit for heroes."

Breakdown in Industry Worldwide

The breakdown in industry seems to be worldwide. In Great Britain at any rate the mental attitude of the worker now is very different as compared with the pre-war period. In many cases the man has risked his life for the state and looks definitely to the state to insure his existence. And the attitude of the authorities to the hitherto illegal street collections and the seizure of London and suburban public baths and libraries is significant. The London unemployed are, in fact, organized.

Nobody can deny the terrible conditions which prevail in central and eastern Europe. The danger exists that these conditions may spread westward. New markets must be sought and the strongest pressure has been put on the government to arrange for the reopening of trade with Russia. The same must apply to Germany; otherwise the exchanges cannot be re-established. There is much sentiment—and not a little personal interest—that naturally opposes dealing with the German; it will have to give way to facts.

The Trend Toward Combination in the German Industries—A Critical Study of the Stinnes' Policy

By C. A. Heise

While the political parties and the government are still at loggerheads as to the best method of procedure for the socialization of the German mines and collieries, fundamental changes are taking place in the mining and manufacturing industries. Never before in the history of modern industrial Germany has there been such a marked tendency for financial transactions on a large scale, company fusions, mergers, and formation of combines as at the present time.

This remarkable activity is all the more noteworthy since it manifests itself at a time when the pauperization of Germany is progressing apace and the utilization and exploitation of the productive capacity of the industry has been diminished by well nigh 50 per cent. Does this tendency for increase of power and expansion spring from a deeper cognition of future indispensable conditions which are to determine the continuance of Germany as an industrial state? Or does it but conceal an intensely nervous uneasiness, the fear of the imminent disintegration of the mighty structure built up during the past decades, that is looking for an expedient to save the sinking ship?

Opinions Vary With Events

The best brains of Germany are hard at work to solve the vast problems confronting that country and yet it would appear as if the utterances and opinions of leading industrialists are at variance with actions and events—a rather pessimistic judgment of the future aspect of Germany's economic development on one hand and a creative activity almost unsurpassable and certainly without parallel in the history of industrial Germany on the other!

German Enterprise Unbounded

One ought to think that the conviction prevailing in Germany—that the industry is doomed to ruin under the crushing terms of the Peace Treaty—has produced an atmosphere of despondency and half-heartedness, tending to paralyze all energy and rendering the execution of projects on a giant scale impossible. Instead, an unbounded enterprise "unternehmungslust" is noticeable, likely to deceive anyone who has not made a close study of the conditions obtaining in the German industry. There is no gainsaying the fact that the latest developments in Germany are an imposing manifestation of strength, but this very manifestation should not blind one to the fact that a development on such lines was largely rendered possible by the enormous inflation obtaining in Germany, and the moment the government orders the printing presses to be run at say, half speed, the industry is sure to lose the ground for business transactions of a kind which may rightly be classed under the heading of "inflation phenomena."

Socialization and Labor

The most active of all the leading industrialists is a man who, though being well known in international industrial circles for years past, gained wide prominence even in lay circles through his remarkable speech and attitude at the Spa coal conference—Hugo Stinnes. Some weeks ago he submitted to a committee of the "Reichswirtschaftsrat" (Federal Economic Council, i.e., the German National Industrial Parliament) a program embodying the essential points for a socialization plan as he conceived it and shortly afterward one of the most remarkable financial transactions of late became known: the interest agreement between the Stinnes group and the Siemens-Schuckert concern. It is highly interesting and instructive to note that the recommendations of the sub-committee appointed by the Federal Economic Council—and presided over by Stinnes—for the adoption of the committee's socialization scheme are generally framed on the lines that formed a basis of the Stinnes-Siemens-Schuckert agreement. While even two labor members of the committee were supporting Stinnes' plan, it would be misleading to infer that organized labor is whole-

heartedly in favor of a socialization scheme as outlined by Stinnes. On the contrary, a decided opposition is noticeable in labor circles toward the salient point in the Stinnes' proposal: Profit sharing of the workers on the "small share" basis. It is held that whatever advantages there may be in labor's participation in profit sharing by the issuance of small shares, such a plan merely represents a substitute for socialization," inasmuch as the worker would always regard his dividends as a mere part of the wages due to him.

However, it is important to point out right here that the Stinnes' proposal does not provide for a commonable amalgamation of congenerous works brought about by the influence of the state. His plan of increasing the productive capacity of the industry is based upon the so-called "vertical combination" of plants—that is, the joining of raw material works with the wholesale consumers—and the whole scheme to be run on private-capitalistic lines the same as the transaction with the Siemens-Schuckert concern.

Combination of Electrical and Mining Concerns

As regards the latter, it is for the first time that an important concern of the electrical industry enters into close relation with the mining industry and it is instructive to note that the interest agreement not only provides for a sufficient supply of raw material but covers joint accounting and distribution of profits as well.

Stinnes suggests the coalition of all consumers of coal, be it in the form of water, gas, electricity, or traffic; and one may not be far off the mark in assuming that in suggesting this plan for the formation of mixed works he expects an abatement of the existing discontent among coal consumers, springing from high prices, as soon as the latter are participating in the profits made by the collieries. Cheapening of production may be another determining factor of his proposed plan. It seems rather unlikely that Stinnes intends to confine this trustification to coal and iron for indications are pointing to an extension of the scheme so as to embrace the iron industry and the refining and manufacturing industries as well. This is no mere conjecture but fully borne out by events and facts.

Expansion of Iron Works

The iron works in general — and particularly those belonging to the Stinnes' concern—have during the last year displayed a steadily increasing tendency for expansion in two directions: on the one hand they took a marked interest in collieries and o. the other they aimed at a closer relation with the manufacturing industry. This tendency is strikingly illustrated in the interest agreement between the "Rein-Elbe-Union" and the "Siemens-Schuckert" concerns. The Rhein-Elbe-Union represents an amalgamation of the "Deutsch-Luxemburgische Bergwerks-und Huetten Aktien Gesellschaft" and the "Gelsenkirchener Bergwerksgesellschaft," the former producing chiefly iron while the latter is largely engaged in mining. The latest addition to the concern is the "Bochumer Gussstahl Verein." These works have now proceeded to strengthen their relation to the wholesale consumers, and the Siemens-Schuckert concern may be regarded the first link in the chain.

The official communique issued by the Siemens-Schuckert company justifies the step taken in this direction by stating that "it is of utmost interest for the electrical industry to gain a certain influence upon the raw material works with a view to insuring a supply of raw material and semi-finished products of a quality as will enable it to cheapen production and raise its products to the acme of perfection."

From the aforementioned statement it would appear that the advantage of transactions of such a kind were largely on the side of the manufacturing industry and it cannot be denied that the present shortage of coal and quality iron tells heavily upon the electrical industry. The question is, however, whether the present state of affairs will continue indefinitely? In this connection it is important to reflect upon the statement made some time ago by General-Manager Peter Kloeckner of the "Hasper Eisen-und Stahlwerk." In the course of his statement—which made a profound impression in Germany—he drew a gloomy picture of the future aspect of the German mining industry, pointing out that France and Belgium are getting swamped with German coal as a result of the Peace Treaty, in consequence of which the iron industry of the aforementioned countries was in a position to offer her products at lower prices than Germany.

The German coal deliveries to the Allies were thus not only aggravating the coal famine at home but were also instrumental toward the ousting of German products from the world's markets, he averred. This statement is not without a certain significance! Should it prove true, German iron consumers will soon cease complaining about the difficulty of getting supplies and the advantage of the interest association will wholly be on the side of the iron works which are thus finding a convenient outlet for their production. For a long time to come German export trade will be confined to finished products, a large part of the price of which will be absorbed by wages. This, however, is principally the case with the products of the electrical industry but not with the staple products of the iron works and while it should not be denied that Stinnes' proposal has also national and economic interests at heart, the private-capitalistic trend of the suggested "vertical combination" stands out in bold relief.

Future Trend Impossible of Prediction

It is impossible to predict with any fair degree of accuracy the future trend of present developments but sight should not be lost of the fact that the socialization problem has ceased to be a mere economic question. It has become a political platform of the first magnitude and, of course, a first-rate propaganda stock tale of the laborites. The conviction is however steadily gaining ground—even among the saner elements of the working class—that socialization on purely socialistic principles would turn out to be a dangerous experiment at the present time. The strength of organized labor in Germany, on the other hand, constitutes a factor which it would not be wise to ignore. Probably some sort of a compromise will be arrived at. It is significant, however—and not without a certain ironical touch — that at a time when the parties determined on crushing capitalism are as strong as never before, private capitalism is extending its sphere of influence day by day.

What Happened to Building Material Prices and Wages in 1920?

The year 1920 opened with building material prices high; they had reached their peak, many people thought. Then they proceeded to climb still higher, until mid-summer showed an average advance of about 40 per cent over what they were at the beginning of the year. This advance was the cause of its own downfall. The demand dropped off sharply, because owners would not build in the face of such prices, and the banks refused to loan money on building investments that could not hope to amortize the excess cost of the structure before the value of the property would be depreciated by the return of normal building costs.

The end of the year finds a reduction in the price of cement, brick, lumber and steel as compared with the peak prices, and the prices of some of the other materials are softening and further declines are expected, but today the general average in material costs is somewhat higher than it was at the beginning of 1920.

Building material prices may be divided into two classes: those which have been normally high, and those which have been abnormally high. The general economic situation of the country, including the average drop of some 35 per cent in wholesale commodity prices for the year, has had its effect in reducing normally high building prices, while investigations and the pressure of public opinion is beginning to knock the props from under those abnormally high prices which have been maintained by unlawful combines and trade "agreements."

We look for a stabilization of material prices at lower levels in the late spring and early summer, when building activity will be revived under the encouragement of these lower prices.

Some upward trend, even, may result from this increased building program, but 1920 peak prices will certainly not be seen again.

The beginning of 1920 found wages in the building trades also high, and on May 1 there was a wage increase in practically every trade. Those not raised on May 1 were advanced on Oct. 1, so that wages in all building trades are higher today than a year ago. In the face of a marked and continuing decline in living costs and a reduction in wages in many other lines of industry, the present wage scale cannot be justified much longer. A softening of the scale is already evident in unorganized and common labor circles. Union labor, however, operates under term agreements which fix the wage scale for definite periods. It will resist any wage decrease to the last, but it must unquestionably adjust itself to the new conditions.

Contractors, like manufacturers, are rejoicing in the decrease in labor unit costs, due to the marked increase in the efficiency of labor, even though the wage scale is not changed. Whether this increased efficiency will be sufficient to keep wages at their present levels, however, is doubtful. Only the future will tell.

The Lockwood Committee investigation has had a very healthy influence on the building business. Temporarily it has tended to check construction, and certainly has revealed some ugly conditions, but this much-needed surgical operation will leave the business as a whole cleaner and healthier than ever before.

The elimination of the evils of trade "agreements" in both material and labor practices will enable contractors to quote lower prices and give their clients better service, which will result in a decided benefit to the community as a whole.—*From a statement issued by the George A. Fuller Co.*

$25,000,000 Locomotive Plant for St. Louis

The American Locomotive Co. plans to build a large plant in St. Louis on which the expenditure may reach $25,000,000, according to the *New York Times*. It is understood that the initial cost will be between $5,000,000 and $10,000,000 and that future additions will make the plant one of the largest units in the company's system. The company already has extensive plants at Schenectady and Dunkirk, N. Y.; Richmond, Va.; Pittsburgh, Montreal; Paterson, N. J., and Chester, Pa. The erection of a plant at St. Louis will create a manufacturing unit further west than any now owned.

Negotiations for the acquirement of land in the St. Louis industrial section have been going on for some time, and it is understood that options have been secured on four tracts, each of about 200 acres. One tract comprising about 205 acres is said to be favored, as the location affords the best of traffic facilities.

All of the options are on land in a relatively small radius. The best tract is located between Granite City and Madison and lies close to the Wabash and Terminal railways.

Near by is the plant of the American Car and Foundry Co., and the St. Louis Coke and Chemical plant also is near at hand, so that a fuel supply is assured. It is understood that efforts to bring the American Locomotive Co. to St. Louis have been under way for several years. There is no intimation as to when the company will start building, but it is thought that this will not be long postponed.

It is believed that the building of a Middle Western plant by the company is in anticipation of a big demand for railroad equipment in the next several years. The railroads are admittedly in need of equipment, the only obstacle to free purchasing being inability to finance the equipment. Furthermore, there is a belief that prices will come down during the next few months. Aside from this, it is agreed that there is a big shortage both as to cars and locomotives.

Railways Urge Immediate Shipment

Shippers who are in a position to do so are being urged by the railroads to take advantage of the present surplus of equipment and, by shipping now, secure prompt movement and delivery of commodities.

For the first time since pre-war days the carriers are now ahead of the nation's business, a condition which is attributed to three factors. First, strenuous and successful efforts on the part of the carriers to rehabilitate their properties; second, the usual win ter lull, and third, the present changing industrial conditions.

Railroad men point out that the present large surplus of freight equipment will not be available in the spring when the annual crop movement develops, and for this reason those who are in a position to anticipate their needs will find it to their advantage to "ship now and avoid the rush."

Fourteenth Annual Meeting of American Society of Agricultural Engineers

That modern application of engineering to the services of agriculture is largely a matter of designing the requisite farming machinery, was the thought brought out at the fourteenth annual meeting of the American Society of Agricultural Engineers, held in Chicago on Dec. 28, 29 and 30, 1920. The meeting had been arranged by the retiring officers including, president, F. N. G. Kranich, Hyatt Roller Bearing Co., Chicago; vice-president, F. W. Ives, of the Ohio State University, Columbus, Ohio; and secretary-treasurer, J. B. Davidson, Iowa State College, Ames, Iowa.

The program covered a wide variety of subjects among which may be briefly mentioned: Wagon Standards, Factors Influencing the Draft of Plows, Wood Preservation, Tractor Testing and Stationary Engines. All papers presented at the meeting will be reprinted in the *A. S. A. E. Journal.*

The officers for the ensuing year were announced as: President, E. A. White, Farm Implement News, Chicago, Ill.; first vice-president, W. G. Kaiser, Portland Cement Association, Chicago; second vice-president, E. R. Jones, University of Wisconsin, Madison, Wis.; secretary-treasurer, Frank P. Hanson, Station A, Ames, Iowa.

The Undistributed Earnings Tax Plan

The committee on federal taxation of the National Association of Credit Men has issued a book entitled "The Undistributed Earnings Tax—a plan to tax the current year's earnings of corporations not disuributed." This tax is designed to take the place of the Excess Profits' Tax.

Copies of this book have been sent to every member of Congress and to thousands of business men throughout the country.

The recommendations of the committee are:

1. Elimination of the Excess Profits Tax.
2. Elimination of the Corporation Income Tax.
3. Dividends from current earnings to be subject to the normal tax in the hands of the individual.
4. Substitution of a corporation undistributed earnings tax at graduated rates.
5. Dividends which are paid from earnings of prior years on which the corporation has paid the undistributed earnings tax, not to be considered as income to the individual shareholder. Dividends may not be paid from surplus until earnings of current year have first been used for that purpose.
6. Adjustment of rates of taxation on personal incomes (both normal and surtax) to meet the requirements of the budget from income taxes.

The elimination of the Excess Profits' Tax is said to be recommended by the committee because it believes that the Excess Profits' Tax discriminates against various types of business, that it exercises a repressive effect on industry, and that it violates the principle of taxation in accordance with ability to pay.

Roy G. Elliott, chairman of the committee, says: "That a substitute for the Excess Profits' Tax should not only yield a substantial portion of the revenue lost by the repeal of this tax but should equalize the distribution of the tax burden. To insure equality of distribution, the committee believes that the individual must be considered, wherever it is practicable, as the tax paying unit, for, since in the last analysis the individual bears the taxes, it is only by considering him as the tax bearing unit that quality of distribution may be obtained.

"The committee therefore recommends that the Corporation Income Tax be eliminated, and that each individual shareholder be made to pay his own normal tax upon dividends, instead of

having it withheld and paid by the corporation.

"If the Excess Profits' Tax is repealed and the Corporation Income Tax is eliminated, absolute equality of distribution will exist, it is claimed, with respect to all the distributed earnings of sole traders, partnerships and corporations. But sole traders and partners are taxed not only on the earnings distributed to them but on their total earnings, whether distributed to them or not. With the elimination of the Excess Profits' Tax the corporate shareholders would be taxed only on the earnings distributed to them; thus a fairly substantial portion of corporate earnings would remain untaxed. The committee proposes that these undistributed earnings of corporations be taxed at rates substantially equivalent to those that would be applied, if this income were assessable in the hands of the shareholder. Under the proposed law the corporate shareholder will have paid for him by the corporation a tax on the income undistributed to him at substantially the rate that would apply to this income if it were distributed to him. The specific recommendation reads "that a graduated tax at rates comparable with the normal and surtax rates paid by individuals and partners on the earnings of their business which are reinvested or remain undistributed, should be paid by corporations upon the current net income not distributed in dividends or made subject in the hands of the shareholders to the individual income tax.

"The purpose of this tax on the current net income of corporations which is reinvested or remains undistributed, is simply to tax that portion of the earnings of the investment of the individual shareholder which, assuming the repeal of the Corporation Income and Excess Profits' Tax, otherwise entirely escapes taxation by reason of not being distributed. This tax should be so levied as to be free from any punitive element and from any attempt to force the distribution of dividends which should, for sound business reasons, be retained as working capital.

"The Committee feels, giving weight to both the considerations of equity and simplicity, that the most desirable factor on which to base this undistributed earnings tax is the percentage of the total current net income which remains undistributed, and considers this factor as being of the greatest importance in seeking equality as between different individuals who prosper equally."

Foreign Trade Financing Committee Progressing

Following a meeting of the executive committee of the committee on organization of the Foreign Trade Financing Corporation recently, announcement was made that temporary quarters had been leased for the corporation at 66 Broadway, New York, and that a staff is at work on the preliminary plans of organization.

The committee gave out the following statement:

"The committee on organization of the Foreign Trade Financing Corporation, through its executive committee and various special committees, is proceeding actively with its work preliminary to presenting the final plans for the corporation to the public, and calling for subscriptions to its capital stock. The crystallization of a definite policy in this respect and of the scheme of operation of the new institution has progressed successfully.

"A carefully thought-out plan relative to the matter of stock subscriptions and designed to reach every element in our commercial organization will shortly be announced. This has been developed with the greatest attention to the section of the resolutions of the Chicago meeting, urging the co-operation of all members of agricultural, manufacturing, financial and labor interests throughout the country and in the firm conviction that every member of our producing and business organization is connected with the welfare of our foreign trade.

"It has further been developed with attention to the necessity of making clear the need for an organization of such magnitude in our present commercial structure. Adequate machinery for the extension of long-term credits to foreign customers is essential to the future prosecution of our foreign trade, as a continued foreign trade is vital to our domestic welfare."

The executive committee is acting for the committee of thirty appointed by the nation-wide meeting of bankers, producers and business men in Chicago last month to carry out the establishment of the proposed corporation.

Across the United States in a Day

The War Department announces that on Washington's Birthday, Feb. 22, 1921, an attempt will be made by the Army Air Service to fly from coast to coast within a period of twenty-four hours.

The present plans call for a plane to leave Jacksonville, Fla., and at the same time for another to start from San Diego, Cal. The distance to be flown will be 2,079 miles, and stops will only be made at Ellington Field, Houston, Tex., and El Paso, Tex. The pilot who will fly the plane from San Diego, Cal., has not as yet been selected but Lieutenant Alexander Pearson, Jr., will guide the plane which leaves Jacksonville, Florida. The distances between stopping places are as follows: From Jacksonville, Fla. to Houston, Tex., 804 miles; from Houston to El Paso, Tex., 660 miles, and from El Paso, Tex. to San Diego, Cal., 615 miles.

The Krupp factories have declared a gross profit for the year of 159,000,000 marks, as compared with 11,700,000 marks in 1919. The net profit is 79,500,000 marks.

National Highway Transportation Exposition Fills Two New York Armories

The armories of the 13th New York Infantry and the 1st Field Artillery were filled during the week of Jan. 3 to 8 with the motor truck and accessory exhibits making up the New York show of the Motor Truck Association of America.

By long odds the most spectacular exhibit was that of the army. In it were included a fully equipped military airplane, Liberty and Hispaño aviation engines, airplane cameras and equipment, an artillery tractor with heavy trailer, the Christie self-propelled 155-mm. gun mount which was shown at the S. A. E. convention last spring, an anti-aircraft gun on a motor truck chassis, two mobile machine shops, etc.

The army also had a battery of six motion-picture cameras showing pictures simultaneously side by side on the same screen on phases of army life.

In general there were few changes in design and construction in the standard trucks. There was, perhaps, a wider use of the larger sizes of pneumatic tires.

Among the novel features were a Reo speed wagon fitted with flanged wheels and an omnibus body for railroad work, and the Adams company trailers that provide a comfortable, though small, bungalow on wheels to attach to the rear of an automobile and make hotels superfluous to the tourist.

Merchants Association Opposes Curb on Immigration

In accordance with the recommendations of its committee on immigration and naturalization the Merchants' Association of New York has addressed a letter to the Senators from New York and to Senator Colt, chairman of the Senate Immigration Committee, in opposition to the Johnson bill, which has been passed by the House of Representatives. This bill would suspend immigration for one year.

The letter of protest reads:

The Merchants' Association of New York earnestly urges that you do not support the Johnson bill, designed to exclude immigrants for one year, which has recently passed the House of Representatives.

This association's committee on immigration and naturalization has just completed a comprehensive study of the whole question of regulation and restriction of aliens and has come to the following conclusions:

The primary purpose of any plan to regulate immigration should be to protect and promote the best interests of this country. Due consideration must, therefore, be given to social, political and economic conditions in the United States, as well as to the character and assimilability of the peoples seeking admission to this country.

In order to safeguard our social and political welfare, adequate laws have already been enacted to prohibit the immigration of such generally recognized undesirables, as criminals, the physically and mentally unfit, and those advocating the destruction of government. These laws were substantially strengthened last spring by the passage of additional legislation, applying particularly to radicals.

In the light of these facts, the Merchants' Association of New York recommends that emphasis at this time be placed not on the addition of further restrictive measures, but rather on the efficient administration of those already on the statute book.

James H. Matthews & Co. Gives Employees Insurance Policies

On Friday morning, Dec. 24, each worker rounding out a year or more of service for the Jas. H. Matthews & Co., Pittsburgh, Pa., was given an insurance policy on his life. This insurance plan calls for increased amounts depending on the years of continuous service to a maximum policy in five years. One of the things which shows the loyalty and feeling of good fellowship among the Matthews workers is that 64 per cent of the workers benefit by this plan and 21 per cent are given maximum policies.

In addition, other gifts were distributed to those of less than a year's service and some of the older members were rewarded with special gifts.

So Christmas at Matthews is, as usual, one to remember and one in which each worker, from the oldest to the youngest and from top to bottom, has had a good share.

To "Scrap" Freight Congestion Evils

Super-costly freight terminals, delayed tonnage and losses which follow in the wake of freight congestion, are economic evils which are to be "scrapped" under plans now being worked out by the transportation committee of the Federal Highway Council.

At a meeting of this committee in New York under the chairmanship of W. J. L. Banham, general traffic manager of the Otis Elevator Co., traffic managers from all important centers of industry were in attendance. It was decided after due deliberation, to "draft" one or more cities in the United States and put what is known as store-door delivery to a final test. Such form of delivery, it was explained, was the use of the motor truck and highway in conveying freight direct to the door of the consignee, instead of allowing tonnage to accumulate in warehouses, thus adding to congestion and financial loss which ultimately come out of the consumer's pocket.

Definite action was taken by the adoption of the following resolution, presented by J. C. Lincoln, manager of the traffic bureau of the Merchant's Association of New York:

WHEREAS: It is the view of the Transportation Committee of the Federal Highway Council that relief from congestion and delay that normally prevails at railroad delivery stations in the handling of merchandise freight requiring station or platform service can only be secured by the introduction of a system for store-door delivery.

BE IT RESOLVED THAT: The subcommittee on Store-Door Delivery be instructed to take the matter up with the carriers and shipping interests at one or more points to be selected by them with the end in view of inaugurating a store-door delivery plan at such point or points together with rates, rules, and regulations under which it should be operated; and

BE IT FURTHER RESOLVED THAT: They are hereby instructed to report to the general meeting of the Transportation Committee a concrete plan for its approval.

Prior to the adoption of the resolution, A. E. Beck, general traffic manager of the Merchants and Manufacturers' Association at Baltimore, outlined the store-door delivery system as tested in that city.

The motor truck in terminal work was presented by B. F. Fitch, president of the Motor Terminal Co. of Cleveland, Ohio, which company has successfully established at Cincinnati a system of auxiliary transportation that promises practical relief to other cities.

The American Railway Association was represented by F. E. Williamson, general superintendent of the New York Central, and Colonel Chas. Hine of New York, representing the president of New York, New Haven and Hartford. The American Express Co. was represented by F. S. Holbrook, vice president and treasurer, and T. H. Stoffel represented the American Electric Railway Association.

Business Items

The Mesta Machine Co., Pittsburgh, Pa., has announced the opening of a branch office at Chicago, Ill. The offices are temporarily located in the Railway Exchange Building, but will be moved to permanent quarters in the McCormick Building after April 1. The Chicago office will be in charge of C. J. Mesta, second vice-president of the company. Messrs. W. R. Dawson and R. W. Schutte will be transferred from the Pittsburgh office to Chicago. This company has also recently opened offices in the Singer Building, New York, in charge of M. M. Moore who was formerly export sales manager. Frank A. Mesta will be transferred from the Pittsburgh office to the New York office as assistant to Mr. Moore.

The Seifert Special Machine Co., Hartford, Conn., has recently changed its name to the Sexton Machine Co. The firm is located at 308 Pearl Street.

The Wallace Barnes Co., Bristol, Conn., manufacturer of steel springs, etc., has announced the increase of its capital stock from $510,000 to $2,040,000.

The Peck Manufacturing Co., New Haven, Conn., has recently been organized and incorporated with a capital stock of $75,000 to deal in machinery, machine tools, etc.

The Goodwin Manufacturing Co., Hartford, Conn., recently organized, has been incorporated with a capital of $50,000 to manufacture machinery, etc.

The Waterbury Tool Co., Waterbury, Conn., manufacturer of gears, etc., has announced the increase of its capital stock from $500,000 to $1,000,000.

The Northern Engineering Works, Detroit, Mich., has established a new office at 990 Union Arcade Building, Pittsburgh, Pa. J. B. Laird, who has hitherto represented the company in western New York and northern Pennsylvania, will have entire charge of this office.

The Chicago Pneumatic Tool Co., New York, announces the appointment of J. F. Huvane as Eastern manager of compressor and engine sales, with headquarters at 6 East 44th St., New York, and G. C. Vanden Boom as Western manager of compressor and engine sales, with headquarters at 300 North Michigan Blvd., Chicago.

J. T. Roche, formerly vice-president and general manager of the Locomobile Co. of America, Bridgeport, Conn., A. L. Riker, formerly vice-president and chief engineer, and H. H. Edge, formerly general works manager, have formed a corporation under the laws of the State of Connecticut, known as the Investing and Manufacturing Co., with offices in the First Bridgeport National Bank Building, Bridgeport, Conn.

Slater & Barnard, Ltd., Ottawa, Ont., Can., has changed its name since January 1, 1921, to N. Slater Co., Ltd.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

The representative of a company in North China is in the United States and desires to secure an agency for the sale in Mongoli and North China of farming implements and machinery, iron and steel products, chemicals, automobiles and trailers, flour-mill machinery, textile machinery, and soap-manufacturing machinery. Reference. No. 34,227.

An American firm having a representative in Japan desires to secure an agency for the sale of machinery, tools, hardware, and iron and steel products. Reference. No. 34,235.

The representative in the United States of a trading company in New Zealand desires to purchase agricultural implements, machinery, hardware, etc. Quotations should be given f.o.b. American ports. Terms to be cash. Reference. No. 34,233.

Forthcoming Meetings

The Cleveland Section of the American Society of Mechanical Engineers will hold a meeting in the Cleveland Engineering Society's Rooms on Feb. 1. R. R. Abbott, of the Peerless Motor Car Co., will speak on the "Uses of Alloy Steel in the Machine Tool Industries."

The Society of Automotive Engineers will hold a meeting in Chicago on Feb. 2 at the Hotel Morrison in connection with the Chicago Automobile Show; also one in Columbus on Feb. 10 at the Winter Garden, New South Hotel, in connection with the Tractor Show.

The Engineering Institute of Canada will hold its thirty-fifth annual meeting in Toronto, King Edward Hotel, on Feb. 1, 2 and 3.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The Spring Convention of the National Machine-Tool Builders' Association will be held on Thursday and Friday, May 19 and 20, at Hotel Traymore, Atlantic City, N. J. The general manager is Ernest F. DuBrul, 817-818 Provident Bank Building, Cincinati.

The Industrial Cost Association will hold a meeting, to organize a New York section, in the rooms of the A. S. M. E., 239 West 39th St., New York City, on Jan. 20, at 8 o'clock.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Solders

Rohde Laboratory Supply Co., 17 Madison Ave, New York.
"American Machinist," Dec. 16, 1920.

"Al-Solder" is made by this company for work on sheet aluminum, lap joints, seams and general repairs in aluminum. This solder comes in the form of white, deliquescent sticks and contains all of the flux necessary for its use. "Tensil" solder is intended for lapping and joining iron, brass, lead, nickel, tin and zinc. The joined parts must, however, first be tinned with "Al-Solder." For work on aluminum castings "Nuflux" solder is recommended for filling up blowholes and pittings. "Clean-Al" is intended for cleaning and de-oxidizing molten aluminum. For soldering cast iron "Rolasco" solder can be furnished. "Silva" solder is of gray color and can be furnished for use on nonferrous copper alloys and german silver. These solders vary in melting point from 650 to 1,250 deg. F., the color and the tensile strength also varying. It is claimed that homogeneous joints of great strength are made. For use on jewelry and scientific instruments a sterling silver solder is also made.

Boring Bar, Expanding, "VV"

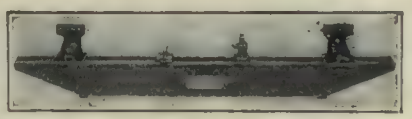
H. A. Hopkins & Co., Inc., La Salle West and La Porte Aves., South Bend, Ind.
"American Machinist," Dec. 16, 1920.



The bar is made in two styles, type "A" being used for holes from 1 to 2⅛ in. in diameter and type "B," shown, for holes from 3 to 12 in. in diameter. It can be furnished with either straight or taper shank and either plain or with a pilot bar. Square toolbits are used. For the bars boring holes 3 in. in diameter or larger, regular commercial toolbits can be utilized, so that worn cutters can be easily replaced. To change the boring diameter the conical-pointed screw is adjusted. The screw opposite it is then tightened to clamp the cutters in place.

Centers, Bench

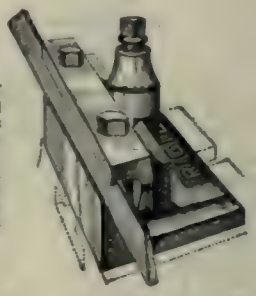
Cadillac Tool Co., 268 Jefferson Ave., Detroit, Mich.
"American Machinist," Dec. 16, 1920.



The bed is a ribbed casting of box-form construction, the ways being scraped. Both stocks may be moved to suit different lengths of work, and when adjusted can be clamped in place by means of levers. The right stock has a spring-actuated spindle that engages the work with sufficient pressure to eliminate play or lost motion between the centers. A fixture for holding a dial indicator is fitted to the bed. The 9- and 12-in. swing bench centers are furnished with stock rests also. Specifications: Made in seven sizes: 6 x 18 in., 6 x 36 in., 9 x 36 in., 9 x 48 in., 12 x 36 in., 12 x 48 in., and 12 x 60 in.

Cutting-Off Tool, "Back-Stroke"

Rigid Tool Holder Co., Washington, D. C.
"American Machinist," Dec. 16, 1920.



This device consists of a narrow tool of high-speed steel held by a hardened steel clamp on the base of the holder, which is a steel casting. The tool can be held by the toolpost of a lathe and swung to cut on either the right or the left, the cut being made from the rear. It is claimed that the blade is always held erect and that it can work very close to a chuck or steadyrest.

Gage, Snap, Thread, Adjustable, "Wickman"

Alfred Herbert, Ltd., 54 Dey St., New York City
"American Machinist," Dec. 16, 1920.



The gap between the anvils of this gage can be adjusted with an accuracy of 0.0001 in., each anvil having an adjustment of ¼ in. Sets of frames are thus made in ¼-in. steps, the anvils for all pitches being interchangeable in them. It is thus possible to gage screws of any diameter and with any limits required. The distance from the top of the thread to the pitch diameter is marked on the "no-go" anvils, so that, with the help of plugs or gage blocks, it is possible to accurately determine and set the pitch diameter of the gage.

Boring Machine, Horizontal, Heavy-Duty

Rockford Drilling Machine Co., Rockford, Ill.
"American Machinist," Dec. 23, 1920.



This machine is intended for work encountered in the automotive field, particularly the machining of crankcase bearings. The machine bores simultaneously two crankshaft bearings 2 $\frac{9}{16}$ in. in diameter by 2¾ and 2 $\frac{13}{16}$ in. long respectively, and three camshaft bearings in aluminum at a cutting speed of 200 ft. per minute and 0.010 in. feed per revolution of the spindle. It is said that the machine can be easily arranged to take care of holes from 1 in. in diameter in steel to 12 in. in cast iron and aluminum. It is rated at a capacity of 2½ in. in diameter when drilling from the solid in steel. The feed and drive mechanisms are completely mounted on one base section and the fixtures holding the work are mounted on the other section.

Chucking Machine, Vertical, Automatic, "Jackson"

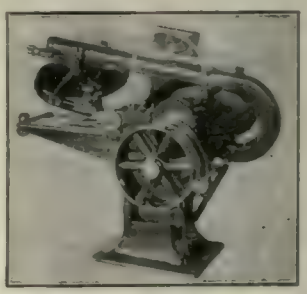
Long-Henkel Manufacturing Co., Reading, Pa.
"American Machinist," Dec. 23, 1920.



Intended for drilling, threading, turning, facing, etc., in the quantity production of small parts, such as nuts, pulleys, pipe fittings, battery terminals and electrical fixtures. The machine is built in three types, the illustration showing "Type B," one of the reciprocating kind. This type has four duplex automatic chucking vises and three pairs of working spindles, being adapted to work requiring drilling or boring, drilling to size, and then threading or tapping. The chucking vises automatically eject the finished articles, and after the operator puts the unmachined parts in place the vises close automatically. The floor space required is 3 x 5 ft., and the approximate weight is 1,450 lb.

Cutting Machine, Metal, "Horizontal Junior"

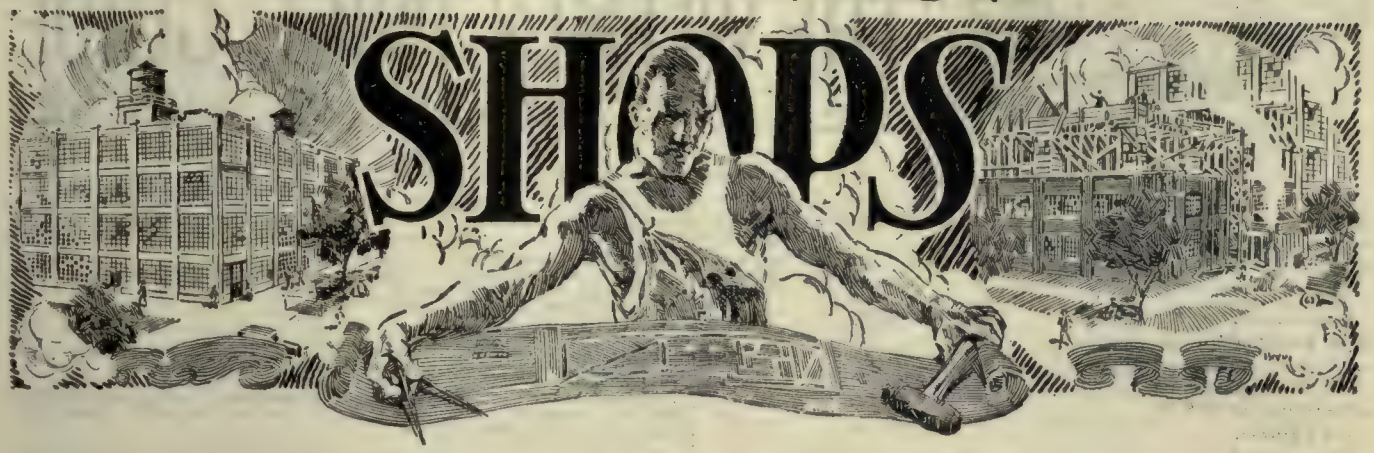
Metal Saw and Machine Co., Inc., Springfield, Mass.
"American Machinist," Dec. 23, 1920.



The cutting is done by means of a bandsaw mounted almost horizontally on a frame that can be swung in a vertical plane in order to raise the saw. A capacity for work up to 4 x 4 in. is provided, the machine being a general-purpose, quantity-production tool. Specifications: Capacity, 4 x 4 in. Saw: length, 8 ft. 4 in.; width, ¾ in.; thickness, 0.032 in.; kerf, 0.047 in. Cutting speed, 120 ft. per minute. Speed of drive pulley, 250 r.p.m. gravity feed. Height, floor to table, 26¼ in. Floor space, 2 ft. 8 in. x 4 ft. 6 in. Weight: net, 425 lb.; crated, 500 lb.; boxed for export, 625 lb. Export box, 54 x 32 x 40 in.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

D. C., Washington—The Bureau of Supplies & Accounts, Navy Dept.—two 14 in. x 36 in. grinders, 2 in. wheels, motor driven, for the Brooklyn Navy Yard, Brooklyn, N. Y.

D. C., Washington—The Bureau of Supplies & Accounts, Navy Dept.—two 14 in. x 36 in. grinders, 2 in. wheels, motor driven, for the California Navy Yard.

N. Y., New York (Borough of Bronx)—H. Medalis, 961 Washington Ave.—lathes, millers, drills and shapers for machine shop.

N. Y., Watertown—The T. N. C. Motor Sales Co.—lathe, drill press, miller and other machine tools suitable for garage repair work.

Pa., Philadelphia—The Amer. Eng. Co., Sepviva St. and Wheatsheaf Lane—machine tools.

Pa., Philadelphia—J. G. Neidinger Co., 1309 North 2nd St., manufacturer of shears and florists supplies—die cutting machine.

Va., Ashland—T. & B. Auto Service Co., H. Bermpass, Purch. Agt.—mechanical outfit for new auto repair shop.

Ill., Chicago—The Blaze Mfg. Co., 743 First Natl. Bank Bdlg.:
No. 410 and No. 408 Bliss press, or 796 Toledo, 108 in. Minimum capacity.
No. 205-F. Toledo, 72 in. to 80 in. capacity, or equivalent of other make.
No. 24-D. Toledo, 48 in. to 54 in. or equivalent of other make (new or used).
Also additional equipment for the manufacture of sheet metal burial caskets.

O., Cincinnati—The Wides Pipe & Supply Co., 1324 Freeman Ave.—1 double head nipple threading machine which can be used for threading close, short and long nipples from ⅛ in. to 2 in.

Wis., Green Bay—The Green Bay Drive Calk Co., 9th and State Sts., F. Van Laanen, Purch. Agt.—forge shop equipment.

Wis., Milwaukee—P. Goldmann, 786 22d St.—tin working machinery.

Wis., Milwaukee—The Modern Grinder Mfg. Co., 49 Oneida St., A. Strauss, Secy.—2 polishing heads.

Wis., Wisconsin Rapids—The Amer. Rotary Engine Co.—lathes, shaper and other air compressor machinery.

Wis., Two Rivers—R. G. Suetlinger—sheet metal working machinery.

Wis., Sturgeon Bay—Wolter & O'Boyle—additional machine shop equipment for ship yard.

Minn., Duluth—The Clarkson Coal & Dock Co., Birch Ave. and Rices Point, J. Davidson, Purch. Agt.—machine shop equipment and crane for Superior, Wis.

Tex., Fort Worth—The Fort Worth & Denver City R.R., Denver Record Bldg., F. E. Clarity, Genl. Mgr.—miscellaneous equipment.

Cal., Gridley—The Freisley Aircraft Corp., Box 368, B. M. Spencer, Chief Engr.—complete machine and wood-working equipment, to include lathes, millers, grinders, punch presses, furnaces, drill presses, planers, shaper, rip-saw, joiners, band saw glue presses, etc.

Machinery Wanted

O., Cleveland—The City Ice Delivery Co., Cadillac Bldg.—ice making machinery for new plants.

Wis., Fond du Lac—The Latex Tire & Rubber Co., East Scott St., G. Lambright, Purch. Agt.—rubber mill vulcanizers.

Wis., Seymour—The Seymour Woodenware Co., S. A. Konz, Purch. Agt.—sectional roll planer.

Wis., West Allis—The School Bd., F. Haker, Pres.—additional manual training machinery.

Que., Quebec—Price Bros., 56 St. Peter St.—equipment for its sawmill at Montmagny

Ont., Stratford—The Canadian Cereal & Flour Co., Ltd., George St.—grinding machines, sifters and other flour mill machinery for its Tillsanbury plant.

Metal Working

NEW ENGLAND STATES

Conn., Bridgeport—C. H. Gregory, 303 Clinton Ave., has awarded the contract for the construction of a 1 story, 32 x 100 ft. factory on East Washington Ave., for the manufacture of metal products. Estimated cost, $20,000.

Conn., New Haven—New York, New Haven & Hartford R.R., Meadow St., has awarded the contract for the construction of an addition to its machine shop at Cedar Hill Yard. Estimated cost, $225,000.

Mass., Boston—The Massachusetts Ave. Station Garage 2355 Massachusetts Ave., will soon award the contract for the construction of a 5 story garage, to cover 22,000 sq.ft. of floor space. Estimated cost, $800,000. J. C. Spofford, 36 Bromfield St., Archt.

Mass., New Bedford—N. Joseph, 1910 Purchase St., is building a 1 story, 47 x 100 ft. garage on Clark St. Estimated cost, $10,000.

MIDDLE ATLANTIC STATES

N. J., Florence—The Florence Pipe Fdry. & Machine Co. plans to build a 1 story, 50 x 100 ft. pattern shop.

N. J., Newark—The Mennen Co., 345 Central Ave., has had plans prepared for the construction of a 1½ story, 75 x 114 ft garage and warehouse at 81 Orange St. Estimated cost, $30,000. Private plans.

N. J., Trenton—Kuhn & Jacob Machine & Tool Co., 28 Wood St., plans to build a 1 story, 30 x 50 ft. machine shop on Pennsylvania Ave. Estimated cost, $10,000. R. A. Schumann, 932 Lambert St., Engr.

N. Y., Granville—The Telescope Cot Bed Co., Inc., 535 West 79th St., New York City, will soon award the contract for the construction of a 1 story, 200 x 300 ft. factory and boiler house, here. Estimated cost, $100,000. R. G. Cory, 50 Church St., New York City, Archt. and Engr.

N. Y., New York (Borough of Manhattan)—M. G. W. Realty Co., 277 Bway., will build a 2 story, 100 x 100 ft. garage on 1st Ave. and 30th St. Estimated cost, $50,000.

N. Y., Watertown—The T. N. C. Motor Sales Co. plans to build a 2 story garage and sales station on Washington St. Estimated cost, $80,000 to $100,000.

Pa., Philadelphia—The Amer. Eng. Co., Wheatsheaf Lane and Sepviva St., has awarded the contract for the construction of a 1 story, 50 x 100 ft. foundry and machine shop. Estimated cost, $25,000. Private plans.

Pa., Philadelphia—City Transit, 1211 Chestnut St., will soon award the contract for the construction of an inspection shop at Bridge St. yard, for Frankford "L."

Pa., Philadelphia—A. Mignatti, 321 Duncannon St., is having plans prepared for the construction of a 1 story, 100 x 125 ft. garage on Clarkson and 2d Sts. Estimated cost, $20,000. E. A. Wilson, 1208 Chestnut St., Archt.

Pa., Philadelphia—H. T. Potts & Co., Inc., 316 North 3d St., has awarded the contract for the construction of a 1 story foundry on D and Erie Sts. Estimated cost, $15,000.

Pa., Pittsburgh—The Pittsburgh Malleable Iron Co. will soon award the contract for the construction of a 2 story, 54 x 100 ft. factory, on 35th St. and Spruce Ave. Estimated cost, between $20,000 and $25,000. P. Dietz, House Bldg., Archt. and Engr.

MIDDLE WEST STATES

Ill., Chicago—The Miles Piston Ring Co., c/o W. G. Uffendell, Archt., 39 South La Salle St., has awarded the contract for the construction of a 1 and 2 story, 98 x 161 ft. piston ring factory at 5345-5353 South State St. Estimated cost, $60,000.

Mich., Adrian—The Michigan Wire Fence Co. is building a 50 x 60 ft. plant for the manufacture of wire fencing.

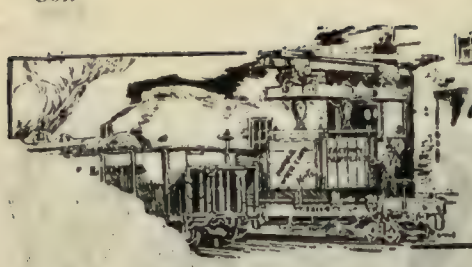
Mich., Detroit—O. L. Buler, 760 Chene St., has awarded the contract for the construction of a 1 story, 50 x 100 ft. garage. Estimated cost, $14,000. Private plans.

O., Cleveland—M. B. Abrams, Society for Savings Bldg., plans to build a 1 story, 70 x 100 ft. garage on East 152d St. and St. Clair Ave. Estimated cost, $40,000. Private plans.

O., Cleveland—The Center Garage Co., c/o H. Emerich, 15205 St. Clair Ave., is having plans prepared for the construction of a 1 story, 50 x 150 ft. garage on St. Clair and Holmes Aves. Estimated cost, $60,000. H. W. Steffens, 1029 Williamson Bldg., Archt.

O., Cleveland—A. Horwitz, 301 Society for Savings Bldg., will soon award the contract for the construction of a 1 story, 90 x 110 ft. garage on Carnegie Ave. Estimated cost, $40,000. R. B. Aley, 764 East 103d St., Archt.

O., Cleveland—F. Ziehm & Sons, 6016 St. Clair Ave., plan to build a 1 story garage. Estimated cost, $15,000. Private plans.



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	Current	One Year Ago
No. 2 Southern	$44.50	$36.60
Northern Basic	40 00	34 00
Southern Ohio No. 2	42.00	36 55
NEW YORK—Tidewater Delivery		
2X Virginia (Silicon 2.25 to 2.75)	51.26	39 40
Southern No. 2 (Silicon 2.25 to 2.75)	48.26	41.40
BIRMINGHAM		
No. 2 Foundry	40.50	33 00
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25-2.75 sil.	42 50	38 10
Virginia No. 2	46 25	39 10
Basic	38 25	34 60
Grey Forge	40 25	34 60
CHICAGO		
No. 2 Foundry local	40 00	36 25
No. 2 Foundry, Southern	46 66	38 00
PITTSBURGH, Including Freight Charge from Valley		
No. 2 Foundry	41 96	28 15
Basic	38 00	34 40
Bessemer	38.00	35 40

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3 80	$3 80	$3.47	$3.58	$3.62	$3.58	$3.47
Soft steel bars	3 70	3 70	3.52	3.34	3.52	3.48	3.52
Soft steel bar shapes	3.70	3 70	3.52	3.48	5.50	3.48	3.52
Soft steel bands	4.65	4 65	4.22	6.25	...	.....	.....
Plates, ¼ to 1 in. thick	4 00	4 00	3.67	3.78	3.82	3.78	3.67

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.25	$3 50
Warehouse, New York	4.75	3.52
Warehouse, Cleveland	3.52	3.42
Warehouse, Chicago	4.12	3.52

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55	4 90	5.50–6 00	5 00	4 [illegible]
No. 12	3.60	4 95	5 56	5 05	4 83
No. 14	3.65	5 00	5 92	5 10	5 03
No. 16	3.75	5.10	6 02	5.20	5 13
Black					
Nos. 18 and 20	4 20	5 80	6 80–7.30	5 60	5 80
Nos. 22 and 24	4.25	5 85	6 85–7.85	5 75	5 85
No. 26	4.30	5 90	6 90–7.90	5 80	5 90
No. 28	4.35	6.00	7.00–8.00	5 90	6 00
Galvanized					
No. 10	4.70	6 40	6 50	6 25	5 30
No. 12	4.80	6 50	6 60	6.35	5 40
No. 14	4 80	6 50	6 60	6 35	5 40
Nos. 18 and 20	5 10	6 75	6 90	6 65	5 70
Nos. 22 and 24	5.25	6.90	7 05	6 80	5 85
No. 26	5.40	7 05	7 20	6 95	5 90
No. 28	5.70	7.35	7.50–9.00	7.25	6.00

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.50	$5.80	$4.84
Flats, square and hexagons, per 100 lb. base	6.00	6.30	5 34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55
Special Nickel and Alloys			
Malleable nickel ingots			45
Malleable nickel sheet bars			47
Hot rolled rods, Grades "A" and "C" (base)			60
Cold drawn rods, grades "A" and "C" (base)			72
Copper nickel ingots			42
Hot rolled copper nickel rods (base)			52
Manganese nickel hot rolled (base) rods "D" — low manganese			64
Manganese nickel hot rolled (base) rods "D"— high manganese			67

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb lots sells as follows, f. o.b. New York: ⅛, 8½c. per lb.; ¼, 8c.; ⅝ to ½, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	9.00
Spring steel (light)	10.00	7 00	12.00
Coppered bessemer rods	9 00	8 00	7 00
Hoop steel	4 65	4 04	4 43
Cold-rolled strip steel	9 50	8.25	9 25
Floor plates	5 75	4.00	6 28

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
¼ to 3	54–57½%	41½–44%	⅛	15½–25½%	+1½–11½%
			¼	19½–29½%	1½–11½%
			⅜ to 1½	24½–34½%	8 –18½%

LAP WELD

2	47 –50½%	34½–38%	1½	.....	.....
2½ to 6	50 –53½%	37½–41%	1¾	.....	.....
7 to 12	47 –50½%	33½–37%	2	20½–28½%	6½–14½%
13 to 14	37½–41 %	.....	2½ to 6	22½–30½%	9½–17½%
15	35 –38½%	.....	7 to 12	22½–30½%	9½–17½%
				19½–27½%	6½–14½%

BUTT WELD, EXTRA STRONG PLAIN ENDS

¼ to 1½	52 –55½%	39½–43%	¼ to 1½	24½–34½%	9½–19½%
2 to 3	53 –56½%	40½–44%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	45 –48½%	33½–37%	1½	.....	.....
2½ to 4	48 –51½%	36½–40%	1¾	.....	.....
4½ to 6	47 –50½%	35½–39%	2	21½–29½%	8½–16½%
7 to 8	43 –46½%	29½–33%	2½ to 4	23½–31½%	11½–19½%
9 to 12	38 –41½%	24½–28%	4½ to 6	22½–30½%	10½–18½%
			7 to 8	14½–22½%	2½–10½%
			9 to 12	9½–17½%	5½–+2½%

Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv	Chicago Black	Chicago Galv
¼ to 3 in. steel butt welded	38%	22%	42%	39%	57½%	44%
2½ to 6 in. steel lap welded	33%	18%	44%	29%	53½%	41%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 45%. Cast iron, standard sizes, plus 5%.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	15.00	15 00	19 00
Tin in 5-ton lots	34 25	35 25	59 00
Lead	5.375	5 75	7 875
Zinc	7.00	7 00	9 25
ST. LOUIS			
Lead	5.25	6 25	7 50
Zinc	6.75	6.75	8 875

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

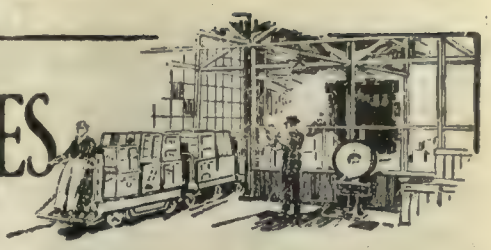
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	21.50	22.50	28 50	22.50	29.50	26.50	35.00
Copper wire (carload lots)	17.00	17 00	28 00	20 00	28 50	24 00	26.00
Brass sheets	20 25	20 25	25 50	23 00	28 00	30 00	26.00
Brass pipe	25 00	25.00	30 50	25.00	34 00	23 25	37.00
Solder (half and half) (case lots)	27.75	27.25	35.00	29.00	35.90	21.00	38 50

Copper sheets quoted above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill. 1000 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	18 25	22.75
New York	18 25	24 00
Cleveland	21.00	28 00
Chicago	21.25	25 00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f.o.b. mill + less 8% for carload lots..... 11.50

	Warehouse			
	—In Casks—		— Broken Lots —	
	Current	One Year Ago	Current	One Year Ago
Cleveland	15.30	11.50	14.70	12.00
New York	14.00	13.00	14.50	13.50
Chicago	14.50	15.00	14.95	15.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	6.25	9.50–9.75
Chicago	6.25	10.00
Cleveland	7.50	11.625

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	—*New York—			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	12.00	18.00	10.00	10.50
Copper, heavy, and wire	11.50	17.50	9.50	10.00
Copper, light, and bottoms	10.00	15.75	9.00	9.00
Lead, heavy	4.00	7.00	4.00	4.00
Lead, tea	3.00	5.00	3.00	3.50
Brass, heavy	7.00	9.00	7.00	10.00
Brass, light	5.50	8.00	5.00	5.50
No. 1 yellow brass turnings	6.50	9.50	5.50	5.50
Zinc	4.50	6.75	3.00	4.25

*These prices nominal because of dull market

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	29.00	26.00	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	28.00	34.00
Chicago	24.50	28.00
Cleveland	23.00	31.00

BABBITT METAL—Warehouse price per pound:

	—New York—		—Cleveland—		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	70.00	90.00	43.00	68.50	70.00	60.00
Commercial	30.00	50.00	14.50	17.25	9.00	13.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York we quote the best two grades, although lower grades may be obtained at from 16.00 to 20.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	— New York —		— Cleveland —		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+$1.25	List	List net	$1.00	+1.15	1.45
Hot pressed hexagon	+ 1.25	List	List net	1.00	+1.15	1.45
Cold punched hexagon	+ 1.25	List	List net	1.00	+1.15	1.05
Cold punched square	+ 1.25	List	List net	1.00	+1.15	1.05

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	70–5%
Chicago	40%	50%
Cleveland	50%	60–10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	35%	50%	40%
Larger and longer up to 1½ in. by 30 in.	25%	40%	30%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $2.75 Chicago..... $2.50

For cast-iron washers, ½ and larger, the base price per 100 lb. is as follows:
New York..... $7.00 Cleveland..... $4.50 Chicago..... $5.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	+ 20%	40%	25%
Larger and longer up to 1 in. by 30 in.	+ 20%	35%	25%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	25%	30%	10%	30%
Chicago	net	20%	net	20%
New York	40%-5%	30%	net	10%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	35%	50%	30%
Tinned	35%	50%	30%

Structural, same sizes:
New York..... $5.50 Chicago..... $5.73 Pittsburgh..... $4.50

Boiler, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York..... $6.00 Chicago..... $5.83 Pittsburgh..... $4.60

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	25.00	28.00	29.00
Brass	24.00	25.00	28.00

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1 c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in. inclusive in rounds, and ⅜-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.60 per 100 lbs.

In Cleveland—$10 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	—— New York ——			
	Current	One Year Ago	Cleveland	Chicago
White	13.00@15.00	13.00	15.00	15.00@17.00
Colored mixed	7.00@12.00	9.00–12.00	11.00	11.00@13.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.00	$2.00	$2.25
Philadelphia	2.75	2.75	2.00
Cleveland	4.00	3.00	2.50
Chicago	2.25	2.75	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.50	$3.50	$3.40
Philadelphia	3.65	3.65	4.625
Chicago	4.00	3.85	4.125

COKE—The following are prices per net ton at ovens, Connellsville:

	Current	One Month Ago	One Year Ago
Prompt furnace	$5.00@$5.50	$6.00@$7.00	$6.00@$7.00
Prompt foundry	6.25@7.00	7.00@8.00	6.00@7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

	—New York—		—Cleveland—		—Chicago—	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels, (5 bbl. lots)	$0.83	$1.90	$1.05	$2.00	$0.97	$1.77
5-gal cans	0.90	2.10	1.30	2.25	1.22	1.97
1-gal cans (6 to case)	1.05	....	....	....	....	....

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		One Year	
	Dry	In Oil	Dry	In Oil	Current Dry and In Oil	Ago Dry and In Oil
100 lb. keg	14.00	15.50	14.50	15.50	14.00	14.50
25 and 50-lb. kegs	14.25	15.75	14.75	15.75	14.25	14.75
12½-lb. keg	14.50	16.00	15.00	16.00	14.50	15.00
5-lb. cans	17.00	18.50	15.00	17.50	17.00	16.50
1-lb. cans	19.00	20.50	16.00	18.50	19.00	17.50

500 lb. lots less 10% discount. 2,000 lb. lots less 10-4% discount. 10,000 lb. lots less 10 7½% discount.

O., Cleveland—V. Terrill, City Hall, plans to build a 2 story, 50 x 125 ft. garage on East 140th St. and Euclid Ave. Estimated cost, $50,000. Private plans.

Wis., Superior — The Clarkson Coal & Dock Co., Birch Ave. and Rices Point, Duluth, has had plans prepared for the construction of a 2 story machine shop and office building, here. Estimated cost, $45,000. R. C. Buck, U. S. Natl. Bank Bldg., Archt.

Wis., Wisconsin Rapids—The Amer. Rotary Engine Co. is having plans prepared for the construction of a 1 story, 60 x 120 ft. factory. Estimated cost, $20,000. La Salle Eng. Co., 337 West Madison St., Chicago, Engrs.

WEST OF THE MISSISSIPPI

Ia., Des Moines—The Keith Furnace Co., c/o R. S. Keith, 326 11th St. S. W., is having plans prepared for the construction of a 1 and 2 story factory, to include a foundry, etc., on East 26th St. and Dean Ave. Estimated cost, $55,000. Boyd & Moore, 1020 Grand Ave., Archts.

Minn., Montrose—W. Wandersee plans to build a 1 story, 50 x 90 ft. garage. Private plans.

N. D., Fargo—G. Schass has had plans prepared for the construction of a 2 story, 56 x 140 ft. garage on 4th St., N. W. F. Kurke, Archt.

N. D., Fargo—J. C. Vincent, 211 Northern Pacific Ave., plans to build a 4 story, 50 x 140 ft. garage on 3d St. and Northern Pacific Ave. Estimated cost, $90,000. Keith & Kurke, Equity Bldg., Archts.

N. D., Minot—The Great Northern Ry. Co., 175 East 4th St., St. Paul, Minn., plans to construct a roundhouse and repair shops here. Estimated cost, $100,000. A. H. Hogeland, ch. engr.

Tex., Childress—The Fort Worth & Denver City R.R., Denver Record Bldg., Ft. Worth, is having plans prepared for the construction of additions to its machine shops, etc., here. Estimated cost, $500,000. R. C. Goway, Denver, Ch. Engr.

WESTERN STATES

Cal., Gridley — The Friesley Aircraft Corp., Box 368, plans to build a plant for the manufacture of large passenger and freight airplanes. B. M. Spencer, Ch. Engr.

Cal., Los Angeles—P. L. Wilson & Co., 631 South Sprague St., will soon award the contract for the construction of a 1 story, 140 x 150 ft. garage, on Bonnie Brae and 7th Sts. Estimated cost, $40,000. Walker & Eisen, Hibernian Bldg., Archts. Noted Dec. 23.

CANADA

Ont., Ottawa — The Beach Fdry. Ltd., Broad St., is building a factory for the manufacture of stoves, ranges and furnaces. Estimated cost, $125,000. B. C. Beach, Pres.

General Manufacturing

NEW ENGLAND STATES

Conn., Danbury — The Beaver Brook Paper Mills, Inc., Beaver Brook St., plans to build a 1 story, 75 x 150 ft. addition to its manufacturing plant.

Conn., Stamford—The Huber Ice Cream Co., 800 Seaview Ave., Bridgeport, will build a 1 story, 40 x 100 ft. ice cream plant on Shippan Ave. Estimated cost, $20,000.

Mass., Leominster — The Viscoloid Co. will build a 1 story, 20 x 95 ft. addition to its plant, for the manufacture of viscoloid sheeting. Estimated cost, $10,000.

Mass., North Adams — The Trojan Ice Cream Co., 276 5th Ave., Troy N. Y., is having plans prepared for the construction of a 2 story, 40 x 50 ft. plant here. Estimated cost, $60,000. E. J. Clark, Cannon Bldg., Troy, N. Y., Archt.

N. H., Manchester — The New England Iron & Metal Co. plans to build a 5 story, 25 x 125 ft. manufacturing plant.

MIDDLE ATLANTIC STATES

Md., Baltimore — The Coconut Products Co., 708 Amer. Bldg., plans to build a 1 story addition to its refinery on 7th Ave. and 6th St. Estimated cost, $15,000. Private plans.

Md., Halpine — The International Shoe Heel Corp., Continental Trust Bldg., Washington, D. C., is having plans prepared for the construction of a 1 story, 40 x 500 ft. shoe factory. Estimated cost, $200,000.

N. J., Perth Amboy—The Barber Asphalt Paving Co. plans to build a plant on a 16 acre site. Estimated cost, $1,000,000.

Pa., Woodlawn — The Beaver Building Block Co., Box 832, is building a 60 x 100 ft. factory. Estimated cost, $30,000. Bontemps & Howard, Woodlawn, Engrs.

SOUTHERN STATES

Ala., Hallawkee—J. A. Allgood plans to rebuild its planing mill recently destroyed by fire. Estimated cost, $25,000.

Ky., Lexington — The Martin Constr. & Eng. Co. plans to build a refining plant to have a 150,000 bbl. capacity.

Ky., Louisville—The Natl. Candy Co., c/o Bradas & Gheens, 817 South Floyd St., has awarded the contract for the construction of a 5 story factory on a 135 x 220 ft. site on Bway between 14th and 15th Sts. Estimated cost, $600,000. Noted Dec. 9.

Tenn., Knoxville — The Knoxville Drug Club plans to build a plant for the manufacture of ice cream. D. M. Chambliss, Pres.

MIDDLE WEST STATES

Ind., Marion—The Standard Glass Co. plans to build a 1 story glass factory. Estimated cost, $75,000. Private plans.

Mich., Detroit—The Detroit Casket Co., 177 Congress St., is building a 2 or 3 story, 114 x 166 ft. addition to its factory on Ash St. between Grand River and Trumbull Aves. Estimated cost, $100,000.

Mich., Jackson — The Michigan State Prison plans to construct 2 and 3 story buildings, to include industrial works. Estimated cost, $5,000,000. H. L. Hulburt, Warden.

O., Cleveland—The Euclid Wood Products Co., Nottingham Rd., will build a 1 story, 36 x 100 ft. addition to its factory. Estimated cost, $10,000.

O., Cleveland—The Mireau Laundry Co., 2232 St. Clair Ave., plans to build a 2 story, 32 x 120 ft. addition to its factory at 2242 St. Clair Ave. Estimated cost, $25,000. Private plans.

Wis., Racine—Journal Printing Co., 328 Main St., will soon award the contract for the construction of a 2 story, 60 x 110 ft. office building and paper plant. Estimated cost, $125,000. F. R. Starbuck, Secy. L. Bassindale, 321 Capitol Bank Bldg., St. Paul, Minn., Archt.

WEST OF THE MISSISSIPPI

Kan., Wichita — The Concrete Products Co., Caldwell Murdock Bldg., plans to build a 2 story, 150 x 210 ft. cement plant and warehouse on Rock Island Ave. and 13th St. Estimated cost, $50,000. K. M. Baker, Secy.

Minn., Little Falls—The Hennepin Paper Co. plans to build a sulphite pulp plant. Estimated cost, $500,000.

Minn., South Hibbing—The Oliver Iron Mining Co., Wolvin Bldg., Duluth, is having plans prepared for the construction of a 1 story laundry. Estimated cost, $45,000. Private plans.

Okla., Henryetta—The Henryetta Oil & Refining Co. plans to improve its plant. Estimated cost, $50,000. C. Harrismen, Secy.

Okla., Lincolnville (Miami, P. O.)—Natl. Tripoli Co., Chamber of Commerce Bldg., Joplin, will soon award the contract for the construction of a 2 story factory, here. Estimated cost, $130,000.

CANADA

N. S., Hartville — Silliker, & McMann, Crogg Bldg., Halifax, plan to build a pulp and lumber mill along the St. Croix River, here. P. H. Moore, local mgr.

Ont., Chatham—The Excelsior Knitting Co. will receive bids until January 18 for the construction of a plant. Estimated cost, $60,000.

Ont., Cornwall—The Canadian Linoleum & Oil Cloth Co. plans to build a 2 story addition to its plant. Estimated cost, $35,000.

Ont., Frankford—The Canada Box-Board Co., Seigneurs St., Montreal, will receive bids in Feburary for the construction of a groundwood plant, here. Estimated cost, $300,000.

Ont., Port Arthur—Pigeon River Lumber Co. plans to construct a 1 and 2 story saw mill. Estimated cost, $50,000.

Que., Montmagny — Price Bros., 56 St. Peter St., Quebec, will receive bids in January for the construction of a sawmill here. Estimated cost, $85,000.

Que., Montreal East — The Royal Duke Oil Co., 157th and James Sts., Montreal, will soon award the contract for the construction of a factory and office building, here. Estimated cost, $50,000.

Que., Three Rivers—The Canadian International Paper Co. will receive bids until Feb. 1 for the construction of an addition to its sulphite mill. Estimated cost, $100,000.

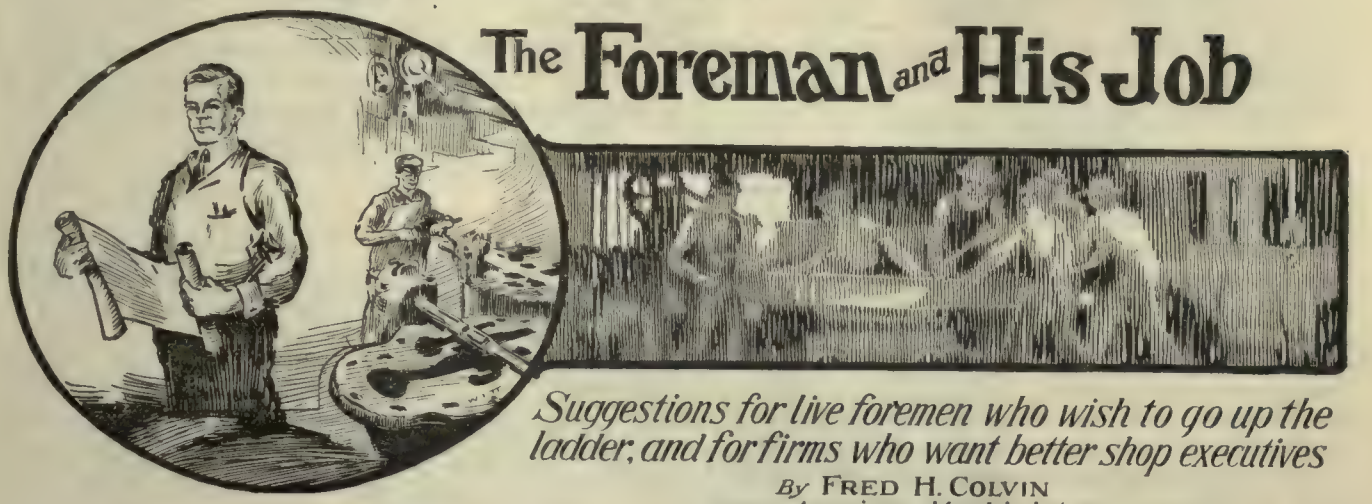
"SEARCHLIGHT"

Business Opportunities
Employment Opportunities
Selling Opportunities, etc.

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January 20, 1921 American Machinist Vol. 54, No. 3

The Foreman and His Job



Suggestions for live foremen who wish to go up the ladder; and for firms who want better shop executives

By Fred H. Colvin
Editor, American Machinist

THE great need of civilization today is the production of more and more of the necessities of life as well as of the things, not vital perhaps, but which go to make life more enjoyable. There is a growing need for machinery which will do more and more of the tiresome and laborious tasks which today make life a burden for countless thousands. These needs can only be satisfied by the safe and sensible direction of men along the line of most economical production. And the necessity for such direction only emphasizes the need of more thoroughly efficient foremen in all kinds of machine building shops. We must not, however, make the mistake of thinking that production is secured by studying machines and machinery alone. This has been the mistake of many efficiency engineers in the past. The most important part of a foreman's duties has to do with the relations to and the contact with his men. There are many instances where shops deficient in machine equipment, are producing work at lower costs than shops that are well equipped but which fail to secure the co-operation of their men. Here is where the foreman can play a most important part and the broadminded plant managers are beginning to appreciate the true value of the right kind of a foreman. The foreman's duties are many and they vary according to the system under which the shop is run. Both the foreman and the management, however, should thoroughly understand and appreciate that the foreman represents the firm to the men. He has the most intimate contacts and can do much to make or mar the good feeling that must exist if hearty co-operation is to be secured. If the foreman is tricky, harsh, unfair, or a driver, it is naturally assumed by the men that this is the attitude of the firm, while if the reverse is true, the firm gets credit for having all the virtues whether it deserves it or not. Unless both the management and the foreman thoroughly understand that real production depends much more upon co-operation than upon machines, methods and systems, neither will attain the fullest success. For while a knowledge of machines, of cost systems, of methods of payment; a study of the men themselves, the best way of handling them, which ones to encourage, which to criticize, and how; the best way of instructing in new methods is even more important. This phase of the foreman's duties and opportunities will be enlarged upon later. The old time foreman was a czar in his own shop or department. He could hire or fire at will, with no one to question his right to do exactly as he pleased. Personal, religious or political differences of opinion, grouches due to indigestion or domestic troubles; whims about the color of a man's hair or his place of birth, all played a part in holding a job, or in losing it. But czars are no longer in favor, either in the shop or elsewhere, and it is generally conceded that it is not a good thing for either a shop or the community in which it is located, to have the welfare or even the livelihood of its inhabitants depend on such a pre-



THE MOST IMPORTANT PART OF A FOREMAN'S DUTIES HAS TO DO WITH THE RELATIONS TO AND THE CONTACT WITH HIS MEN

carious basis. For we have learned that it costs real money to hire and fire men; not only in clerk hire, for that is a small part of the business; but in the time taken to train men and in the delay in production. This cost is estimated at from $25 to $250 per man, according to the kind of work. Even at a medium figure it is well worth considering.

The Employment Office

It was the change in ideas regarding hiring and firing that led to the establishment of employment offices and employment managers. And as with all changes of this kind it brought friction and decided differences of opinion in many shops. Foremen were jealous of their former rights and power, *and argued that they could not maintain discipline without the club of dismissal to hang over a man's head.*

Then, too, they very naturally wanted to pick their own men.

On the other hand, advocates of the new plan hugged the delusion that the establishment of an employment department solved all the difficulties of the shop personnel. They desired and claimed the right to select men, to apportion them to such departments as their questioning indicated they were best fitted for and to take away all the power of the foreman regarding the hiring and firing.

And, as is almost always the case, neither side was entirely right nor all wrong.

Irresponsible Clerks

In too many cases the employment office has been turned over to inexperienced clerks who do not appreciate the responsibilities of their position and who



THE OLD-TIME FOREMAN WAS A CZAR IN HIS OWN SHOP

have become even more czar-like than the old time foreman.

There has, however, been much improvement along this line and we have developed some big men in the industries, who have done much to reduce the great, wasteful labor turn-over.

The general opinion seems to be that the foreman should not be burdened with the interviewing of applicants as they come for employment. His training in shop work makes his time more valuable in getting out production. In most cases, however, the foreman is called in to the final interview before a man is hired for his department. In one very successful plant the shop superintendent, the foreman and the employment



THEY COULD NOT MAINTAIN DISCIPLINE WITHOUT THE CLUB OF DISMISSAL TO HANG OVER A MAN'S HEAD

manager meet the applicant before a final decision is made. A neat room is provided and the man made to feel as much at ease as possible with the three interviewers mentioned.

Co-operation on All Sides

As with every other phase of shop life, good results can be secured by each trying to see the other man's point of view and by working together to secure the best results for the shop as a whole. A little care on all sides will obviate the resentment which sometimes arises from the feeling that one or the other is encroaching on the rights of authority which the position confers.

(Other articles on this subject will appear in later issues.)

Grinding and Lapping

By Frank C. Hudson

The making of definitions is perhaps one of the most difficult problems which confronts us. It is easy enough when one who reads what you have written already knows what you are talking about. He recognizes the definitions because he knows what is being described. But if he doesn't, it's another matter entirely. Recognizing the piece by the definition is a different story.

Try it on the simplest thing you know and then see how many other things can be fitted equally well to the same definition.

As a concrete case, what is the difference between grinding and lapping? Does it depend on the kind of work, the kind of abrasive, the way the abrasive is used or the speed of cutting? Or are there other factors which enter into the processes and what are they?

The Industrial Co-operative Course of the Lansing High School

A Course, Open to the Youths of the City of Lansing, Intended to Provide Thorough Training and Experience in Technical Trades

By E. M. HALL
Director of Vocational Education



TO PROVIDE for the youth who will eventually fill the non-commissioned offices in life, such as highly skilled tradesmen and foremen, many school customs were departed from in nineteen twelve when an industrial course for local high school boys was inaugurated in Lansing, Mich. It was patterned after a similar course then being tried out at Fitchburg, Mass. Due to the inherent characteristics of the work, it was established in a separate department of the school. Since its inception, similar courses have proved to be national needs.

The course is distinct from the Academic Course in that it is not a college preparatory course. A post-graduate course of one year is necessary for a graduate of the industrial course to make proper preparation for college entrance. It is distinct from the commercial course in that it does not aim to prepare the student for work in business offices or in mercantile establishments.

Qualifications for Enrollment

At present, any boys having the equivalent of an eighth-grade education may elect the course. Boys who have completed work in other courses may transfer to this without loss of ninth-grade credits, providing they have good reasons for the change. Provision is also made for those who have done work in the continuation school to apply it toward this course. An important consideration for those who have left school before they are eighteen, is that since they are required by the James law to spend four days a month at school they might better spend ten days a month in school on this regular high school course and get their trade thoroughly and at the same time get a high school diploma.

There are now one hundred twenty-five enrolled. Of course some of the students do not finish the four year course, but when circumstances prevent a student's continuance, arrangements can usually be made so that he can find big advantage from the work done on the course up to the time of leaving. The type of student is indicated by Figs. 1, 2 and 3, which show school views and by the headpiece which shows some of the students engaged in the study of electrical apparatus.

Work of the First Year

During the first semester the study of proper methods of organization and the duties and privileges of our democratic society is taken up in a very vital and interesting manner. Visits to the various civic sessions such as meetings of the council, the court and the state legislature result in plenty of first hand and up to date matters for discussion. Time is spent also in English and algebra, the required subjects in all high school courses. Both of these subjects are vitalized through special adaptation to the interests of the student. These boys proceed in the same manner as other freshmen, except that all take up the study of mechanical drawing instead of an elective subject. This study is of utmost importance, for it is to the mechanic what shorthand is to the office worker.



FIG. 1. SHOP MATHEMATICS



FIG. 2. MECHANICAL DRAWING

In the second semester industrial arithmetic replaces community civics. Guidance in the choice of a vocation is given through the agency of readings and trips to the various industries of the city. A systematic effort is made to assist each student in his choice of some trade which he would like to try out as soon as he has completed the semester of school work. The fundamentals of shop work are studied and methods of learning a trade are explained. While getting this prevocational work of the ninth grade, the student spends his full time in school. The following is an outline of the four year course:

Outline of the Four-Year Course

First Year

First Semester	Second Semester
English 1 Composition	English 2 (Voc. Guidance)
Community Civics 1	Shop Mathematics 1
Algebra 1	Algebra 2
Mechanical Drawing 1	Mech. Drawing 2
Physical Education 1	School Shop
	Physical Education 2

Second Year (every other week in school building)

First Semester	Second Semester
Shop Work 1	Shop Work 2
English 3	English 4
Shop Mathematics 2	Shop Mathematics 3
Physics 1 (Mechanics)	Physics 2 (Mechanics)
Mech. Drawing 3	Mech. Drawing 4
Physical Education 3	Physical Education 4

Third Year (every other week in school building)

First Semester	Second Semester
Shop Work 3	Shop Work 4
English 5	English 6
Shop Mathematics 4	Shop Mathematics 5
Chemistry 1	Chemistry and First Aid 2
Physics 3 (Electricity)	Physics 4 (Electricity)
Drafting 5	Drafting 6

Fourth Year (every other week in school building)

First Semester	Second Semester
Shop Work 5	Shop Work 6
English 7	English 8
Physics 5 (Heat)	Physics 6 (Sound and Light)
Chemistry 3	Chemistry 4
Drafting 7 (Design)	Drafting 8 (Design)

Vocations Open to Students

Pattern making, automobile mechanics, mechanical drafting, sheet metal layout and construction, cost figuring, molding, woodworking, forging, toolmaking, tool design, general machine work, gas engine work, electrical work, house building, plumbing, steam-fitting and printing have been pursued thus far. Other occupations may be elected by students and given in case of no serious obstacle. Surveying, for instance can not be given well on this course at present because of its seasonal characteristics. Molding, printing and plumbing offer exceptional opportunities for such men as will graduate from this course and it is expected that more boys will elect one of these substantial trades. There are shown in Figs. 4 to 12 inclusive, nine views of students engaged in productive tasks at their respective shops.

As soon as the first year's work has been done the student enters upon his trade work as an apprentice. He is given a trial period, at the end of which (if he has shown evidence of future success in that line of work) arrangements are made for his continuance of it upon the part time basis, every other week being spent as an apprentice on real, profitable work in Lansing industries. If he fails in his trial, or dislikes that particular trade, he is encouraged to try another trade or to change to an academic or commercial course.

Features of the Part-Time Work

During the three years as an apprentice, the student gets fair wages, gradually being increased in accordance with the interest and ability displayed. The wages, which are obtained from the beginning of the trial period, make it possible for the student to support or partly support himself while getting his high school education. One thing which counts greatly toward the attainment of the trade is the fact that the boys contine their trade work through the entire fifty-two weeks of the year except for two weeks of vacation in the summer and one week at Christmas time. Most of the boys have been greatly interested in their shop work and prefer less vacation, but all are supposed to take the two weeks. Sometimes the co-ordinator recommends an extended vacation for some good reason such as poor health. Every other week is spent by the student in school on subjects which are closely related to his trade, although enough general work is included to enable him to take his place as an American citizen when he steps out into the full responsibilities of life.

Subjects vary somewhat with the trade pursued; but in all technical trades a knowledge of the principles of the simple machines, mechanics of fluids, heat, sound, light, shop mathematics, letter writing, drafting, chemistry, metallurgy, electricity, first aid, and a good command of the English language are great factors toward promotion and pleasure.

Much of the school and shop work is interdependent. In order to maintain this relation and to adjust various matters which arise with the student in his shop and school work, a co-ordinator is engaged who visits the boys frequently while they are at their trade work in the industries. At present the director of vocational education acts in this capacity. Shop note books and technical reports are turned in periodically and are corrected in regard to proper English, sketches and facts. The weekly report shown in Fig. 13 is of great assistance to co-ordination.

Practical suggestions are given in many ways. Each student is regarded as an individual case and novel and varied methods of teaching proper relations and procedure while he is learning the trade are resorted to. Many little errors and opportunities for improvement are called to the attention of the student by the foremen and co-ordinator so that he may progress just as rapidly as his native ability and interest allow. Every student is taught how to use the periodicals devoted to his particular trade and is assisted in the study of some good instruction book on the shop phase of his trade. A recent movement has been made for each co-operating concern to appoint one of its men who has had some previous educational experience to take special interest in each of these apprentices and to assist the co-ordinator in behalf of these boys. The Reo Motor Car Co. employs former educators who go into great detail to perfect their embryo mechanics. In other concerns the manager himself gives detailed attention to this work.

For a final task in his school work in chemistry the student selects some important material which is used in his trade, makes a special study of it, including experiments and writes a theme in regard to it. A long



FIG. 3. PHYSICS LABORATORY



FIG. 4. AUTOMOBILE BODY-MAKING, AUTO BODY CO.







FIG. 5. ASSISTING THE FOREMAN, NOVO ENGINE CO. FIG. 6. GAS ENGINE ASSEMBLY, REO MOTOR CAR CO.
FIG. 7. STORAGE BATTERY REPAIR, LANSING BATTERY SHOP

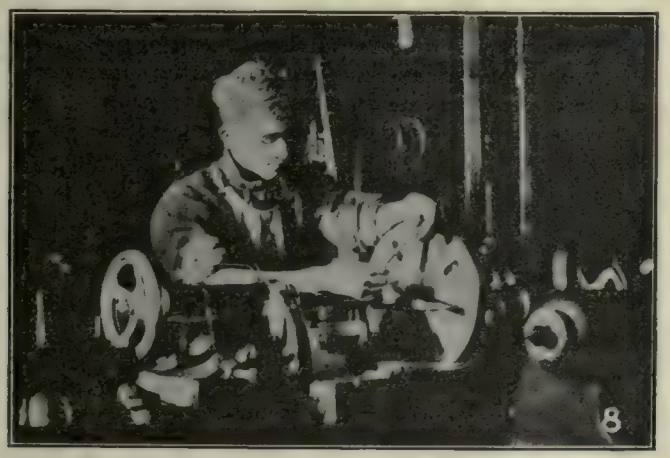




FIG. 8. TOOLMAKING, REO TRUCK CO.

FIG. 9. TOOLMAKING, MICHIGAN SCREW CO.

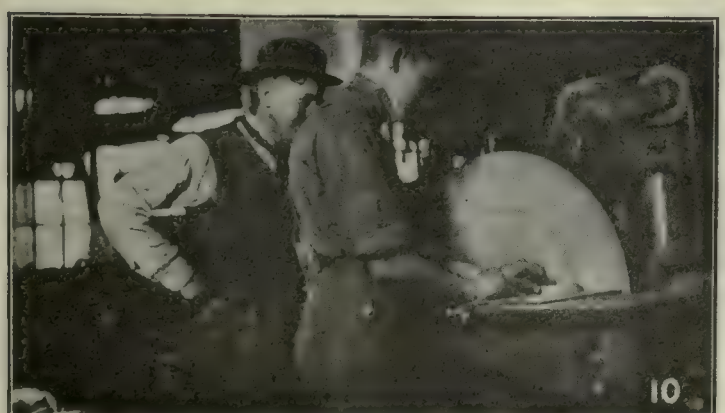




FIG. 10. PATTERN MAKING, NOVO ENGINE CO.

FIG. 11. INSPECTING FORGINGS, ATLAS DROP FORGE CO.

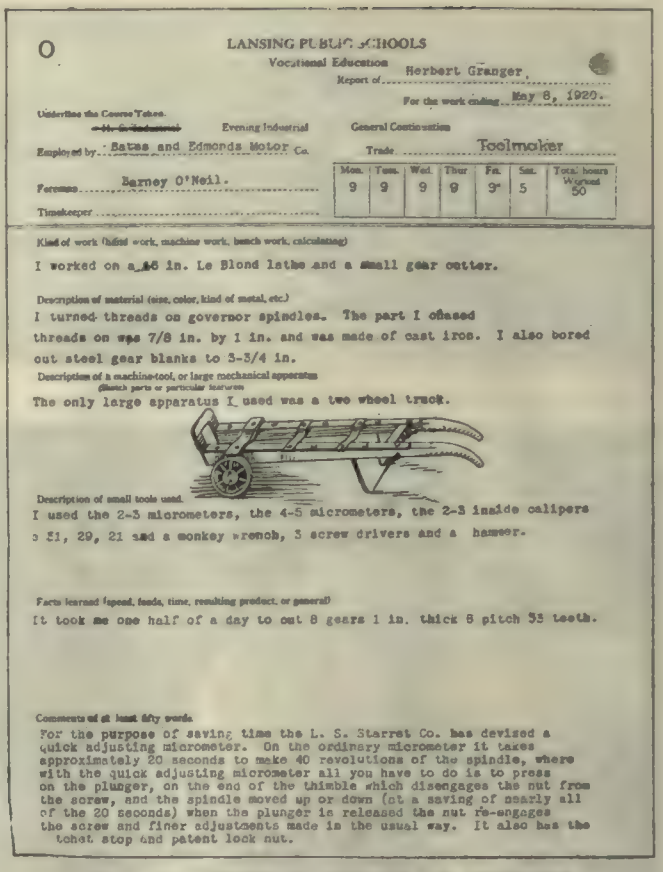
theme which relates the trials and triumphs of his four years of combined school and trade work closes the class work in English.

Beside a large number of social functions of the high school which interest many of the industrial course students the "Knights of Industry" caters especially to the social needs of the part-time students. Their evening meetings with debates, discussions and talks by local captains of industry help them to create lasting fellowships and proper habits. The annual picnic has come to be an institution. At one, the game of baseball between the "All Stars" and the "Boilermakers," with faculty members and students on each side, proved to be well worth while.

Concerning the moral guidance of the students taking this course, it may be said that not much can be done



FIG. 12. PATTERN MAKING, REO MOTOR CAR CO.



LANSING PUBLIC SCHOOLS
Vocational Education
Report of Herbert Granger
For the work ending May 8, 1920.

Underline the Course Taken.
~~Day Industrial~~ Evening Industrial General Continuation
Employed by Bates and Edmonds Motor Co. Trade Toolmaker
Foreman Barney O'Neil.
Timekeeper

Mon.	Tues.	Wed.	Thur	Fri.	Sat.	Total hours Worked
9	9	9	9	9*	5	50

Kind of work (hand work, machine work, bench work, calculating)
I worked on a 16 in. Le Blond lathe and a small gear cutter.

Description of material (size, color, kind of metal, etc.)
I turned threads on governor spindles. The part I chased threads on was 7/8 in. by 1 in. and was made of cast iron. I also bored out steel gear blanks to 3-3/4 in.

Description of a machine-tool, or large mechanical apparatus (sketch parts or particular features)
The only large apparatus I used was a two wheel truck.

Description of small tools used.
I used the 2-3 micrometers, the 4-5 micrometers, the 2-3 inside calipers a 21, 29, 21 and a monkey wrench, 3 screw drivers and a hammer.

Facts learned (speed, feeds, time, resulting product, or general)
It took me one half of a day to cut 8 gears 1 in. thick 8 pitch 33 teeth.

Comments of at least fifty words.
For the purpose of saving time the L. S. Starret Co. has devised a quick adjusting micrometer. On the ordinary micrometer it takes approximately 20 seconds to make 40 revolutions of the spindle, where with the quick adjusting micrometer all you have to do is to press on the plunger, on the end of the thimble which disengages the nut from the screw, and the spindle moved up or down (at a saving of nearly all of the 20 seconds) when the plunger is released the nut re-engages the screw and finer adjustments made in the usual way. It also has the tonet stop and patent lock nut.

FIG. 13. WEEKLY REPORT OF STUDENT

for one with very little moral stamina. However, the boys who have had an average home training will see that in order to keep proper standings both in their school and shop work, they must select that which is good in life and shun the evil things. The contact which they get with all sorts of people will strengthen, rather than weaken their characters by early cultivation of the habit of overthrowing temptations.

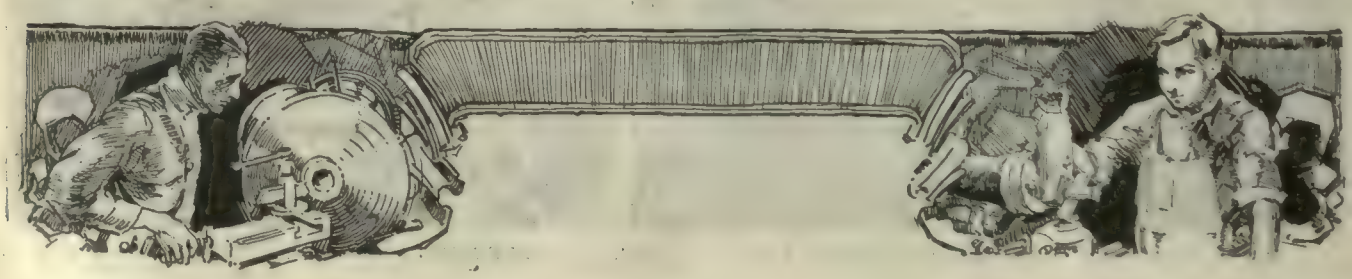
Equipment

In 1918 many of the old handicaps were removed. Well appointed classrooms are now provided. Chemistry and physics laboratories which allow each individual to experiment, are at hand. The mechanical drafting room is perfectly lighted even in dull weather. Its equipment is sufficient for all sorts and grades of classes in architectural, sheet metal and machine part drafting. The machine shop is in readiness for teaching blueprint reading, lay out work and bench work. Recently twenty-two machine tools have been added. There are lathes, milling machines, grinding machines and drilling machines. Provisions have been made in the electrical laboratory for the study of a great variety of electrical apparatus, repair and installation.

Of course pride is taken on the special equipment needed and provided in the school plant, but in this regard it may be said that one of the excellent characteristics of this part-time course is that the equipment used by the upper classes for *learning* their trades is identical with that which will be used when they *ply* their trades. On alternate weeks they find themselves with more ideal equipment and in more real surroundings than could be placed in a school building even with thousands of dollars at the disposal of the head of the department.

Requirements of the Smith-Hughes Law Fulfilled

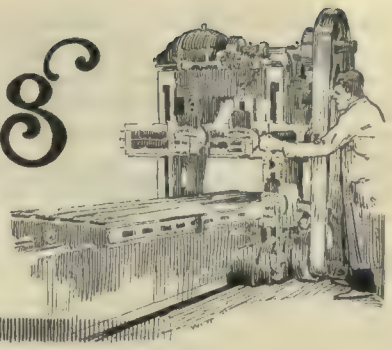
Although not many cities were giving such a course in 1918, it is somewhat gratifying to know that Lansing was one of three cities to have its work approved by the state authorities. Detroit and Muskegon were the other two. Such approval not only stamped the work as successful but brought a fund of $1,884 which was a reimbursement on the salaries of teachers in this department. Had Lansing refrained from accepting the Smith-Hughes and Tufts legislation, that is, had not provided properly organized industrial courses, this money would have gone to other localities without reducing our taxes in the least, since one-half of it was from the national treasury and one-fourth was from the state treasury. The work has been approved each year since the Smith-Hughes law.





Metal Cutting Tools.

By A.L.DeLeeuw



II. Consideration of the Element of Feed—Analysis of the Round-Nosed Tool—Effect of Fundamentals of Cutting Action on Design

IN THE foregoing pages it was supposed that the work was stationary, and the tool moving in one direction only; namely, in the direction in which the cutting took place. As we have seen, this condition actually exists in the plate planer. In practically all other applications of metal cutting tools the relation of work and tool is not quite so simple; the element of feed must be considered. The feed may take place either during the cut or after the cut. This latter condition we find in planers, shapers, slotters, Fellows gear shapers, etc., whereas the former condition exists in lathes, boring machines, drilling machines, etc. There is finally a third case which differs slightly from these two cases; namely, the milling machine. In a planer or slotter either the work or the tool makes a stroke, after which some movement is made by which the relative position of tool and work is altered. In the boring machine or lathe this change of position of tool in relation to the work takes place while the cut is on. The condition peculiar to the milling machine is this: That the feed takes place in the same direction as the cut, that it is continuous as in the lathe, and yet to a certain extent is also intermittent as in the planer.

When the Work Is Wider Than the Cut

If the work is wider than the cut, then a condition prevails, as shown in Fig. 22, where the shaded sections indicate the successive cuts taken. The tool would remove section 1 moving in a straight line, then return, then move to the left the width of one cut, then take another cut under exactly the same conditions as the first one, etc. It will be seen that cutting action takes place at the bottom and at the left side of the tool. If the cutting took place at the bottom only the chip would curl upward, if on the left side only the chip would curl to the right. A particle of metal close to point *A* would have a tendency to move both upward and to the right. It will readily be seen, then, that the chip must be deformed, and that the particles separated close to the point *A* must exert a pressure on the rest of the chip so as to cause this deformation and, therefore, that the part of the tool close to point *A* is subjected to additional pressure or strain besides that caused by the removal of the chip. It will also be seen that even if there were no additional pressure at the point *A*, yet the fact that heat is developed near the point *A*, both at the bottom and at the left, will cause this point to receive more heat than any other point of the tool. Besides the section of metal through which this heat can be carried off is small and in addition the heat would have to be carried off, at least partly, by other sections of the tool which themselves are heated. This point *A* of the tool then removes more metal, does it under heavier pressure, and is in a less favorable condition for dissipating the heat than any other point of the tool, and we may expect that this point will break down first under the pressure and heat developed. This we find to be actually the case in practice, and for this reason it is customary to make tools with a rounding contour, where bottom and side join. Even when constructed this way there still remains the condition that the bottom chip crowds the side chip and vice versa. This cannot entirely be avoided. But if a tool were constructed as shown in Fig. 23, the amount of crowding would be very small and the area over which the pressure could be distributed and by which the heat could be dissipated would be quite large, so that such a tool might be expected to stand up well under heavy service. As a matter of fact it does.

Advantage of Round-Nosed Tool

However, another element enters in here which makes it less advisable to use a tool of this description. In the previous article mention was made of the fluctuating pressure of the tool when making a chip. This condition was observed in a series of tests made by Dr. Nicolson, and a diagram showing these fluctuations may be found on Folder 12 of "On the Art of Cutting Metals" by F. W. Taylor. Mr. Taylor points out how these fluctuations have a fixed period of time under a given set of conditions (such as nature of metal to be cut, depth of cut, form of tool). If this period synchronizes with the natural period of vibration of tool or work of some part of the machine, then the vibrations may be much magnified and cause what is known as "chatter." Such a condition of synchronism is avoided by constructing the tool in such a manner that the chip is broken up in different ways at the different points of the cutting edge. It is partly for this reason that he recommends his round-nosed tools.

The Broad-Nosed Tool

Mr. Taylor also calls attention to the fact that what he calls the broad-nosed tool, a tool more along the general lines of Fig. 23, would probably be somewhat more efficient and have some other advantages; but he considers these advantages of minor importance because in constructing his round-nosed tools he aimed for a general utility tool for roughing work and he was willing to sacrifice some of the smaller advantages to be obtained for the sake of standardizing the tool; in other words, he aimed at a tool which might successfully be used under a great number of varying condi-

tions. As such the round-nosed tool is very successful. In late years conditions in machine shops have changed materially from those that existed at the time Mr. Taylor conducted his experiments. In those days most lathe work was done on the engine lathe and with standard tools. At the present time the great majority of lathe work is done on specialized machines

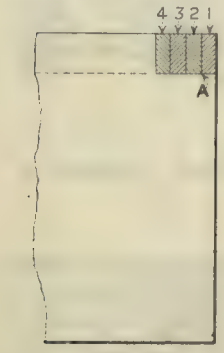
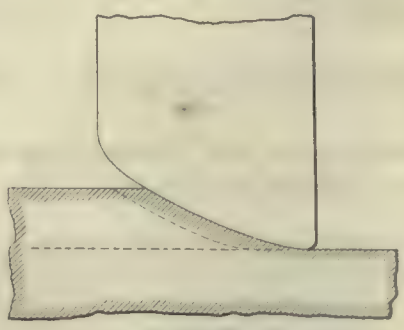


FIG. 22


FIG. 23

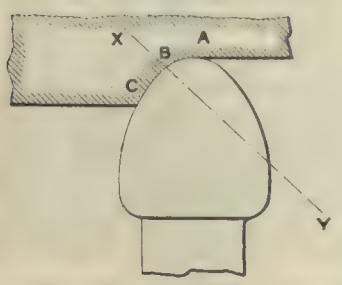


FIG. 24

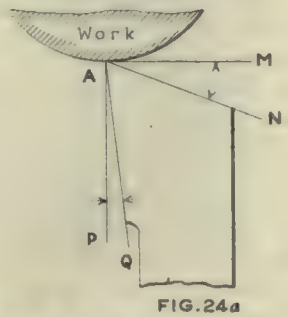


FIG. 24a

FIG. 22. SUCCESSIVE CUTS INDICATED. FIG. 23. BROAD-NOSED TOOL. FIG. 24. RAKE AND CLEARANCE

and with special tools. For this reason the writer believes that it is necessary to look into the fundamentals of the action of cutting tools so as to enable the tool-setter, the toolmaker and the tool designer to select the kind and form of tool specifically adapted to the work he has before him. In other words, though agreeing fully with the conclusions reached at that time by Mr. Taylor, the writer believes that the round-nose tool is only one of the many kinds of tools to be used under modern conditions.

Rake and Clearance

In the following pages frequent use will be made of the terms *rake*, *front clearance* and *side clearance*. In order to give definitions which can be easily remembered we will suppose a tool clamped in the toolrest of a lathe so that the extreme tool point touches the finished part of work at exactly the height of the center.

Under those conditions, we give the following definitions:

Rake will always be given for a single point of the cutting edge.

Note: If Fig. 24 is the top view of a tool, the points *A*, *B* and *C* may each have a different rake.

Rake is measured in a vertical plane going through the point for which the rake is to be determined.

Note: Fig. 24a shows a vertical section of the tool through the point *A* and at right angles to the work.

Rake is the angle measured in the vertical plane at right angles to the work between a horizontal line and the top of the tool.

Note: If the rake were to be measured for point *B*, we would have made the vertical section *XY* and proceeded as before.

Clearance is the angle measured in the vertical plane at right angles to the work between a vertical line and the edge of the tool.

Note: In Fig. 24a the angle *PAQ* would be the rake and the angle *MAN* would be the clearance.

Front clearance is the clearance between the tool and the finished part of the work.

Side clearance is the clearance between the tool and the work measured in a vertical plane parallel to the feed motion of the tool.

Note: There is no really good reason why a distinction should be made between front and side clearance except that it indicates in a general way about which part of the tool we are speaking.

The above definitions are somewhat different from the ordinary conception of rake and clearance but they fit in with the way we should look at the action of the tool.

The angle *NAQ* in Fig. 24a is the angle of the tool and in the future we will call it the contained angle. As far as the cutting is concerned this angle is of no importance. If, for instance, the clearance angle were very large but the material of which the tool is made were of such a nature that the tool would not crumble or break down, then all conditions of cutting would be exactly the same as if this angle *MAN* were very small. However, a change in the rake angle *PAQ* will change the cutting conditions very materially. Again we may look at it this way: If we leave clearance and rake angles as they are ground on the tool the same, but take the tool and turn it in a vertical plane around the point *A*, we will get an entirely new tool, though the contained angle has not changed. We will get a tool which may cut better, because its rake angle in relation to the work (its true rake angle) has been increased, or we might get a tool which wears away very quickly because its clearance angle is too small.

The Contained Angle

The contained angle is of interest when we look at the lasting qualities of the tool but not when we look at its cutting qualities. A razor blade, for instance, would have splendid cutting qualities but no lasting qualities. A tool of which the contained angle closely approaches a right angle might have good lasting qualities but would have poor cutting qualities. A large contained angle makes a strong tool and a tool which readily caries off the heat.

Rake angle is something of which we should have *as much* as we dare to use; clearance angle is something of which we should have *as little* as we can get along with. The contained angle should be as large as possible.

Here again is a contradiction, for we cannot make both rake angle and contained angle as large as possible at the same time, and it will be up to the tool designer to compromise between these two contradictory requirements.

Dr. Nicolson found that there was a certain rake angle above which it was not profitable to go, and Mr. Taylor, investigating this condition, found very much the same thing. However, both investigations confined themselves to roughing cuts only. Under these condi-

tions the amount of power required for a given cut or the pressure on the tool were of minor importance, whereas the speed at which the tool could be run for a given cut and the length of time a tool could be used before resharpening were of major importance. There are, however, cases where considerations of an entirely different nature come to the foreground. Our chief consideration might be a smooth finish, or absence of spring in the work, or great accuracy of diameter; and if such points are of main importance then we should look at those qualities of the tool which produce these results.

Grinding the Round-Nosed Tool

Referring back to the tendency of a broad-nosed tool to cause chatter, we must recall to mind the previous chapter in which attention was directed to the effect of a change of rake angle on the shape of the chip. We found that the tool will penetrate further before a chip splits off. In other words, the fluctuation of pressure occurs with a longer period with a greater rake angle than with a lesser one. A round-nosed tool might be ground in various ways; for instance, as indicated in Figs. 25a or 25b or 25c. In each case the light lines represent the low part of the ground surface. Whichever way the tool is ground there will be a difference in the amount of rake in the points *A*, *B* and *C* and, as a consequence, the period of pressure fluctuations will also be different at these three points. For this reason a round-nosed tool is particularly desirable when a heavy and deep cut has to be taken for roughing purposes.

In Fig. 25c, arrows are drawn at various points of the tool and at right angles to the edge of the tool at that point. It will be seen that all points to the left of point *A* can be used as cutting points because they are higher than any other point of the tool further along the arrows; in other words, they have rake. But the condition is different with the point to the right of Point *A*. Point B_1 is so located that its arrow is parallel to the grinding lines. Any point between *A* and B_1 will still have some rake, but very little. All other points from B_1 on, such as C_1 and D_1, would have negative rake; that is, these points would be lower than other points further down the arrow. A tool of this description, therefore, can be used for one direction only. A tool ground like Fig. 25a can be used for right- and left-hand cutting, but the rake becomes very small as soon as we go some distance away from the center line. In other words, such a tool is not suitable for deep cuts. A tool ground like Fig. 25b would have its best rake far away from the center line; it could be used on one side only and, even then, it would have no rake at all right at the center so that it would be necessary to set the tool at an angle with the work as shown.

Various Types of Planer Tools

Planer tools can be divided into two classes—roughing tools and finishing tools. This does not mean that a roughing tool can never be used for finishing or vice versa, but that each class has those qualities which make it particularly adapted to its particular duty. The qualities for roughing are:

1.—A sufficiently large contained angle to stand the pressure and carry off the heat.
2.—Absence of sharp corners.
3.—A heavy shank to permit of the unavoidable bending of the tool without bad results.
4.—Made of material which has great strength and can attain a high temperature without losing its hardness.

Qualities Which Finishing Tools Should Possess

Finishing tools, on the other hand, should possess the following qualities:

1.—They should be made of a material which will permit them to retain a keen edge for a long time.
2.—They should have a shape so as to minimize the depth of the tool mark left on the work.
3.—If necessary, they should have sharp points to enable them to square up work.
4.—For some purposes they should be so constructed as to permit a certain amount of bending.

The main varieties of roughing tools are the round-nosed tool, the diamond-point tool, the square-nosed tool and the cut-off tool. For roughing plane surfaces such as the tops of beds, tables, large pads, etc., the round-nosed tool is to be recommended. The figures given for the various angles of such tools by Mr. Taylor can safely be followed, but the clearance is somewhat larger than is absolutely needed, due to the fact that a planer tool does not need to penetrate under the action of the feed. It is subject to the feed motion only while it is out of the cut, and not, as the lathe tool, when it is in the cut.

Whether a horizontal surface is planed up by a tool in the cross-rail head or a vertical surface by a tool in the side head does not affect the shape of the tool.

Necessity of Strong Shank or Toolholder

Too much emphasis cannot be placed on the necessity of having a very strong, heavy tool shank or, where toolbits are used, a very substantial toolholder. If the shank or holder is flexible, then the tool will bend under the pressure of the cut, causing the tool point to dig deeper into the work. We have seen that for the ideal functioning of the tool absolute rigidity is required, so that the bending of the tool will bring us further

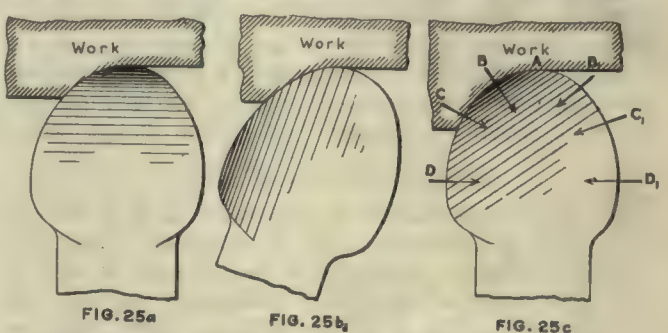


FIG. 25. WAYS OF GRINDING ROUND-NOSED TOOL

and further away from ideal conditions. Practical results of this digging-in are that the tool will follow all the fluctuations of the depth of the cut, so that it will actually not merely assume a new position but it will be jumping in and out with every little variation of depth or hardness of the metal. This jumping action brings sudden, heavy strain to bear on the tool edge and destroys it rapidly.

In planing it is often unavoidable to have a great overhang of the tool, but wherever possible the overhang should be made as short as conditions will permit.

Given a choice between the best imaginable toolholder or a solid tool of equal section, the solid tool has some advantages because its overhang can be made less. Given, on the other hand, conditions which require

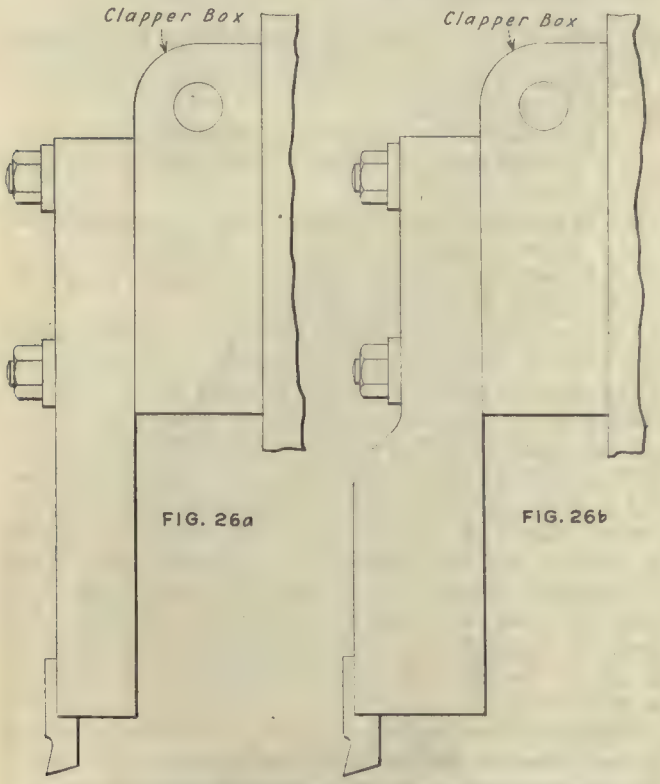


FIG. 26. TWO FORMS OF PLANER TOOLHOLDERS

a great overhang, and it will be better to use a toolholder than a solid tool, for the toolholder can be made as heavy as desired, whereas the size of tool is limited by the high cost of tool steel, especially if high-speed steel is used. With long overhang the tool designer is often limited as to size of toolholder by the dimensions of the clapper box and the distance between the clamping bolts, or the length of these bolts. He reasons, probably unconsciously, that it is of no use to make the toolbar 4 in. square when he can get only 3 in. under the clamps, but this reasoning is not entirely correct. A toolholder bends over its entire length when under pressure, and by making part of it heavy, the total amount of deflection will be reduced. (See Figs. 26a and 26b.)

The Diamond-Point Tool

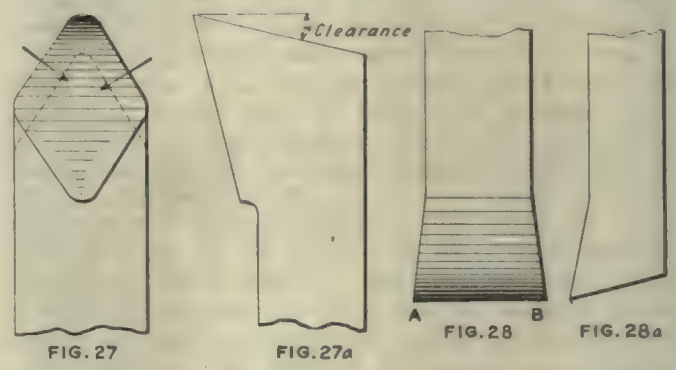
The diamond-point tool is illustrated in Fig. 27, and the way of grinding the rake is indicated in our conventional manner. Looking at the arrows, it will be seen that there is rake in all directions and that the tool can be used as right- or left-hand tool. Besides, it is very simple to produce this rake. It is not quite so simple to grind the clearance, which is indicated in dotted line and also in Fig. 27a. This tool is very useful for relatively light roughing cuts, but cannot be used for the very heaviest cuts. It used to be the one style of tool which every machinist would use for planer as well as lathe work. It is doubtful whether there is any tool which has quite such an all-round usefulness.

For jobbing shops and for single jobs in a machine shop or toolroom this tool is just as useful as ever, but for regular production and for heavy cuts the round-nosed tool should be used.

The square-nosed tool illustrated in Fig. 28 and 28a is often used wrongly when a round-nosed tool might be employed to better advantage. Its chief use is for roughing out where the cut ends against a shoulder and must be squared later on, as in Fig. 29, in which the metal to be removed is shown in section. It is also quite properly used for planing slots as in Fig. 30. Taking a cut such as shown in Fig. 30, there is front rake only, and no side rake, which is liable to produce a rough cut unless a very fine feed is used. As a rule the corners *A* and *B* of the tool are sharp. (See Fig. 28). This also reduces the amount of feed which it is possible to take with such a tool. On the other hand, rounding the corners would aggravate the effects of lack of side rake. For heavy cuts the tool should be ground as shown in Fig. 31, which requires a double setting for the grinding and is not easily accomplished. By splitting the tool in two, in other words, by using two tools side by side and properly clamped together, this difficulty can be overcome. (See Fig. 32.)

The cut-off tool has the same requirements as the square-nosed tool. As a matter of fact, it is merely a square-nosed tool of less width.

While on the subject of roughing tools the multiple tool should be mentioned. The multiple tool consists of a number of toolbits so placed in a holder that one after the other enters the planing cut. The first one takes a cut the full depth and with one-fourth of the amount of feed—that is, if there are four tools in the holder. The next tool enters a little bit later and again takes the same amount of feed, and so forth. A single, heavy tool might take the entire amount of feed, and the only reason why multiple tools are used is the fact that such a heavy feed with a single tool would cause the metal to break out at the end of the stroke. Where such heavy planing cuts regularly recur it is better to use a single tool and guard against the breaking-out of the metal in some way; for instance, by casting the piece with a bevel edge where the tool is



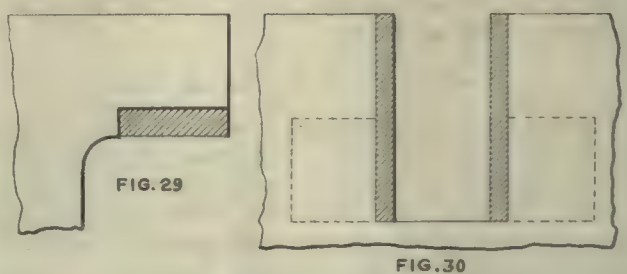


FIG. 27. DIAMOND-POINT TOOL. FIG. 28. SQUARE-NOSED TOOL. FIG. 29. CORRECT PLACE FOR USING SQUARE-NOSED TOOL. FIG. 30. SLOT PLANING WITH SQUARE-NOSED TOOL

to run out. The advantages of the multiple tool are that a wide feed can be taken, even where no provision is made against the breaking-out of the edge, and that this can be done without the expenditures for heavy, high-speed tools. The disadvantages are that such a tool requires four bits which should be carefully ground and set, and that for every variation in the feed a new tool setting is required so as to divide the tool feed as evenly as possible among the cutters. Fig. 37 shows the principle of the multiple tool and the way it is arranged to provide for quick adjustment for varying feeds. The holder proper is made to swivel on the shank, and has four openings with the necessary clamping screws for the toolbits.

There are a great many varieties of finishing tools used for a planer. The most important, perhaps, from the standpoint of frequent use, is the square-nosed tool. This tool is often made without lip. There is no good

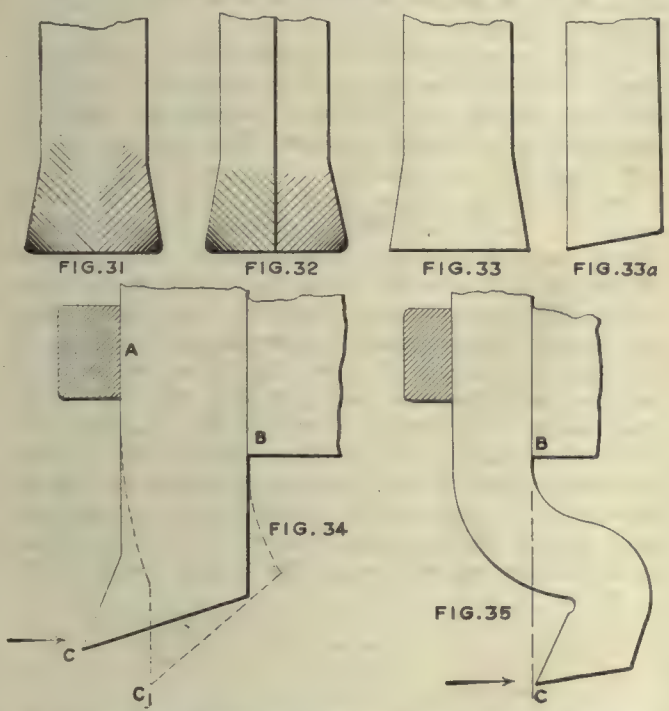


FIG. 31. TOOL GROUND FOR HEAVY CUTS. FIG. 32. DOUBLE TOOL. FIG. 33. FINISHING TOOL. FIG. 34. BENDING ACTION IN STRAIGHT-SHANK TOOL. FIG. 35. TOOL FOR WIDE FINISHING CUTS

reason why this should be so. The absence of rake merely increases the pressure and causes more spring. Such a tool will do fairly good work on cast iron but is not at all permissible on steel work. The proper way to construct this tool is to make it like the roughing tool. (See Fig. 33.) One of the reasons which might be given for the absence of rake is that the tendency to dig into the metal on account of spring is greater with than without rake, and this leads us to a close study of the spring of tools and its effect.

In Fig. 34 the tool is clamped at *A* and supported against the clapper box as far down as *B*, but from there on it is free and overhanging. The pressure being against the point *C*, the tool will bend with the point *B* as center. The position after bending is shown in dotted lines, very much exaggerated of course. As the point *B* lies back of *C*, *C* will be further down after bending, thus causing the tool to dig deeper in the work, increase the pressure, increase the bending, make it dig in still deeper, and so forth, until an equilibrium has been reached. If the metal to be cut is of a brittle nature, such as cast iron, the chip will jump away from the tool so that there will be even more fluctuation in pressure on the tool point than when the metal is tough, such as steel. When the chip flies away the tool point

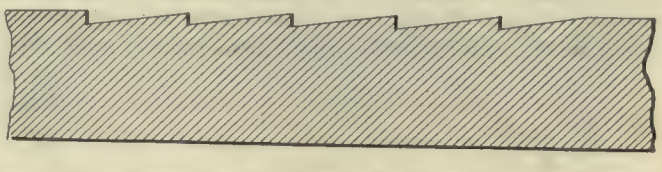


FIG. 36. EFFECT OF HAVING TOOL NOT SET SQUARELY

jumps forward, is caught against the uncut metal, pressed down again, and keeps on repeating this performance, causing chatter. This is particularly noticeable when an attempt is made to take a wide cut. As a rule the width of the cut is less than the width of the tool; for instance, when finishing cast iron a tool $1\frac{1}{4}$ in. wide might be used, taking a cut $\frac{1}{16}$ in. wide. The resistance of the tool against bending is directly proportional to its width. If now we should attempt to take a cut $\frac{1}{8}$ in. wide with this same tool the pressure will be twice as great and therefore the deflection will also be twice as great, and the increase in depth to which the tool is made to penetrate, due to this deflection, will be twice as great, or rather to be correct, more than twice as great. Should we attempt to take a cut $\frac{1}{16}$ in. wide, the deflection, and consequently the extra penetration, will be three times as great. It has

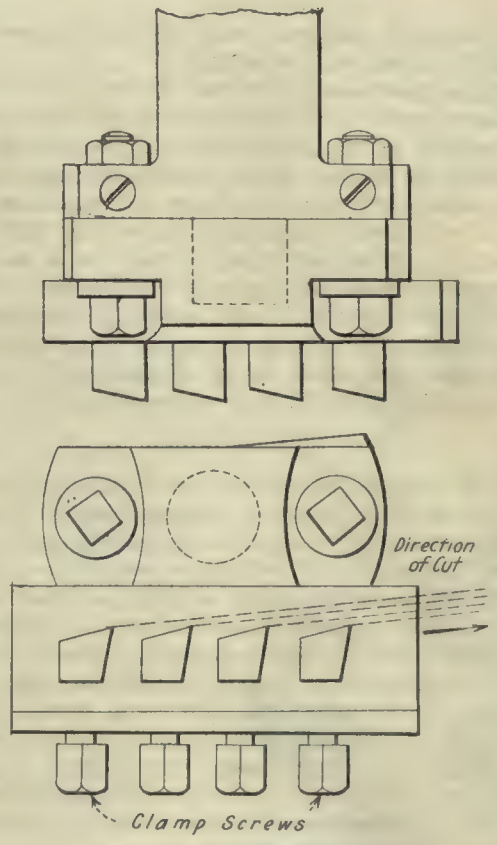


FIG. 37. MULTIPLE TOOL

been found extremely difficult to take wide finishing cuts with this style tool, and if such wide cuts are to be taken a tool should be used as shown in Fig. 35. Such a tool is called a spring tool. The cutting point *C* lies back of the extension of the back line of

the shank of the tool. If such a tool is under pressure, the point *C* will again move with *B* as center and, as a result, will be moved backward and slightly—very slightly—upward. When the chip jumps off, the tool will have a tendency to spring forward but will immediately be steadied by the increased amount of metal it finds. Spring tools are capable of taking very much wider cuts than the simple broad-nosed tool. The

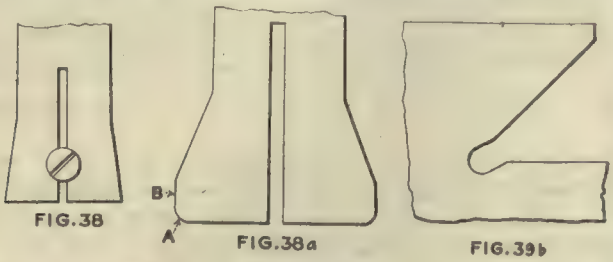


FIG.38 FIG.38a FIG.39b

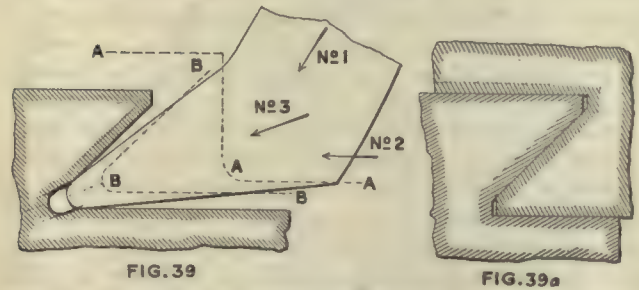


FIG.39 FIG.39a

FIG. 38. TOOL FOR FINISHING SIDES OF SLOT. FIG. 39. DIFFERENT DESIGNS FOR SLIDE-WAY CROSS-SECTIONS

writer has seen cast-iron chips 12 in. wide and rolled up tightly taken by a spring tool.

Cast-iron surfaces are often scraped after having been planed, and it is advantageous to reduce the amount to be scraped off to a minimum. If the casting warps or springs the amount to be scraped off will naturally be more than desirable, but these are conditions which are not influenced by the tool. If, on the other hand, the tool is not set absolutely square with the work, the finished surface will appear as in Fig. 36. This also causes an unnecessarily large amount of scraping. To avoid this the tool should be perfectly straight at its cutting edge and should be set straight with the work. To obtain this the following is recommended:

Tool Grinding

The tool should be ground on a surface grinder instead of on a tool grinder, the edge should be stoned, and the tool should be set to a hardened setting piece clamped to the table of the planer and not to the rough or semi-rough surface of the work to be finished. Further, in order to produce a close-grained surface this tool should have very little clearance, from 2½ to 3 deg. This will have more or less of a burnishing effect which will close up the pores and reduce the amount of loose metal to be scraped off. The writer has seen the maximum finishing feed increased from ⅛ to 1 in. with a simultaneous reduction of the time required for scraping off the loose metal to one-third of the original time by following this method.

When the square-nosed tool is used for finishing slots, that is, when the sides only are used, it is not so necessary to have side rake. On the other hand, it becomes important to make the tool accurately to a given size so as to be able to plane two sides of the slot at a time. As a rule such a tool is constructed with sharp corners, but in the majority of cases it would be permissible to make the corners slightly rounded which is much better if it is important to maintain size.

In Fig. 38 such a tool is shown slotted in and with a small taper screw for holding the two sides apart and to the proper size. This Fig. 38 also shows the tool with sharp corners. A better construction would be to make the corners as shown on the enlarged view, Fig. 38a, where a round is shown at *A* and a small flat at *B*. The finish produced by this tool will be better and it will be possible to take a much wider feed with the same degree of accuracy.

In many cases three cuts are taken—a roughing cut, a semi-finishing cut and a finishing cut. In most cases the roughing tools can be used for the semi-finishing cut; but where shoulders must be produced a finishing tool will have to be used for the second cut. Generally speaking, it would be possible to get the advantages of the use of roughing tools for the second cut by the following method:

In Fig. 39 a slide-way is shown which must be finished. Due to the fact that the included angle is only 45 deg., a very delicate finishing tool must be used with a very sharp point. This requires a very light feed, for two reasons: To save the tool, and to avoid the sharp ridges which would be made in the work if a coarse feed were employed. The line *AAA* shows the outline of the rough casting. The line *BBB* shows the outline after roughing. If now we use a tool as shown for the second finishing cut, a round corner will be left where a sharp corner should be. However, this sharp corner is not desirable; it would be better to have the corner as shown in Fig. 39a and in any good design the mating piece for this slide-way will have its corner cut off as shown in Fig. 39a. Referring back again to Fig. 39, the semi-finishing tool has moved in the direction of arrow No. 1 for the bevel side, and in the direction of arrow No. 2 for the flat side. If now we had moved the tool by hand and for

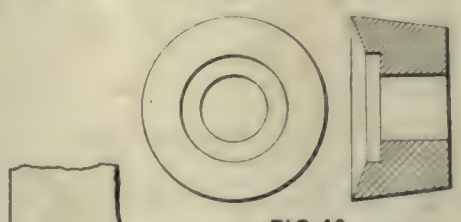


FIG.40

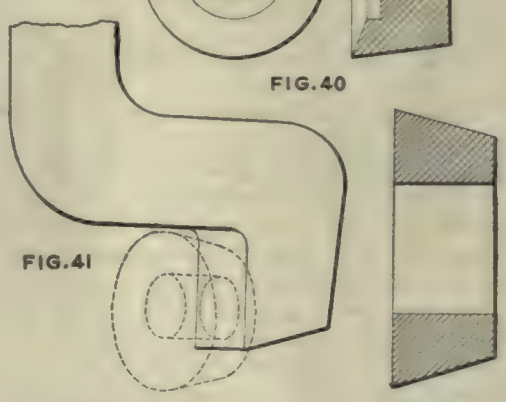


FIG.41 FIG.41a

FIG. 40. BUTTON TOOL. FIG. 41. CORRECT MOUNTING OF BUTTON TOOL

a short distance in the direction of arrow No. 3, the piece after the second cut would appear as shown in Fig. 39b, and this section will permit the use of a finishing tool of more rugged construction and without delicate points. Besides, the planer hand saves the trouble of matching two surfaces. Designers of parts

that have to be planed with shoulders should give this matter careful thought. This method will permit the use of better tools, save much time, make a smoother finish and, due to the round corner, will make a stronger casting in the end.

Form Tools

Form tools are not much used on planers, but they are used to quite some extent on the shaper and the slotter. A case in point is the Fellows gear shaper which, as far as its mechanical action goes, is essentially a slotter. Among the form tools used quite frequently on the planer may be mentioned the rounding tool, the fillet-cutting tool and the button tool. The rounding tool is used for such light service and the round corner to be made requires, generally speaking, so little accuracy that it is not necessary to take any special precautions; but when the round is of large radius and it is necessary to make it with some degree of accuracy some little thought should be given to this tool. Under those conditions the rounding tool and the fillet-cutting tool become crude forming tools and should be treated as such. For a further treatment of form tools in general, the reader is referred to a later chapter.

The Button Tool

The button tool is shown in Fig. 40 and is, in a way, related to form tools. However, it is different from form tools in this respect: Form tools are so constructed that they maintain their shape after grinding, whereas a button tool does not. Button tools are often used for making fillets, where accurate size is not essential. They cannot be used for small fillets, but are very handy tools for larger ones. A few sizes should be kept in stock in the toolroom. Button tools can easily be ground on the circular grinding machine, though grinding of course reduces the radius of the fillet which it will make. As a rule button tools are screwed on the front of a straight bar or holder. It would be better to mount them as shown in Fig. 41

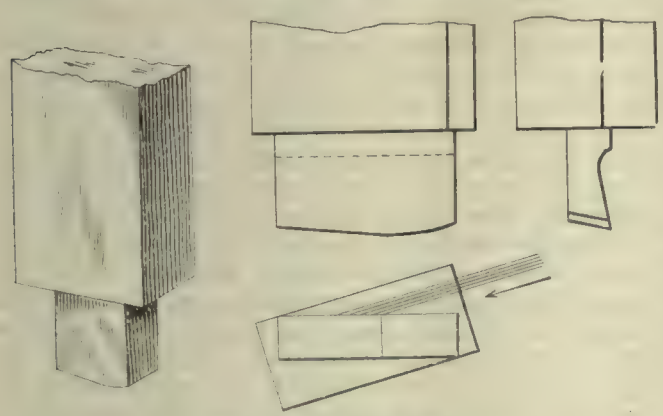


FIG. 42. SHEAR TOOL

where the holder is shown in full lines and the button tool in dotted lines. As will be seen, the holder is finished somewhat like a spring tool, having that part which receives the tool twisted in relation to the shank so as to give the tool both front and side rake. With such a holder the button tool itself can be constructed as in Fig. 41a. If it is desirable to use the button for right- and left-hand cutting in one setting, then a tool as shown in Fig. 40 should be used, and the toolholder should not have the twist or angle shown in Fig. 41, but should still be constructed on the lines of the spring finishing tool.

Shear Tools

A special chapter will be devoted to shear tools and to a more complete study of their action, construction, advantages and disadvantages. The planer is about the only machine tool on which a shear tool is occasionally used at the present time, and for this reason its general construction will be mentioned here.

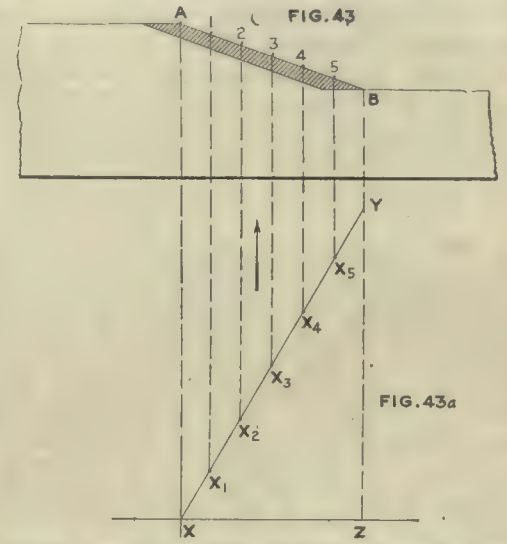


FIG. 43. CUT TAKEN BY PLANER SHEAR TOOL

It is used where a high-grade finish is required on steel and it meets this requirement admirably. Fig. 42 shows a shear tool arranged to feed toward the left. It will be seen that it is not possible to finish up to a shoulder with such a tool, and this is one of the chief disadvantages of all shear tools. The cut taken by a planer shear tool seldom exceeds $\frac{1}{64}$ in. in depth. Fig. 43 shows the cut taken by the tool very much enlarged. The workable distance from *A* to *B* is probably not more than $\frac{1}{64}$ in. The points *A* and *B*, as well as a number of intermediate points, are projected in Fig. 43a, and are marked *1*, *2*, *3*, *4* and *5*. The tool has cut out the point *A* at *X* (see Fig. 43a), the point *1* at *X1*, the point *2* at *X2*, the point *3* at *X3*, the point *4* at *X4*, the point *5* at *X5* and the point *B* at *Y*. Constructing the tool from this diagram we see that the lowest point of the tool—the point *Y*—must be the distance *YZ* ahead of the highest cutting point—*X*—of the tool. This distance *YZ* is, in a properly constructed shear tool, very large as compared to *XZ*, so that though the rake of the tool may be quite moderate, the effect is the same as if the rake were very large, or, in other words, as if the contained angle were very small. (For a more complete discussion of this feature see the chapter on Shear Tools.) This results in a much gentler action of the tool due to the fact that the small sections of chip are not completely split off but only slightly moved one over the other, and this in its turn causes a smoother surface of the work. The surface made by a shear tool has more the appearance of a polished surface and does not show the torn-out fibers common on steel which is finished by a square-nosed tool. A planer shear tool is not very well adapted for finishing cast iron as the fine edge is readily destroyed by the gritty material and this fine edge is absolutely essential for a nice finish. This matter will also be discussed more in detail later on.

Correspondence Supervision

By JOHN T. BARTLETT

Importance of Psychology in Business Letters—Women as Business Letter Writers—Duties of the Correspondence Supervisor

WHAT can we do about Jim Benedict who knows the Triangle line inside and out and is the logical man to handle complaints and requests for adjustment or repairs? Technically, Jim is the one man to handle such situations—but his letters! Last week we got that hot letter from Blink & Blink because Jim bluntly, without tact or courtesy, had refused an adjustment. Is Jim losing customers for us right along because he lacks ability to handle adjustments by letter?

S. L. Betts, head of the machinery department, has the idea he can take the brightest and best of the girl stenographers and make correspondents of them. He is trying the experiment with Elsie Snowden—nice girl, mighty good stenographer, been with us years. She seems to get along rather slowly, though. Somehow doesn't seem to grasp a letter problem; always says something that spills the beans. Betts is strong for his new idea. Is there anything in it? Does Elsie simply lack training, or are we wasting effort on a blind trail?

"Psychology" and "Costs"

What's all this talk about "psychology" in business letters? Is it something we ought to have or have we got it already? Of course business letters have definite and sometimes very important things to do. Are our letters doing them as well as they should?

How about our correspondence costs? Are we spending too much on our letters or would it pay us to spend more?

Does Edwin Climmer, sales manager, answer inquiries as well as he should? Ed is a fluent talker. He can write a three-page single-spaced reply without losing his breath once. He prides himself on his letters. But we wonder sometimes. He muffed that Debblebit export contract. We read the letter he wrote those people. It struck us as inadequate, but Ed was cocksure.

Such questions as I have put down above arise not alone in the isolated manufacturing organization, nor are they confined to any particular line. They are universal. They are questions with you and with your competitor. And more often than not, heretofore, the answers have been just guessed. The mechanical side of correspondence has had expert attention for years. All sorts of highly efficient machines and devices have been developed. Business schools have annually trained their thousands of stenographers. Dictating machines have come to contribute their help. The routine of business letters has been highly systematized in thousands and thousands of business institutions.

But the human side of correspondence—that is where the failure has been. In most cases, dictators have "just happened." They have written important letters not because they have been trained, efficient correspondents, but because letters were a part of their jobs, something that "had to be done." As regards efficiency in letter writing and such natural business questions as I have started this article with, they were accomplished or solved only as a matter of haphazard.

There should not be unanswered questions such as those I have enumerated in any business organization. Where they exist, plain good business demands that they be eliminated. It is the job of the correspondence supervisor—which is what I am leading up to—to answer such questions and in so doing to solve the problems which are connected with them.

What the Supervisor Does

Correspondence supervision, as it is practiced today in some of the country's largest and most successful business organizations, is built around the letter expert, the supervisor, who gives a part or all of his time to the organization, depending on its size. The supervisor may be described as a combination of expert, systematizer and trainer. As an expert he is partly good business man, partly psychologist, partly literary person. By virtue of these qualities he knows personally how to apply business judgment to a letter problem and how, in meeting that problem in a letter, to cause in the addressed person the reaction desired. The supervisor himself is a capable, clever business letter writer.

As a systematizer, the supervisor straightens out correspondence conditions. He standardizes letter forms. He develops the most efficient routine. He introduces a systematic method of reaching all correspondents with the general supervision plan.

As a trainer—and here I like to compare his functions to those of the baseball manager or the veteran theatrical producer—he takes raw material, probes it for natural ability and makes the most that human skill can of such precious aptitude as he finds. The supervisor trains men to write good business letters. Occasionally he finds and develops a star. More often he does not—only one man in many, no matter what the accident of birth, environment and education—can become a star letter-writer. Always, however, the supervisor can raise the level of individual letter-skill. He turns the "hopeless" correspondents into "passable," the "passable" into "good," the "good" into "extra-good."

In performing such functions as I have indicated, supervisors use widely different methods. The character of the individual organization, the type of dictators, the kind of business the concern does—all these fundamentally enter. Sometimes the supervisor's contact is only by letter, dealing with each individual's letter methods. Here general instruction is pursued by means of the correspondence manual or by a series of bulletins on letters sent out weekly or monthly to all correspondents. In other cases the supervisor has personal contact and interviews weekly or oftener with the dictators. Methods inevitably vary, but the general aim is always the same.

I have said that it is the supervisor's job to solve such problems as I stated in beginning this article. From the angle of the supervisor I am going to deal with a couple of these questions in this article. The information itself will be of interest. It will gather further appeal

from the general subject of correspondence supervision to which it relates.

Can a Woman Write Letters About Machinery?

The project which S. L. Betts has in hand is significant, in its general as well as particularized aspects, to all business organizations. Concerns which manufacture or handle machinery should especially heed the points involved. The whole tendency of the times points to continued extension of the fields in which female labor can be used. Should we look for correspondents to the ranks of girls and women and build a plan for systematically developing these employees as they are needed? There might be economy and—who knows—added efficiency, in the plan.

We have discovered unguessed powers in women in recent years. Is it possible that we have overlooked something here? Can training make a picked eligible girl into an efficient letter writer, just as training will make her a good stenographer?

Supervision has exact information on these questions. The best business letter-writers will always be men because business ability, business enterprise and business keenness will always reach higher levels in man than in woman. Business judgment bears a critical relation to business letter-writing, and men have it in greater proportion than women. On the ground of business experience alone girls and women will always lack as a class in this necessary back-ground of good-letter skill. Business is man's life-work. Business is woman's stepping-stone, or interim occupation.

Sex differences between man and woman also enter. The principles here would, enlarged, make a book. Briefly, the part woman plays in the perpetuation of the race has, normally, a tremendous influence on her type of mind. Man is naturally adventuresome, enterprising, imaginative, ambitious. To meet family responsibilities and simultaneously throw great energy into his business endeavors is second nature to him.

It is not so with woman. Her normal interests, unlike man's, are narrow and restricted, centering about motherhood. Being a father and several other things simultaneously is man's nature. Being a mother and several other things simultaneously is not woman's nature. The function gets woman's all, or very nearly all, normally; even when, as so often happens now, woman enters industry, her normal woman's nature asserts itself in the unenterprising attitude she usually maintains toward her employment. Her instinctive attitude toward business is to regard it as interim employment. Instinctively in her, ambition, imagination, and enterprise, are curbed.

There are numerous exceptions to the rule, but the fact remains that woman is not a natural-born business person and man is just that.

We find the explanation in the same fundamental difference—sex—which explains why women can bear much greater physical pain than men. A different manifestation is the fact that women don't make humorists. All great humorists are men.

From the letter standpoint, the significance is in the degree of capacity. First, the ordinary business experience woman gets does not develop in her business judgment. Second, in respect to systematic letter training, the potentialities of the average woman are inferior to those of the average man. As a general proposition there is little incentive to experiment in this field as S. L. Betts started out to do. Woman's limitations here are definite and very marked. Within those limitations, however, there is room to use woman correspondents. It is being done successfully in some of the largest business organizations in the country, the national mail-order houses. Where correspondence resolves itself into a few routine situations, requiring relatively little letter skill, girls can be trained to write adequate letters. Sears, Roebuck & Co. does this, for instance. The girls write their own letters on the typewriter. It is a low-cost system. Moreover, the girls, trained by a supervisor, do good work. I have seen their letters and know. They deal with simple situations, however, writing certain kinds of letters over and over. The merchandise sold, too, lends itself to the plan. Housewives order a large percentage of the merchandise that Sears, Roebuck & Co. sells. It is merchandise for the home. There is nothing incongruous in girls writing letters to consumers about such merchandise.

On the other hand, machinery is something normally of such alien interest to the female mind that training girls to handle correspondence concerning it is not practical. They do not understand mechanical principles. They are not interested in them, or in machines. Writing letters day after day about machinery, they fail to grasp their subject, even when all the skill of an expert helper, the supervisor, is applied to the problem. I could refer S. L. Betts to a correspondence supervisor who has dealt with this very same problem and who determined that it was impractical. The women were patently out of their depth and eventually were transferred to other work. The letter expert had made some headway with them but little beside that which equal effort would have accomplished with a man. "Women have their limitations here," he says, "and it is folly not to recognize them."

At Sears, Roebuck & Co., supervision turns a girl high-school graduate into a competent correspondent in six months to a year. That is how efficient the supervision system is. Extensive use of woman correspondents, however, is only among mail order houses and concerns whose product or products are within the woman's field. There is no indication that the machinery industry can use female correspondents. On the contrary both theory and experience are decidedly against it because of the degree of business judgment demanded and the nature of the general product.

The Problem of Jim Benedict

In their letter-writing troubles, the Jim Benedicts of the country were without friends—except their fellows in misery—until the supervision system came along. In industrial and business organization, positions of authority and responsibility are held by men who qualify by virtue of definite knowledge, experience and aptitude, technical ability, the power to handle men, the ability to sell goods, loyalty to the firm and knowledge of the line and the trade. A combination of things, or one outstanding quality maybe, lands a man in a responsible job. Most of the business letters of the United States are written by such men. Most business letters always will be. Nevertheless, the lack of letter-writing skill often characterizing an official holding an important position is no light matter. There is something more than inconsistency in the spectacle of a department head 95 per cent efficient, or better, in performing all other duties, whose letters grade 35 per cent or lower still.

It was probably true that Jim Benedict, referred to

in my question number one, was losing business right along for the company. Meet Jim in person, and you find him the sort of person easy to get along with. He sees that things go right in his department, but there are no fireworks in the process. There is a look about Jim's eyes and around his mouth that win your liking. And meeting men face to face, the man is tactful, diplomatic. I think it is not so much in what Jim actually says or doesn't say, as in the way he looks and acts. It smoothes your fur the right way—if you know what I mean. In letters, Jim is awkward, abrupt, cold. He doesn't put his smile, or anything like it, in a letter. He doesn't know how to break bad news gently and good news he butchers in the telling. He has caught at stereotyped phrases, like "Yours received and contents noted," and clings to them as though to life-savers. Often he says too much in a letter and at other times he says far too little.

Jim's Letters Lack Business Punch

Letters with Jim are just something to be got through. When he dictates, his stenographer would pity him if Jim didn't do his darnedest to look self-possessed and in his element. At heart he knows he writes "bum" letters but he thinks of them—as do most of the Jim Benedicts—as something which can't be helped. He writes letters not because he knows how to, or wishes to, but because they are a part of his job. And as fate has ordained it most of the letters he must write are a difficult kind of letter. Adjustment letters always are. Of course it's easy to say what you can or what you can't do—to concede, or refuse. But that isn't enough. The function of the good adjustment letter is more than simply to do something in satisfaction or otherwise of a customer's complaint. *It must hold the customer.* Lord knows, Jim's grammar isn't much. Jim, Jr., now in the fifth grade, could pick plenty of flaws in it. But we are not arraigning Jim Benedict, letter-writer, on literary grounds, but on business grounds. His letters have definite business functions to perform, and Jim, dictating an important reply, muffs the ball.

Every supervisor lifting the level of company letter efficiency has Jim Benedicts to train—often dozens of them in the same organization. In making the Jims into correspondents who handle their letters acceptably, or better, the supervisor necessarily adapts his methods to the individual. There is the matter of Jim's good will to be got, initially. Jim must be reconciled to the advent of this new expert. Jim's co-operation must be won. Right here is one of the toughest problems the supervisor usually meets with.

Will Teach Jim Some Psychology

I cannot predict how long it will take to convert Jim into a better correspondent, nor the exact methods the "letter doc" will use. But I can indicate some of the things that Jim will be taught.

Jim is going to be taught some psychology. That's a hard word; call it "human nature" if you want to—it doesn't matter. Jim will be taught to use "Dear Mr. ———" instead of "Dear Sir" in every situation where the customer relation justifies. This detail will help a little. Jim never heretofore has got beyond the "Dear Sir" stage, absurdly stiff, cold and formal to men the company has dealt with for years and years and considers, or should consider, friends.

Jim will be taught to use such words as "sorry," "regret," right and left in relation to situations in which the company appears to be at fault. It'll be hard for him. He's loyal to the house, and he's strong for dignity, but it'll have to be, because Jim *has got to hold customers.* Jim Benedict by-and-by will have fluent command of "sorry," and "regret," and along with them, "glad," "pleased," and others of that general family. When Jim makes an adjustment he isn't just going to let it go at that, as he always has. He's going to say the company is glad to do it. And if he can't oblige the customer, he's going to say the company is "sorry."

Jim's Lack of Tact

Jim's use of explanation in adjustment letters will also be revised. I was shown one of Jim's letters yesterday, making an adjustment but making it grudgingly. The company had fallen down in its service—that was the plain fact. Accidents will happen. A customer sarcastically had kicked and it had made Jim sore clean through. He had to make the adjustment in conformance with company policy—personally, Jim never would have—but got satisfaction for himself with a letter which attempted to justify the oversight. He was sore, you see, and did a very human thing. But it wasn't a business thing. Jim's explanation would only start an argument with the other fellow. It would spoil half or all the satisfaction the adjustment otherwise would have furnished the latter. The customer should have been mollified by the letter, written right. But he wasn't by the one that was written, which Jim really wrote, not to mollify but get resentment out of himself.

"In letters which must refuse a customer's request," the supervisor will tell Jim, "explain just why and at as great length as seems needed. You can't satisfy the customer by making the adjustment asked for and your object should be to satisfy him by convincing him the company has adequate ground for refusal and is only doing what is reasonable under the circumstances. Try to make the letter reflect a fair, reasonable, meet-you-more-than-half-way spirit. Look out that your explanation isn't abrupt or impatient. Say you're sorry you can't make the adjustment—use the word 'sorry.' And here's another thing. Don't argue. Don't feel obliged to point out the absurd or the ridiculous in the customer's appeal. Don't disagree with a customer except as you absolutely have to and then do it in a courteous, reasonable way, not so much trying to show the customer wrong as to indicate just what the company's position is and why it is right."

Short, Snappy Adjustments

That's just tact, of course. A more difficult task will be to wean Jim from his worst habit—making adjustments grudgingly. There is no necessity under ordinary circumstances for a letter which adjusts to the customer's satisfaction to go into long explanation. The adjustment's the thing and it ought to be announced in the first sentence. Such explanation as is given should not be to justify the mistake or fault but as a courtesy and a form of regret. The impulse which prompts explanation should be regret, not resentment. Jim's explanations are always of the latter variety except in the case of refused requests in which case he is cold and abrupt.

The supervisor will change all this. Also, he'll get Jim out of the habit of using stale phrases. He would write fifty per cent better letters if he took double the time over them. He writes his letters "any old time"

he can sandwich them in, often the tag end of the afternoon when he is mentally fagged. The supervisor will make Jim systematic about letters. He will insist probably on a regular hour for dictation—in the forenoon.

Any time Jim gets stuck on a difficult letter, he will be free to appeal to the supervisor for assistance. And when the supervisor criticizes it will be constructively with the right way clearly illustrated for Jim's benefit. Jim Benedict will never make a star correspondent but I can predict in advance that he will be turned into a satisfactory one. He will learn how to write adjustment letters which, while not literary gems, will hold customers.

Correspondence supervision is a new thing. The number of concerns using it is still very limited. Some of the supervisors have hundreds of correspondents under them, scattered all over the country because of the branch form of company organization. In other cases the number is only a handful. But whatever the concern with respect to size or product the attitude of the supervisor toward correspondence is always the same.

The supervisor's attitude is a business attitude. "The kind of letters we write," he declares in effect, "has a great deal to do with the volume of business we secure. Poor letters lose customers. Good letters hold customers and turn them into permanent friends of the house. My job is to raise the percentage of good letters until it is as near 100 per cent as it is humanly possible to get it."

There are a thousand and one details to supervision work which need not be touched on here. The essential thing to realize is that supervision performs an essential and vital business function. It brings dollars and cents in returns to the concern employing it vastly out of proportion to its cost.

A Railroad Shop's Apprentice School

Apprenticeship in This School Compelled by the Crafts—Current Expenses Defrayed by Assessing the Apprentices—Regular and Helper Courses Given

By J. V. HUNTER
Western Editor, *American Machinist*

AN INTERESTING apprentice training school has been opened in the Decatur locomotive and car shops of the Wabash Railway Co. This step was urged by the shop crafts organization, with the offer to underwrite a portion of the expense of starting the school.

The leaders of this organization expressed the desire that their apprentices should have a better grounding in many fundamentals than they were receiving under the old system, and finally co-operation with the railway's shop officials resulted in arrangements that enabled the school to be opened in September, 1920.

The railway company furnished an old coach and fitted it up to make the very excellent classroom shown in Fig. 1. The coach was put in first-class condition and freshly painted, the inside receiving a glistening coat of white enamel to give the proper light for drawing classes. It stands on a siding adjoining the main locomotive shop and is attached to the shop steam and electric lines for heating and lighting. The company also supplied the chairs and drawing tables.

The crafts organization supplied a full equipment of drawing instruments and the necessary class books, and obtained an instructor from the local manual training high school to serve for the whole of each Saturday. It also guaranteed his salary for these services.



FIG. 1. APPRENTICE SCHOOLROOM IN THE DECATUR SHOPS OF THE WABASH RAILWAY

To defray all current expenses apprentices are assessed the sum of $1 per month, which assessment is made directly from their pay checks by the company and turned over to the local crafts organization for dispensing. This sum was found to be sufficient for defraying all expenses and also provides a sinking fund that by the end of two years will reimburse the original investment in equipment and supplies.

The students are selected from the three trades that have subscribed to the agreement regarding the maintenance of the school; namely, the machinists, boilermakers and pipe fitters. It is hoped within a short time to have the blacksmiths also co-operating and their added number will enable the formation of another class. As the Saturday schedule is now filled, this fourth class will have to be held some time during the mid-week and is planned as another drawing class, for which it is expected an instructor will be assigned from the local drafting room of the railroad company.

The course of studies as at present organized consists of arithmetic, advanced mathematics and mechanical drawing. To each of these a class of twenty-two has been as-

signed, this number representing the full capacity of the classroom. Attendance on the part of the apprentice is compulsory, and the method of class arrangement is fully explained in the original shop bulletin issued on this subject, which is quoted verbatim as follows:

WABASH RAILWAY COMPANY APPRENTICE SCHOOL

The apprentice school will begin session on Sat., Sept. 5, and will be in session each Saturday thereafter.

The first ten Saturdays' instructions will be given in arithmetic, advanced methematics and mechanical drawing. Two hours' time will be allowed for each subject.

The first class will be for arithmetic. All apprentices assigned to this class will quit work at 8 a.m., clean up and be prepared to be in school at 8:10 a.m. and continue in session until 10:10 a.m.; the advanced mathematics class will quit work at 10 a.m. and be prepared to be in school by 10:10 a.m. The mechanical drawing class will quit work at 2 p.m. and be prepared to be in school at 2:10 p.m.

As soon as apprentices are excused from school they will return immediately to their respective jobs.

All apprentices in service eligible to attend school will be expected to be on hand each Saturday and no excuse other than sickness will be accepted for leave of absence.

SHOP SUPERINTENDENT.

Previous to starting the classes the boys were all required to fill out application blanks showing the amount of schooling that they had received. These applications showed that some of the boys had high-school training while others only had a few years of ordinary grammar-school education. Assignments to the classes were made from a study of these lists, being arranged so that those who had deficient school training should start first in the elementary course in arithmetic. The class in advanced mathematics covers such subjects as decimals, square and cube root and elementary algebra. The class in mechanical drawing will study this subject from the beginning and advance through all stages according to the students' proficiency in this work.

TABLE I. REGULAR APPRENTICE RECORD CARD

Name..... Date On..... Date Off....

Moves	No. Boys	Days on Job	Date On	Date Off	Performance	Days Lost	Foreman
Bolt Lathes	3	36					
Shapers	4	36					
Slotters	2	36					
Lift Shift Lathe	1	36					
American Lathe	2	36					
KneeType Miller	2	36					
Crank Planer	2	36					
Bullard 24 in.	2	36					
Bullard 36 in.	2	36					
Turret Lathe	2	36					
Brass Lathe	1	36					
Cylinder Bor. Mill	1	36					
Piston Grinder	1	36					
Piston Job	1	36					
Rod Job	1	36					
Engine Truck Job	1	36					
Brake and Fire Door Job	1	36					
Tank Valves and Steam Pipe	1	36					
Link Job	1	36					
Valve Bench	1	36					
Swing Job Lathe when open	1	..					
AIR ROOM	6	75					
Injector and Lubricator	..	..					
Cab	..	..					
Bells and Air Reverse	..	..					
Governors and Generators	..	..					
Pump	..	..					
Engine Brake Valve	..	..					
TOOL ROOM	2	75					
Lathe	..	..					
Miller	..	..					
Grinder	..	..					
FLOOR GANG NO.	..	..					
Cab Job	4	36					
Shoe and Wedge Job	4	36					
Valves	4	73					
General Work	4	73					
Round House	4	73					

TABLE II. HELPER APPRENTICE RECORD CARD

Name..... Date On..... Date Off....

Moves	No. Boys	Days on Job	Date On	Date Off	Performance	Days Lost	Foreman
Bolt Lathes	3	36					
Shapers	4	36					
Slotters	2	36					
American Lathe	2	36					
Knee Type Miller	2	36					
Crank Planer	2	36					
Bullard 24 in.	2	36					
Bullard 36 in.	2	36					
Turret Lathes	2	36					
Brass Lathe	1	36					
Cylinder Boring Mill	1	36					
Brake and Fire Door Job	1	36					
Link job	1	36					
Valve bench	1	36					
Swing job lathe when open	1	..					
AIR ROOM	6	75					
Injector and lubricator							
Cab							
Bells and air reverse							
Governors and generators							
Pump							
Engine Brake valve							
TOOL ROOM	2	75					
Lathe							
Miller							
Grinder							
FLOOR GANG NO.							
Cab job	4	36					
Shoe and wedge job	4	36					
Valves	4	73					
General work	4	73					

Arrangement of the classes is in terms of twelve weeks each, and after the finish of the term it is planned to promote students from one class to the other. Attendance at these training classes must be continued by the apprentice throughout his entire training.

Another step toward the better training of apprentices in the shop has been made by the company through the assignment of a regular instructor who will have full control of the training of the boys during the working hours in the shop. This instructor will assign the boys to the machines, teach them in regard to the setting of tools and the handling of all their work, and generally devote his time to giving them instruction that is desirable for the education of a finished mechanic. There are two classes of apprentices in the shops, one serving a course known as the "regular apprentice" and the other the "helper apprentice." The length of shop service for the first of these is four years and for the second, three years.

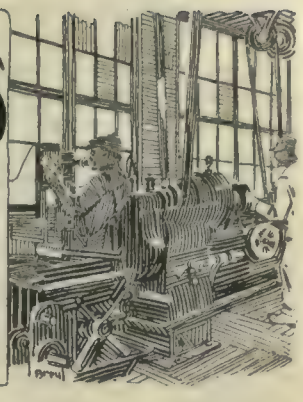
For each of the regular apprentices in the machine-shop course a printed card is filled out similar to that shown in Table I. This shows every machine and job which he is expected to serve while in the shop and the amount of time to be devoted to each of these. The instructor keeps up this card record, noting on it the time an apprentice started and stopped his various machine assignments and his performance while on each type. Jobs of work coming into the machine shop that can be handled by an apprentice are turned over to the instructor, who in turn gives them to an apprentice and sees that the work is completed satisfactorily.

The helper apprentice only serves a total of three years in his apprenticeship. His machine training is not so extensive as that given to the regular apprentice and his assignments for all classes of work is also kept by a chart card which is similar to Table II.



MODERN PRODUCTION METHODS

By
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XIII. Departmentalizing the Overhead Expense

The Complex Problem of Proper Distribution of Overhead — Examples of Incorrect Distribution — Relative Proportions of Productive and Contributory Costs

"LAST year, the overhead expense of my shop was 100 per cent of the labor and material cost. How does that compare with other machine shops? Is it high or low?"

That question was asked me recently by the owner of a machine shop which, I knew, was not making nearly the profit it should make, considering the excellence of its product and the breadth of its market. In nearly identical form, it has been asked me, I suppose, a hundred times by men in nearly every kind of manufacturing. That a man looks upon all of the expenditures that he makes for other than labor and material as a "burden" of the business as a whole, and allots it in proportion to the amount of labor and material each item of output contains, shows lack of thought. It would be almost as accurate to apportion the overhead on the basis of, say, the color; if painted red, the product would carry $10 of the overhead; if blue—$20; yellow, $50. Nearly every other inaccurate method has been used, apparently.

The tendency to lump overhead and then to distribute it over the entire output on some system or other, shows how little careful thought has been given to just what overhead is and what causes it. The fact is that overhead is complex; it consists of many charges for many purposes mixed together, as a rule, into a lump sum, thanks to the accounting methods of old time bookkeepers who were interested only in lump sum figures of profit for the business as a whole, at the end of a year.

If a shop made but one thing, a 10-in. pulley, say, this lump sum of overhead could be divided over the output. Then, if the overhead were $100,000 a year and the output were 100,000 10-in. pulleys, all alike, each pulley would carry the same overhead, namely, $1. And that would be the figure whether we divided the overhead by the totals produced, on the basis of a percentage of the labor and material, on the labor alone, the material alone, or the productive hour basis.

But there are practically no single-product plants. Even though the shop made nothing but cast-iron pulleys, it would make them in different sizes and styles That means that one pulley would take up more floor space in moving through the plant. Another would take longer to go through one process and a shorter time to go through another process. When we consider that the overhead expense borne by a unit of output is really the rent paid by that unit to the business for the use of the facilities which the business furnishes, it is evident that seldom will two different items of output carry the same amount of overhead expense, any more than they would be likely to carry the same amount of labor and material cost. The exact basis for allocating overhead expense so that the correct proportion will find its way to the individual items of production will be discussed in a later chapter. Our present problem is to gather the expense in such a way that it may ultimately be accurately charged to every unit produced by the plant.

For the sake of effective supervision, it is common practice to divide a machine shop into departments so that each foreman will have under his charge operations or machines of a type with which he is especially familiar. The executive who gives thought to the whys and wherefores of his business has realized that his complex manufacturing plant is thus in reality a group of small, specialized plants. As a business grows, it is common practice to bring more and more of the manufacturing processes under the ownership and control of the parent plant and to rely less upon outside manufacturers for the preliminary manufacturing of raw material. The most elementary manufacturing—and there is a great deal of that kind still done—consists of buying all of the component parts of an assembly in their finished state from outside suppliers and simply assembling those parts in the plant.

Since each department in the complex factory can be considered as an individual business, it is logical and, fortunately, accurate, to develop the overhead burden for each department as though it were a separate business. This fits in with the demands of accurate cost accounting for it has also been found that since the activities of different departments are essentially different, it is frequently necessary to distribute the overhead expense for the various departments on different bases.

We have seen in a preceding article that the machine tools in a machine shop may be arranged in batteries where all machines of a type are grouped or in units, where the machines performing consecutive operations on a part are arranged in order. This is called the unit layout. From the cost accounting point of view, either arrangement of departments is satisfactory. Because the battery arrangement is that most com-

monly found, we shall in the present series of articles deal with the cost problems in such a shop.

None of these batteries or units could properly be consolidated for cost purposes, although for purposes of operation they may be under the same supervision. Lathes and milling machines cannot as a rule be grouped for cost purposes in the same department because, although the machines may be approximately the same size and so take up equal amounts of floor space per machine, and be of relatively equal value, that is, take about the same insurance and depreciation charge, the tool usage is widely different. The lathe tools are relatively cheap but the milling cutters are so disproportionately valuable that if both classes of machines are grouped in a single department, lathe work going through that department would appear to be high in expense cost because of the absorption of some of the charge for milling cutters that would be made to the department.

Now we often find that lathes and planers use the same kind of tools—so far as cost goes. Yet these two machines cannot be grouped in one department, due to the disproportionate amount of floor space occupied.

The typical machine shop may have any number of manufacturing departments. Each of them, we want to emphasize, is a separate manufacturing business. Were each of these manufacturing departments in reality a separate plant, widely separated and under separate management, they would each need a general superintendent, an office, a selling staff, a toolroom, a boiler room and so on. One of the advantages of being under a single management and under a single roof, is that they all can be served by one superintendent, one selling staff, one boiler room and so on; and, by each of the manufacturing divisions bearing its just share of these general expenses, the expense for each is reduced.

Productive and Contributory Departments

We are now at a point of the discussion where it becomes evident that the departments of a machine shop may be separated into two groups; those which actually perform manufacturing operations on the product and which are therefore called "productive" departments, and those departments which serve either the productive departments or the business as a whole and which are therefore called "contributory" departments. For the typical machine shop which we are discussing, we set up on the fixed charge sheet as "productive" departments the lathe, milling machine, planer, automatic, assembly, polishing and hardening departments, and as contributory departments we showed the boiler department, the power department, the toolroom, the office, the general factory and the shipping department. The selling department is not included in the manufacturing cost, but the methods of handling selling expense will be taken up in a later article.

While, in practice, these departments may often approximate the geographical divisions of the plant, it is not essential that they do so. It is important to keep this point in mind. Any collection of workers or equipment may form a department, with the result that we may have in a single room several departments, while another department may occupy several rooms. It is often good practice to set up a single expensive machine as a department. The real test of the unity of a department is, "Can the overhead expense of this department safely be distributed over the output of the department on the same basis?" If expensive machines were in the same department with inexpensive ones, this could not be done. We therefore do not group in a single department hand work and machine work, nor do we group in a single department machines which require expensive tools, such as automatics and milling machines, with those requiring inexpensive tools, such as drill presses; nor do we, as a rule, include very expensive machines in the same department with inexpensive ones.

An exception to this rule is in the shop where the unit line-up of machines is used. For, of course, in such a line-up, there may be a dozen machines of different types ranging from the least expensive to the most expensive. But we really consider such a group of different machines as a single semi-automatic machine performing a regular sequence of operations. There is, therefore, no error in considering such a line-up as a department.

Contributory Department Divisions are Arbitrary

In determining the contributory departments, their divisions are more or less arbitrary and obvious, but the correct division of contributory departments is essential to accurate machine shop cost accounting. No matter how elaborate the routine of collecting labor and material costs may be, if this big item of overhead expense is not finally distributed accurately to the various units of output, the final costs will be worse than useless. Ignorance of costs, like ignorance on any subject, is less dangerous than false conviction. The manufacturer whose various lines of product are carrying incorrect amounts of overhead, but who is convinced that his overhead is spread correctly, is traveling toward bankruptcy, for he will be selling some of his lines at a loss and failing to sell his profitable lines because he has priced them too high. Inasmuch as errors in spreading the overhead can, in ninety-nine cases in a hundred, be traced back to incorrect departmentalization, it is evident why I lay so much emphasis on the importance of getting these items correctly laid out in the first place.

The point to consider then, in laying out the productive departments, is to ignore the size of the department and its geographical location and contour. It may be an entire building or a single, high-priced machine. The ideal department will consist of machines having the same value and costing the same to operate, and all the employees in that department will receive identical wages. Of course, it is seldom possible to meet this ideal. Practically, it is sufficient to group machines and employees of about the same operating cost or about the same wage scale.

Admittedly, the division into correct productive departments may sometimes be intricate and difficult, but in any plant it is entirely possible to strive toward the correct departmental divisions. Without them, no distribution of overhead can be correct.

Now, there are many items of expense which can be charged directly into the productive departments. The wages of the department foreman and the supplies in that department are examples. We also charge directly into the productive department its share of the fixed charges from the fixed charge sheet, which was described in Part XII. Other items that can be

charged directly to the productive department will occur to every manufacturer. They are such as the time of set-up men, non-productive labor such as inspection labor, belting, cutting compounds, lubricating oil, waste and so on. Labor and materials for repairing machines is such a direct charge; but the expense of the maintenance department, whether there is a separate maintenance department or whether this work is done by the toolroom, is distributed at the month's end, in proportion to the amount of labor and material so absorbed. The time of crane men is often charged in the same way, with the expense of the crane following it. This is especially true of shops doing a mixture of light and heavy work.

The cost of making special and general tools is handled the same way. Spoilage is charged directly to the productive department where the spoilage occurred.

But, as we have seen, there are certain departments which contribute to the welfare of the business as a whole and thus to the welfare of the individual productive department. Since the productive departments benefit by the expense of the contributory departments, we must make them bear a share of their expense, in fact, among all of the productive departments, they must absorb all of the expense of all of the contributory departments. It is easy to see how the total expense of the power department can be distributed among the productive departments. This is done in much the same way that the fixed charges are divided. We know what the total consumption of power is, and by simple tests, we can determine the normal consumption of power by each department. The total power expense will thus be divided among the productive departments on the basis of their normal consumption of power. The cost of heating will be absorbed in the same way. Occasionally, we find a plant equipped with consumption measuring devices. The task of distributing the heating and power costs is then much simplified. The expense of operating the boilers is distributed between the power and heating on the basis of the steam consumption for each purpose. Where exhaust steam is used for heating, it is common practice to charge 10 per cent of the boiler expense to heating. The heating may be distributed on a square-foot basis or on the radiation used in each department.

Office Department Expense Simple

It is simple enough to gather the expense of the office department which obviously facilitates the work not only of the general factory, but of the selling department. For the individual business, an analysis of the office's activity will show about what percentage should be charged to the selling department and what per cent to the general factory. This division once set up, will govern unless a radical change in the activities comes about, warranting a new basis for dividing office expense.

This brings us to consideration of the contributory department which we set up as "general factory." This department facilitates the operation of the manufacturing departments of the business, but only such charges are put into general factory as cannot be directly charged to a productive department. For example, we may be paying a general superintendent $6,000 a year. One month he might give nearly all of his attention to the affairs of the automatic department. Normally, however, his attention is spread impartially over the entire plant. Among other items of expense which are properly chargeable to the general factory department in the typical machine shop, are a share of the executive salaries, the superintendent's assistant, cost and planning clerks, janitors, general or inter-department truckers, watchmen and so on. Yard men usually turn in time cards which apply part of their time direct to certain functions. Thus, unloading coal would be charged to the boiler department, loading cars to selling expense, or maybe to a specific sales order. When all of these expenses have been grouped and totaled, they must be distributed to the manufacturing departments on some fair basis. It is in this distribution that much specious reasoning is done with very sad results in the accuracy of costs.

Some Incorrect Methods

Let us consider briefly, some of the incorrect methods in order to emphasize some of the fallacies. It would be entirely possible, for instance, to spread this general factory expense among the productive departments in the same way that the depreciation of plant was distributed, that is, on a square-foot basis. I have seen this done. But we must remember that general factory is largely a supervisory expense. What connection could there possibly be between the floor area of a department and the effort of supervising it? One department, for instance, might contain several thousand square feet and yet be much more easily supervised than a department less than 500 square feet in area. This leads us to see that supervisory expense is really dependent upon the number of human beings or machines in a department, but as some productive departments will have many machines and few workmen, while others will have many workmen and few machines, we obviously come up against a difficulty if we try to divide the expense on the basis of the number of machines or number of men in a department.

Our next thought might be that we can make a department with a large payroll bear a proportionately larger share of general factory than the department with a small payroll. But we run up against several obstacles here; the one just mentioned and another which arises from the fact that we may have low-paid unskilled labor in one department, and highly paid, highly skilled labor in another. The highly skilled labor usually requires less supervisory expense than the unskilled, so apparently we cannot use this system of distribution.

The method in almost universal use—although not 100 per cent correct—is to divide the general factory expense among the productive departments on the basis of the productive hours of each department. We, therefore, from the payroll, determine the total productive hours for the plant and for each of the productive departments in the plant, and divide the general factory expense among the departments in the same ratio that the departments' productive hours bear to the total productive hours of the plant. This method is not entirely correct but is in accord with the best common practice and has been the accepted theory. For the usual run of machine shops, it probably is practically correct, but for the shop which has a disproportionately large amount of hand work or automatic machine work, special division and distribution of the general factory expense should be resorted to. As this comes under the case of special conditions it cannot well be treated in this article.

We have now shown the plan of departmentalizing the factory and have indicated how the entire overhead expense is gotten into the productive departments. We have not yet traced the non-productive labor and the non-productive materials or supplies from the books of original entry to the departmental expense. This we will do in the next two articles.

From the above, it will be seen that a method for distributing and handling the expenses of the various departments must be provided. While we have indicated how some of the items of expense find their way from the original invoices into the departmental burdens, we have not shown the mechanics by which these expenses are kept track of and are checked against the controlling account in the ledger.

In order to allocate the expenses to the departments, and to give the executives a means by which to check undue expenses in the various departments, we set up and maintain a record which we call the "expense analysis." This is one of the most important records in cost accounting. We have already said that any cost system which did not check with the general books was of little or no value. Therefore this expense analysis must check with the balance of the manufacturing expense account as shown by the ledger for the period. A study of the expense analysis, Fig. 60, shows that each sheet is arranged to take care of a department and that on each sheet for each department is shown in detail the various items of expense, month by month. Also you will note that a column is provided which is headed "normal." This column is to enable the executive to set up a standard or budget figure for each item of expense in that particular department, with which he can gage the actual expense for the item in question.

To save space, we are compressing the expense analysis to show figures for one month only. Actually the expense analysis is headed like that at the top of Fig. 60 to give a comparison for three consecutive months of the expense for each month and for the period to date.

The ledger account of manufacturing expense is made up of a series of debits and credits from the main books of original entry. In the manufacturing expense account shown in Fig. 57 there appears an item posted from the voucher register for $1,829.63. This amount we distribute to the various departments by means of the "Analysis of Expense from Voucher Register," shown as Fig. 61. On the left side of Fig. 61 are listed the different items of expense that have developed during the month. Across the top of the sheet are listed the different departments. At the extreme right hand of the sheet is a total column showing the amount against each item. The sheet is divided into two sections, the top part dealing with manufacturing expense which is controlled by the manufacturing expense account in the ledger, and the lower part dealing with the selling expense. At present, we are interested in the manufacturing expense items.

From the voucher register, we enter in the proper column on the proper line the various items of expense as shown in the manufacturing expense column on the charge register, which produces the result as shown on Fig. 60. From this form, we post to the expense analysis sheets themselves, against the different departments, the charge for each item that has developed during the month.

On Fig. 60 we show the expense analysis for all of the contributory departments and for one typical productive department, the automatic, which we will carry through as examples of the expense analysis as it develops. Each of these items on the expense analysis has after it small letters to show the source of that particular item. The letters V. R., for instance, indicate that the item came from the voucher register; F. C. S. from the fixed charge sheet and so on.

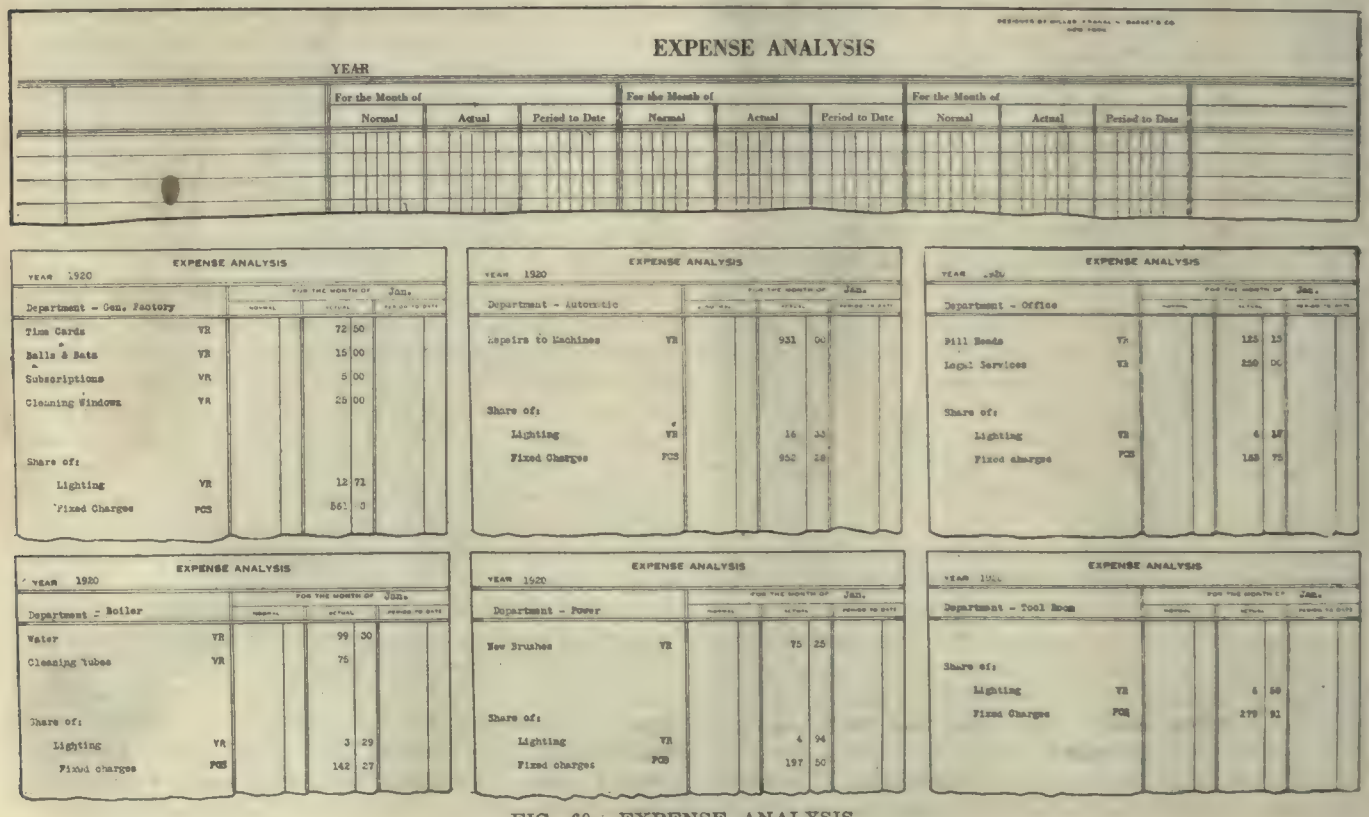


FIG. 60. EXPENSE ANALYSIS

ANALYSIS OF EXPENSE FROM VOUCHER REGISTER
M'f'g EXPENSE

VOUCHER NO.	ITEM \ DEPARTMENT	BOILER	POWER	OFFICE	TOOL ROOM	GEN. FACTORY	AUTOMATIC	MILLING	LATHE	PLANER	POLISHING	HARDENING	ASSEMBLING	SHIPPING	SELLING	TOTAL
01	NEW BRUSHES		75.25													75.25
	WATER	99.30														99.30
	BILL HEADS			125.13												125.13
	TIMECARDS					72.50										72.50
	BALLS & BATS (WELFARE)					15.00										15.00
	REPAIRS TO MACHINES						93.00									93.00
	LIGHTING (O/S ON AREA)	3.[illegible]	4.94	4.17	6.[illegible]	12.71	16.35	2.75	21.41	8.24	2.[illegible]	16.47	24.70	10.98	1.92	137.25
	SUBSCRIPTIONS					5.00										5.00
	CLEANING WINDOWS					25.00										25.00
	LEGAL SERVICES			250.00												250.00
	REPAIRS TO TRUCK													19.70		19.70
	CLEANING TUBES	75.00														75.00
	ETC															
	TOTAL	177.98	80.19	379.[illegible]	6.50	130.21	947.35	2.75	21.41	8.24	2.75	16.47	24.70	30.68	1.92	1827.63
			SELLING EXP.						SELLING	EXPENSE						TOTAL
	TRADE PAPER ADVERTISING		29.30													29.30

FIG. 61. ANALYSIS OF EXPENSE FROM VOUCHER REGISTER

Insufficient space prevents showing the standing of the ledger accounts when the journal entry for the fixed charges has been made. This journal entry was noted on the bottom of the fixed charge sheet, Fig. 59. In the next article we will show the ledger accounts as they stand after this entry and those necessitated by the labor charges have been made.

On the expense analysis we are showing against each department the monthly charge made against it for fixed charge, that is for tax, insurance and depreciation. This figure shows in the extreme right-hand column of the fixed charge sheet, Fig. 59. As the different items of expense develop, we shall show the building up of the expense analysis. And when we have accumulated all of the various items and charges against each department, we will then show how the expense of the contributory departments is carried forward and absorbed by the productive departments. We will also take up at the completion of the posting of our expense analysis the method by which the expense of each department is relieved and how it finds its way finally into the cost of the finished article that has been fabricated in a given department.

That—to get every item of overhead expense into the finished product in the right proportion—is the ultimate end of cost accounting. It is most accurately and quickly done by means of the expense analysis.

Want Ads

BY CHARLES F. SMITH

On page 892, Vol. 53, of the *American Machinist*, A. W. Forbes takes exception to an article which appeared in a previous issue under the title "Putting Punch Into Help Wanted Ads." The only trouble I see is that the punch is misdirected.

I have been both employer and employee and have found many times that a good man may be found for a position that he can fill in every way, but his letter composition does not meet with the expectations of the advertiser; therefore, he will not take the trouble to look up the man's references, or have the common courtesy to reply to the applicant's letter. If the man is honest in his belief that he can fill the position advertised and shows it by giving reference to his past and present employers, it is his due that the advertiser should acknowledge his letter in some way, even if he is in touch with someone else who, he thinks, is better qualified to fill the position.

From my own experience it seems to me that most of the advertisements are blinds, as seldom have I ever received an answer from any of them. It may be that my composition is not to their expectations, or that my experience has been too extended to suit the position advertised or the price they expect to be asked is too high. Again it may be that my age is against me, although I am in middle life. Or it may be because I do not give a detailed explanation in a letter, for it would take many sheets of writing to do it, but give only a general outline of my experience which should be sufficient to let the advertiser know if it in any way corresponds with the line that he has to deal with. If so, he could write and ask any questions necessary after learning from my references that I am a man who can be depended upon and can qualify for the position open. And I have always supposed that references were called upon to substantiate the claims of the applicant, although sometimes what will suit one concern will not suit another.

I would suggest that the *American Machinist* have a "blue list" for advertisers for "Positions Vacant" and "Position Wanted," and only accept such advertisements as will bear the fullest investigation before publishing, each and every one obligated to answer all letters received. Of course an extra charge should be made to cover the trouble of looking up references and qualifications; it would also eliminate extortion demanded by the employment agencies.

Meeting the Present Emergency

By An Eastern Machine-Tool Manager

WE ARE bending most of our energies to the building of parts both for standard machines and obsolete repair parts, and to a limited extent, units and sub-assemblies. We go as far in the direction of building complete machines as our floor space will allow. There are certain objections to this, that set a limit to the practice, however, since under some conditions of bookkeeping in connection with the present income tax and excess profit taxes, a given amount of labor and material would show a higher inventory value of finished machines than it would in any other form. This means there would be a higher book profit at the end of the year, and a higher tax, even though not a machine was sold and no money was made.

The present excess profits and war tax penalize the company which tries to keep its plant going and its men employed, and makes it almost absolutely necessary for most firms to shut down flat if they are to exist in times like these. That is one of the many advantages of that particularly beautiful piece of legislation.

Our principal task is to maintain our organization. It is the most valuable piece of property which the company possesses, far more valuable than the patterns, the drawings, the shop, the machinery, or the goods and material in stock. For this reason, we plan in such times instead of laying off a certain percentage of the men to run the whole shop a certain percentage of the time, so that the whole organization may be carried along as long as the money lasts; and the whole problem of running the shop becomes one of making the resources last as long as possible in holding the organization together.

In this connection, times like these are the ideal times in which to push new developments whether in machinery, tool design, method of work, improvement of shop processes, or anything else that may be important. The firm not only has the time for it but such work is of a nature to be day work rather than premium or bonus work, and also to require almost the entire payment in the form of wages rather than material; as compared with regular production work, therefore, the available resources can be used to carry the organization a longer time, at the same time producing results which will give a big boost to the production business when the demands for that again return.

Reduction of overhead expense is taken for granted but this is a matter of detailed supervision on which we can make no general remarks.

The Automotive Field Outlook

It is our opinion that the automotive industry has reached the limit of its expansion and has, perhaps, even gone a little beyond that limit. This does not, however, in any way set bounds to the amount of business that we will get from this field in the future, inasmuch as our knowledge of it makes us very strongly of the belief that the renewal of old machine tools and the replacing of obsolete machines and methods will require fully as much expenditure as has gone into the expansion of the business in the past. The field will not be as lucrative a one as in the past for builders of standard machinery like lathes, drill presses, etc.; and for the makers of more special types of machinery it will mean a keener and more intelligent competition, but we are prepared to meet that competition and expect to get, if anything, an even larger share of the business than we have gotten in the past, although it will require more effort to get it.

We are still looking for further expansion in the truck fields, although this may be affected by absorbing some of the excess automotive capacities. We are still more hopefully looking to the development of the tractor, either in the immediate or more remote future, to be the next industry to undergo a rapid and large expansion. This, however, is consequent on the solution of the fuel problem. That it will be solved in some satisfactory way is to be expected but just what the solution will be is not yet apparent, at least not to us. Railroads, at the best, while important in many fields, cannot take the place for us of the automobile and other heavy production industries. There is much new work to be obtained in minor and miscellaneous industries, particularly in the textile and electrical fields as well as in all sorts of special machinery. All these have been neglected in the past in favor of the easily obtained order from the automobile manufacturers, but intensive and continuous work in combing out the possibilities of these new fields should produce good results.

> Now is a good time to build repair parts, units and sub-assemblies. The effect of this on Income Tax reports.
>
> Maintain the organization as it is the most valuable asset which a company possesses. Run the shop part time rather than lay off a lot of good men.
>
> Automotive field must have more efficient equipment to lower production costs. This means much new machinery in automobile shops.
>
> Maintain wages and reduce costs by securing greater cooperation in the organization.

Maintaining Wages—Securing Co-operation

We have no immediate expectation and do not think it will be necessary in the future to reduce wages. The machinist has been poorly paid as compared with some of the organized industries and we believe he should not suffer because of the fact that he is unorganized.

In looking over our own works, we are sure that with the intelligent co-operation of the workman and by the exercise of the same engineering skill and operating ability that we have put into the work of our customers, we can so develop the processes in our own shop that we will be able to continue our present rather high rate of wages and at the same time have a margin left, which will later on permit of a reduction—if that becomes necessary.

We are at present running four days a week, eight hours a day, and with full force. The office and drafting rooms are running the regular six days or 48 hours a week.

WILLAMETTE'S WAR WORK

By Fred H. Colvin
EDITOR - AMERICAN MACHINIST



FEW of those who have not visited the Pacific Coast during the past two years can appreciate the great contributions which this section of the country made to the requirements of the Emergency Fleet Corporation. One of the shining examples is to be found in Portland, Ore., in the shops of the Willamette Iron and Steel Works, the mainspring being President Bert C. Ball, and a corps of able assistants. When it came to the building of marine boilers this company covered itself with glory, averaging 22 boilers per month on one rush contract, including February, 1918, when it completed 23 boilers, or one for every work day. Nor were these small boilers, as can be seen from the headpiece, and also Fig. 6. They were 15 ft. in diameter, 11 ft. 6 in. long, of the Scotch type and had three furnaces. The shells were 1⅛ in. thick, which made a problem in boiler construction that could only be handled by good machine equipment and skilled executives and men. One of the interesting methods which contributed to this result is that devised for the drilling of the plates as shown in Fig. 1. Plate drilling by usual methods is a comparatively slow process and in order to drill these heavy boiler plates satisfactorily and in good time, the arrangement shown was laid out and put into operation. Along one bay of the shop the substantially supported track with a gage wide enough to allow the widest plate to lie in between the rails was built as shown at *A* and *B*. Then the four-wheeled trucks as shown at *C* and *D* were built, each

Unless one is familiar with the capacities and the products of some of the larger shops of the Northwest, it is impossible to realize what was accomplished by them in carrying out the war program. Although the Willamette shop had turned out large marine repair work, it required the war demand for large marine boilers to give it the opportunity to show what could really be accomplished by a wide awake management and crew.

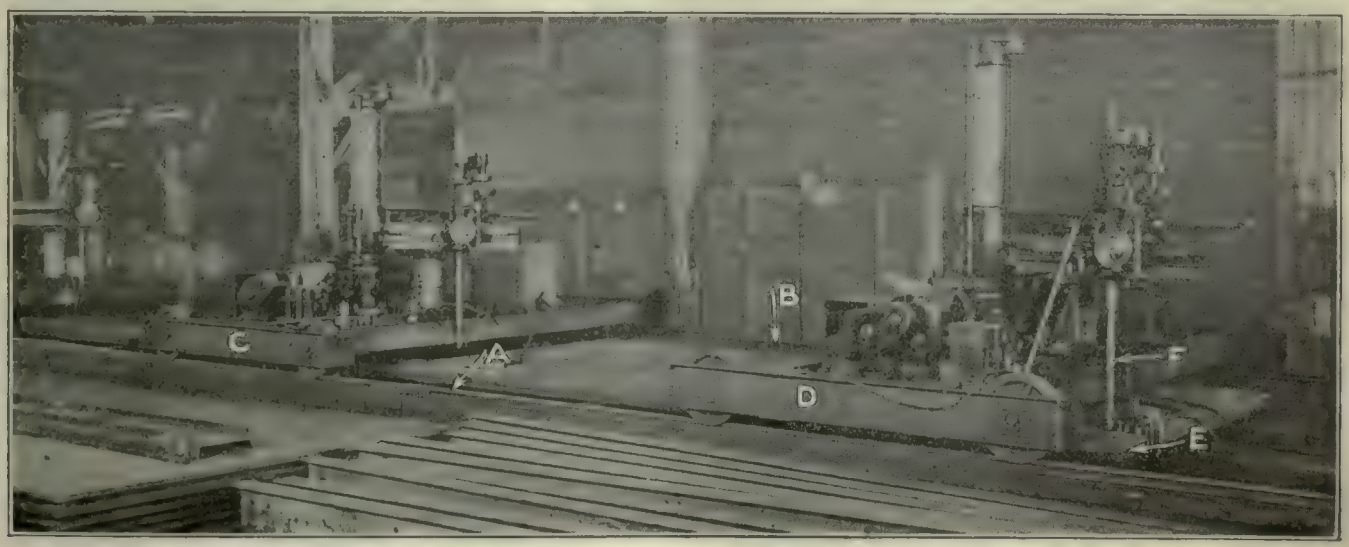


FIG. 1. PORTABLE RADIAL DRILLING MACHINES FOR BOILER PLATES



FIG. 2. A LARGE "OLD MAN" FOR AIR DRILLS

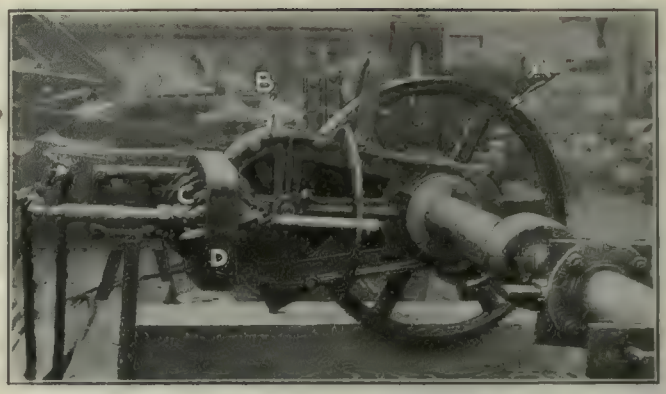


FIG. 3. BORING BAR FOR PROPELLER-SHAFT TUBES

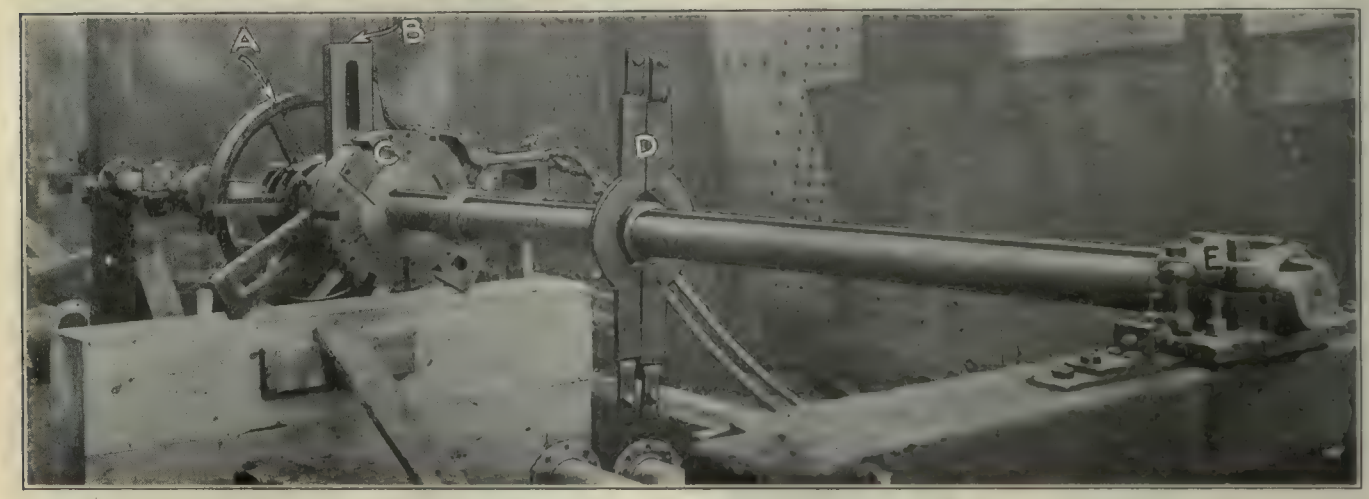


FIG. 4. DETAILS OF THE DRIVING MECHANISM

truck carrying a large radial drill, the two shown in this view being of the "American" type. These drilling machines were so placed on the trucks that the columns were approximately at one-third of the length of the truck, instead of being in the center. By doing this a shorter and stiffer arm could be used, and, when it becomes necessary to reach the other end of the long sheet, a crane picked up the whole truck and turned it end for end. By having some turned one way and some the other all parts of the sheet could be readily reached.

The sheets were laid out in the usual manner, clamped together as shown at *E* and by the use of extension drill spindles or sockets, as at *F*, the work of drilling was rapidly and easily handled.

Another drilling device which helped materially to increase the output of boilers is shown in Fig. 2, this de-

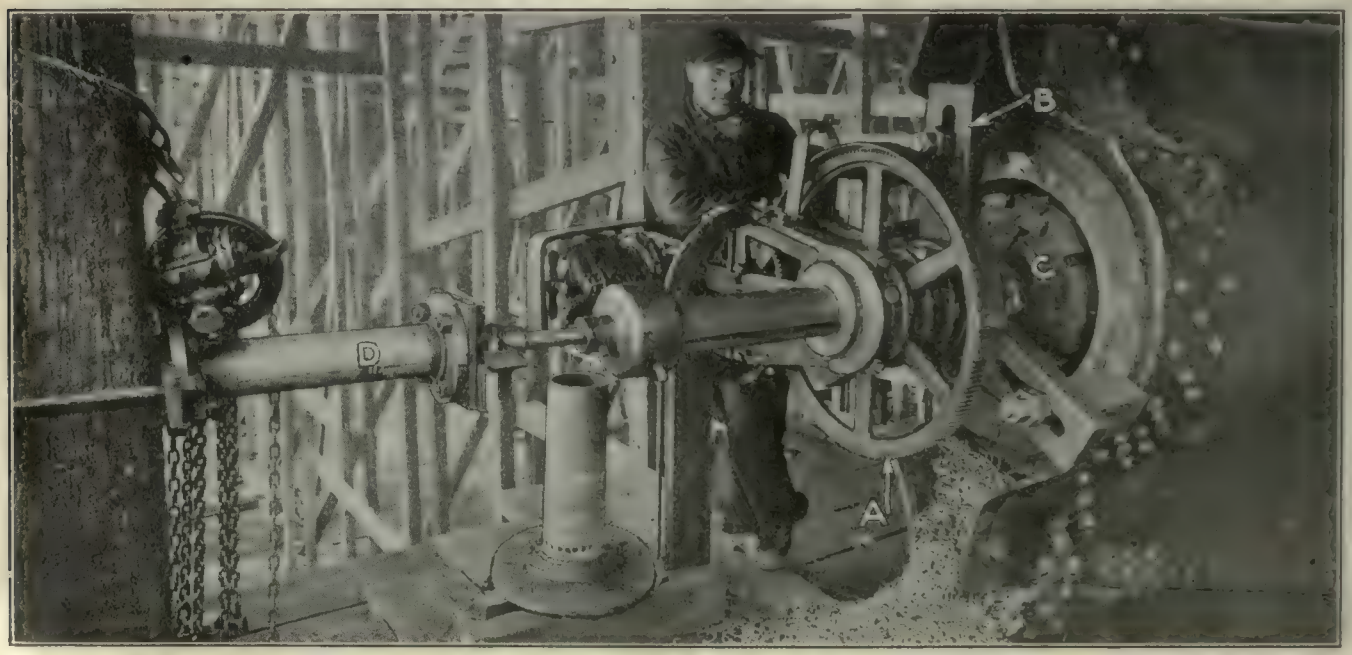


FIG. 5. THE BORING BAR AT WORK

vice being a sort of glorified "old man" and was used in connection with an air drill for drilling tube plates of water headers and similar work. This device is also mounted on truck wheels and moves along a track to any desired position over the work, which is supported on horses so as to be at a convenient height for the operator. The heavy I-beam *A* which forms the top of the crane not only acts as a support but also as a runway for the small trolley *B* which carries the air motor. The rest of the framework is composed of angles and flat plates, as can be seen. The motor hangs from the small truck and receives air through the head *C*. From this head hang the two arms *D* and *E*, which carry the air drill loosely, supporting it while being moved from one position to another. This arrangement makes a very convenient way of drilling small holes in work which for any reason it is not advisable to put under the larger drilling machines.

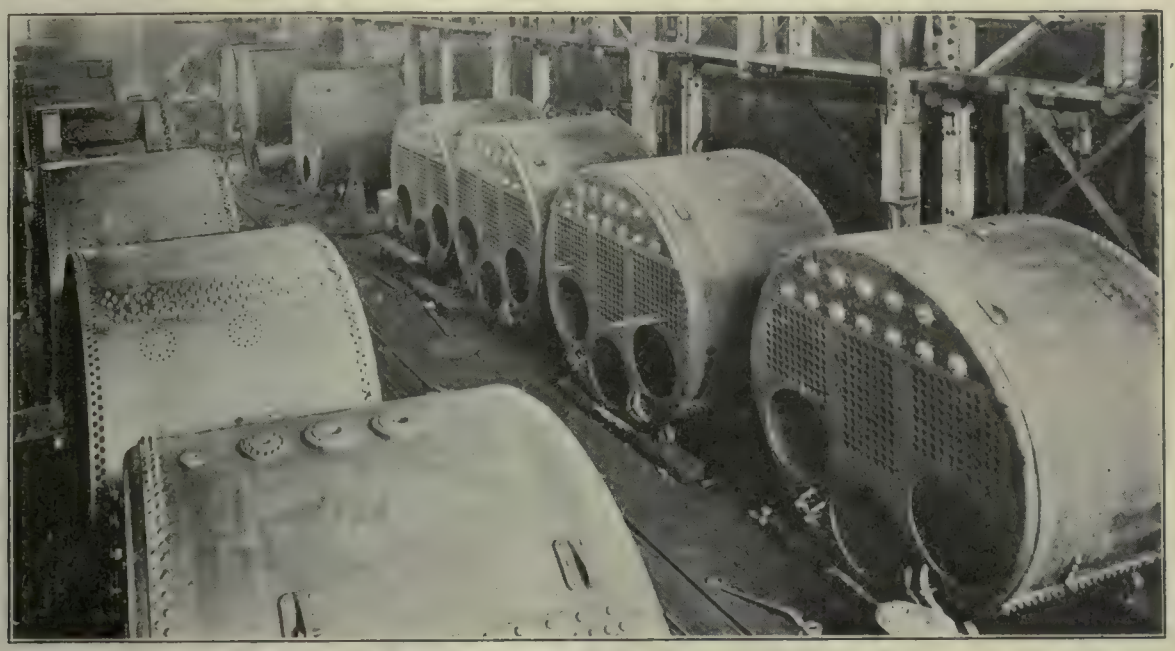


FIG. 6. THE ASSEMBLING BAY IN THE BOILER SHOP

Boring Ship Stern Tubes

An entirely different type of work is illustrated in Figs. 3, 4 and 5, these showing a special boring bar which was designed and built for boring shaft tubes after they are in place in the vessels. The boring bar itself is shown in Fig. 3. This view also shows the driving gear *A*, the three pronged supporting spider *B*, the toolhead *C*, and inner support at *D*, and an end bearing at *E*. Further details, together with the way in which the bar is used, are shown in Figs. 4 and 5.

In Fig. 4 are the details of the driving mechanism, consisting of the large driving gear *A*, suitable reduction gearing in the housing *B* and the motive power *C* in the shape of an air drill, which is mounted in the frame *D* in order to hold it in proper relation to the gear reduction.

In Fig. 5 we have the boring bar set up and in operation, the gear *A*, spider *B* and toolhead *C* being lettered to correspond with the other illustration of the bar. This shows the reduction gearing as well as the motor and its supporting frame. In addition it shows the thrust mechanism *D*.

The shape of the chips shown below the stern tube indicates what sort of a cut is being taken by the boring tool, and it is interesting to note that this device proved entirely satisfactory both as to time and quality of the work done.

A general view of the type of boiler referred to in the first part of the article, together with the use of rollers for mounting them, shows that they could be readily turned for various operations as shown in Fig. 6. One of these boilers for each working day is an extremely large output for a plant of this size.

Help-Wanted Advertisements

By A. W. Forbes

The article by H. M. Fitz on page 1199, Vol. 53, of *American Machinist*, gives some interesting criticisms of want ads and states why they do not bring the desired results, but fails to say how they can be written to appeal to the desired class of applicants.

The advertisement that showed me the difficulties of giving the proper appeal was a 215-word display advertisement in a newspaper. It stated age required, line of advancement open, nature of the work, qualifications required and some details as to how I should test the applicant to determine those qualifications. The only blind part was my name and address. This advertisement would certainly meet all of Mr. Fitz's suggestions.

A good number of replies was received, but every one gave the impression that the applicant had not read the advertisement. Not one was worth considering. Since that date I have used a simpler form of advertisement something like the following: "Young man wanted. Must know something about electricity." It is much cheaper and seems to be just as good, but that isn't saying much.

I feel that the real trouble is that the applicants do not know anything about their own ability or lack of it. Few men seem to realize that is is possible to operate a machine for years without knowing anything about it, or that they can wire a house without knowing anything about electricity.

Continuous Milling of Pump Bodies

High Production Rate Obtained by Using Continuous Process—Table Revolves to Feed the Work—Castings Replaced While Machine Is Cutting

BY SPECIAL CORRESPONDENCE

THE idea of continuous machining has been given considerable attention, although only in recent years has the principle become generally recognized. When a number of parts of the same kind require milling, continuous milling machines have proved effective. The Goulds Manufacturing Co., Seneca Falls, N. Y., is using a continuous milling machine to finish some of the parts of small high-speed pumps which it manufactures. The nature of the surfaces to be machined is shown in Fig. 1. On the cylinder itself, to be seen at *A*, the two ends and the bearing on the side for the valve box require finishing, while two adjoining sides of the valve box are machined, as can be seen at *B*. All of this work is performed on one machine, by the use of interchangeable fixtures, a rather large lot of the castings being put through the successive operations, so as not to necessitate too frequent changing of fixtures. The machine used was made by the Newton Machine Tool Works, Inc., Philadelphia, Pa., and is designated as the Model C-28 continuous milling machine, described in the *American Machinist*, page 642, Vol. 53.

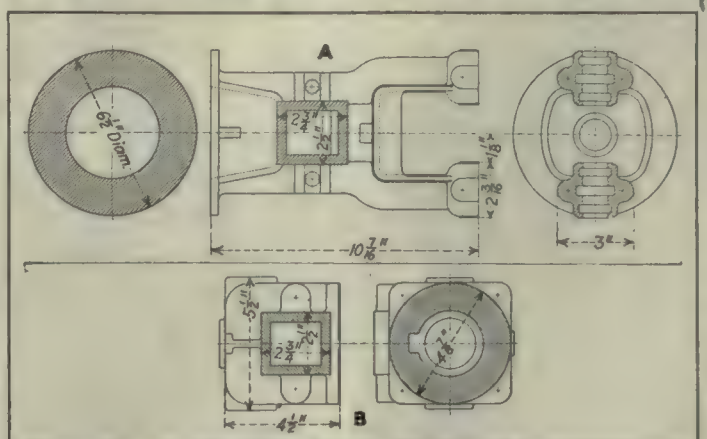


FIG. 1. CHART SHOWING SURFACES TO BE MACHINED ON CYLINDER AND VALVE BOX

In Fig. 2 can be seen the arrangement used when milling the bottoms of the cylinder castings. A rotating fixture holding sixteen castings is employed. The roughing is done by the cutter on the left and the finishing by the one on the right, the depth of cut being ⅛ in. Both of the face milling cutters are 10 in. in diameter, the cutting tools of the roughing cutter being stellite, and those of the finishing cutter being high-speed steel. The castings are held in place by means of studs and rest upon a ring which fits in the half hole for the journal bearing. The table revolves continuously and the operator removes the finished castings and replaces them with unmachined ones while the tools are cutting. It is stated that a lot of 100 are machined in three hours. The tops of the cylinder castings are machined to provide bearing surfaces for the caps of the journal boxes, see Fig. 3. The same cutters and fixtures are used, the fastening being different.

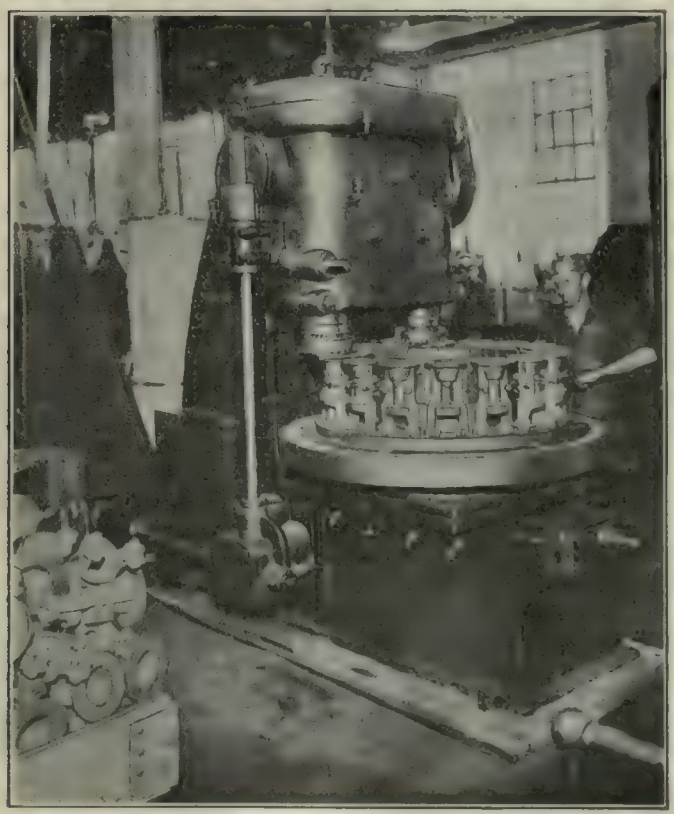


FIG. 2. CONTINUOUS MILLING THE BOTTOMS OF CYLINDERS

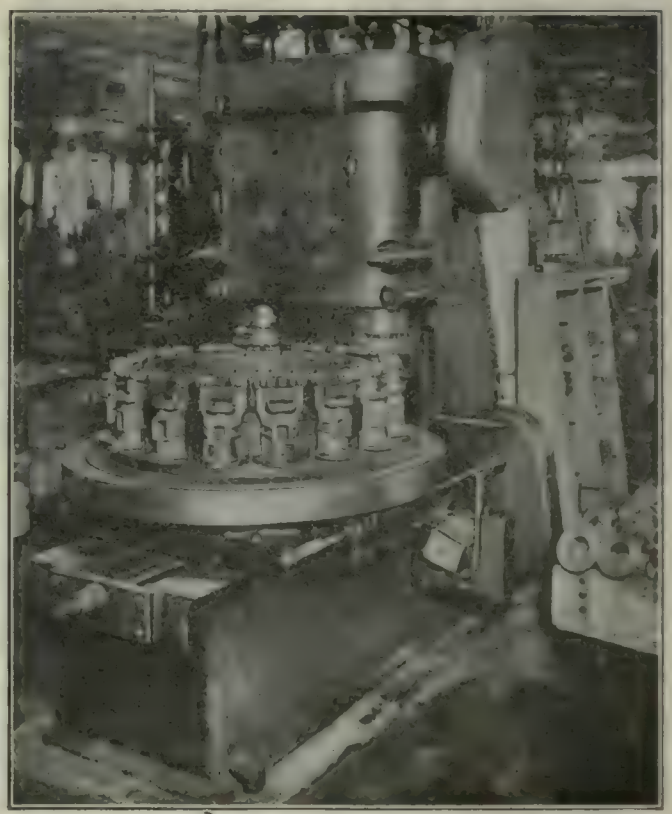


FIG. 3. MILLING THE TOPS OF THE CYLINDER CASTINGS

The castings rest directly upon the base of the fixture, and each one is held in place by a clamp secured by a single stud. The production is 100 pieces in three hours.

Milling the Valve-Box Pad

The last of the milling operations on the cylinder is the machining of the side for the valve box, see Fig. 4. A different fixture is used for this work, as well as different cutters. High-speed steel cutters of 4-in. diameter are used, because of the fact that the surface to be machined is not large and is somewhat lower than adjacent parts of the casting which it is not desired to machine. It should be noted that the work is not held rigidly in the fixture, but each piece is practically clamped separately to the large plate on the table. The ring in the center supports the small end of the cylinder, on which a clamp is placed. The large end, also, is held in position by an L-clamp. Ten castings can be placed on the table at once, it being stated that 100 parts can be machined by this method in 4 hours.

Owing to the fact that the machined surfaces are spaced far apart, time is lost by the passing of the cutters from one casting to the next; and it seems that a greater production rate could be obtained by an arrangement which would bring the surfaces to be machined closer together.

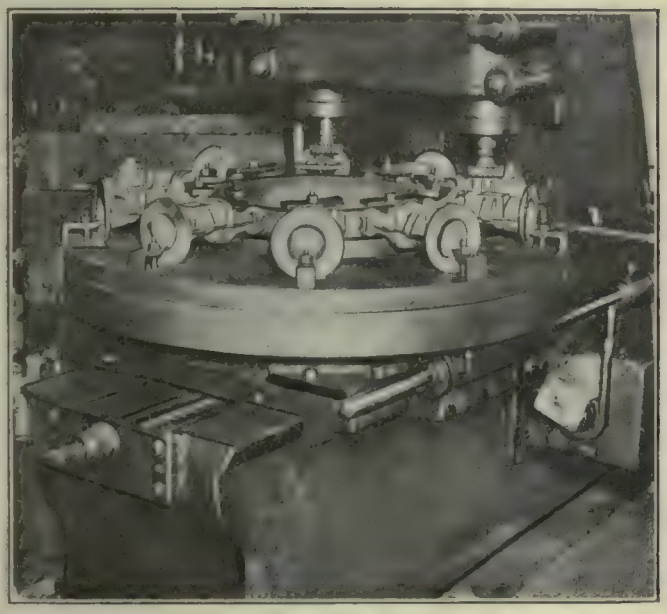


FIG. 4. MACHINING SURFACE FOR VALVE BOX ON CYLINDER

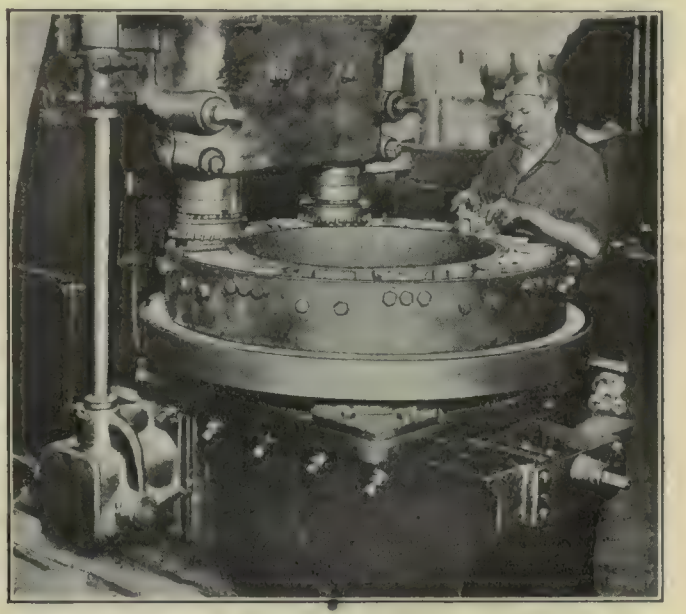


FIG. 5. METHOD OF HOLDING VALVE BOX WHILE MILLING

Method of Holding Valve Box While Milling

To machine the valve box which fits on the side of the cylinder, a different fixture is used, as shown in Fig. 5. The same 10-in. diameter cutters used for the first operations are employed, however. Since it is necessary to machine two sides of each box, the fixture is so made as to hold the boxes in two different positions. One station of the fixture holds the box so that the top can be machined, and the next one so that the side is up. Thus, by merely shifting a box to the next position in the fixture after one surface has been machined, the other side can be finished. Since the fixture holds 18 castings, 9 valve boxes are completely machined at one revolution of the table. A lot of 100 boxes can thus be machined in 4.3 hours, it is stated.

From the illustrations it can be seen that the work is placed on platforms, which can be conveniently moved about the shop. The machine is belt-driven from an overhead shaft. The two spindles have small independent vertical adjustments, so that the cutters can be set at the right height relative to each other. The head carrying the spindles has a vertical adjustment to permit of the cutting of work of different heights. Since it is necessary to change the height of the head frequently, because of the change in the character of the work done, a counterweight has been attached, so as to balance the weight of the head and make the adjustment easy. The weight is inclosed in the cylindrical protector at the rear of the machine, and is fastened to the head by means of the cable to be seen at the tops of Figs. 2 and 3.

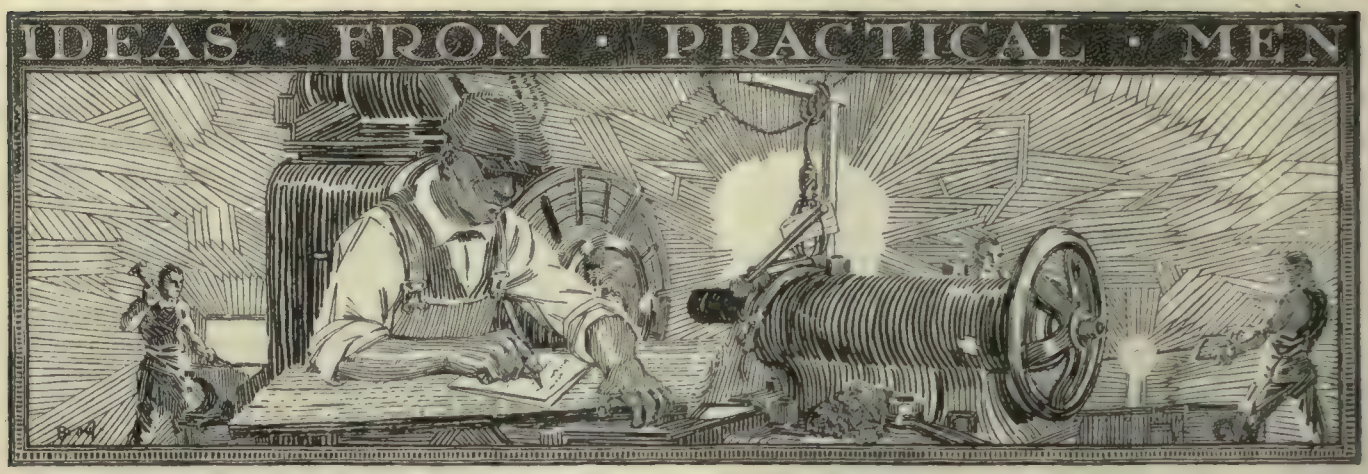
The machine is not equipped with quick-change gears in the drive or in the feed, so that the rate of each of these is kept constant throughout the work. The speed of the spindles is 32 r.p.m., which gives a cutting speed of 80 ft. per minute when the 10-in. cutters are being used.

A feed of 7 in. per minute on the maximum diameter was used, the depth of cut being about $\frac{3}{8}$ in. The maker of the machine states that the speed of the roughing cutter should be increased to 100 ft. per minute, and a feed of 15 in. per minute be employed.

Satisfactory Results Obtained

Despite the fact that the machine did not seem to be pushed, the user claims that by the system just outlined very satisfactory results have been obtained. The three surfaces to be machined on the cylinder were formerly milled simultaneously on a three-spindle machine. It was stated that the method here described enables the production of the part in half the time formerly required, despite the time now needed for changing the fixtures.

It seems that the principal loss of time formerly occurred in the replacing of the work, which action is now performed while the machine is cutting.



Is This a Punch Press Job?

By G. R. Richards

In response to a request by Mr. Hudson, printed on page 267, vol. 52 of *American Machinist*, for information upon the subject of producing flats upon small round rods, several suggestions have appeared in the columns of that journal; the suggested methods including milling, broaching, rolling, and shaving.

All of these methods leave something to be desired. The main difficulty with any method of cutting is to hold the work firmly enough to resist the tendency of the rod to turn over, and yet avoid marring or springing it with the clamps. A further difficulty is presented by the burr that naturally results from any of the above methods, inasmuch as this burr involves a second handling to remove it, and, if the work is carelessly done, the finish may be spoiled.

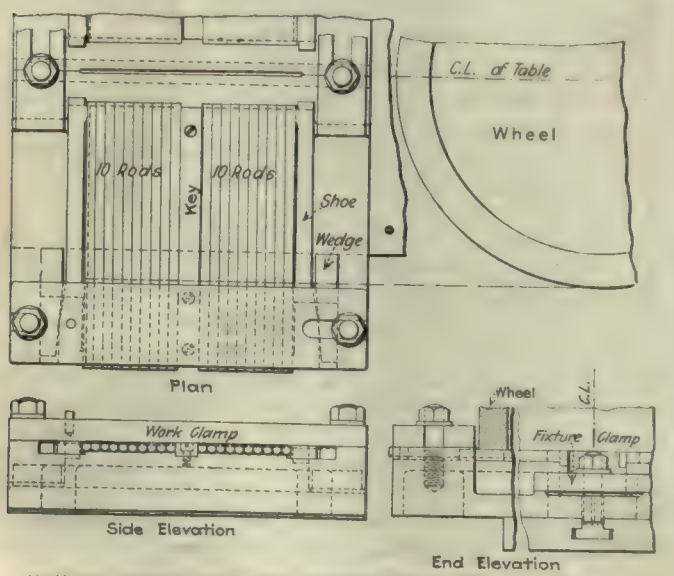
There is another method that has not thus far been mentioned, and that is grinding. The machine I would suggest is a vertical-spindle surface grinding machine with a large ring wheel and a reciprocating table. Such machines are made by several manufacturers and are in common use in the larger shops.

A sketch of a holding fixture is presented herewith. A number of small units is suggested instead of one large fixture, both to save in cost of pattern and machine work and to make them more convenient for handling. This method also permits the use of extra fixtures which can be loaded while the tableful of rods is being ground. The cost of the extra fixtures is small compared with the time saved, as these machines work so fast that the loading time on a job of this kind would practically equal the machining time.

To load, place the rods and shoes in the fixture with the wedges and clamping bar removed. Then slip on the work clamping bar, stand the fixture on end to line up the rods endways and bring up the work clamping bar nuts lightly. Then drive home the wedges and set up the work clamping bar nuts tight. The spacing of the fixture is to suit the diameter of wheel.

The work clamping bar and shoes above mentioned should be of tool steel—spring tempered, and slightly bowed, so that the ends are higher than the middle. Then, when tightened, the middle bearing will always seat on the work.

Allowing ten minutes for grinding and loading a tableful—120 pieces—would give a production of 720 an hour, not allowing for lost time.

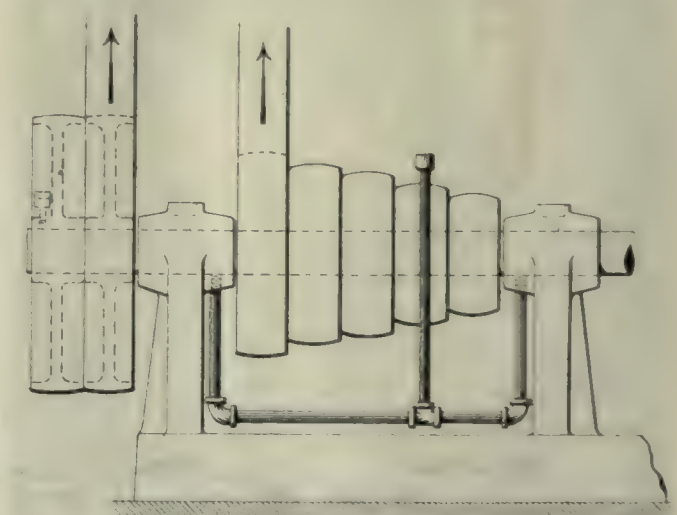


FIXTURE FOR HOLDING ROUND RODS FOR GRINDING

Oiling the Lower Shaft on Upright Drilling Machines

By W. Burr Bennett

Our machine-tool equipment included a number of the so-called standard 20-in. upright drilling machines. The belt drive pulls up toward the line shaft as does the belt on the cone pulleys, putting the total pull on



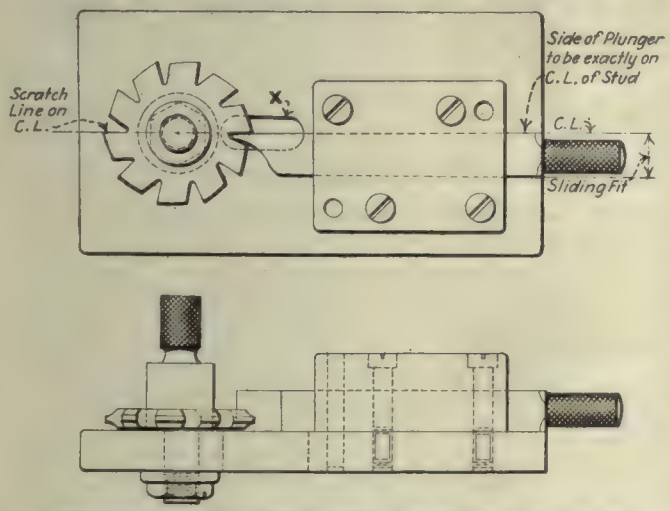
PIPING FOR OILING THE LOWER SHAFT ON UPRIGHT DRILLING MACHINE

the lower shaft upward and in proportion to the tension on the belts. Both bearings, as shown in the sketch, were provided with oil holes and cup-shaped recesses to hold oily waste. Allowing for the fact that these machines were being loaded away beyond their capacity, we were at a loss to account for the too frequent babbitting on these bearings. Naturally we were not interested in replacing bearings all the time so we proceeded to make a little study of conditions. An analysis showed that the upward shaft pressure was causing the oil to pump out of the so-called oil hole in the top half of the bearing. In other words, our oil hole was directly in line with the resultant bearing pressure and was worse than useless. In fact the bearings would probably have stood up better with a grease cup that would force the grease down into them. As a remedy we plugged these oil holes up, tapped the bottom of each bearing for ⅛ in. pipe and arranged a piping system as shown, with a long vertical filler pipe fitted with a cap. This arrangement completely solved the problem, allowing the oil to feed from underneath as it should and also keeping a little head on the oil. It cost about $8 per machine to apply, and has saved $80 worth of bearings so far.

Grinding Gage for Gear Cutters

By E. A. Dixie

The importance of properly ground gear cutters does not seem to be appreciated as it should be. Even new cutters of standard makes, when checked up recently



FIXTURE FOR GAGING THE ACCURACY OF GEAR CUTTER TEETH

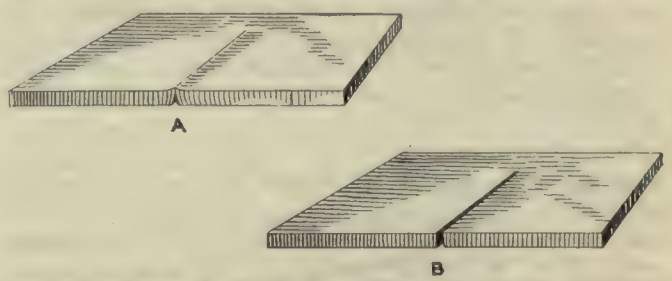
before putting them in service, were found to have teeth which had not been sharpened radially. Cutters which had been sharpened in the shop were mostly found to have been ground with a "hook" evidently with the idea that they would cut freer, no doubt they would on the general run of materials but at the expense of tooth form in the finished gears. It was just this feature of incorrectly formed teeth which forced us to devise some simple fixture for checking up the quality of the work of the cutter sharpener.

The fixture shown in the illustration is mounted on a box about 12 in. long by 10 in. wide and about 8 in. deep. The top of the box is plain wood except for a small window of ground glass which is let in as shown by the oval *X* in the plan view. Inside the box there is an electric light. With a cutter in place on the stud the plunger is slid forward into one of the gashes and the cutting face of the tooth brought to bear on the face of the plunger. As the plunger face is in accurate alignment with the center of the stud any error in grinding will be at once apparent against the illuminated ground glass background.

Cutting Fine Slits in Sheet Metal

By E. Lytton Brooks
Helensburg, Dumbartonshire, Scotland

A few years ago it so happened that I had some very fine slits to cut in mild steel and brass plates ranging in thickness from $\frac{1}{64}$ to $\frac{3}{64}$ in., and as this job has



EXAGGERATED SECTIONAL VIEWS OF RAISED PORTION AND OF THE FINISHED PIECE

cropped up again quite recently I think the proposition may be of interest.

Although this method, being so simple, is probably known and practiced by some; at the time I required such knowledge no one seemed able to help me out, and not a few considered it impossible. I solved the problem by experiments, and now hope to save others the trouble. The slits referred to, varied in width from 0.0005 in. to 0.001 in. and in length from 0.210 in. to 1 in.

In the first place it becomes necessary to have some means of measuring the width of the slits as accurately as possible. This was accomplished with feeler, or thickness, gages rolled, and afterwards further thinned down, from steel tape. The method employed was as follows: The steel ribbon was carefully rolled from 0.005 in. to 0.002 in. in a pair of close and even fitting rollers. The latter dimension being reached, our rollers refused to reduce it further. A boxwood cylinder was then turned, coated with fine emery powder, and run at a speed of 5,000 r.p.m.; the steel ribbon being lightly drawn over the cylinder until the micrometer gave the correct reading over at least a 1-in. length. The piece required was cut out and used as the gage.

Next a finely pointed blade was made from a piece of ¼-in. drill rod; similar to a pocket knife blade, only thinned more at its extremity. This was carefully tempered and inserted in a file handle of suitable size.

With the plate to be cut laid flat on a piece of faced hardwood, (the position of slit having previously been marked out) the blade is drawn with even pressure against a straight edge until it has sunk deep enough in the metal to follow the groove. Laying aside the straight edge the groove is deepened by continuing to pass the blade over it until a faint, slightly raised line shows on the under face. The illustration at *A* gives a magnified impression of the work at this stage.

The raised line is now lightly and evenly rubbed with a stick of rotten-stone or fine carborundum until it is flat, or nearly so. It must not be rubbed through, but should leave a film of metal still unbroken.

A small sharp piece of the prepared steel ribbon,

(using the correct thickness) inserted in something which allows of its being handled easily, is used to cut through the remaining film. The steel ribbon is gradually worked through, and from one end of the groove to the other, until the slit is of the correct length. If the face of the plate from which the groove was started is cleaned off flat with emery paper, say a French No. 1, it makes a very neat job. Also a slight dust with a No. 00 paper on the slit side removes the bur, but it must not be worked hard enough to open the slit. All that remains to be done is to rinse in petrol which removes the metal dust sticking in the slit.

The reader will note that the correct width of slit is only on one side of the plate as at *B* in the illustration, but nine times out of ten this is of no importance. The usefulness of this method is appreciable because it does not entail any expensive apparatus and is simple; also lengthy practice is not required to become fairly proficient.

Laying Out a Circular Arc When Center Is Unknown or Unavailable

By William S. Ayars

Having recently had occasion to lay out a circular arc when it was impossible to get a center and when as a matter of fact the radius was not known, I looked in several handbooks for a rule. In one book the following formula was given, the letters referring to Fig. 1:

$$y = \frac{x^2}{L^2} h.$$

Now this can be written $y = \left(\frac{h}{L^2}\right)x^2$ in which $\frac{h}{L^2}$ is a constant and can be called a.

Then the equation takes the form $y = ax^2$ (1)

which is the equation, not of a circle, but of a parabola, as can readily be proved, either by analytic geometry or by laying out a number of points and noting the shape of the curve. But in the case of a large value for L and a small one for h (as in the case of a deck-beam) the difference is not worth noting; in fact, the parabola may be the better curve. The only object of this curved deck-beam is to make a "crown" so as to shed water, for structurally a straight beam is better as there is then no thrust outwards against frames when carrying a deck load.

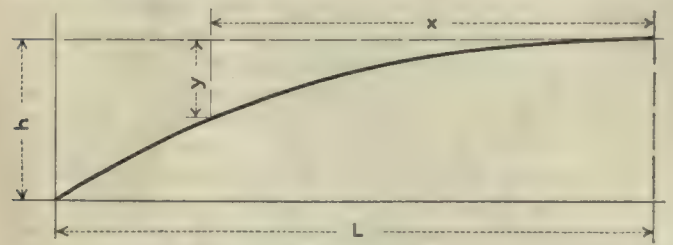


FIG. 1. REFERENCE FOR FORMULA (1)

But there are occasions when the actual arc of a circle is required and it can be laid out as follows:

Referring to Fig. 2, let AX and AY be axes and AB the arc of a circle, with center at O, on AX.

Let P be any point and its ordinates x and y. Now PEO is a right triangle and $\overline{PE}^2 + \overline{EO}^2 = \overline{OP}^2$.

But $PE = y$; $EO = R - x$; and $OP = R$. So we can write the equation

$$y + (R - x)^2 = R^2$$

or

$$y^2 + R^2 - 2Rx + x^2 = R^2$$

which reduces to $x^2 + y^2 = 2Rx$. (2)

By the same reasoning,

$$L^2 + h^2 = 2Rh \quad (3)$$

To apply this to the usual case we are given only h and L. In other words, we are required to lay out a circular arc having given the chord (or half-chord) and the versed sine, or rise, or amount of camber. We do not know what the radius is and, if we did, the chances are that in the usual shop we would have no proper means of striking the arc. If the radius is wanted, it can easily be found from equation (3), for if $L^2 + h^2 = 2Rh$

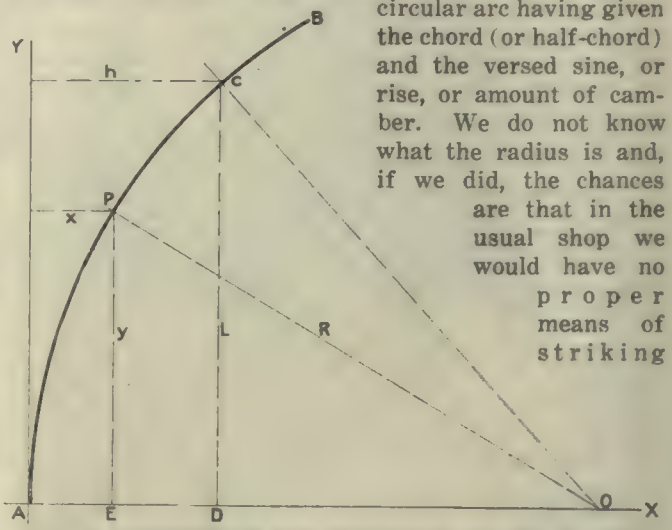


FIG. 2. REFERENCE FOR FORMULAS (2) TO (8) INC.

Then

$$R = \frac{L^2 + h^2}{2h} \quad (4)$$

To solve the problem as usually required, given L (or $2L$) and h, take equation (2) and substitute for R the value as deducted above in (4). Then

$$x^2 + y^2 = 2\left(\frac{L^2 + h^2}{2h}\right)x \quad (5)$$

This may be written

$$x^2 - 2\left(\frac{L^2 + h^2}{2h}\right)x = -y^2 \quad (6)$$

which has the form of an ordinary quadratic. Completing the square,

$$x^2 - 2\left(\frac{L^2 + h^2}{2h}\right)x + \left(\frac{L^2 + h^2}{2h}\right)^2 = \left(\frac{L^2 + h^2}{2h}\right) - y^2.$$

Extracting the square root of both sides

$$x - \frac{L^2 + h^2}{2h} = \pm\sqrt{\left(\frac{L^2 + h^2}{2h}\right)^2 - y^2}$$

$$x = \frac{L^2 + h^2}{2h} \pm \sqrt{\left(\frac{L^2 + h^2}{2h}\right) - y^2} \quad (7)$$

Now equation (7) *looks* harder than it is; by assigning arbitrary values to y, and L and h being already known, it is very easy to get corresponding values for x. Let us assume an arc with a chord length of 12 ft. and a versed sine or height of 2 ft. Then $L = 6$ ft. and h = 2 ft., $\frac{L^2 + h^2}{2h} = \frac{36 + 4}{4} = 10.$

Letting $y = 5$, $x = 10 \pm\sqrt{100 - 25} = 10 \pm\sqrt{75}$ $= 10 \pm 8.66 = 18.66$ or 1.34. While the $\pm$ sign is used, it is only the $-$ sign that we need, as the $+$ sign gives the ordinates for the other side of the circle. Hence for $y = 5$, $x = 1.34$.

When

$y = 4$, $x = 0.835$
$y = 3$, $x = 0.461$
$y = 2$, $x = 0.202$
$y = 1$, $x = 0.050$

It is, of course, obvious that the quantity $\frac{L^2 + h^2}{2h}$ is the

radius of the arc, and if the radius is given it can be used, the equation then becoming

$$x = R - \sqrt{R^2 - y^2} \qquad (8)$$

which looks much simpler. But as the problem usually comes to the layer-out giving only the chord and its "rise," the form in (7) is easier to apply. No special mathematical knowledge is required beyond the ability to read a formula, as the square roots needed can be found in any handbook if the man in question cannot work them out for himself, and even if he can, the time saved and accuracy gained in using a handbook makes that method preferable.

A comparison of values worked out by the formula $y = \frac{x}{L^2} h$ (referring to Fig. 1) and formula (7) shows the differences, after this formula is written

$$x = \frac{y^2}{L^2} h$$

to make it correspond with the axes as in Fig. 2. This comparison is given in the following table:

COMPARISON OF VALUES OBTAINED BY DIFFERING FORMULAS

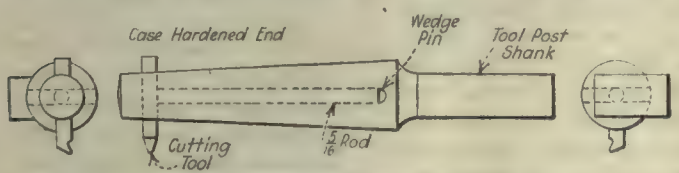
Assigned Values of y	Values of x in $x = y^2/L^2 \times h$ Ft.	Values of x in Formula (7) Ft.	Difference
5	1.39	1.34	0.05′ = 0.06″
4	0.89	0.835	0.045′ = 0.54″
3	0.50	0.461	0.039′ = 0.468″
2	0.222	0.202	0.02′ = 0.24″
1	0.0555	0.0505	0.005′ = 0.06″

From these results it can be seen that for an accurate arc of a circle the first formula would be quite a bit out, but for merely a smooth curve it is quite good enough, especially when L is large compared to h.

A Boring Bar of Merit

BY E. LYTTON BROOKS
Helensburgh, Dumbartonshire, Scotland

Referring to an article under the above title, with sketch, by John Houssman, on page 278 of *American Machinist*, I am afraid there is one point on which I



MR. HOUSSMAN'S BORING TOOL

am not quite clear. Mr. Houssman points out that small bottom clearance is required when boring blind holes.

First of all I may not quite understand what he means by a "blind hole." If he means one that is bored out and squared up, or bottomed at the blind end, I don't see how it can be done with his tool. I am from Missouri this time. As the end of the bar holding the tool projects beyond the tool itself at the leading end, and as his sketch does not show the tool inclined, but at right angles to the bar, how is it accomplished?

I have attempted a plan of this bar in rough sketch which illustrates my point. With the exception that a hole cannot be finished out on the bottom it looks to be quite a good tool. But don't let me catch a turner using a machine spanner to knock the pin in, out, or, for that matter, anything else except nut and bolt manipulation; that's all.

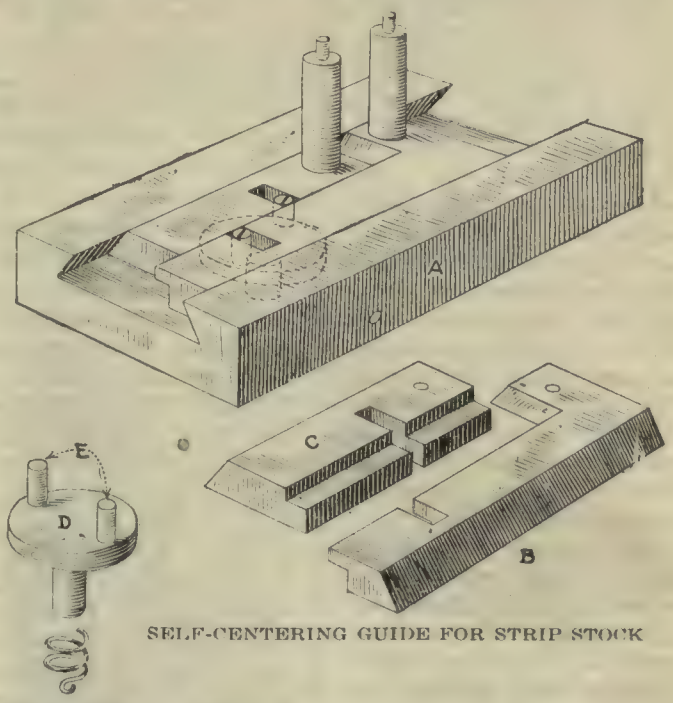
A Self-Centering Guide

BY R. H. KASPER

A common source of trouble, when punching a cheap grade of stock in an automatic punch press, is the fact that the stock often varies in width, making it necessary frequently to center the stock under the punch. To overcome this difficulty, the guide, shown in the sketch, was designed.

This guide, after the initial adjustment, always carries the stock central under the punch, regardless of any variation in width, because of the fact that neither of the rolls can move in either direction without a corresponding movement of the other roll in the opposite direction.

The guide consists of an outer case *A*, which carries two sliding members *B* and *C*. These sliding members are each slotted to receive a pin carried on the disk *D*. These pins are placed equally distant from the center of *D*, which fits freely in a recess counterbored in the bottom of case *A*. A helical torsion spring provides the necessary tension to keep the rolls in contact with the stock at all times. As will be seen by the sketch, the sliding members *B* and *C* are constructed with dove-



SELF-CENTERING GUIDE FOR STRIP STOCK

tailed edges so that it is unnecessary to provide a retaining plate or other means to keep them in the outer case.

When assembling the guide, the disk *D*, with its spring. is placed in position first, and after attaching the spring, is given a few turns to tighten the latter. A pin is inserted through the hole in the outer case and into the hole in the disk, serving to prevent the spring from unwinding while the guide is being assembled. *B* and *C* are then slipped in from the end and the small pins *E* inserted in the disk, after which the pin in the outer case may be withdrawn. The slots in *B* and *C* should be so placed that when a piece of stock of the average width is placed between the rolls, the slots will coincide. This will permit the same motion of the rolls, both above and below the average width and at the same time keep the stock in a central position.

IN THIS ISSUE

WE WILL best introduce the first of Fred Colvin's group of articles on "The Foreman and His Job," which is the first in this issue, by quoting from it: "The foreman's duties are many and they vary according to the system under which the shop is run. Both the foreman and the management, however, should thoroughly understand and appreciate that the foreman represents the firm to the men. He has the most intimate contacts and can do much to make or mar the good feeling that must exist if hearty co-operation is to be secured."

About 1906 Herman Schneider, at present Dean of the Engineering College, University of Cincinnati, started the word "co-operative" on its way to fame in educational matters by getting under way his now famous co-operative engineering course. Since that time many universities and public high schools have seen the light and have instituted similar courses of education. Among them is the course of the high school of Lansing, Mich., told about by E. M. Hall, Lansing's director of vocational education, on page 83. Mr. Hall confines his article to facts and photographs, both of which make for easy and profitable reading. Incidentally, the photos show that the course has attracted a bunch of fine looking boys.

De Leeuw's treatises on metal cutting tools become more and more absorbing the further they go. This week he introduces "feed" showing that it adds to the complexity of design problems and that it must be given a proper amount of consideration. Round-nosed, square-nosed, diamond point and several other types of tools are treated and toolholders come in for a share of discussion.

A rather unusual article is that by John T. Bartlett on "Correspondence Supervision," page 94. There is no doubt that on the average certain effects on the recipient are produced by given types of letters, and that many correspondents have much room for improvement of their understanding of how to write a letter to accomplish a particular result. Says the author, "The kind of letters we write has a great deal to do with the volume of business we secure. Poor letters lose customers. Good letters hold customers and turn them into permanent friends of the house." Are needed betterments in business letter writing to be brought about by correspondence supervision?

A railroad article by J. V. Hunter, page 97, deals with an apprentice school, a school different because attendance of the apprentice is compulsory and because he is assessed a fixed sum per month to apply against current expenses. An old coach furnishes the class-room. The boys attending such a school ought to feel as though they were getting somewhere.

To use a word not elegant but expressive, it is no cinch to properly distribute overhead to departments. This week's installment of "Modern Production Methods" (W. R. Basset), page 99, takes up the departmentalizing of overhead expenses. We shall not attempt to point out the high spots of this article, believing that the subject and the author will sell it to those of our readers who keep in touch with this page.

On page 104 we have an article "Meeting the Present Emergency." We believe you will agree with us that it is correct to call present conditions of deflation and readjustment an emergency. We do not know, of course, how long our emergency conditions are going to last. But we do know that how we meet the emergency is all-important. What one eastern machine-tool concern is doing is told on page 104 by the manager. It is building spare parts, units and subassemblies, making every effort to maintain organization and wages, and at the same time doing all possible to reduce costs. We are open to receive statements and suggestions from other managers and executives. Dissemination of such information cannot but help the industry at large. May we not have your help?

We have a tendency, and a very good one it is, to forget the war—all but the lessons it taught. There was so much, however, in the way of development and accomplishment that a great deal of it remains to be told. Among Fred Colvin's Pacific coast articles we found one along the lines mentioned—Willamette's War Work—page 105. The Willamette plant built boilers for the Emergency Fleet Corporation and built them well and quickly, says Colvin. He then goes on to tell how a wide-awake management and crew got results.

Coming Features

Next week will usher in the series on magnetic chucks by Ellsworth Sheldon. Any comprehensive series such as this almost invariably devotes the first part to origin, history and elementary construction, which should not be missed if the following parts are to be fully understood. It is so with Sheldon's series, his initial article dealing with original development and construction.

Fred Colvin's "Building Motors on the Pacific Coast" will be continued in the next issue. The machining of the connecting rod and its assembly with the piston are the chief subjects treated. There will be another motor article, "Casting and Machining Oil Engine Pistons, Piston Rings and Cylinders," by Samuel Rosswell.

It is not the intention to name all of the major articles for coming weeks in these paragraphs. We want to let you in on two or three more, though. Chesla Sherlock writes on "Arbitration," I. William Chubb, one of our European editors, presents notes on improvement in British machines, and there is quite an article by a special correspondent on the locomotive repair shops of the B. & O., at Glenwood, Pa. All will appear next week.

EDITORIALS

National Thrift Week—A Timely Event This Year

THIS week is the National Thrift Week of the economic program of the Young Men's Christian Association. It has particular significance for every one connected with the machine industry this year. We are all suffering the consequences of the wild inflation of last year and as a result we should all be unusually receptive to preachings of thrift, no matter what their source.

The manufacturer is facing the serious losses involved in idle plants, heavy taxes based on the previous year's business and shrunken inventories. The merchant is up against the problem of selling on a falling market, goods bought when prices were high. The workman is on part time or laid off altogether and is undoubtedly in the worst position of all. The condition is only temporary, fortunately, but not much easier to endure even so. It is like a toothache. You know it can be stopped as soon as you can get to the dentist, but that doesn't make it hurt any the less.

The careful men in any walk of life have practiced a thrift that will see them through the present depression and put them in an advantageous position when business picks up. Their example should stimulate the improvident citizen in his present sad state to turn over a new leaf and make provision for the future when he begins to get on his feet.

The Ten Financial Commandments laid down by the Y. M. C. A. are well worthy of adoption by any citizen of this country and we recommend them unreservedly. They are so well stated that they might well have come from the pen of the patron saint of thrift, Benjamin Franklin, an anniversary of whose birthday came on Monday, the seventeenth of January, the opening day of National Thrift Week. The Commandments urge everyone, and particularly the workman, to:

1. Work and Earn.
2. Make a Budget.
3. Record Expenditures.
4. Have a Bank Account.
5. Carry Life Insurance.
6. Own Your Own Home.
7. Make a Will.
8. Pay Your Bills Promptly.
9. Invest in Reliable Securities.
10. Share with Others.

A sermon could be preached or an editorial written on each one of the ten. For the individual it is difficult to single out any one that is more important than the rest, but when we take into account not only the benefit to the man himself but to his industry and to his country as well, number nine stands out well above the others.

We feel that the matter of sound investment of the worker's savings has been given so little attention and holds out such possibilities of good both for himself and for the country at large in the present serious situation that it is deserving of careful thought.

For a Free Exchange of Ideas

PROBABLY two-thirds of our industrial disputes are directly due to ignorance or misunderstanding. Most of the time the men don't understand the position of the management because they have been kept in complete ignorance of managerial problems by the negligence and inertia of the executives and by the malicious intention of some of their own leaders.

On the other hand the management is sometimes in much the same position because no one has made it his business to get close enough to the men to find out what they think and to try to straighten out trivial difficulties.

Underneath it all is a woeful lack of knowledge of the simple fundamental economic principles that govern all industry and commerce.

A most commendable attempt to solve both of these problems at the same time is the Open Forum Movement described on another page by Alvan T. Simonds, president of the Simonds Manufacturing Co. Mr. Simonds has the right idea. Intelligent and free discussion will bring together some of the most violently opposed antagonists and reconcile conflicting contentions.

Save the Air Mail Service

ECONOMY and retrenchment should be our watchword, but there are cases where apparent economy is decidedly expensive. Firms are sometimes tempted to curtail their research departments. But they usually find that they lose more than they save.

We heartily approve the motive of economy as expressed by the House of Representatives when it slashed a million and a quarter from its appropriation bill. The great difficulty is that it picked the wrong item, the Air Mail Service. This is a research department for the development of commercial aviation in this country. Incidentally it can by no means be called an expense as it gives at least some return on the investment in the way of saving railroad expense for carrying mail. Some figures indicate that the air mail cost no more than that sent by rail.

Every country in Europe is using the airplane in mail service to an increasing extent. They all credit our Mail Service as the best in existence. And now it is proposed that we abandon it all to save an appropriation of one and a quarter million dollars.

This amount is about one-twentieth of the cost of one modern battleship. Can there be any question as to which expenditure is of the greater good to the country?

Let us by all means be economical. But let us reduce expenses where they do not stop the development of a new industry, an industry which originated in this country and in which we should regain the lead we lost before the war.

In reducing expenses it is well to consider first the heaviest items and those which mean the least in human development. Cutting one first-class battleship from the naval appropriation will look after Air Mail Service for twenty years, at the rate proposed this year.

The Air Mail Service must not be abandoned!

How To Get Rid of Hard Times

The Open Forum as a Means of Settling Disturbing Differences — Economic Ignorance the Cause of Many of Our Troubles

By ALVAN T. SIMONDS
President, Simonds Manufacturing Co.

MAN can do only three things—he can feel, think, and act. Without the benefits of education and civilization, his actions are almost wholly determined by his feelings. As he advances up the scale he more and more subdues his feelings and is guided by his thinking. Feeling is based to some extent upon knowledge; but what a man thinks is determined almost wholly by what he knows.

It is always possible to tell how any man will react in any situation provided you know all about the man, his inheritance, his training, experience and knowledge. Every man reacts to a new thought or a new situation according to what he is. We see with what we are, and we are so made that it is absolutely impossible to see, judge, determine or act in any other way. Because men are different in heredity, in experience and education, they see things differently, and act upon them differently. By meeting each other and discussing the problems before them, men become more alike and therefore more given to similar thinking and acting. Take two extremes—a rabid Bolshevist and an equally decided Reactionary, put them together in the same prison cell (where some people say they both ought to be) and leave them there long enough to talk the matter out and they will be very much closer together in their views and in what they would do if given freedom of action.

The Open Forum Movement is based upon this truth. It brings men together in public discussion of important questions. It increases their knowledge and decreases the likelihood that they will act guided only or chiefly by feeling. Feeling is really heat, knowledge is light. Each man in his mental action has only about a certain amount of the two combined. If much of it goes to heat, there is less light. If little of it is expended in heat, there is much light. The motto of the Open Forum Movement might be "Less heat and more light" in thinking and acting upon public questions.

Practically every one knows that his life is determined by law. His behavior is determined by the laws which society makes to protect itself from the unrestrained individual. Men familiarize themselves with these laws and usually obey them. They know if they fail to obey them that sooner or later they will be removed from troubling society and confined within the walls of a prison. The individual seeks to know and to obey laws of health. He realizes that if he violates them, he will suffer physically and be weakened or rendered inefficient or perhaps removed entirely by disease.

Most men live for growth, success and happiness, but few realize that these are determined by the action of economic laws that are as sure and constant as the laws of gravitation, and much more so than the laws enacted by society through its law-making bodies. But nearly every one is ignorant of these laws and little encouragement has been given to remedy the situation.

The public press has its articles dealing with economic subjects, but they are usually on the financial page and read by those who already are familiar with the principles of economics, and need this additional instruction less than others. Rarely does a magazine publish an article on economics because the public can not or will not read it, for the men and women who make up the public have no background of thinking along economic lines, to make the article of interest to them. Very few attempts have been made to publish the simplest economic ideas in a form suited to a public that has practically no economic knowledge.

Our schools do not teach economics until the college age and then usually only to those who elect it. The public high schools, almost without exception, omit it from their courses of study, and the normal schools training the teachers of the coming generation have entirely overlooked it.

Yet it is true that almost every act of every man's living is determined to a greater or less extent by economic laws that he might understand and apply.

A group of factory foremen, in meeting to discuss simple economic bases of their work, were asked the following questions: Are you in any measure responsible for the industrial depression existing at the present time? If so, how? Can you do anything to remedy it? If so, what? To the ordinary man these questions are about as blind as "Are you in any way responsible for the coming eclipse of the sun, and can you do anything to prevent it?" Yet both are according to law, and some day one will be predicted with almost as much accuracy as the other.

The best means available at present of interesting the public in this question, seems to be the Open Forum where problems of citizenship and economic relations can properly be discussed.

In order to start an interest in the public schools, I am offering two prizes for the best essays upon "The Teaching of Adam Smith in the Wealth of Nations Applied to the Present Economic Situation." These prizes are $1,000 for the best essay and $500 for the next best and are open to high school and normal school pupils.

The offer was made not only to stimulate an interest in the study of economics, but also to discover how far public school education had prepared the soil for planting the seeds of such a subject. The prizes were made comparatively large in order to make them worth while as a recompense for the work necessary, and to attract as nearly as possible 100 per cent of those ready to undertake such a task. The results will be of extreme interest and will show fairly well the attitude of high school pupils and normal school pupils in the United States toward economics.

The Public Forum will reach those who are older but something additional should be done, and done right away in our public schools. I understand the study of economics has been required in the last year in all the high schools of greater New York. It is to be hoped that this good example will be followed by many others.

SHOP EQUIPMENT NEWS

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and • equipment •

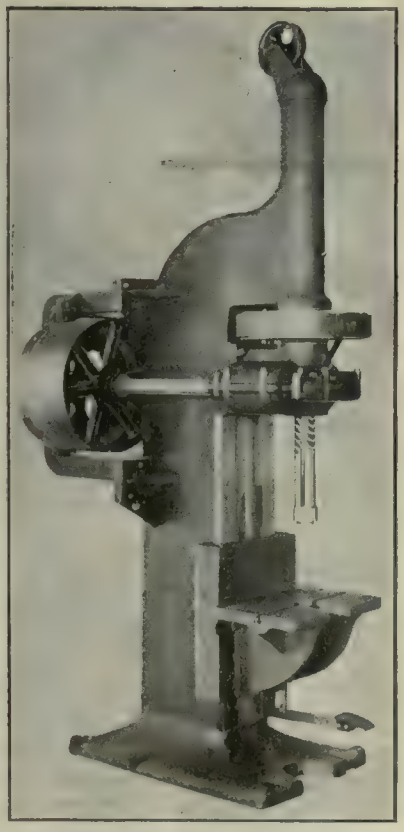
Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs • and equipment •

General Manufacturing Co. "Flexible" Power Press

The General Manufacturing Co., Detroit, Mich., has placed on the market the power press shown in the illustration. The machine is called "flexible" because the amount of pressure applied by the ram can be varied by the operator from a few pounds to 20 tons, depending upon the pressure applied to the pedal. It is stated that a wide range of work can thus be handled, the machine being adaptable to such work as push broaching, straightening, and pressing in bushings. The ram has a stroke of 18 in. and the position of the knee is adjustable, a maximum distance of 28 in. between the table and the ram being obtainable. The knee is adjusted for height by means of a rack and pinion, and it is held in position by clamping gibs tightened by six nuts, and by a spring plunger engaging teeth cast in the front of the column.

The column is of the box type. The machine is belt driven, the power being applied to the ram through a worm and worm gear of 10 to 1 ratio, running in oil. There are two $\frac{3}{4}$-in. keys fitting in splines on the ram, which thus runs at constant speed in one direction. The ram is threaded and the nut, which forms the drum for the friction brake, fits on it and turns with it when the ram is not moving vertically. When the asbestos-lined brake band is tightened against the drum by means of the pedal, the nut is stopped from rotating, thus causing the ram to travel downward at a speed of 100 to 140 in. per minute, depending upon the speed of the driving pulley. When the ram strikes the work and is stopped from moving downward, the pressure builds up so that the clutch slips and the nut revolves as before, thus making it possible to maintain constant pressure. When the pedal is released, the nut can revolve freely, and the ram is raised quickly by means of a counterweight inside the column. The end thrust from the ram is taken by means of a ball bearing between the nut and the column casting.

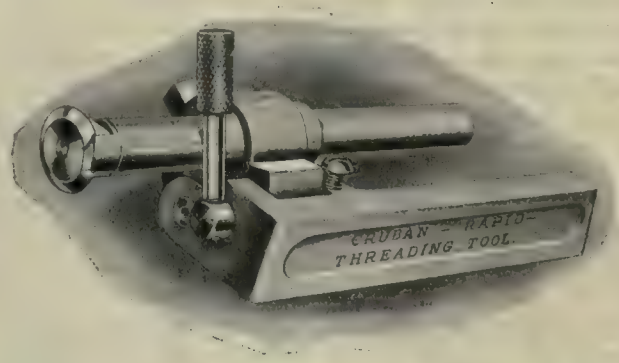


GENERAL MANUFACTURING CO. "FLEXIBLE" POWER PRESS

Cruban "Rapid" Internal Threading Tool

An internal threading tool, shown in the illustration, has recently been placed on the market by the Cruban Machine and Steel Corporation, 63 Duane St., New York, N. Y.

The cutting tool is mounted on a bar carried in a bracket hinged on the shank of the holder. The tool can thus be moved through a small arc by means of the lever.



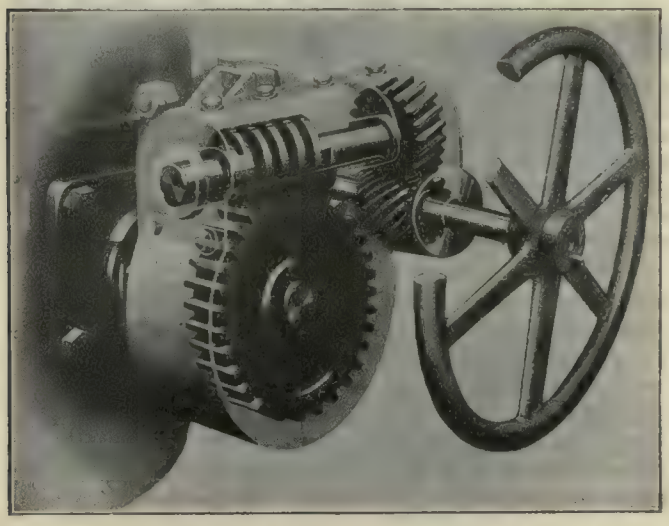
CRUBAN "RAPID" INTERNAL THREADING TOOL

When the cut is started, the lever is turned down. When the end of the cut is reached, the lever is raised manually, thus dropping the cutter back out of contact with the work. The feed is then reversed so as to bring the cutter to the starting position, the cross-slide being fed in to the proper depth for the next cut. By means of a screw, the amount of swing of the tool can be limited, so that the back of the tool does not strike the threads. Thus, the machine can be kept running continuously without the necessity of withdrawing the tool from the work by means of the toolslide, when reversing the feed motion. The device is made in three sizes, the shanks being $\frac{3}{8}$ x $\frac{7}{8}$, $\frac{1}{2}$ x $1\frac{1}{4}$ and $\frac{5}{8}$ x $1\frac{3}{4}$ in. in size.

The smallest diameter of hole that can be threaded is $\frac{5}{16}$ in.

Whiting "Helical-Worm" Geared Crane Ladle

The illustration shows the pouring device used on a crane ladle recently put on the market by the Whiting Foundry Equipment Co., Harvey, Ill. The device consists of a pair of forged-steel helical gears actuated from the handwheel, and a worm engaging a gear mounted and keyed on the trunnion of the ladle. The use of the worm-gear makes the device self-locking. The worm shaft is placed at an angle, so that the forged-steel worm meshes properly with the straight teeth of the large cast-steel gear. Different ratios of helical gears can be provided, so as to vary the speed of tilting the ladle. All gears have machine-cut teeth. They are inclosed in a dustproof cover, are readily accessible and can be oiled through small oil holes with spring caps.

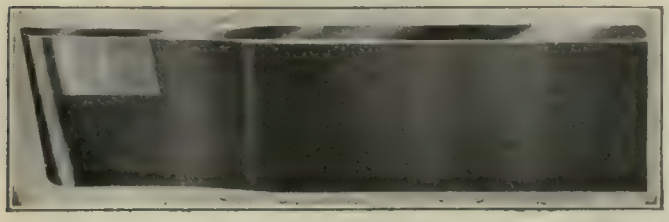


POURING DEVICE ON WHITING CRANE LADLE

The gearing is mounted on the trunnion instead of on the bail, so that distortion of the ladle or bail, or wearing of the trunnion journals, will not interfere with the alignment of the gears. The ladles can be furnished for either iron or steel.

"Cinch" Steel Cement

Deeds & Chapin, 2130 Montcalm St., Indianapolis, Ind., has recently placed on the market, under the name of "Cinch Steel Cement," a compound for joining pieces of steel. It is in the form of a powder and is intended for fastening high-speed steel or stellite to low-carbon steel in making cutting tools, punches, dies and shear blades. When tipping the cutting edge of a lathe tool, such as shown in the illustration, it is stated that only 3 per cent of the tool need be made of high-speed steel. Besides securing cutting edges to different types of tools and knives, the cement can be used for fastening the tool-steel wearing surfaces on punches and dies of the kinds used both for ordinary forming and cutting and for hot forging.



LATHE TOOL WITH CUTTING BIT FASTENED BY "CINCH" STEEL CEMENT

The cement melts at approximately the hardening temperature of high-speed steel, or 2,200 deg. F. Thus, the cementing and the hardening of the tool can be done at one heating, it being allowable to cool the cemented tool by oil or airblast, if desired. Quenching in air only is used for stellite. It is stated that the cement fastens the steel parts securely and solidly supports the cutting edge, and that one pound of it is sufficient to cement in place 250 pieces each 1-in. square.

Lavoie Pilot-Bar and Drill-Press Chucks

The Frontier Chuck and Tool Co., 30 Letchworth St., Buffalo, N. Y., has added two models to its line of Lavoie air-operated chucks, such as described on page 291 of the *American Machinist*. They are made with either two or three jaws, in either the manufacturing or the adjustable type, and in four sizes, 10, 12, 15 and 18 in.

The chuck shown in Fig. 1 is intended for use when the tools used are equipped with pilot bars. The pilot bushing is screwed into the chuck and does not slide on its seat.

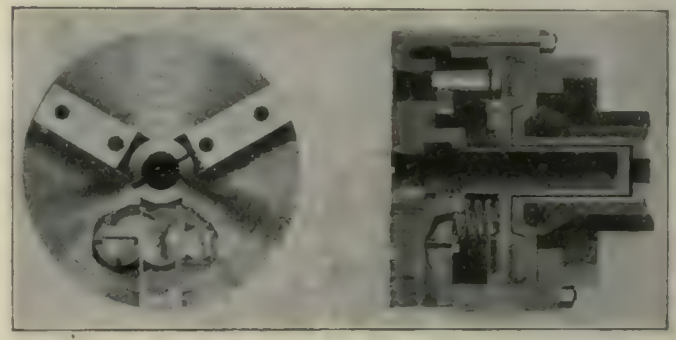


FIG. 1. LAVOIE AIR-OPERATED PILOT-BAR CHUCK

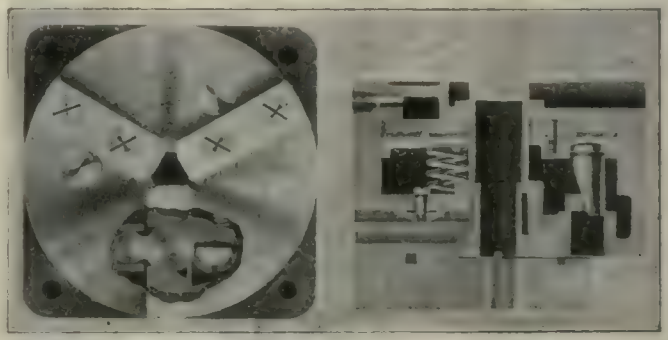


FIG. 2. LAVOIE AIR-OPERATED DRILL-PRESS CHUCK

A chuck intended for holding work on the table of a drilling machine is shown in Fig. 2. The bushing extending through the center of it allows chips to fall through, so that they do not get into the mechanism of the chuck. The base rests on four legs, thus raising the bottom of the air cylinder about 1 in. above the table, so that chips can be easily removed.

Contour Buffing Machine

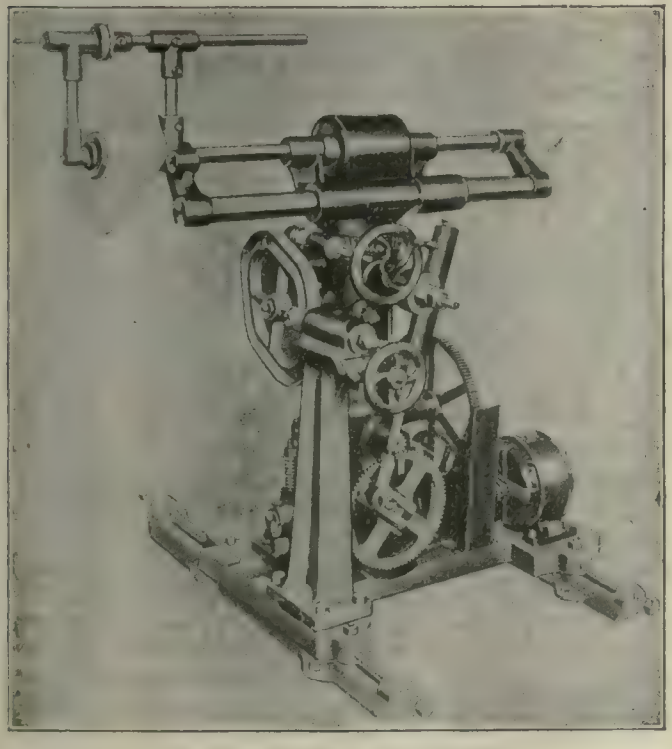
The Contour Buffing Machine Co., Inc., 410 Bird Ave., Buffalo, N. Y., has recently placed on the market a machine, shown in the illustration, for feeding against the wheels of standard buffing or polishing lathes, articles of circular, oval, triangular or rectangular form.

The machine is driven by an electric motor attached to the bed plate, which rests on rails that permit a travel of 8 in. to or from the polishing wheel or buff, so as to suit work of different diameters and different sizes of polishing wheels. The work-carrying spindle is slowly rotated and is supported on a sliding frame that has a mechanical reciprocating motion adjustable up to 16 in. in length.

The column is supported on trunnions at the bed plate and is free to oscillate through about 10 deg. When polishing the periphery of an article of irregular contour, the oscillating movement is controlled by a cam suited to the shape of the piece. When the article is of circular form, the cam is not required and a link is substituted, thus keeping the column stationary. The upper part of the column and the sliding frame can be swiveled by means of a worm gear and handwheel, so that the operator may swing the article to or from the buffing wheel without stopping the machine.

The article being polished is held on the chuck by the work holder, the outer arm, which holds a wooden washer, being pulled against the work by a long adjustable-tension spring inside the pipe at the top. This outer arm is held in position by stops, but can be swung through a half circle, where it stays while the article is being removed from the chuck and another put on. A variable-angle attachment can be fitted to the outer head of the sliding frame for use when polishing conical articles and bottoms of pans. The motor is reversible, the work being presented to the polishing wheel with a direction of motion opposite to that of the wheel. The machines are made right- and left-handed, as two machines are run in conjunction with one polishing or buffing lathe by one man.

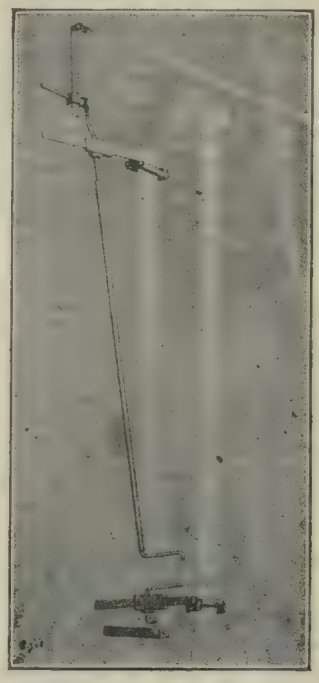
Various modifications of the machine can be furnished to suit special requirements. If the articles to be polished or buffed are all of circular form, the cam mechanism can be dispensed with; and for many classes of work the mechanically operated reciprocating motion is not necessary, as the sliding frame can be moved easily by hand to any desired position and locked there. The complete machine when boxed for shipment weighs 1,000 lb., and the outside measurements of the crate are 44 x 30 x 45 in.



CONTOUR BUFFING MACHINE

Spurgin Belt-Shifting Device

The Spurgin belt-shifting device, shown in the illustration, has recently been placed upon the market by the R. G. Haskins Co., 27 S. Desplaines St., Chicago, Ill. It consists chiefly of two strikers or guides, one at the top and the other at the bottom of the belt and operated by a single lever, so as to enable the shifting of the belt on the cone pulleys. The operator can thus move the belt from one step to another with one hand, it being claimed that the action is performed so quickly and easily that the shift can be made while a cut is being taken. It is stated that, consequently, the proper speed of cutting can better be maintained. The belt need not be touched with the hands, so that the device makes belt shifting safer for the operator.

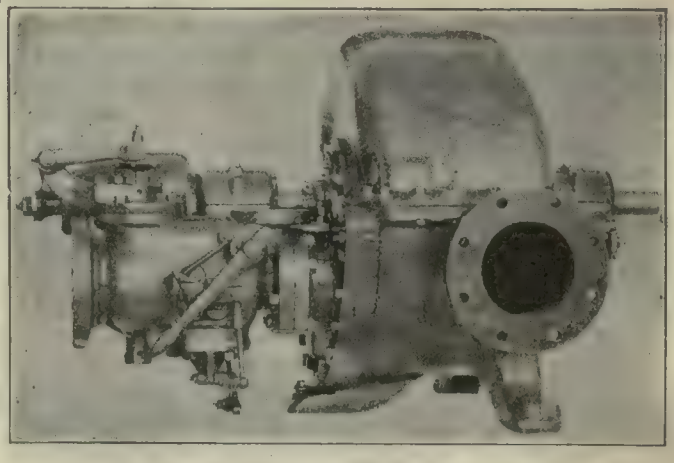


SPURGIN BELT-SHIFTING DEIVICE

The belt guides are fitted with rollers running on oilless bearings, both on the edges and on the faces of the belt, so that it is not damaged by the guides. They are automatically locked in position, so that the belt stays on the steps to which it is shifted.

G. E. Curtis-Type Steam Turbine

The General Electric Co., Schenectady, N. Y., has recently developed a turbine of the Curtis type suitable for driving such apparatus as centrifugal pumps and blowers. The turbine is made in either one, two, or three stages, and operates at steam pressures of from 50 to 300 lb., either with or without superheat, and either condensing or non-condensing. The illustration shows a two-stage, type-*L* unit.



G. E. CURTIS-TYPE STEAM TURBINE

The turbine is heavily and rigidly constructed. The casing is divided horizontally into halves, the upper of which can be easily raised for inspection or removal of the wheels. The steam connections are so arranged that they need not be disturbed when it is desired to remove the top of the casing. The steam passes through the first-stage nozzles from the steam chest, the nozzles being opened or closed by hand valves placed in the steam chest. The governors control the flow of steam to all nozzles.

The turbine is equipped with speed control in the form of a centrifugal governor, and, if desired, an emergency governor also. The former is of the centrifugal, tension-spring type, the motion of the weights being transmitted through ball-bearing connections to the governor valve. The speed may be adjusted while the turbine is running by a simple operation of the governor valve. The emergency governor operates independently of the main governor when the speed rises to about 15 per cent above normal.

Cancellations

By J. P. Brophy

In the last few months many have suffered in the extreme through reckless cancellations. Is it possible that a contract between two people can be ignored in a somewhat flippant manner by stating that "Owing to business not being very satisfactory we would ask you to kindly cancel the machines that we ordered from you some time ago?" This has been going on so frequently that it is noticeably damaging to a vast number of people in the manufacturing business.

In many instances machines are ordered, and also the necessary special equipment for producing, but nevertheless the purchaser ignores his obligations to the extent of forming a flimsy excuse to bring about a complete cancellation, which means that the tools and equipment of various kinds that the manufacturer prepared at considerable expense are not in the mind of the purchaser as a reason why he should pay for this equipment.

The trouble is that orders are placed when business is good for large quantities of merchandise. The plans of the manufacturers have to be along the lines of ordering material of all descriptions, carrying along the necessary parts to take care of the orders on their books. Something happens that the business of the country is lessened in the extreme through strikes, scarcity of money or other reasons. The first thought that has come to some people is to unload their obligations regardless of their contracts and the effort put forth by the manufacturer to produce that which the contracts call for. They seem to care nothing about those they do business with so long as they can extricate themselves from paying for that which they claim they cannot make use of. This manner of doing business has unquestionably had considerable to do with many receiverships that have been appointed in the last few months, because it places a burden on the man who has received the order and invested his money to produce what the customer called for. Consequently a vast amount of capital is tied up on account of those who are not inclined to do business in an honest way.

Without question many of those who have been countermanding their orders for material are likely to stand pat in any case where someone has purchased some of their product, by forcing them to accept according to contract, which is considered legal to their way of thinking when looking at their side of the question, but illegal when considering the other ellow. Is it possible that such selfishness is going to continue and that all contracts will be considered as nothing more than the paper they are written on regardless of the great loss to multitudes?

The Kaiser in the late war when forcing his way into Belgium considered the treaties between countries as nothing but mere scraps of paper. This we all condemned very vigorously when it actually occurred but a vast army of business men is following very closely in the footsteps of this same Kaiser in the manner of doing business. If we all had considered this question in an honest way when times became dull a few months ago, and approached one another honestly, not attempting to break contracts in a reckless way, then the business of today would be vastly better than it now happens to be. The exchange of ordered product, if accepted by all individuals would have kept money moving in business circles. But some were unprincipled, unloading their burdens by cancelling, and were instrumental in the laying off of a great number of men, which could possibly have been avoided.

Some even go to the extent of plainly stating, "If you do not like to accept cancellations, go into the courts." Now this is easily said but not so easily carried out. None of us care to take a case to the courts because a man will not accept our product, because this same man, undoubtedly, when forced to accept, would find the most flimsy excuse for not making payments, by claiming the goods as not up to the specifications, however, the only alternative in some instances is drastic action, allowing the law to settle the case.

To evade living up to your contract, having in mind the possibility of price reduction, regardless of the damage to others, is without question a most contemptible procedure. If we all had sincerely considered this question and asked for extended time for making payment, forgetting unscrupulous cancellations, the stability of business would to a great extent have been maintained, but as it is today, we have in many instances shamefully ignored all that means fair dealing.

In these dull times we should all stand together as one mighty force for our country's welfare. We did it to defeat the enemy in the recent war for self protection, but now we seem to have become enemies of one another, using unlawful means to avoid our business obligations. If it were otherwise, the banks unquestionably would relax somewhat to help us solve our present business depression, but when we disregard our contracts with impunity our bankers are perfectly justified in considering our action and protecting themselves, because they question seriously our business sagacity.

Reduction in the Number of Locomotive Failures

Reduction in the number of passenger-train detentions due to locomotive failures is shown in a statement for the month of October just compiled by the eastern region of the Pennsylvania system.

In October, there were 521 passenger-train detentions on the eastern region caused by locomotive failures. The number was eighty-three less than the total for the previous month, and 364 less than the number occurring in October of last year, when there were 885 such detentions.

Annual Meeting of Society of Automotive Engineers Brings Out Valuable Papers

Automobile and Airplane Sessions Hold Center of Stage—C. F. Kettering Explains Chemistry of Engine Fuels—Beecroft Elected President

THAT the automotive engineer has a clear idea of his responsibilities in these unsettled times was made plain at the annual meeting of the Society of Automotive Engineers in New York. As usual, the meeting was held during automobile show week and at the Engineering Societies Building. The Standards and Sections Committee meetings were held both morning and afternoon of Tuesday, January 11.

The first professional session took place on Tuesday evening and was devoted to aeronautical engineering. Glenn L. Martin, aeronautical vice-president of the society, was in the chair. The papers were as follows: "Propellers," by F. W. Caldwell; "Design Requirements of Commercial Aviation," by Grover C. Loening; "Airplane Wings," by C. O. Hanscom; "Progress in Military Aeronautics," by Major Thurman H. Bane.

Some of the statements made by Mr. Loening met with considerable opposition from some of the members present and resulted in valuable discussion.

The Commercial Aviation Session was well attended. Glenn L. Martin, who also presided, read a paper. Professor E. P. Warner told what was being done in Europe; Ralph H. Upson, of ballon and dirigible fame, showed where the different methods of transport are to find their fields; and S. W. Sparrow had a paper on "Compression Pressures and Engine Performances."

Major Leon B. Lent, who has charge of the Air Mail Service, spoke of the work which had been accomplished, the time saved and the reliability record. He told of the handicaps of using planes built for war purposes rather than for mail.

There was some difference of opinion as to the advisability of using large, multi-motored planes, or smaller planes with single motors. As was to be expected, this seems to depend entirely on the service required, both as to distance, loads and the character of the country over which the flight is made.

Business Meeting

The annual business meeting was held Wednesday morning and was devoted to the address of the retiring president, Col. J. G. Vincent, and the usual committee reports. Then H. M. Crane and Col. H. W. Alden told of their ideas as to the position of the automotive engineer in his industry and of his chances for the future. Both men said that the engineer could make of himself and his department what he pleased, that the industry was face to face with a turning point in its career where the survival of the fittest only was possible, and that the engineer was the man on whom the burden of foreseeing future developments would rest.

On Wednesday evening the annual carnival was the center of attraction. It was well up to the usual standard of the society's affairs of this nature and was thoroughly enjoyed.

As in former meetings the fuel session attracted the most attention. But instead of listening to various more or less authoritative estimates of the supply of petroleum in the earth and the length of time it would last, the members discussed ways and means of improving the automobile to make the fuel supply last longer.

Former president Kettering was the first speaker at the morning session on Thursday. He prefaced his remarks by admitting that the fuel situation is the dead line in the automotive industry and went on to say that great progress had been made during 1920.

Mr. Kettering then took up the chemistry of fuel combustion in the internal combustion engine cylinder and described what actually happened in a way that would have driven an old chemistry professor to drinking the alcohol in his own laboratory. His hearers, however, got the idea perfectly.

The research work of Mr. Kettering and his assistants has resulted in the discovery that the addition of the correct percentage of colored aniline oil to what is sold commercially as gasoline eliminates all tendency to knock and permits the use of higher compression ratios. The compound is also an excellent carbon remover. The work has not as yet reached the commercial stage.

The next speaker, Frank A. Howard, of the Standard Oil Co., took up the volatility of motor gasoline and showed that the vapor tensions of the various constituents of that complex fuel are such that condensation is practically impossible under ordinary conditions and that consequently any liquid fuel that appears in the cylinders or crankcase was never really volatilized. He showed the apparatus used to determine vapor tension and demonstrated its operation.

The last paper of the morning session was by C. A. Woodbury and the subject was "Flame Propagation in a Closed Cylinder." As Mr. Woodbury was unable to be present the paper was read by one of his assistants.

Afternoon Schedule of Papers

The papers scheduled for the afternoon session were as follows: "Thermostatic Inlet Temperature Control," by R. E. Fielder; "Résumé of Bureau of Standards Fuel Study," by Dr. H. C. Dickinson, of the Bureau; "Fuel Problem in Relation to Engineering Viewpoint," by A. L. Nelson; "Mixture Flow in Manifolds," by P. S. Tice; "Symposium of Answers to S. A. E. Questionnaire."

Mr. Tice was not present and as his paper was in print it was not read. The feature of the session was Mr. Nelson's paper. The author described road tests made on a modern high-grade car and emphasized the need for a complete change in engineering viewpoint. In his tests the engine never reached even quarter load at speeds below 40 miles per hour, the average figures ranging from 16 to 19 per cent.

Mr. Nelson went on to show how he changed his viewpoint and what radical departures he made from accepted practice. They are too far reaching and comprehensive to be covered here. His conclusions, however, are interesting. He believes that with high-compression pistons, higher axle ratios, better fuel vaporizers and different transmissions, we can get "miles per gallon" figures 100 per cent higher than those now obtained.

Interesting figures on the percentage of carbon monoxide gas in automobile engine exhausts were presented by Mr. Fieldner, of the Hudson Vehicular Tunnel engineering staff. They were obtained in tests run to obtain data for the design of the tunnel ventilating system and showed that approximately 7 per cent of the exhaust gas is CO.

The session on body engineering was also held on Wednesday afternoon, with W. G. Wall as chairman. The papers were: "Passenger Car Designing and Its Problems," by Andrew F. Johnson; "Can Body Weight be Reduced?" by Charles A. Heergeist; "Automobile Body Style," by George J. Mercer; "Relation of the Body Engineer to the Industry," by Kingston Forbes; "All-Steel Body Methods," by George E. Goddard.

The discussions were pertinent and brought out many good points as to best material to be used, governed largely by quantity to be produced and method of finish to be used on the bodies.

It was deplored that there is such a lack of co-operation between the chassis engineers and body engineers. The statement was made that the body design was much affected by the method of suspension of the engine and the general framework of the chassis.

Many times, too, a body design would be turned down by the chief engineer of the plant, who would not be nearly so competent to judge body design as the man who designed it. Along this line it was suggested that the next meeting should have a joint session of the chassis and body engineers.

A recommendation was passed that steps be taken by the society to establish a school, or courses in schools, for teaching body designing and drafting.

An excellent series of movie films was shown by the Dodge Brothers body engineer, illustrating how their all-metal bodies were made, step by step, and the assembling methods used.

The annual dinner which wound up the meeting was particularly enjoyable, with the inimitable C. F. Kettering as toastmaster. There were over a thousand present, including representatives of the Army, Navy and Post Office departments.

R. E. M. Cowie, vice-president of the American Railway Express Co., spoke on the "Co-ordination of Transportation" and urged the simplification of the motor vehicle as the best way to increase its field of usefulness. He further urged that immediate attention be given to the development of aircraft for commercial purposes. This necessitates the preparation of landing fields, of aerial beacons to compare with the lighthouses which guide the mariner at sea, of directional wireless apparatus and other devices which make for safety and continuity of operation. This is just as much a government function as that of marine navigation. And when we can depend on a regular air service there will be no lack of work for it to do.

Mr. Kettering defended the engineers on the question of simplification; stating that they have always been handicapped by the sales department urging the adoption of devices as talking points. Until recently they had been urged to produce in large quantities, as there were not enough cars. Now with the sales at a low point, they were being told that they were not good enough to attract customers.

The financial situation was discussed by George E. Roberts, of the National City Bank, who pointed out that the times were out of balance. And, just as an engine out of balance does not run well, so the world is limping along as best it can. He was optimistic as to the future, but said that balance cannot be regained until all the factors conform to the readjustment. While pre-war conditions will never return in all particulars, the returns from labor or capital must purchase as much as before, in order to restore equilibrium. He also pointed out that this country could not consider itself as a separate machine, as it was a part of the world. And as long as Europe was out of balance, this country could not get to running smoothly.

The new president, David Beecroft, also made a short address.

Cutting Metric Threads Without a 127-Tooth Gear

By Chester E. Josselyn

A. W. Forbes, article entitled "Know What You Are Doing and Why You Do It," published on page 612 of *American Machinist*, no doubt struck a responsive chord in the minds of many readers. He concludes by saying: "A way that leads to knowledge, but often to various troubles also, is to break every rule and see what comes of it."

Some time ago I had occasion to cut some metric threads on a lathe having a 4-pitch, single-thread lead screw. The first method that suggested itself was to use a 127-tooth gear in connection with the regular gears, but after some thought upon the subject I decided that the odd gear was not necessary, for with the regular gears I could cut metric pitches with but little variation from exactitude.

Instead of using the constant 5 : 127, which represents one millimeter, I used the constant $4\frac{1}{2} : 108$, equaling 0.03935; a difference of but 0.00002 in. By basing my gear calculations upon this ratio I was able to cut fifty 1-mm. threads with a variation of but 0.001 in.; and in the case of larger threads ten 15-mm. threads showed an error of but 0.0028 in. in the entire length of nearly 6 in.

The rule to use for finding the gears is as follows: The product of driving gears must equal the product of the thread pitch in millimeters multiplied by the pitch of the lead screw times the factor $4\frac{1}{2}$; the product of the driven gears must equal the other factor, 108, thus:

For example we wish to cut an 8-mm. thread upon a lathe the lead screw of which is 4-pitch, single-thread.

Product of drivers $8 \times 4 \times 4\frac{1}{2} = 8 \times 17$

Product of driven gears $108 = 9 \times 12$

As we have neither 8-, 9-, 12-, or 17-toothed gears we multiply these factors by some common multiplier, say 5, to find gears that are available, thus:

$8 \times 5 = 40$, $17 \times 5 = 55$ } drivers

$9 \times 5 = 45$, $12 \times 5 = 60$ } driven gears

To prove the actual lead cut by these gears we have but to establish the ratio of stud to lead screw thus:

$\frac{4}{5} \quad \frac{5}{7} \quad \frac{11}{22} \quad 1\frac{7}{7}$

and multiply it by the lead of the screw

$1\frac{7}{7} \times 0.250 = 0.314813+$

Subtracting this from 0.31496 (8 mm.) we have

$0.31496 - 0.314813 = 0.000147 \times 8 = 0.001176$ in.,

an error approximating 0.001 in. for every eight threads cut.



NEWS SECTION

New York Motor Show Sales Please Dealers

Enthused with the unqualified success of the twenty-first National Automobile Show at New York nearly 1,000 automobile manufacturers and their representatives made merry at the annual National Automobile Chamber of Commerce banquet at the Hotel Commodore recently. The enthusiasm is due to reports that the public is buying cars at the show. The show has surprised New York dealers. They expected to have to go out and look for business. Three days of the show have proved to them that cars are in demand.

At the dinner Francis H. Sisson, vice-president of the Guaranty Trust Co. of New York, told automobile men about the credit situation with reference to the industry. Mr. Sisson in his speech told the automobile trade frankly that bankers would finance business, but only when conditions necessitated funds.

At the Grand Central Palace in making the round of exhibits the six-cylinder car was was still found to predominate. New models of cars making their first appearance are pretty evenly divided between fours, sixes and eights. More complete equipment is another noticeable tendency. In this sense equipment is held in the light of regular installations on all production cars at the factory and not extra fittings, which may be attached later to meet the individual needs of different owners. Luxuriously equipped vehicles that catered to the comparatively few in other shows are not so conspicuous this year.

Throughout the show there is noted a trend toward better cars rather than the introduction of radical designs. Refinements include improved engines aiming at greater economy of operation. Chief of the improvements is that of carburetor systems to cope with the decreasing grades of fuels.

Another Metric Bill

Representative Britten, of Illinois, has introduced in the House of Representatives a metric system bill identical, except for two or three minor changes in verbiage, with that introduced a few weeks ago in the Senate by Senator Frelinghuysen, of New Jersey.

Lumber Back to Normal

In an article prepared by the Northern Pine Manufacturers' Association and published in the advertisement sections of newspapers in an effort to prevent continued building stagnation to bring about a resumption of construction activities, it is stated that "lumber prices have been reduced from 40 to 45 per cent."

"While it is true that lumber is back to normal," it says, "it is necessary for the public to know that lumber represents only about 30 per cent of the total cost of the ordinary building. The remaining 70 per cent which goes to make up the balance of the cost has not returned to the normal basis.

"That is the reason why the cost is still out of line and building operations cannot be financed. Money is only available for this purpose when the entire building can be erected at normal costs. Otherwise the security is not attractive.

"Not only is lumber down, but farm products have fallen in the same proportion. Wheat, oats, corn, flax, cotton, wool, cattle, hogs, hides, and any number of such items are back to normal. These basic products form the foundation upon which is built the purchasing power of the general public.

"Under such circumstances, building operations will not start until the 70 per cent represented by plumbing, heating, hardware, lighting, painting and labor get back to normal.

"The reluctancy of the '70 per cent' to get back to a normal basis, has stagnated building activities. There will be no resumption of work until these prices return to normal.

"This is one of the principal reasons why labor is, at the present time, unemployed, and why the situation is becoming worse every day.

"The public has decided the question. It is not buying and it will not resume buying until everybody is willing to get back to a normal basis. As soon as this is brought about things will begin to move. Money, which is always available when building costs are normal, will be plentiful. People will begin to build homes. Rents will begin to come down. Building materials will begin to move and saw mills will start operations."

Changes in the Office of the Director of Sales

The office of the Director of Sales has been militarized. The new director of sales is Lieutenant-Colonel E. S. Hartshorn, of the General Staff. The same general sales policy developed under civilian control of the office, will be continued by Colonel Hartshorn and his associates.

Lieutenant-Colonel William M. Connell, cavalry, and Lieutenant-Colonel William N. Haskell, cavalry, have been designated as assistant directors of sales. Major O. H. Saunders, infantry, will become executive officer, succeeding Major S. D. Graff, whose discharge from the service became effective Dec. 31, 1920.

Colonel Connell will have charge of the plant facilities, railway contractor's equipment and building materials, and machine-tool sections; while Colonel Haskell will supervise the workings of the general supplies, sales promotion, and transfer and inventory sections, also all foreign negotiations and sales, succeeding A. La Mar, whose resignation also became effective on Dec. 31, 1920.

The contract and administrative sections will be directly under Colonel Hartshorn.

The general policy of the sales promotion section will be continued and Charles M. Willoughby will continue as chief of that section.

E. C. Morse, who has been director of sales, and Mr. La Mar, the head of the division of foreign sales, will enter the service of a large importing and exporting firm. Major H. S. Johnson, of the old organization, goes to the Old Hickory plant as representative of the Ordnance Department. F. B. Grant will resume the practice of his profession as an electrical engineer in Boston.

Calls for Steel Express Cars

Senator Robinson of Arkansas introduced a bill in the Senate on Jan. 11 requiring railroads to equip baggage and express cars with sanitary drinking water containers and facilities, and requiring that after July 1, 1924, all full railway express or baggage cars shall be of steel or shall have steel underframes.

Business Conditions as the Big Banks of the Country See Them

National City Bank of Chicago Is Cautiously Optimistic

Despite the world-wide readjustment in commodity prices and resultant unsettlement in many quarters, the new year opens under circumstances which justify taking a cautiously optimistic view of the future. The country has cast aside all delusions about the possibility of maintaining war prices in peace times and the Federal Reserve Board has rejected all efforts to secure credits with which to support speculative undertakings or to defer the inevitable restoration of a reasonable price level. Congressional leaders are insisting upon the introduction of important economies to offset in part the sharp decrease in the federal tax collections, which must result from the enormous decline in business profits realized during 1920 as compared with those cleared during the previous year of high prosperity, upon which were based the immense tax collections of the year just closed.

This is a favorable sign, for the high cost of government is bearing heavily upon the people and must be reduced forthwith. For more than thirty weeks there have been more recessions than advances reported in commodity prices, which in the nature of things must ultimately reduce the cost of living and make it easier for the industrial worker to make both ends meet. This is of great importance, since wages are being reduced everywhere, not because capital is trying to get the better of labor, but because the country cannot continue wage advances in a period of declining profits. The people are getting back to a sane basis of living and while the liquidation means heavy losses in some quarters, the general influence will be highly beneficial to the great mass of American citizens, 95 per cent of whom are "ordinary" citizens in the best sense of the term.

Bank Credit Generally Devoted to Sound Business Undertakings

There are many problems to be solved and numerous hazards to be reckoned with, but the distinguishing feature about this year as compared with the situation of twelve months ago is that inflation has ceased, extravagance is on the wane, and operating costs are being gradually reduced. These changes are reflected by the decline in the average prices of the stocks of eighteen typical industrial corporations to 64¾, the low level of five years. These shares are selling nearly twenty-eight points below last year and within about one point of the pre-war average. This shows that virtually all the war inflation in these special stocks has been wiped out, for it was in the industrial shares that war inflation was most pronounced. Eighteen railroad stocks show an average loss of only about six points for the year. There has been also a vast reduction in the amount of credit tied up in loans upon speculative collateral, the present estimate for outstanding brokerage loans in Wall Street being $700,000,000 as against $1,750,000,000 of bank credit so employed in July, 1919, when this account was at peak level. It is worth noting also that within the last eighteen months there has been a vigorous campaign waged against unessential loans in the effort to finance productive industry ahead of everything else. This has purified the country's loan account in a remarkable way and it seems safe to say that never has a new year opened with bank credit devoted more generally to the support of genuine business undertakings than is the case today.

Unemployment Still Serious

With the slowing down of business the labor shortage has been not only wiped out, but the country faces today an unemployment problem of considerable significance. This grows out of the partial shutting down of textile mills, silk mills, steel works, and other industries which a year ago were running full time. The railroads have been gradually weeding out the less desirable men, with the result that efficiency in the transportation industry is much greater than it was. It is difficult to estimate the number of unemployed in the country, but a conservative figure, taking in all industries, might show 300,000 or 400,000 men. In Great Britain the labor surplus is materially larger than in the United States. In several instances, however, men and women operatives have petitioned their employers to retain their services at a lower wage if that should be necessary in order to keep the plants in operation. This contrasts sharply with the arrogant spirit of a year ago and emphasizes the changes in working conditions throughout the world. Most employers are trying to do the right thing by their men so as to prevent unnecessary hardships and build up good will. With the slowing down of business the movement towards higher wages has been checked and the strike evil has largely disappeared. It is to be hoped that employers and employees may co-operate so that the splendid organizations built up during the war period may be left intact.

Better Times Ahead

There are better times ahead for the country, provided orderly deflation runs its course and we do not hinder the natural reaction from a long period of inflation. A good deal of constructive legislation will be considered by the next Congress, but the country will not tolerate such changes in the Federal Reserve Act as tend to weaken it, restrict its policy, or restrain the Federal Reserve Board from acting as it sees fit. If ever the country needed high grade financial leadership it is in these days of readjustment and business depression. Our banking system has held up well under a strain which would surely have crushed it completely, had it been unsound or improperly put together.

Guaranty Trust Company Official Points Out Need for Constructive Leadership

In an address at the annual banquet of the National Automobile Chamber of Commerce, Hotel Commodore, New York City, Tuesday, Jan. 11, 1921, Francis H. Sisson, vice-president of the Guaranty Trust Co., said in part as follows:

"The question uppermost in the minds of all business men at this time is 'When will present readjustments be completed and a stable basis for business re-established?'

"While, of course, years must elapse before the tremendous amount of life and property destroyed in the war can be fully replaced and the political and social problems it has created can be solved, there is ample ground for believing that we shall reach a relatively stable condition in this country in the very near future. We have undoubtedly passed through the most critical of our post-war readjustments, although many more must yet be made. And any answer to the question that I have quoted is contingent upon the length of time it takes to effect the remaining necessary readjustments.

"I refer especially to the readjustment of retail prices to declining wholesale prices and the readjustment of the costs of production to present purchasing power. These necessary readjustments have been tardily started, as was to be expected, but they are now under way, fortunately, and will be completed gradually but with ever-accelerating speed. The sooner they are accomplished, with a minimum of distress, the sooner we will reach a comparatively stable business basis, but we cannot reach that basis until they are finished.

"The business conditions of this nation are fundamentally sound. But after the great crisis through which we passed in the World War, and in which we demonstrated our tremendous economic strength, we have relaxed and permitted ourselves to be bound like a Gulliver by Lilliputian uncertainties and pessimistic reactions. With the richest

and most abundant resources, facilities, and capabilities of any nation on earth we stand on the threshold of the New Year in the rôle of a Doubting Thomas, lacking faith in our manifest destiny; supplanting the eagle with the ostrich as our national emblem.

"Leadership that will direct our national thought into logical channels is imperatively demanded at the beginning of 1921. And it will be the duty, as well as the opportunity, not only of the incoming Administration but also of Congress to assume that leadership. It is equally the duty, as well as the opportunity, of American business intests to co-operate fully in giving the country such leadership."

United States Trade with Germany in 1920

Trade of the United States with Germany in the year just ended aggregated nearly $400,000,000 against $533,000,000 in the biggest year preceding the war—the calendar year 1913. This estimate, says a statement by the National City Bank of New York, as to the trade with Germany during the full year is based upon actual figures for the eleven months, which show exports to Germany in the eleven months ending with November, 1920, at $253,000,000 and imports from Germany in the same period $84,000,000. Should the December figures equal or even approximate those of November, the grand total of trade with Germany for the calendar year 1920 would fall little short of $400,000,000, as against the high water mark of $533,000,000 in 1913, for it happened that the year immediately preceding the war showed that our trade with Germany was bigger in value than in any preceding year.

Of course, it does not follow that the approximately $400,000,000 worth of merchandise forming our trade with Germany in the calendar year 1920 represents anything like the *quantity* of material represented by an equivalent sum prior to the war, for, even measured in our own gold standard, the valuation per unit of quantity is now fully twice as much per pound or per ton or bushel or barrel or gallon as prior to the war. But nevertheless it is a fact that in stated value, measured by United States dollars, the trade of 1920 with Germany is about three-fourths as large as in the biggest year preceding the war but in quantity probably less than half as much.

Latest reports regarding the trade of Germany, both those of her own officials and those of other countries, suggest that the United States is now supplying directly and indirectly about one-third of the merchandise entering Germany, most of it coming direct, while a considerable quantity, of United States origin, reaches her through other countries, notably Great Britain, Netherlands, and Belgium, which have always had the habit of passing on to Germany considerable quantities of merchandise which they imported from the United States.

National Foreign Trade Council To Hold Eighth Annual Meeting in May

With its efforts exerted toward securing more definite and aggressive co-ordination of the varied foreign-trade activities and to reinforce them with the co-operation of the various governmental agencies, the National Foreign Trade Council is making preparations for its eighth annual convention in Cleveland, Ohio, on May 4 to 7 inclusive.

All the problems confronting the American manufacturer in his initial reaching out for control of the world's marts will be presented for first-hand consideration.

Save during the convention, which is wholly educational, the Council devotes its energies to promoting and fostering foreign trade extension throughout the world. Its officers, headed by James A. Farrell, president of the United States Steel Corporation, serve without compensation, and its membership of approximately seventy-five representatives of leading commercial, industrial, agricultural, financial and shipping interests defray its expenses. It is strictly non-partisan and non-political.

Growth of Industrial Production

American industrial production during the last ten years has experienced a wonderful and unprecedented growth. Stimulated during the war period by an exceptional foreign demand, manufacturing plants generally increased their producing capacity far beyond their normal requirements. In many instances today their purely domestic trade falls short of consuming their output, with the result that America is more than ever facing a situation where it is imperative that we become a nation of world traders if our industries are to continue in active operation and our prosperity as a nation is to endure. It is a radical departure from former conditions.

In the old days the American manufacturer, generally speaking, was content with his domestic trade. He looked to the foreign markets only in periods of overproduction or depression at home. Under these conditions he shipped his surplus stock abroad with selling instructions and made the best of a bargain that usually was unsatisfactory. His interest in foreign trade naturally was not overly keen. He made no effort to extend his foreign acquaintance and connections. For years our exports, chiefly promoted by the larger industrial interests, averaged but a trifle in excess of 7 per cent of our production.

Under the stimulus of a war-made foreign demand American exports increased from less than two and one-half billions in 1913 to more than eight billions in 1920. The remarkable period of prosperity that attended this revolutionary condition fully awoke the American manufacturer to the tremendous possibilities of a well-developed and permanent foreign trade. But out of it all grew no really definite and lasting foreign connections for the great majority of those who profited chiefly from munition making. It is this class of manufacturer who should be most keenly interested in the problems that will come up for discussion before the next National Foreign Trade Council convention.

Preliminary arrangements for the convention will be in the hands of a committee of fifty representative Clevelanders officered as follows: Samuel Mather, Pickands, Mather & Co., honorary chairman; E. R. Fancher, governor of the Federal Reserve Bank, Myron T. Herrick, president the Society for Savings, Henry Howard, the Grasselli Chemical Co., William P. Palmer, presiden the American Steel & Wire Co., and Ambrose Swasey, president the Warner-Swasey Co., honorary vice-chairmen; and H. F. Seymour, the Columbian Hardware Company, executive chairman.

A. W. Douglas Predicts Good Spring Business

The new year begins with general business conditions throughout the country "poor but sound," says Archer Wall Douglas, chairman of the Committee on Statistics and Standards of the Chamber of Commerce of the United States in his semi-annual review of the business situation issued recently.

According to Mr. Douglas a determined and constructive effort is being exerted to bring about a change for the better by teamwork and co-operation. In the entire absence of any apprehension of a money panic he sees the most encouraging feature of the whole situation.

"How long the present situation will last is a subject of much speculation and inquiry," says Mr. Douglas. "The general thought is that the winter months will be quiet and that as the spring opens there will be an appreciable change for the better. In the industrial districts there is a general feeling that the situation will improve when prices of commodities reach a figure that will tempt the ultimate consumer to begin purchasing for other than his immediate wants. It is rather significant that some sales can be made at bargain figures but very few at moderate concessions. The answer apparently is, therefore, that when the readjustment now in active operation has resulted in a sufficiently low level of prices for manufactured commodities, business in the industrial districts will assume more normal proportions."

New Income Tax Bulletin Out

Income Tax Bulletin F on the subjects of depreciation and obsolescence has just been issued by the Bureau of Internal Revenue of the Treasury Department. It should be secured at once by every manufacturer as it may point the way to considerable savings in tax returns.

Evolution of an "American Machinist" Article—I

That *American Machinist* readers and contributors may comprehend more clearly the steps a prospective article must take before being published we are starting herewith a series of picture stories. The illustration shows the home of the editorial force. To the right between the two rows of cabinets Editors Condit and Colvin do their daily labors, while the larger space



to the left houses the remainder of the force, from the typists to the managing editor. In subsequent pictures we will show close-ups of the men through whose hands a contribution must pass; besides showing the various steps that must be accomplished in the mechanical departments. The greater number of contributions arrive in the *American Machinist* office through the mails and these are sorted out in the mailing department and sent to the managing editor. What he does with them will be shown in our next installment.

Astronomical Device for Measuring Angles to One Ten-Thousandth of a Second

Those who have followed the development of methods of making exceedingly minute measurements will be interested in a new device that has just been invented for astronomical work. Like the methods that have been developed for checking very accurate gages this device employs the principles involved in the use of the interference bands of light. The methods developed are stated to be accurate within 0.0001 second of an arc. The exceeding minuteness of such an angle may be appreciated from the fact that it is roughly equal to the angle that would be subtended by a pin-head at a distance of over a thousand miles from the observer.

This new device was developed by Professor Albert A. Michelson of the physics department, University of Chicago, and was described by him before the American Physical Society on Dec. 29, 1920. The method used was first applied with the eight-foot reflecting telescope at Mt. Wilson, in southern California. The mirror of the telescope is obscured by an opaque cap that has two slits. The slits are adjustable both for their width and distance apart. When the instrument is focused on a star, instead of an image of the star, there appears a series of interference bands arranged at equal distances apart and parallel to the two slits. When the slits are separated, a distance between them will be attained at which the fringes of the bands disappear. From the measurement of this distance and by calculating with a simple formula it is possible to ascertain the angle subtended by the star. When this angle and the distance to the star are known it is easy to determine the diameter of the star.

A still more powerful device is obtained by using two adjustable mirrors with an interferometer attachment, instead of the telescope and slots. The latter device was applied with remarkable success to the measurement of the diameter of Alpha Orionis. This star is located in the constellation of Orion and its distance had previously been determined by parallax methods. It has been possible hitherto to determine the distance of some of the nearer stars by measuring their parallaxes, and the masses of binary stars have been computed by methods involving mathematical considerations and a knowledge of their observed periods. However, Professor Michelson's method is the first which has successfully determined the actual diametrical size of a star.

The result of the measurement is astounding. The star Alpha Orionis has a diameter three hundred times that of the sun or equal to that encompassed by the orbit of the planet Mars. If it were placed as near to us as the sun, its brilliant surface would fill the whole visible heavens. Its volume is 27,000,000 times that of the sun.

The method of Professor Michelson has also been applied by a member of the staff at Mt. Wilson Observatory to the measurement of the star Capella. This has been known from spectroscopic observations to be really a double star, although the two stars are so near together as to appear as one through the most powerful telescopes. With the new attachment on the eight-foot reflecting telescope it was possible to measure the minute angle of 0.045 seconds subtended by the two stars, and to determine their successive positions as they revolved in their orbits. The calculated and observed results agreed with astonishing precision, the maximum error being 0.0001 of a second.

Professor Michelson is a scientist of unique distinction. He numbers among his achievements one of the most accurate determinations of the velocity of light. He has applied the methods of light interference to numerous delicate physical measurements of lengths and angles, and among these were his accurate determination of standards of length for the French government. The so-called Michelson-Morley experiment gave much of the inspiration out of which has grown the recent theory of relativity. Professor Michelson has been awarded the Nobel Prize for his researches.

How To Avoid "Cancellitis"

How to avoid becoming a victim of the new business epidemic known as "cancellitis" is pointed out in a chapter devoted to "fifteen points on contracts and cancellations" of the new Credit Man's Diary and Manual of Commercial Laws for 1921, now being sent to members of the National Association of Credit Men, with branches in 130 cities. This volume is the product of a representative board of editors from the various states headed by William Walker Orr of New York City.

Some people do not know what constitutes the sale and purchase contract and as a consequence fail to start the sale right. This is one of the reasons for the easy cancellations that have been sweeping the entire country and which have resulted in more than $250,000,000 losses to American manufacturers, wholesalers and jobbers. This publication tells what to guard against; what to do to minimize the evil of cancelled orders and advises how to cut down losses.

The new $1 Treasury savings stamp will help you to accumulate a reserve fund. The 25c. thrift stamp is the children's way to a "success fund." Keep right at it!

Secondary Boycott Against Factory Products Illegal

A decision hitting at union labor activities was rendered on Jan. 3 by the Supreme Court of the United States in a case involving an injunction obtained by the Duplex Printing Press Co., of Battle Creek, Mich.

In the decision, which was written by Justice Pitney, it is held that the use of the secondary boycott against products of the factory was illegal. It is further held that provisions of the Clayton act designed to permit labor unions a certain degree of freedom are not broad enough "to become a cloak for an illegal combination or conspiracy in restraint of trade as defined by the anti-trust laws."

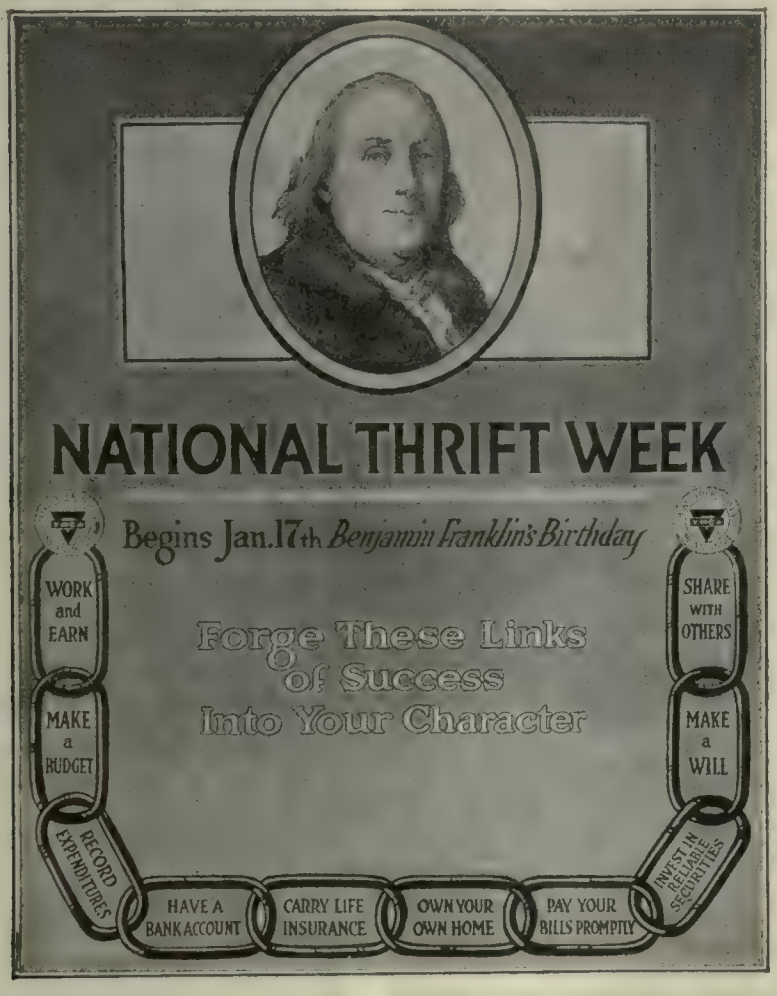
Justice Brandeis read a dissenting opinion. This was concurred in by Justices Holmes and Clarke. Justice Brandeis held that the acts complained of could be justified by self-interest and that it was not the province of the courts, but rather of legislative bodies to determine what acts might be in conflict with the rights of the community.

The case did not involve any acts at the factory of the company at Battle Creek, but a secondary boycott against products sold in New York. The Circuit Court of Appeals held in favor of the labor union. The Supreme Court has reserved that decision and held the issuance of the injunction to be justified.

The Duplex Printing Press Co. employs 200 machinists at its factory at Battle Creek. The company maintains an open shop and when a strike was called only eleven machinists and three others who superintend the installation of presses quit work. The company was enabled to continue operation with non-union men. The union then directed its effort toward a nation-wide boycott of its products. The acts of the union embraced a warning to customers that it would be better for them not to purchase from this company, or having purchased, not to install the presses, and threatening them with loss.

Justice Pitney in the majority opinion held that "by no fair or permissible construction" could acts contrary to anti-trust laws be considered as made permissible by the Clayton act.

Justice Brandeis said that he had come to the conclusion that both the common law of a state and a statute of the United States declare the right of



Federal District Court in the Southern district of New York issued an injunction against Emil J. Deering and William Bramley, business agents of the International Association of Machinists. industrial combatants to push their struggle to the limits of the justification of self-interest. He said that all rights are derived from the purposes of the society in which they exist and above all rights rises duty to the community. He declared it is not for judges to determine whether conditions exist causing danger to the community. He said "it is the function of the Legislature, which, while limiting individual and group rights of aggression and defense, may substitute processes of justice for the more primitive method of trial by combat."

In describing the history of the case Justice Brandeis said that there were in 1909 only four plants making large printing presses. By 1913 all or the plants except the Duplex had agreed to the eight-hour day, the minimum wage and other conditions demanded by the unions. The other plants then served notice that they would not agree so long as the fourth plant stayed out. The strike was called against the Duplex to bring that plant into line. Justice Brandeis held that the acts complained of did not constitute a secondary boycott, but were as much a primary boycott as was the strike called in the plant of the Duplex plant itself.

Philadelphia Foundrymen Meet

The 303d meeting of the Philadelphia Foundrymen' Association, Inc., was held at the Manufacturers' Club as usual on Wednesday evening, Jan. 12.

D. R. Yarnall, of Yarnall-Waring Co., maker of power-plant devices, Chestnut Hill, Philadelphia, who has just returned from Germany and Central Europe, where he had been doing relief work, gave a lantern-slide talk on what Germany has been doing since the armistice; how Germans are living, what they earn, what they eat and drink, the cost compared with our own; also their ability to procure coal and coke, raw material, etc., so as to make their goods for other countries as they did before the war; the great Krupp works, etc.

The election of officers for 1921 and the usual luncheon was served in the grill, following.

National Chamber of Commerce To Hold Ninth Annual Meeting in Atlantic City

Joseph H. Defrees, president of the Chamber of Commerce of the United States, announced today that the ninth annual meeting of the National Chamber will be held at Atlantic City, April 27, 28 and 29.

In announcing the time and place of the annual meeting, President Defrees let it be known that consideration had been given to New Orleans and Washington as likely cities in which to hold the meeting. New Orleans was eliminated because of the desire of the Chamber to hold the meeting in a place near Washington. Lack of hotel accommodations and suitable meeting quarters to seat the three or four thousand business men who will attend the meeting were the reasons for not selecting Washington.

The eighth annual meeting of the National Chamber also was held at Atlantic City.

Hoover Heads Move for Public Works

The Engineering Council, formed in 1917 to enable the engineers of the nation to aid in meeting the war emergency, passed out of existence on Jan. 1, 1921, when it was formally merged into the American Engineering Council of the Federated American Engineering Societies under the leadership of Herbert Hoover. The new council, representative of nearly 200,000 engineers, aims, says a statement authorized by Mr. Hoover and his associates, to voice the aspirations and ideals of the engineering profession, in whose behalf, and with the coming of the new year, it will carry on an active and comprehensive plan of public service.

J. Parke Channing, of New York, who has been chairman of Engineering Council since its formation, will be actively identified with the new council as vice-chairman. Other vice-chairmen who will aid Mr. Hoover in pushing the council's program of national advancement, social, economic and technical, are Calvert Townley of New York, William E. Rolfe of St. Louis and Dean Dexter S. Kimball of Cornell University.

Governmental efficiency will be one of the chief concerns of the American Engineering Council, which, it was announced, will continue the old body's campaign to bring about the establishment of a National Department of Public Works. The council has decided to co-operate with the National Public Works Department Association, which was organized as a result of the action of Engineering Council, and which has committees at work in every state.

The Washington headquarters of the association will be maintained. Adolph Lewisohn is chairman and James T. Grady, Director of the Department of Public Information at Columbia University, is secretary of the New York Committee of the Association. Senator Harding, according to a statement given out at the committee's headquarters, 71 Broadway, by Mr. Lewisohn, has assured the committee that he "is very much in favor of bringing together under one department all of the present agencies of public works now scattered around Washington."

The New York Committee has been furthering a nation-wide campaign for the passage of the Jones-Reavis bill for the creation of a department of public works by making over the Department of the Interior and changing its name. Many Republican leaders, including President Nicholas Murray Butler of Columbia, Senator Reed Smoot, Senator Medill McCormick, Governor Lowden of Illinois, Vice-president-elect Coolidge, favor the principle of the plan. Ex-Secretary Franklin K. Lane and Governor Cox take the same view.

The Smoot-Reavis reorganization resolution, passed by both houses of Congress, represents, according to the New York Committee, a broadening of the public works idea, whose original sponsor was Engineering Council. The new American Engineering Council will not confine its interest to the public works project alone, but will seek to promote economy and efficiency in all branches of the Government service.

"American Engineering Council," said a statement issued at the council's offices in the headquarters of the American Society of Mechanical Engineers, "recognizes the fact that the activities of the technical bureaus of the Federal Government are of fundamental importance in the development of our economic resources and recommends that great care and careful discrimination be exercised in any reductions that may be necessary."

The council has appointed a committee on public affairs with Mr. Channing as chairman. Mr. Hoover, as president of the council, has, it was announced, by direction of the council, appointed the present committees of Engineering Council. Among the committee chairmen are Col. William Barclay Parsons, chairman of the Board of Trustees of Columbia University, Military Affairs; Curricula of Engineering Schools, Dr. Alexander C. Humphreys, Stevens Institute, Hoboken; Patents, Edwin J. Prindle; National Public Works Department, F. T. Rubridge; New York State Government Reorganization, H. deB. Parsons; Water Conservation, Calvert Townley; Types of Government Contracts, Arthur P. Davis.

The council starts the year, it was announced, with an executive board of twenty-four members representing engineering societies in every industrial center. A call for a meeting of this board on Feb. 11 will be sent out in a few days. The meeting will be held either in New York or Washington.

One of the first acts in the council's plan of public service will be the appointment of a committee to investigate industrial waste. This committee, it was stated will be the agency through which the council will deal with labor, chambers of commerce and other organizations in an effort to solve the problems of industrial relations.

Opposes Cut in Foreign Trade Appropriations

Appealing to Congress for increased appropriations for support of the Government Service of Trade Promotion and Trade Information, the National Foreign Trade Council declares that it is wise economy to spend money in proper ways that will promote commerce and thereby increase the Government revenues. The Council points out that 60 per cent of the revenues for 1919 come from successful commercial activities and that our foreign trade produced more than 13 per cent of the total revenues. The Council has sent to each member of the House of Representatives a leaflet entitled "A Square Deal for Our Foreign Trade," in which it makes a number of interesting statements regarding our international commerce and the extent to which it is promoted by private enterprise, as compared with Government support. The leaflet with the exception of its title, follows:

Every man woman and child in the United States is vitally concerned in the maintenance of our foreign trade.

Seventeen per cent of our total production is devoted to foreign trade
One-fifth of our industrial and agricultural population depend for their livelihood on foreign trade.
Every industry exports some part of its finished products.
Most industries import essential raw materials.
The price of our agricultural products is determined by the laws of supply and demand in the markets of the world.
Certain imports are essential to the fertility and operation of our farms.
All parts of the United States, however distant from the seacoast, contribute directly or indirectly to our foreign trade.

Congress has never granted appropriations in support of the foreign service of our Government in any way commensurate with its importance or at all comparable with appropriations granted other services.

Our foreign commerce in 1919 amounted to $11,824,790,922.
As $916,510 was appropriated for the Bureau of Foreign and Domestic Commerce, and as approximately $1,880,505 of the State Department's appropriations were used solely to aid foreign commerce, the United States Government spent in promoting foreign trade only 2/100 of 1 per cent of the value of our exports and imports.
Our agricultural production in 1919 was valued at $24,982,000,000.
As the Department of Agriculture was granted $33,899,761 to aid agriculture the U. S. Government spent in promoting agriculture 13/100 of 1 per cent of the value of our agricultural products.
In proportion to their respective values therefore, Congress appropriated *six and one-half times* as much for agriculture as it did for foreign trade.
It was true economy to make these appropriations for agriculture. It delivered the goods.
It will be true economy to make similarly liberal appropriations for foreign-trade promotion. Foreign trade will deliver the goods.
In 1920 the Government devoted 93 per cent of its expenditures to payments upon wars, past, present and future.
Our foreign commerce produced more than 13 per cent of the total revenues of the Government in 1919, out of which these payments on account of war were made.
But the U. S. Government devoted to foreign trade promotion only 5/100 of 1 per cent of its total expenditures.

Private enterprise has done its full share in promoting our foreign trade.

Private concerns spend an average of 7 per cent in promoting their foreign trade.
Private concerns spent in 1919 a total of approximately $550,000,000 in promoting exports alone.
Therefore, private enterprise spent 180 *times* as much on exports alone as did the U. S. Government on both exports and imports.
Some private firms each spend more than does U. S. Government in promoting foreign trade

It is a legitimate function of government to carry on certain foreign trade promotions which cannot or should not be handled by private enterprise.

American business with foreign countries cannot be conducted without the assistance of the Consular Service or without protection by the Diplomatic Service
Private firms cannot obtain from official sources information which may be readily available to Commercial Attachés.
Government foreign service can collect information which small producers individually cannot afford to gather.
Government foreign service avoids duplication of effort in the collection of data of general interest.

There is no economy in diminishing the sources of our Government revenues.

Taxes on income and profits supplied 60 per cent of our Government revenues in 1919.

These taxes accrue only if our industries operate at a profit.
This profit depends on the maintenance of our foreign trade, which disposes of our 17 per cent surplus production to the best advantage.
Customs duties supply 3.6 per cent of our Government revenues.
These duties obviously depend on the maintenance of our imports.
The greater our foreign trade becomes, the greater will be the revenues based on profits and on imports.
The more Congress grants the Government Departments for constructive work which cannot be carried on by private enterprise the greater our foreign trade will become.

It is dangerous to weaken an organization when the strain upon it is greatest.

Our foreign trade is now faced by renewed foreign competition, with exchange everywhere unfavorable to our exports.
Foreign governments are reorganizing and increasing the government services which support their foreign commerce.
It is the part of prudence and of economy for the United States to do the same.

A. S. M. E. Forms Material-Handling Section

The American Society of Mechanical Engineers has formed a Material Handling section. About 700 members of the Society have been enrolled, although only a small part of the Society's membership has been formally notified of this professional section.

The executive committee of the section, consisting of R. M. Gates, chairman; H. V. Coes, Kern Dodge, Nathan C. Johnson and F. A. Wardenberg, has issued a statement saying that great potential interest has been aroused in the bringing together of individuals who desire to help in solving the handling problems of mining, transporting, manufacturing and distributing of all materials.

"It is the desire of the executive committee of the Material Handling section," the statement says, "before proceeding with a definite program, to consider all major phases of the subject in order that the work of the section can be made of the greatest possible benefit to the engineering profession, to industry and to the general public.

"Our members have expressed their interest in all broad phases of the great transportation problem which confronts industry: (1) How the mechanical engineers can improve machinery and equipment for the handling of materials; (2) how our great material handling costs can be reduced if the whole subject of transportation is analyzed and co-ordinated from the viewpoint of making economies over our present methods.

"The executive committee in its preliminary study of the proposed activities of this section, is considering the advisability of organizing committees, as required by the amount of work in the province of each, along two entirely separate lines: (1) According to types of material handling equipment, such as conveyors, cableways, cranes and the like; (2) according to industries which have material handling problems, such as steel manufacturers, storage warehouses, commodity distribution centers, construction work, automobile or tire industries and the like.

"It is the intent of the section to so thoroughly discuss the controlling factors in each line by meetings held by these various committees so as to develop better methods of handling materials and to standardize equipment and methods where the same are desirable.

"Other important work along research lines could be undertaken to build up, through the formation of specialized committees, certain classes of data and of information of general interest to others. The actual cost of handling materials at terminals, for example, the relation of the cost of handling material to the general costs in factory operation, the percentage of cost of commodities which merely represent transportation in its various phases.

"There is a wonderful opportunity for such research committees to be placed on subjects of national importance, such as the distribution of commodities. Such research would undoubtedly get at the heart of certain of our economic problems. Men could be found for these committees, in the judgment of the executive committee, who are the biggest men in the field, providing it was understood that the work of investigation would be of a non-political, non-commercial character and undertaken by engineers in the spirit of research for the benefit of the public, the industries and the engineering profession."

Workers Got Less Under Profit-Sharing System Than Normal Pay

More than twenty of the employees of the New Bern Iron Works and Supply Co., New Bern, N. C., who were among those to go out on strike when the system of income sharing adopted by the company at the suggestion of the employees resulted in a considerable decrease in their normal salaries, have returned to work accepting a wage scale of 70 cents an hour, which is a reduction of approximately 20 per cent under the previous scale.

The labor situation at the New Bern plant attracted national attention a few weeks ago when, following a proposal of the company for a second reduction of 10 per cent in the wage scale, the employees suggested a division of the profits after the manufacturing costs and the overhead expenses had been deducted.

The owners of the company adopted the suggestions retaining full control of the plant but giving the employees all of the profits. The pay checks for the first week under this plan showed that the division of the profits approximated the salary scale that had been proposed by the company. Thereupon the men went out on strike and the plant was closed down temporarily. It resumed operations when the twenty or more men returned to work, accepting the wage scale offered by the officials. It is expected that the others will return on the same basis—namely, seventy cents per hour.

C. H. Wills & Co. Causes Boom in Marysville

C. H. Wills & Co., Marysville, Mich., manufacturer of automobiles, has completed the first two units of its plant with a floor space of 448,000 sq.ft. The company expects to make deliveries of its motor cars in February.

Some time ago the company picked Marysville for its ideal physical characteristics and facilities for the manufacture of motor cars, and purchased 4,200 acres. It has arranged for houses for its employees; it built sewers, streets, two steamer piers and five miles of railroad sidings. In short, it made such improvements that today Marysville offers many attractions as a manufacturing center.

The officers of the company are: C. H. Wills, president; J. R. Lee, vice president; K. B. Alexander, vice president; Chas. Morgan, vice president; F. D. Stone, secretary; Frank P. Book, treasurer, and G. S. Anderson, assistant treasurer.

Machine-Tool Situation of Rockford, Ill.

The situation existing in the machine-tool and general manufacturing industries in Rockford, Ill., is much the same as that found in other localities. Business has been remarkably quiet for several weeks. Manufacturers here are taking a hopeful view of the situation and expect business to be more brisk as the spring season begins. Several of the large machine-tool builders of Rockford have other lines that are offshoots of the parent organizations, and these in all cases show a greater degree of activity. While not engaged to full capacity the latter can be used in a beneficial manner to hold the skilled labor organizations together.

A few of the machine-tool builders have seen fit to close their plants for a period of several weeks through the holidays and during the period of inventory. Some have not definitely decided upon a date for re-opening. Others who have not closed are operating at from 40 to 50 per cent of their capacity, and are doing this by running short hours in order to give work to a maximum number of mechanics. Nearly everyone reports a surprising number of inquiries that in many cases request early deliveries. However, the business continues to hang fire and it is impossible to get the customer to close definitely with an order. One machine builder who does considerable exporting reports that there is still a small volume of this business.

Auto Plants Reopen

The Buick Motor Co. resumed operations at Flint, Mich., on Jan. 11, giving employment to 12,000 men. The plant has been idle three weeks. Normally the company employs 18,000 men. Announcement also was made that the Champion Ignition Co., employing 2 000 men, has started operations.

Business Items

The Hazard Lead Works, Inc., of Hazardville, in Enfield, Conn., has voted to increase its capital stock from $50,000 to $100,000.

The Bridgeport Screw Co., of Bridgeport, Conn., will increase its capital stock from $500,000 to $1,000,000.

The Allan-Diffenbaugh Wrench and Machine Tool Co., Baraboo, Wis., which was incorporated recently, has started the manufacture of tools and wrenches in Baraboo, Wis.

A reorganization of the Tomahawk Steel and Iron Works of Tomahawk, Wis., has been effected. F. J. Callan, formerly vice president and general manager, has disposed of his interests, and is succeeded by William G. Bauman. Mr. Bauman was a salesman for the Scully Steel and Iron Works of Chicago for a number of years. William Dever and Lenore Larson were re-elected president and secretary respectively.

The Clarksvilie Foundry and Machine Works, Nashville, Tenn., has taken over the plant, equipment, and stock of the Drane Foundry and Supply Co. on Commerce Street. The firm will operate the Drane plant in addition to its old plant near the Red River Iron Works near Clarksville, Tenn.

The directors of the Wizard Check Endorser and Printing Machine Co., 457 Calvert Bldg., Baltimore, Md., have elected the following officers: President, F. S. Weise; vice president, R. Norman Cadle; secretary and treasurer, John H. Hessey. The board of directors elected is composed of the above officers and J. Norris McFarland and George A. Wilson.

Geo. H. Olney & Co., 50 Church St., New York City, has announced the addition of a machine-tool division to its regular line of woodworking tools, engines, boilers, stacks, etc. C. F. Loretz, mechanical engineer, will be in charge of its power plant and B. E. Carpenter in charge of the iron and woodworking machinery department.

A general meeting and business session of its district managers and sales engineers will be held by the Pawling & Harnischfeger Co., Jan. 25 to 27. A general review of the past year's business will be discussed and plans for future sales in the various lines—cranes, hoists, excavating machinery and machine tools—will be outlined.

The Baird Machine Co., of Stratford, Conn., a suburb of Bridgeport, has increased the capital stock of the company from $500,000 to $1,200,000. The company manufactures machinery of various types.

Alexander Palmros, formerly engineer of the Pneumelectric Co. of Syracuse, N. Y., has established offices with his son, G. A. Palmros, at 445 South Warren Street. The partnership will practice in mechanical and electrical engineering and development of manufacturing processes.

With extensive iron-ore properties in Georgia, railroad and coal mining properties in several counties of Tennessee, the aggregate value of which exceeds $700,000, the Dayton Coal, Iron and Railroad Co., of Dayton, Tenn., has gone into the hands of a receiver.

The Whiting Foundry Equipment Co., Harvey, Ill., announces that it has changed its name to the Whiting Corporation, increasing its authorized capital stock from $700,000 to $3,000,000. The Whiting Corporation remains under the same management and will continue the manufacture of cranes, foundry equipment and railway specialties as heretofore.

A new corporation of Detroit capitalists, in company with M. Chester, an experienced mining engineer of Ellijay, Ga., has taken over the iron ore mines near Ellijay and extensive developments of the property are planned. The mines have lately been shut down but active operations have been again resumed. These mines produce a brown hematite ore of extra good quality.

The Southern Textile Exposition Co. has announced that arrangements are being made to hold a Southern products show in Greenville, S. C., Oct. 6 to 12, 1921. At this show all kinds of products manufactured in the industrial plants of the South will be exhibited, including mainly textile products, machinery and iron and steel products.

Barnes & Irving, dealers in machinist, tool and steel supplies in Syracuse, N. Y., has recently purchased a plot 200 x 150 ft. in the heart of Syracuse's industrial center, at West Fayette and Niagara Sts. for the erection of a warehouse to cost approximately $100,000.

The L. S. Starrett Co., Athol, Mass., distributed a bonus on Jan. 7 to its employees. The bonus ranged from 4 to 10 per cent on the amount of wages earned during the last six months, figured on the length of time each employee has been with the company.

The Chicago Pneumatic Tool Co., New York, announces the appointment Jan. 1, 1921, of R. F. Eissler as assistant to the vice president with headquarters in the company's new office building at 6 East 44th Street, New York. W. C. Straub, formerly district manager of the New Orleans branch, has been appointed district manager of the Pittsburgh branch to succeed Mr. Eissler; and Ross Wyeth, formerly attached to the Pittsburgh branch, has been appointed district manager of the New Orleans branch to succeed Mr. Straub.

The annual dinner and convention of the Harmony Club, sales organization of the J. M. & L. A. Osborn Co., Cleveland, Ohio, was held at the Hotel Cleveland, that city, on Jan. 12-13. About twenty-five members were present, district managers from Buffalo, Columbus, Adrian, Mich., and Binghamton, N. Y. attending.

Obituary

CHARLES H. ARMSTRONG, secretary and treasurer of the Armstrong Manufacturing Co., Bridgeport, Conn., manufacturer of tools, etc., died at his home here on Jan. 1 after an illness of one week with angina pectoris. Mr. Armstrong, who was nearly sixty-one years old, was born in Waterbury, Conn., Jan. 28, 1860, and came to Bridgeport when fifteen years of age. He has been secretary and treasurer of the Armstrong company for the past thirty-five years. Mr. Armstrong was also active in municipal affairs, having served on various city commissions.

JOSEPH SCHREIBER, 63 years old, civil and hydraulic engineer, died Jan. 5 at Johns Hopkins Hospital, Baltimore, from heart trouble. He had been ill about three weeks. In 1879 he became construction engineer of the St. Louis Water Works and went to Baltimore to supervise the erection of pumping machinery for the St. Louis plant. He remained in Baltimore and planned numerous important improvements. He also was at the head of the Suburban Gas Works, Baltimore, for some time.

Personals

GEORGE H. GRUNDY, for many years connected with the Crucible Steel Co., of America, as manager of its New York branch, is now associated with the Poldi Steel Corporation of America, New York as its general sales manager.

FELIX J. WASILKOWSKI has recently ben promoted from assistant to works manager to production and efficiency engineer of the Central Metal Products Corporation, College Point, N. Y., formerly the Empire Art Metal Co., Inc.

JOSEPH J. ZUMBERG has several connections with the Oesterlein Machine Company of Cincinnati and has taken a position as designer for the Cincinnati Grinder Co.

BRUNO C. LECHLER, formerly general manager for the S. S. Hepworth Co., of New York City, is now manager of the sugar machinery department of the Fletcher Works, Philadelphia.

FREDERICK G. KENYON, formerly chief checker in the tool drafting room of the Bullard Machine Tool Co., has resigned and is now instructor in mechanical and architectural drafting and machine design at the State Trade School, Bridgeport, Conn.

SOLOMON E. GILLESPIE, formerly assistant engineer of the Murray Co., Dallas, Tex., has opened an office as consulting engineer in Dallas.

HARRY P. MEREDITH, formerly manager of manufacturing of the Curtiss Aeroplane and Motor Corporation, of Garden City, L. I., and Buffalo, N. Y.,

has become connected with the Maxwell-Chalmers Motor Co., Inc., of Detroit, Mich., as general works engineer in charge of all building design, changes on construction, plant maintenance and power-plant operation for all of the company's plants in Detroit, Dayton, Ohio, Newcastle, Ind., and its Canadian plants.

FRANK L. EIDMANN, mechanical engineer of the Cowan Truck Co., Holyoke, Mass., makers of elevating trucks, tractor trucks, etc., has recently resigned. Previous to joining the Cowan organization, Mr. Eidmann was with the Heald Machine Co., of Worcester, Mass.

H. W. BLAKE, senior editor of the *Electric Railway Journal*, was given a dinner on Jan. 6 by his associates, as a tribute to his thirty years' of continuous service with that paper. As a tangible remembrance of the occasion, Mr. Blake's friends in the McGraw-Hill company presented him with a de luxe edition of Gibbon's "Decline and Fall of the Roman Empire."

New Publications

Compressed Air Plant. By Robert Peele, Mining Engineer and Professor of Mining in the School of Mines, Columbia University. Four hundred and eighty-five 6 x 9-in. pages, with many diagrams, illustrations and tables. Bound in cloth boards. Fourth edition. Published by John Wiley & Sons, Inc., New York, N. Y.

In this edition a new chapter has been added: Chapter XXVII on "Measurement of Air Consumption." It contains data on the flow of air through orifices and short tubes and a discussion of appliances for measuring air at both low and high pressure, including simple tank apparatus that can be readily improvised. A note has been appended to chapter XXV relative to some important air-lift work recently done at a large mine in Mexico. The third edition was reviewed in Vol. 50, No. 15 (April 10, 1919) of the *American Machinist*.

Automotive Ignition Systems. By Earl L. Consoliver, M.E., sometime assistant professor of mechanical engineering at the University of Wisconsin, and Grover I. Mitchell, B.S., assistant professor of mechanical engineering at the University of Wisconsin. Two hundred and sixty-two 6 x 9-in. pages, with three hundred and forty-five illustrations and diagrams. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y.

This volume furnishes a comprehensive, systematic course of study dealing with the ignition systems used on automobiles, tractors, trucks and airplanes. It will be found to be of real value to men who install, adjust and repair ignition systems and to the automobile owner who wishes to understand the principles and construction of modern ignition systems. Many well-known systems are described and illustrated and wiring diagrams are given.

The following chapter headings will serve to indicate the extent of the field covered and the order of presentation: Principles of Electricity and Magnetism; Ignition Batteries; the Jump-spark Ignition System; Modern Battery Ignition Systems; Battery Ignition Systems for Multiple Cylinder Engines; the Low-tension Magneto; Modern High-tension Magnetos—Armature Types; Modern High-tension Magnetos—Induction Types; Care and Repair of Ignition Apparatus; Ignition Troubles and Remedies.

Straight Business in South America. By James H. Collins. Two hundred and eighty-five 5 x 8-in. pages, cloth boards. Published by D. Appleton & Co., New York City.

The impression given by reading this volume is that the author is well qualified to write on his subject and that he has given facts. The book gives definite information necessary to establishing and maintaining business in South America. The material was drawn entirely from Argentina, Brazil, Chile, Uruguay and Peru, being obtained by the author during an eight months' tour, resulting in a series of articles for the *Philadelphia Public Ledger*, from which his book has been the outgrowth. Some of the material appeared in other publications.

The following typical chapter titles indicate very clearly the contents of the book: Wanted—Business Imagination for Export; What South America is Like; What the People and the Countries are Like; The Tools of the Trade—Our Own Banks, Our Own Ships, Investments, Distribution, American Retailing, American Consumer Advertising; Doing Business with South America; The Other Fellow—Our Competitor; What Do South Americans Think About Yankees? The Importance of Buying as Well as Selling; What Chance for Me in South America? What You Will Need in South America.

The Essentials of Descriptive Geometry. By F. C. Higbee, M. E., Professor and head of Department of Descriptive Geometry and Drawing, State University of Iowa. Third edition, revised. Two hundred and eighteen pages; 6 x 9 in.; 156 figures; 302 problems. Published by John Wiley & Sons, Inc., New York, N. Y.

The book is intended chiefly to serve as a foundation for mechanical drawing, the aim of the author being to include only those portions of descriptive geometry which possess industrial utility and which develop the qualities of mind essential in a draftsman. The order of the material is somewhat different than that usually employed, although the development is logical and should be effective. The book is well made up with regard to such matters as sub-heaings and the placing of illustrations. Problems relating to the work are inserted at the ends of chapters. The chapter on model-making is worthy of special note. In an illustrated appendix are given various geometrical constructions which can be made use of in solving the problems.

An idea of the scope of the work can be gotten from a survey of the list of chapter headings, which follows: Orthographic Projection; Profile Plane; Assumption of Points and Lines; Planes; Location of Points, Lines and Planes; Revolution of Points; Problems on the Line; Problems on the Plane; Problems on Angles; Problems on Points, Lines and Planes; Surfaces; Plane Surfaces, Cylindrical Surfaces; Conical Surfaces; Intersection of Surfaces Surfaces of Revolution; Warped Surfaces; Tangent Planes and Lines; Model Making.

How to Keep Invention Records. By Harry A. Toulmin, Jr. Eighty-five 5 x 8-in. pages; illustrated by 12 form diagrams. Bound in brown cloth boards. Published by D. Appleton & Co., New York.

The author emphasizes the necessity of protecting inventions, generally termed patents, trade marks and copyrights, by keeping records of them. He presents a practical method of insuring recording of dates in a series of twelve forms. The last chapter deals with the methods of patent investigations.

Trade Catalogs

Pumps. Taber Pump Co., Buffalo, N. Y. This folder illustrates and briefly describes the company's pumps for oils, gasolines and other clean fluids.

Steel Hoists, Hand Cranes and Steel Trolleys. Wright Manufacturing Co., Lisbon, Ohio. Catalog No. 10, pp. 47, 6½ x 9½ in. This catalog gives descriptions and illustrations of the "Wright" steel hoists, hand cranes and steel trolleys; the price list is also included.

P. & H. Chronicle. Pawling & Harnischfeger Co., Milwaukee, Wis. Booklet, pp. 58, 5 x 7½ in. This booklet sketches the company's history and is profusely illustrated with photographs of the personnel, the different departments and their products.

Cutler-Hammer Catalog. The Cutler-Hammer Manufacturing Co., Milwaukee, Wis. This company has issued in pad form a catalog containing prices and dimensions of its electric controlling apparatus.

Cushman Chucks. The Cushman Chuck Co., Hartford, Conn. Catalog for 1921, fifty 4 x 7-in. pages. Describing various types of Cushman chucks, including the parts of the chuck and other attachments. Specifications, tables of operations and price lists of replacement parts are included.

Ross Heaters. Ross Heater and Manufacturing Co., Inc., Buffalo, N. Y. Catalog F, pp. 39, 6 x 9 in. This catalog illustrates and describes the various types of heaters, condensers, expansion joints, coolers and Airjector pumps which this company makes.

Cranes. Milwaukee Electric Crane and Manufacturing Co., Milwaukee, Wis. Catalog, pp. 48, 7½ x 10½ in. This company has issued a new 48-page catalog illustrative and descriptive of its complete line of cranes. The last page gives a partial list of the purchasers of the "Milwaukee Crane."

Thread Milling Machines. Smalley-General Co., Inc., Bay City, Mich. This is a revised eight-page circular showing illustrations and brief description of the Smalley-General No. 1 thread milling machine, No. 1C thread milling machine with power traverse and Smalley-General No. 4 thread milling machine.

Burrows Defectoscope and Magnetic Analyzer. Holz & Co., Inc., 17 Madison Ave., New York. Bulletin No. 41, pp. 20, 7½ x 10½ in. This bulletin describes the Burrows defectoscope and magnetic analyzer which is used for the inspection of steel rails, rods, wire, cable and all other steel and iron stock of uniform section.

La France Safety Devices, Edition D. American La France Fire Engine Co., Inc., Elmira, N. Y.

"And the end is that the workman shall live to enjoy the fruits of his labor; that his mother shall have the comfort of his arm in her age; that his wife shall not be untimely a widow; that his children shall have a father, and that cripples and helpless wrecks who were once strong men shall no longer be a by-product of industry."

Starting off with the above quotation from Juhnke, the catalog gives a complete summary of La France safety products.

Forthcoming Meetings

The Cleveland Section of the American Society of Mechanical Engineers will hold a meeting in the Cleveland Engineering Society's Rooms on Feb. 1. R. R. Abbott, of the Peerless Motor Car Co., will speak on the "Uses of Alloy Steel in the Machine Tool Industries."

The Society of Automotive Engineers will hold a meeting in Chicago on Feb. 2 at the Hotel Morrison in connection with the Chicago Automobile Show; also one in Columbus on Feb. 10 at the Winter Garden, New South Hotel, in connection with the Tractor Show.

The Engineering Institute of Canada will hold its thirty-fifth annual meeting in Toronto, King Edward Hotel, on Feb. 1, 2 and 3.

The National Civic Federation will hold its twenty-first annual meeting at the Hotel Astor, New York City on Feb. 14, 15 and 16, to discuss International, European and American labor problems.

The National Foreign Trade Council will hold its eighth annual convention in Cleveland, Ohio, on May 4, 5, 6 and 7. J. G. Hammond, care of the Council, 409 Park Bldg., Cleveland, is secretary.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The Spring Convention of the National Machine-Tool Builders' Association will be held on Thursday and Friday, May 19 and 20, at Hotel Traymore, Atlantic City, N. J. The general manager is Ernest F. DuBrul, 817-818 Provident Bank Building, Cincinnati.

The Industrial Cost Association will hold a meeting, to organize a New York section, in the rooms of the A. S. M. E., 239 West 39th St., New York City, on Jan. 20, at 8 o'clock.

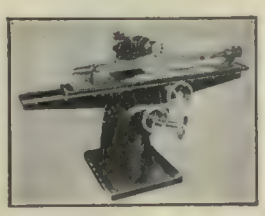
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Grinding Machine for Broaches

J. N. Lapointe Co., New London, Conn.

"American Machinist," Dec. 23, 1920.



The capacity of the machine is ample to grind broaches 64 in. long and 8 in. in diameter. The grinding wheel is carried on a spindle supported by a swiveling-head, which makes it possible to grind both the rake angle on the back of the broach teeth and to undercut the faces. The head swings on the column of the machine to any angle in the horizontal plane and so permits the grinding of teeth at any angle to the axis of the broach. The machine occupies a floor space of 39 x 164 in.

Truck, Malleable Pot, Electric

Elwell-Parker Electric Co., Cleveland, Ohio

"American Machinist," Dec. 23, 1920.



The truck is intended for conveying the pots from the foundry and to the rattlers after the heating, as well as for charging the ovens or furnaces. The capacity of the truck is 4,000 lb., the pots being mounted on stools, so that the forks at the front end of the machine can fit underneath them. The toggle lifting mechanism is driven by a series motor through worm gearing and a special clutch. By means of the switch, the forks and the pot may be stopped at any point in the up or down travel. The lifting mechanism is completely inclosed and runs in oil. The overall length of the truck is 12 ft., and the weight with the battery is 3,600 lb.

Riveter, Truck-Frame

Baird Pneumatic Tool Co., Kansas City, Mo.

"American Machinist," Dec. 23, 1920.



This device is adaptable to any steel fabrication within its range where the work is suspended from above and worked to completion from that position. The riveter itself is rigidly mounted on a stand. The sliding valve is controlled by two pedals, thus leaving the hand of the operator free to guide the work to its proper place. The riveter drives and heads ¾-in. rivets, hot. It occupies little space, being but 38 in. high and weighing approximately 600 lb.

Controller, Clapper-Type

Allen-Bradley Co., Milwaukee, Wis.

"American Machinist," Dec. 23, 1920.

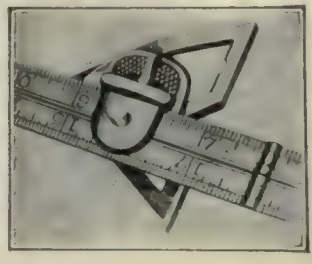


The controller, made in sizes ranging from 1 to 150 hp., is known as the "clapper-type controller," primarily because all switching and contact-making are done with a clapper-switch contactor. It is made for either alternating or direct current. The frame is constructed of steel, with pressed-steel inclosing covers. The controller is said to have advantages by virtue of the simple wiring and switch gear and the use of the compression resistor. Under-lever control gear, limit switch, brake connections and inclosing covers for the resistor compartment can be furnished.

Angler, "Arrow"

Barnes & Irving, Inc., Syracuse, N. Y.

"American Machinist," Dec. 23, 1920.



The device is intended primarily for attachment to a straight-edge or a folding rule, being small enough to fit in the pocket conveniently. It is stated that it does not deface the rule and can be quickly attached and adjusted. The device can be used for such purposes as a T-square, try-square, depth gage or scratch gage. It is said to form a quick means of laying out or finding angles, of bisecting angles, or of finding centers, diameters or tangents of circles. It is made of light-weight, non-corrosive metal.

Reamer, Hand, Expansion, "Rex"

Schellenback-Hunt Co., Cincinnati, Ohio

"American Machinist," Dec. 23, 1920.



The reamers are split clear through the lengths of the teeth and are thus expanded at the starting ends of the cutters and not in the center only. The expanding screw is taper threaded and engages tapped threads near the starting end of the reamer. The ends of the teeth are ground at an angle and are locked after adjustment by means of a beveled locknut as shown. The construction permits of a wide range of expansion of the cutters—0.025 in. or more is easily obtainable in a ½-in. reamer, with corresponding increase in the larger sizes. The adjusting screw and locknuts are hardened.

Drilling Machine, Semi-Automatic, Five-Spindle (Changed Design)

Detroit Machine Tool Co., 1487 St. Antoine St., Detroit, Mich.

"American Machinist," Dec. 23, 1920.



The chief new feature of the machine lies in the clutch in the feed mechanism contained in a housing on the right of the machine. The long, horizontal rod to be seen below the work tray is used to actuate a jaw clutch, so as to engage or disengage the worm drive in the feed. The type of work-holding fixture shown has a V-shaped jaw and a standard machine handle, although it is essentially the standard fixture No. 6100. It is intended for holding either hexagon or round stock from ¼ to 1⅛ in. in diameter, as when drilling cotter-pin holes in screws and bolts.

Attachment, Grinder, for Portable Drill

Arnold Electric Tool Co., Inc., New London, Conn.

"American Machinist," Dec. 16, 1920.



This attachment is recommended for the company's type-B portable electric drill. The frame carrying the wheel spindle is clamped to the body of the drill, a belt running on the sleeve of the chuck transmitting the power to the spindle. The tool can thus be used as a portable grinder, or it becomes a small bench grinder by clamping in position by means of a bracket, as shown in the illustration. The use of the attachments is said to greatly increase the field of application of the tool.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

N. Y., Albany — The Simmons Machine Co., 981 Bway.—two spindle tapping machine for work on cast iron pipe flanges.

N. Y., New York (Borough of Manhattan) —The Chicago, Rock Island & Pacific Ry., 66 Bway.—one improved style 5-A pipe bending machine.

N. Y., New York (Borough of Manhattan) —V. Lowener, 114 Liberty St.—several special machines for finishing work on automobile motors.

N. Y., New York (Borough of Manhattan) —L. Schlesinger & Co., 64 Wooster St.——one spinning lathe with oval chuck and 12 in. swing.

N. Y., New York (Borough of Manhattan) —R. Snider, 2001 Grand Concourse—
Five No. 79, two No. 78 and two No. 77 Toledo geared presses or equivalent.
One No. 666 Toledo embossing press or equivalent.
One 2⅜ in. Gridley automatic mult. spindle.
One No. 22A New Britain automatic mult spindle, (used).

Pa., Harrisburg — The Harrisburg Machine Electric Welding Co., 43 North 18th St.—machine tools.

Pa., Philadelphia — E. McDevitt, 5212 Woodland Ave.—small lathe for auto repairs work.

Pa., Philadelphia — The Philadelphia Navy Yard—Armstrong tool holders and drill press vices.

W. Va., Logan — The Guyan Machine Shops—B. Shell, Purch. Agt.—Large back geared shaper.
Radial drill; motor driven, 220 volt, 3 phase, 60 cycle.
Punch and shear.
Bending rolls.
Round steel and shafting, 4-16 in. in diameter.
Lathe chucks, 2 jaw for light work.

Mich., Ann Arbor—The Ann Arbor Metal Products Corp. — miscellaneous equipment for making bronze blans.

Mich., Detroit — Schwartz Upholstering Co., 205 Moffat Bldg.—Medium sized lathe and drilling machine.

Mich., Detroit—The Steere Eng. Co., Box 43, North End Sta.—one squaring shear, having capacity to take plates of 100 in. x ¾ in., motor driven, 440 volts, 60 cycle, (used).

Mich., Lansing—The Michigan Brass & Iron Wks., Depot St., T. E. Hackett, Genl. Mgr.—miscellaneous equipment for making and machining castings.

Mich., River Rouge—Whitehead & Kales Co., (iron and steel workers)—pipe threading machine, power driven for cutting 3 in. pipe and smaller.

O., Youngstown—The Bd. Educ., 16 West Wood St.—equipment for metal and wood working shop.

Wis., Baraboo—F. and C. Goolmar, manufacturers of patented sectional tubular frames—additional equipment.

Wis., Milwaukee—The Natl. Blowpipe & Ventilating Co., 489 12th St.—F. Goethel Purch. Agt.—sheet metal working machinery.

Wis., Milwaukee — Sprecher Mfg. Co., 1910 Fond du Lac Ave.—P. W. Sprecher, Purch. Agt.—automatic screw machine.

Wis., West Allis — Allis Chalmers Mfg. Co., A. E. Bateson, Purch. Agt. — special machinery, also small tools for the manufacture of farm tractors.

Machinery Wanted

Mich., Negaunee—The Oliver Mining Co. —5 locomotive cranes.

O., Cleveland—The Fairmount Creamery Co., Bolivar Rd. east of East 4th St.—equipment for the manufacture of dairy products.

O., Cleveland — The Last Long Hoisery Co., 1375 West 6th St., M. I. Roth, mgr.—knitting machinery.

O., Forest—J. Herzog & Son, J. Herzog, Purch. Agt.—one 100 x 30-36 ft. stone elevator, one heavy duty pan crusher feeder, bin gates, chutes, etc.

O., Warrensville—The City Farms, Warrensville Rd.—wood-working machinery.

Wis., Milwaukee — The Milwaukee Bag Co., 206 South Water St.—manufacturer of burlap bags, etc., monorail crane.

Wis., Milwaukee—The South Side Wet Wash Laundry, 641 15th Ave., laundry equipment.

Metal Working

NEW ENGLAND STATES

Conn., Newington—The Amer. Mchy. & Equipment Co., will build a 2 story, 36 x 40 ft. factory for the manufacture of tractors and machinery.

Conn., Norwalk — The Amer. Insulator Co., New Freedom, Pa., is having plans prepared for the construction of a 2 story factory on Main St., here. E. A. Barth, New Freedom, engr.

Conn., Norwich—The Standard Oil Co., 26 Bway., New York City, has awarded the contract for the construction of a 1 story, 50 x 80 ft. garage on Forest St., here. Estimated cost, $15,000.

Conn., Stonington—Mystic Auto Station, Inc., East Main St., Mystic, will build a 1 story, garage, etc., here. Estimated cost, $15,000.

Mass., Allston (Boston P. O.)—The T. L. Harkins Machine Co., 44-54 Farnsworth St., Boston, has awarded the contract for the construction of a 2 story, 50 x 100 ft. plant on Cambridge St., here, for the manufacture of special machinery.

Mass., Cambridge—The Barth Press, 28 Oliver St., Boston, has awarded the contract for converting a 5 story factory on Massachusetts Ave. and Windsor Sts., here, into a printing plant. Estimated cost, $25,000. Noted July 1.

Mass., Lynn—The General Electric Co. will soon award the contract for the contruction of a 4 story, 76 x 125 ft. addition to Bldg. 74. Estimated cost, $175,000.

Mass., Pittsfield — W. G. Boudreau, 34 Wilson St., is having plans prepared for the construction of a 1 story garage. Estimated cost, $15,000. Private plans.

Mass., Springfield — The Chaplin Realty Co., 374 Main St., will build a 1 story, garage on Water St. Estimated cost, $35,000.

Mass., Springfield — J. Freedman, 80 Greenwood St., will build a 1 story, 80 x 160 ft. garage, on Church and North Sts. Estimated cost, $25,000. Noted Sept. 2.

Mass., Springfield—M. Groth, 43 Church St., will build a 1 story, 50 x 52 ft. garage. Estimated cost, $15,000.

R. I., Providence—The Gilbane Building Co., 96 Harris Ave., will build a 1 story, 100 x 100 ft. garage on Opie St.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Baltimore Car & Fdry. Co., Curtis Ave. and Locust St., has had plans prepared for the construction of two 1 story additions to its plant. Estimated cost, $18,000.

N. Y., New York (Borough of Manhattan) —The Ria Constr. Co., c/o G. H. Van Auken, archt., 1269 Bway., has awarded the contract for the construction of a 2 story, 100 x 100 ft. garage, at 841 10th Ave. Estimated cost, $75,000.

Pa., Bellwood—The Natl. Steel Constr. Co., 237 4th Ave., Pittsburgh, has purchased the plant of the Bellwood Eng. Co., here, and will enlarge and equip same for the manufacture of electrical equipment for the production of fabricated steel plates. S. Kakorski, Mgr.

Pa., Clearfield—Kurtz Bros., 2d St., are having plans prepared for the construction of a 2 story, 50 x 160 ft. addition to its present printing establishment, and newspaper and school supplies manufacturing plant, on 4th and Reed Sts. Estimated cost, $75,000. Hersh & Shollar, Commerce Bldg., Altoona, Archts.

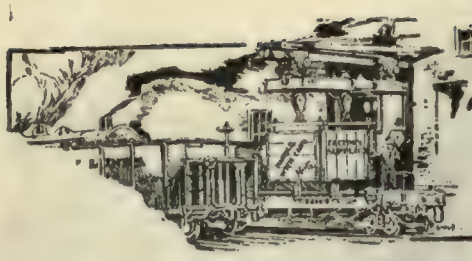
Pa., Darmont—The R. I. M. Motor Serv. Corp., Pittsburgh, has awarded the contract for the sonstruction of a 2 story, 89 x 107 ft. garage on Tennessee Ave., here. Estimated cost, $50,000.

Pa., Philadelphia—The Apex Hosiery Co, Lawrence and Luzerne Sts. is having plans prepared for the construction of a 5 story, 92 x 110 ft. addition to its factory. Private plans.

Pa., Philadelphia — The General Baking Co., 45 East 17th St., New York City, has awarded the contract for the construction of a 1 story, 80 x 104 ft. garage, on Reed and Percy Sts., here. Estimated cost, $15,000.

Pa., Philadelphia—J. G. McIlvain & Co., 58th and Woodland Sts., has awarded the contract for the construction of a 1 story, 30 x 122 ft. garage.

Pa., Philadelphia—A. Mignatti, 321 Duncannon St., will build a 1 story, 100 x 125 ft. garage on 2d and Clarkson Sts. Estimated cost, $20,000. Noted Jan. 1.



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	Current	One Year Ago
No. 2 Southern	$44 50	$36.60
Northern Basic	40 00	34.00
Southern Ohio No. 2	42 00	36.55
NEW YORK—Tidewater Delivery		
2X Virginia (Silicon 2.25 to 2.75)	51 26	39.40
Southern No. 2 (Silicon 2.25 to 2.75)	48.26	41.40
BIRMINGHAM		
No. 2 Foundry	40.50	33.00
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25-2.75 sil.	42 50	38.10
Virginia No. 2	46 25	39.10
Basic	38 25	34.60
Grey Forge	40 25	34.60
CHICAGO		
No. 2 Foundry local	40 00	36.25
No. 2 Foundry, Southern	46.66	38.00
PITTSBURGH, Including Freight Charge from Valley		
No. 2 Foundry	41 96	28.15
Basic	38 00	34.40
Bessemer	38.00	35 40

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and la rger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.80	$3.80	$3.47	$3.58	$3.62	$3.58	$3.47
Soft steel bars	3.70	3 70	3.52	3.34	3.52	3.48	3.52
Soft steel bar shapes	3.70	3 70	3.52	3.48	5.50	3.48	3.52
Soft steel bands	4.65	4 65	4.22	6.25	.....	.....	.....
Plates, ¼ to 1 in. thick	4.00	4.00	3.67	3.78	3.82	3.78	3.67

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.25	$3.50
Warehouse, New York	4.75	3.52
Warehouse, Cleveland	3.52	3.42
Warehouse, Chicago	4.12	3.52

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55	4.90	5.50–6 00	5.00	4.68
No. 12	3.60	4 95	5 56	5.05	4.83
No. 14	3.65	5 00	5 92	5.10	5 [illegible]
No. 16	3.75	5 10	6 02	5.20	5 13
Black					
Nos. 18 and 20	4.20	5 80	6 80–7 80	5.60	5.80
Nos. 22 and 24	4.25	5 85	6 85–7.85	5 75	5 85
No. 26	4.30	5 90	6 90–7 90	5 80	5 90
No. 28	4.35	6 00	7 00–8.00	5 90	6 00
Galvanized					
No. 10	4.70	6 40	6 50	6 25	5 30
No. 12	4.80	6 50	6 60	6 35	5 40
No. 14	4.80	6 50	6 60	6 35	5 40
Nos. 18 and 20	5.10	6 75	6 90	6.65	5 70
Nos. 22 and 24	5.25	6.90	7 05	6 80	5 85
No. 26	5.40	7 05	7 20	6.95	5 [illegible]
No. 28	5.70	7.35	7.50–9.00	7.25	6 00

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.50	$5.80	$4.84
Flats, square and hexagons, per 100 lb. base	6.00	6.30	5 34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55
Special Nickel and Alloys			
Malleable nickel ingots			45
Malleable nickel sheet bars			47
Hot rolled rods, Grades "A" and "C" (base)			60
Cold drawn rods, grades "A" and "C" (base)			72
Copper nickel ingots			42
Hot rolled copper nickel rods (base)			52
Manganese nickel hot rolled (base) rods "D" — low manganese			64
Manganese nickel hot rolled (base) rods "D"— high manganese			67

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb lots sells as follows, f. o.b. New York: ⅛, 8½c. per lb.; ¼, 8c.; ⅜ to ½, 7½c Domestic iron sells at 1 2c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents perpoundare from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	9.00
Spring steel (light)	10.00	7.00	12.00
Coppered bessemer rods	9.00	8.00	7.00
Hoop steel	4.65	4.04	4.43
Cold-rolled strip steel	9.50	8.25	9.25
Floor plates	5.75	4.00	6.28

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
BUTT WELD					
⅛ to 3	54–57½%	41½–44%	⅛	15½–25½%	+1½–11½%
			¼	19½–29½%	1½–11½%
			⅜ to 1¼	24½–34½%	8 –18½%
LAP WELD					
2	47 –50½%	34½–38%	1½		
2½ to 6	50 –53½%	37½–41%	1½		
7 to 12	47 –50½%	33½–37%	2	20½–28½%	6½–14½%
13 to 14	37½–41 %		4½ to 6	22½–30½%	9½–17½%
15	35 –38½%		2½ to 4	22½–30½%	9½–17½%
			7 to 12	19½–27½%	6½–14½%
BUTT WELD, EXTRA STRONG PLAIN ENDS					
⅛ to 1¼	52 –55½%	39½–43%	⅛ to 1¼	24½–34½%	9½–19½%
2 to 3	53 –56½%	40½–44%			
LAP WELD, EXTRA STRONG PLAIN ENDS					
2	45 –48½%	33½–37%	1½		
2½ to 4	48 –51½%	36½–40%	1½		
4½ to 6	47 –50½%	35½–39%	2	21½–29½%	8½–16½%
7 to 8	43 –46½%	29½–33%	2½ to 4	23½–31½%	11½–19½%
9 to 12	38 –41½%	24½–28%	4½ to 6	22½–30½%	10½–18½%
			7 to 8	14½–22½%	2½–10½%
			9 to 12	9½–17½%	5½–+2½%

Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv	Chicago Black	Chicago Galv.
⅛ to 3 in. steel butt welded	44%	28%	42½%	33½%	57½%	44%
2½ to 6 in. steel lap welded	39%	24%	44½%	29½%	53½%	41%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 45%. Cast iron, standard sizes; plus 5%

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	15.00	15.00	19 00
Tin in 5-ton lots	34 25	35.25	59.00
Lead	5.375	5 75	7.875
Zinc	7 00	7 00	9.25
ST. LOUIS			
Lead	5.25	6.25	7.50
Zinc	6.75	6.75	8.875

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

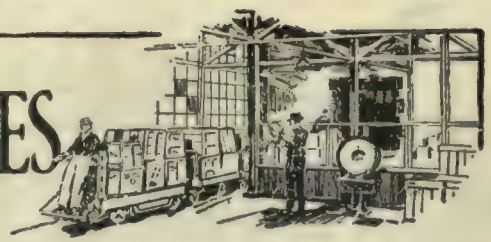
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	21.50	22.50	28.50	21 50	29 50	26.50	35.00
Copper wire (carload lots)	17.00	17.00	28 00	19 00	28 50	24 00	26.00
Brass sheets	20.25	20 25	25 50	24 00	28 00	30.00	26.00
Brass pipe	25.00	25 00	30 50	23 00	34.00	23.25	37.00
Solder (half and half) (case lots)	27 75	27.25	35.00	29.00	35.90	21.00	38 50

Copper sheets quoted above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill. 1000 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	18.25	22.75
New York	18 25	24 00
Cleveland	20.00	28.00
Chicago	21 25	25 00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f.o.b. mill + less 8% for carload lots..... 11.50

	Warehouse			
	—In Casks—		— Broken Lots —	
	Current	One Year Ago	Current	One Year Ago
Cleveland	15.30	11.50	14.70	12.00
New York	14.00	13.00	14.50	13.50
Chicago	14.50	15.00	14.95	15.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	6.25	9.50–9.75
Chicago	6.25	10 00
Cleveland	7.50	11.625

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	*New York			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	11.50	18.00	10.00	10.50
Copper, heavy, and wire	11.00	17.50	9.50	10.00
Copper, light, and bottoms	9.00	15.75	9.00	9.00
Lead, heavy	4.00	7.00	4.00	4.00
Lead, tea	3.00	5.00	3.00	3.50
Brass, heavy	7.00	9.00	7.00	10.00
Brass, light	5.50	8.00	5.00	5.50
No. 1 yellow brass turnings	6.00	9.50	5.50	5.50
Zinc	4.00	6.75	3.00	4.25

*These prices nominal because of dull market

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	29.00	26.00	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	28.00	34.00
Chicago	24.50	28.00
Cleveland	22.00	31.00

BABBITT METAL—Warehouse price per pound:

	—New York—		—Cleveland—		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	70.00	90.00	43.00	68.50	40.00	60.00
Commercial	30.00	50.00	14.50	17.25	9.00	13.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York we quote the best two grades, although lower grades may be obtained at from 16.00 to 20.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	— New York —		— Cleveland —		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+$3 00	List	List net	$1.00	+1.15	1.45
Hot pressed hexagon	+ 3.00	List	List net	1.00	+1.15	1.45
Cold punched hexagon	+ 5.00	List	List net	1 00	+1.15	1.05
Cold punched square	+ 5.00	List	List net	1 00	+1.15	1.05

Semi-finished nuts, $\frac{7}{8}$ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	70–5%
Chicago	40%	50%
Cleveland	50%	60–10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	25%	50%	40%
Larger and longer up to 1½ in. by 30 in.	25%	40%	30%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York..... $2.00 Cleveland..... $3.00 Chicago..... $2.50

For cast-iron washers, ½ and larger, the base price per 100 lb. is as follows:

New York..... $7.00 Cleveland..... $4.50 Chicago..... $5.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	+15%	40%	25%
Larger and longer up to 1 in. by 30 in.	+15%	35%	25%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	25%	30%	10%	30%
Chicago	net	20%	net	20%
New York	40%–5%	30%	net	10%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel $\frac{1}{16}$ and smaller	35%	50%	30%
Tinned	35%	50%	30%

Structural, same sizes:

New York..... $5.50 Chicago..... $5.73 Pittsburgh..... $4.50

Boiler, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York..... $6.00 Chicago..... $5.83 Pittsburgh..... $4.60

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	25.00	27.00	29.00
Brass	24.00	24.00	28.00

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1 c.: for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in. inclusive in rounds, and ⅛-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.60 per 100 lbs.

In Cleveland—$10 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	New York		Cleveland	Chicago
	Current	One Year Ago		
White	7.50@13.00	13.00	15.00	15.00@17.00
Colored mixed	7.00@11.00	9.00–12.00	11.00	11.00@13.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.00	$2.00	$2.25
Philadelphia	2.75	2.75	2.00
Cleveland	4.00	3.00	2.50
Chicago	2.25	2.75	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.50	$3.50	$3.40
Philadelphia	3.65	3.65	4.625
Chicago	4.00	3.85	4.125

COKE—The following are prices per net ton at ovens, Connellsville:

	Current	One Month Ago	One Year Ago
Prompt furnace	$5.00@$5.50	$6.00@$7.00	$6.00@$ 7.00
Prompt foundry	6.25@ 7.00	7.00@ 8.00	6.00@ 7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

	—New York—		—Cleveland—		—Chicago—	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels, (5 bbl. lots)	$0 83	$1 90	$0 95	$2.00	$0 94	$1 77
5-gal cans	0 90	2.10	1.20	2.25	1.19	1 97
1-gal cans (6 to case)	1 05	...	...	...	...	

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	14.00	15.50	14.90	15.50	14.00	14 50
25 and 50-lb. kegs	14.25	15.75	14.75	15.75	14.25	14 75
12½-lb. keg	14.50	16.00	15.00	16.00	14.50	15 00
5-lb. cans	17.00	18.50	15.00	17.50	17.00	16 50
1-lb. cans	19.00	20.50	16 00	18.50	19.00	17.50

500 lb. lots less 10% discount. 2,000 lb. lots less 10–4% discount. 10,000 lb. lots less 10–7½% discount.

SOUTHERN STATES

La., New Orleans — The Orleans Demolishing & Supply Co., Inc., 413 North Rampart St., will build a 3 story, factory and office building on a 50 x 128 ft. site on North Rampart St. between St. Louis and Tonlonse Sts. Estimated cost, $50,000. R. K. Mulnix, Secy. and Treas.

W. Va., Fairmont — The Central Automobile Corp. is having plans prepared for the construction of a 2 story, 50 x 120 ft. garage. Estimated cost, $75,000. M. Keenan, Mgr.

MIDDLE WEST STATES

Ill., Chicago Heights—The Railway Steel Spring Co., 30 Church St., New York City, has awarded the contract for the construction of an addition to its factory, here. Estimated cost, $60,000.

Ill., Granite City—The Amer. Locomotive Co., Seymour St., Pittsburgh, plans to construct a locomotive plant, at the intersection of Wabash and Terminal Rys., here. Estimated cost, $15,000,000.

Ill., Springfield—The Chicago & Alton R.R., Transportation Bldg., Chicago, will build a roundhouse and a track shop at Ridgely Yards, here. Estimated cost, $300,000. H. T. Douglas, Jr., Ch. Engr.

Mich., Battle Creek—The Amer. Stamping Co., Burchard St., is having plans prepared for the construction of a 1 and 2 story, office and factory building. Estimated cost, $100,000. J. C. Llewellyn, 38 South Dearborn St., Chicago, Archt.

O., Cincinnati—The Steel Tool Gear & Pinion Co. has awarded the contract for the construction of a 1 story, 45 x 115 ft. addition to its factory. Estimated cost, $35,000.

O., Cleveland—Detello Bros., 3502 Orange Ave., are having plans prepared for the construction of a 1 story, 42 x 135 ft. garage on East 35th St. and Orange Ave. Estimated cost, $40,000. F. A. Azzerello, 2500 East 20th St., Archt.

O., Toledo—The Holt Farm Light Co. plans to construct a 4 story factory. Estimated cost, $300,000. Private plans.

O., Zanesville — The Baltimore & Ohio R.R., 2 Wall St., New York City, will enlarge its shopps here and install new machinery for repairing box and refrigerator cars.

Wis., Baraboo—F. and C. Goolmar plan to construct a 3 story, 60 x 112 ft. factory on Main St., for the manufacture of patented sectional tubular frames, for tents, camps and portable garages. Estimated cost, $55,000. Architect not selected.

Wis., Burlington — The E. and R. Orr plans to construct a 2 story, 60 x 80 ft. garage. Estimated cost, $75,000. Architect not selected.

Wis., Kenosha—The North Side Garage, 603 Milwaukee Ave., will soon award the contract for the construction of a 1 story, 80 x 100 ft. garage on Division St. Estimated cost, $35,000. R. Paine, 733 Fremont Ave., Engr.

Wis., Milwaukee—The Panay Horizontal Show Jar Co., 1102 32d St., has awarded the contract for the construction of a 2 story, 40 x 120 x 125 ft. factory. Noted Dec. 30.

Wis., Two Rivers—Langer Bros. are having plans prepared for the construction of a 2 story, 60 x 95 ft. garage on Jefferson St. Estimated cost, $75,000. G. Froelich, Two Rivers, Archt.

Wis., Two Rivers—R. Suettinger plans to construct a 2 story, 60 x 90 ft. foundry, on 16th St., for the manufacture of sheet metal. Estimated cost, $75,000. Architect not selected.

WEST OF THE MISSISSIPPI

Col., Denver—The Chicago, Burlington & Quincy Ry., 547 West Jackson Blvd., Chicago, has purchased 160 acre tract in north Denver, and is having plans prepared for the construction of new shops.

Ia., Davenport — The Crane Co., 600-24 East 4th St., manufacturers of steamfitters' supplies, is having plans prepared for remodeling buildings at 213 East 2d St., and constructing machine shop and two 3 story buildings, on Front St. Estimated cost, $225,000. W. T. Cotton, Mgr. Architect not announced.

Minn., St. Paul — The Bd. Educ., City Hall, is having plans prepared for the construction of a 3 story, 70 x 130 ft. school, to include manual training shop, on 14th St., between Jackson and Roberts Sts. Estimated cost, $200,000. C. A. Hausler, City Archt. L. S. Ferguson, Comr.

Mo., Joplin—The Machinery and Supply Co., 317½ Joplin St., is building 3 warehouses and a 1 story, 40 x 160 ft. machinery plant on 4th Ave. and School St. Estimated cost, $15,000.

Tex., Houston—The Southern Pacific Ry., plans to rebuild its shops here, which were destroyed by fire. Loss, $1,000,000. H. M. Lull, Houston, ch. engr.

WESTERN STATES

Cal., Los Angeles—F. Fallas has awarded the contract for the construction of a 1 story, 80 x 120 ft. garage on Central Ave. Estimated cost, $26,000.

Cal., Los Angeles — P. L. Wilson, 631 South Sprague St., has awarded the contract for the construction of a 1 story, 140 x 150 ft. garage and store on 7th and Bonnie Brae Sts. Estimated cost, $18,000.

CANADA

Ont., Chatham—The Mack Furnace Co., Detroit, Mich., has purchased the factory of the Defiance Iron Wks., here, and plans to remodel, build additions and equip same for its own use. Estimated cost, $20,000.

Ont., Cyrville—The Canadian Pacific Ry., Windsor St., Montreal, Que., plans to build roundhouses, sheds and repair shops, here. J. M. R. Fairbairn, ch. engr.

General Manufacturing

NEW ENGLAND STATES

Mass., Everett—J. Briggs & Co., Inc., 45 Purchase St., Boston, manufacturers of paint, has purchased a 3 story building on Paris St., here, and plans to remodel and equip same for its own use. Estimated cost, $25,000.

Mass., Holyoke—The Farr Alpaca Co., Jackson St., is having plans prepared for the construction of a cotton warp building at its plant. S. M. Green & Co., 293 Bridge St., Springfield, Archts. and Engs.

Mass., Woburn—F. C. Parker & Son will rebuild their tannery which was recently destroyed by fire. Loss, $200,000.

R. I., Pawtucket Valley—The Interlaken Mills, Phenix, plans to construct a 1 story weave shed, here, for the manufacture of textile goods. Architect not selected.

R. I., Providence—The Ward Baking Co., 461 Eddy St., will soon award the contract for the construction of a 2 story, 51 x 116 ft. addition to its bakery. Cost between $50,000 and $60,000. C. B. Comstock, 110 West 40th St., New York City, Archt.

MIDDLE ATLANTIC STATES

N. J., Maurer—The Barber Asphalt Paving Co., 2 Land Title Bldg., Philadelphia, Pa., has awarded the contract for the construction of a power house, manufacturing plant and machinery building, here. Noted Nov. 18.

N. Y., New York (Borough of Brooklyn) —The Metropolitan Macaroni Co., 110 Waterbury St., will build a 1 story, 25 x 115 ft. factory on Maeyer and Waterbury Sts. Estimated cost, $40,000.

Pa., Johnstown—The Gallager Ice Cream Co. is having plans prepared for the construction of a 3 story, 98 x 100 ft. ice cream plant. Estimated cost, $150,000. McCormick Co., Century Bldg., Pittsburgh, Engrs. and Archts.

Pa., Spring City — S. Blum Corp. has awarded the contract for altering a 3 story, 50 x 100 ft. mill building. Estimated cost, $10,000.

SOUTHERN STATES

Fla., Tampa—J. L. Greer, Greer, will rebuild his 100 x 200 ft. lumber mill, here, which was destroyed by fire. Estimated cost, $75,000.

La., New Orleans—The Natl. Brewing Co., c/o C. A. Wagner, pres., 2600 Gravier St., has awarded the contract for converting its brewery on Dorgenois and Gravier Sts., into an alcohol manufacturing plant, and constructing a 1 story, 30 x 75 ft. fermenter building and a 4 story, 30 x 54 x 75 ft. distillery building. Estimated cost, $140,000.

MIDDLE WEST STATES

Ind., Hammond—The J. Campbell Soup Co., Camden, N. J., has purchased the Reed-Murdock plant here and plans to build a huge 6 story building.

Mich., Detroit—The Detroit Packing Co., 40 Bushey St., is having plans prepared for the construction of a 5 story, 110 x 110 ft. addition to its plant. Packers Architectural and Eng. Co., Manhattan Bldg., Chicago, Ill., Archts. and Engrs.

Mich., Detroit—Park, Davis & Co., Atwater St. and McDougall Ave., is having plans prepared for the construction of a 4 story, 100 x 200 ft. drug factory. The above is the first unit of plant expansion, which will cost approximately $4,000,000. Smith, Hinchman & Grylls, 710 Washington Areade, Engrs. and Archts.

O., Cleveland—The Cleveland Society for the Blind, c/o A. Palmer, 2275 East 55th St., is having plans prepared for the construction of a 2 story, 40 x 80 ft. broom factory. Estimated cost, $40,000. Meade & Hamilton, 1002 Natl. City Bldg., Archts.

O., Youngstown—The Bd. Educ., 16 West Wood St., will soon award the contract for the construction of a 2 story, 250 x 250 ft. high school on Ohio St., to include a wood and metal working shop. Estimated cost, $1,000,000. C. F. Owsley, 1301 Mahoning Bank Bldg., Archt.

Wis., Blackcreek—The Outagamie Limestone Co. is having plans prepared for the construction of a plant. J. B. Huhn, Secy.-Treas. H. O. Weldon, 10 La Salle St., Chicago, Ill., Archt.

Wis., Kenosha — The Bruner Dairy Co., 418 Newell St., has awarded the contract for the construction of a 2 story, 30 x 66 ft. addition to its dairy. Estimated cost, $10,000.

Wis., Mauston—L. B. Hoech had plans prepared for the construction of a 2 story, 60 x 150 ft. ice cream factory. Private plans.

Wis., Milwaukee — The South Side Wet Wash Laundry, 641 15th Ave., plans to construct a 2 story, 40 x 50 ft. addition to its laundry. Estimated cost, $10,000. Private plans.

Wis., Neenah—The Wolfax Co., Main St., plans to construct a 4 story, 60 x 150 ft. factory, for the manufacture of pottery and porcelain ware. Estimated cost, $80,000. Architect not selected.

Wis., Seymour—The Seymour Woodenware Co., c/o S. A. Konz, pres., has awarded the contract for the construction of a 2 story, 70 x 136 ft. factory, on Main St. Estimated cost, between $35,000 and $50,000.

WEST OF THE MISSISSIPPI

Minn., Granite Falls — The St. Cloud Crushing Plant plans to construct a crushing plant. Estimated cost, $50,000. J. R. Howes, supt. Architect not announced.

Mo., St. Louis—The Axelson Machine Co., Boyle Ave., Los Angeles, Cal., is having plans prepared for the construction of a oil machinery factory, on Walsh St. along the tracks of the Missouri Pacific Ry., here. Estimated cost, $50,000. P. J. Bradshaw, International Life Bldg., Archt.

WESTERN STATES

Idaho, Kellogg—The Bunker Hill and Sullivan M. & C. Co. plans to build an electrolytic zinc refinery. Estimated cost, $1,000,000. F. M. Smith, Dir.

CANADA

N. B., St. George—The New York World Publishing Co., 63 Park Row, New York City, has purchased the plant of the St. George Pulp Co., here, and plans to enlarge same. The plans call for an increased output of from 30 to 100 tons daily.

N. S., Wolfville — The Gaspereau River Light, Heat & Power Co., plans to build a 10 ton dry ground wood pulp mill.

Que., Matane — The Hammermill Paper Co., Erie, Pa., will soon award the contract for the construction of a plup and paper mill, here. Estimated cost, $1,000,000.

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Magnetic Chucks



Ellsworth Sheldon
ASSOCIATE EDITOR AMERICAN MACHINIST

I. Principles of Magnetism — Energy of the Magnet — Single- and Multiple-Magnet Types — Elementary Points in Design — Classification

THE magnetic chuck, though in almost universal use, still remains in the minds of many who come in daily contact with it, a tool of mystery. Though its ability to hold flat pieces that will bear evenly upon its surface is accepted, there are many toolmakers and production men who will pass it up in favor of vise or clamps when pieces of irregular under-surface are to be machined. A knowledge of the principles and construction of the chuck will enable them to greatly extend the range of usefulness of an already very useful tool.

The magnetic chuck is a labor- and time-saving device that, although not new and by no means unknown to the older generation of mechanics, is in these later years rapidly winning its way to a wider recognition in machine shop practice. Not only in tool and machine jobbing shops is this true; but also in the machinery building industry, as well as in other lines of manufacture that use magnetic metal wholly or in part as raw material, this chuck is becoming a more and more important consideration as a factor in production.

Originally Designed to Hold Flat Pieces Only

Originally designed to hold only flat pieces for the very light operations commonly (or rather uncommonly) performed on the surface-grinding machine in the early period of its history, and considered purely as an adjunct of the toolroom, the magnetic chuck has been developed to a point where it holds pieces of magnetic metal of almost any shape, even rough castings and forgings, against the heavy pressures that are brought to bear by modern methods of production.

Far from being solely an accessory to the surface-grinding machine the magnetic chuck is now quite commonly used on the planer and the milling machine, the cylindrical grinding machine, and even on the lathe and boring mill. From requiring a flat and smooth surface in order to display any considerable holding power it now takes its place with the universal chuck and the milling machine vise, ready to hold almost anything that comes along provided that the duplicate pieces brought to it are sufficient in number to warrant making the special fixtures necessary to adapt it to the holding of irregular shapes.

Two things have been necessary to bring about this metamorphosis of the magnetic chuck from an interesting but almost useless toy to a substantial and respect-compelling unit of modern machine-shop equipment: the constant intelligent research and experiment by manufacturers and the education of the workers who use it to an appreciation of its limitations as well as its possibilities.

First Chucks "Leaked" Magnetism

The earlier chucks were not only inefficient as to holding power but were also very "leaky" as to magnetism. The electrical energy consumed by the average modern chuck is not much, if any, in excess of that applied to the earlier devices; but because of a better understanding of the laws of electro-magnetic induction the metal of the chuck body, magnet cores and polepieces is so distributed and the current-carrying members, or coils, so adapted that practically all the energy delivered in the form of electric current is converted to useful holding power.

Magnetic leakage, besides being a waste of energy, was a source of decided annoyance and constituted a most serious objection to the use of the chucks. Not only would chips cling to the body of the chuck but in a short time the stray magnetic currents induced a considerable degree of residual magnetism in the wrenches, the squares, scales, etc., used by the toolmaker, and even in the machines upon which the chucks were used. When used for a long time upon a milling machine, for instance, stray currents, escaping, found their way through the table and column of the machine, the arbor, and finally the cutter, back to the upper poles of the magnets they were seeking. In due time the milling cutter, being of hardened steel, would become permanently magnetized, causing it to attract chips to itself until it resembled an old-fashioned waterwheel in action.

The writer can well remember when a toolmaker, having occasion to use the surface grinder (it was practically always a surface grinder then) upon which was the "'lectric chuck," would hang his vest upon a nail as far removed as conveniently possible from the machine in order not to magnetize his watch. Chucks are now constructed, however, so that the

mysterious "lines of force" are confined strictly to the paths designed for them, leaving the chuck bodies as free from magnetism as any other piece of cast iron or steel.

Principles of Magnetism Not Obscure

While electro-magnetic induction is not exactly an obscure science, some of its phenomena are not so clear as they might be to those of our trade who are not directly connected with the designing and building of motors, generators and other electrical machinery; and therefore before taking up the study of magnetic chucks in detail it might be well to look into the principles of magnetism and discover just what takes place when a current of electricity is brought into the proximity of a piece of magnetic material.

Every intelligent mechanic knows that if a conductor carrying a current of electricity be wrapped around or even brought near to a piece of iron the iron will become to some degree a magnet. He knows that the strength of this magnet is dependent, among other things, upon the amount of current flowing, and that the magnet will possess two poles, either of which is capable of attracting and holding other magnetic material to itself.

About here the average man's knowledge stops. He does not know what this mysterious force called magnetism is; and it may soothe his complacency to know that neither does anybody else. However the action of this force, its relation to the other forces which bring it into existence and to the materials in which it is manifested may be very clearly defined.

Magnetic Influence, or "Lines of Force"

When a current of electricity is passed through a wire the space immediately surrounding that wire assumes a different character than it possessed before. Though the change is not perceptible to the physical senses, this zone has acquired the power of attracting to itself and arranging in position to suit itself particles of iron or other magnetic material. If the wire be passed through a sheet of paper held horizontally and very fine iron filings be dusted upon the surface of the paper they will arrange themselves concentrically around the wire as illustrated graphically in Fig. 1.

This would seem to indicate that the electrified wire is surrounded by some definite though impalpable thing that is directly related to the electric current. For the purpose of illustration this condition surrounding the wire has been assumed to be caused by magnetic currents passing around the wire and called for purposes of distinction "lines of force." Whether or not such lines of force do actually flow around the wire is still a disputed point which we will leave to scientific minds; but the disposition of them, their characteristics, what will affect them, and how, are matters readily susceptible to demonstration.

While the lines of force will under any condition surround the wire through which the current is flowing, whether in air or encased in rubber, glass, or other material, if the wire be enclosed by a continuous ring of *iron* such as an iron pipe, the "number" or density of these lines of force will be enormously increased.

If two (or more) wires lying parallel to each other have a current passed through them *in the same direction* the lines of force do not enclose each wire separately but combine in an elliptical shape to enclose *all* of them. Thus if a wire be wound into a continuous coil with an open space through the center and an electric current be passed through the wire lines of force will pass through the open space in one direction (assuming for the purpose of illustration that they actually have a direction) and back over the outside of the coil. All of the lines surrounding the coil are thus compelled to pass, as a part of their circuit, through the restricted space enclosed by the coil and the flow therefore becomes very dense at this point. Such a coil is shown in Fig. 2, and is called a solenoid.

The "magnetic flux" or "magnetic current," as these lines of force are commonly called, has a great affinity for iron, and if a piece of this metal is brought within the sphere of influence of a solenoid it will be drawn into the central opening of the coil as in Fig. 3 and held there with a degree of strength depending upon the number of turns of wire in the coil multiplied by the amount of electric current flowing. With such a piece of iron in the center the strength, or density, of flow of the magnetic current is increased many hundred times and the coil has become an electro-magnet.

Magnetic Current and Its Conductors

Magnetic current, then, tends to form a closed circuit, and will form such a circuit about any electrified body, regardless of any attempt to alter or modify it. There is no known material that will intercept it;

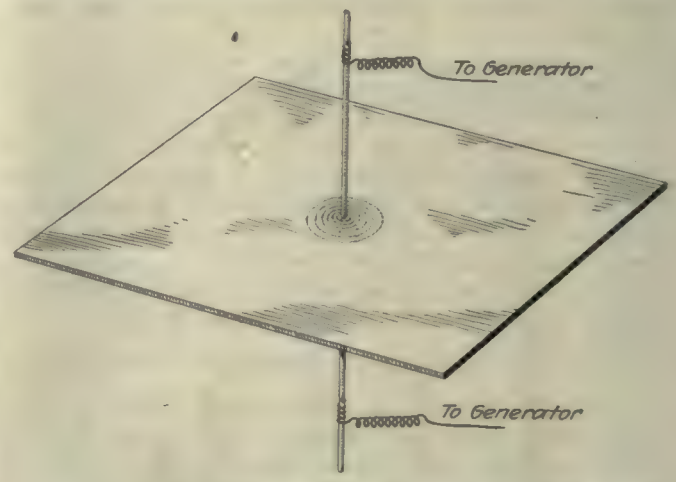


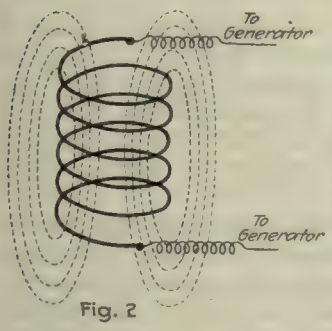
FIG. 1. THE LINES OF FORCE AROUND THE WIRE

the circuit cannot be broken. Neither is there any great difference in the matter of resistance to its passage between materials of different nature (with one pronounced exception) whether air, gases, or solid material.

Iron in any of its numerous forms is practically the only exception to this rule. Nickel and cobalt are susceptible to some extent to magnetic influence and are sometimes classed as magnetic metals, but they are far less so than iron and therefore need not be considered. For practical purposes *all* elements may be divided into two classes—non-magnetic materials and iron.

Magnetic current is somewhat like lighting in some respects; it is very much in a hurry to get where it is going, and while it may be easily diverted from its natural circular path by providing iron for it to

travel on there is a limit to its amiability in this respect; if conducted too far out of its way it will suddenly jump the air-gap or pass through other non-magnetic material to complete its circuit. Another characteristic peculiar to the magnetic current and lightning is that neither likes to go around abrupt corners. A bolt of lightning will frequently leave a perfectly good conductor at an abrupt bend or elbow and jump a long air-gap where the electrical resistance is thousands of times greater in order to reach



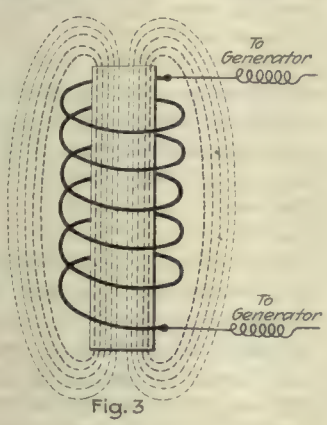


FIG. 2. A SOLENOID FIG. 3. AN ELECTROMAGNET

a "ground." For the same reason—whatever that is—the magnetic current will under similar circumstances act in like manner, and will leave an iron circuit to pass through brass, lead or air where the resistance is all out of proportion. Ignorance of these peculiarities or a limited understanding of them was one of the chief causes of magnetic leakage in the early chucks.

Magnetic Currents Not Manifest Unless Interrupted

If the coil of wire previously considered instead of being made into a solenoid were to be wound on a part of an iron ring as in Fig. 4, the magnetic current would traverse the ring and the metal would remain inert as far as exercising an influence over another piece of iron was concerned (unless the point of magnetic saturation is passed), for it is only when the lines of force are not provided with a satisfactory and sufficient conductor that their presence is manifested. If, however, a short section were to be cut out of the ring as in Fig. 5, forcing the current to jump the gap in order to complete its circuit, the ends adjacent to the gap would become "magnetic" and capable of attracting other pieces of iron, though other parts of the ring would remain as inert as before.

Polarity

Testing these magnetic ends with a piece of soft iron would disclose no difference between them—either would attract with equal power; but if they were to be tested with a permanent magnet a remarkable difference would be revealed. The cut ring has become the "core" of an electromagnet and has developed "polarity." One of the ends has become what is called a "north-seeking" and the other a "south-seeking" pole; oftener called simply north and south poles.

This polarity is peculiar to all magnets, both of the induced (electromagnet) and the permanent kind. A permanent magnet is a piece of hardened steel magnetized by bringing it in contact with another magnet. Magnetism is "induced" in the permanent magnet as truly as in the electromagnet, but the hardened steel will retain magnetism indefinitely while the soft core of the electromagnet loses its magnetism immediately the electric current is off.

Hardened Steel Becomes Magnetized

If the north pole of a permanent magnet be brought into the proximity of the south pole of our electromagnet, or vice versa, it will be attracted, but if the two north or the two south poles be brought together there will not only be no attraction but the pieces will be repelled, more or less violently according to the relative strength of the magnets. As much of the toolroom work that is brought to the surface-grinding machine is hardened steel and becomes a permanent magnet immediately upon being laid upon the chuck, this phenomenon alone should explain many otherwise mysterious failures to hold such pieces.

If the severed ends of the ring shown in Fig. 5 be brought over a loose piece of soft iron lying upon the bench in such a way that its freedom of movement is not restricted, the iron will be so drawn to the magnet as to bridge the gap between the poles. While it will be attracted to either pole with equal strength the attraction when touching *both* poles at once is many times stronger than is that of one pole alone. If the loose piece be of hardened steel and magnetized it will behave exactly as did the loose piece of soft iron, *except* that if the electromagnet is presented in such manner as to bring two similar poles into proximity the loose piece will turn itself around in the air during the jump from the bench to the magnet.

The lines of force exert no attractive power so long as plenty of iron is provided to give them a path that is not too great a departure from the one they would naturally follow in air; the ring in Fig. 4 exhibits no magnetic characteristics because this condition is fulfilled. If, however, the iron circuit were constructed as in Fig. 6, some of the current would pass across the air-gap as indicated rather than go so far out of its way to complete the circuit; in other words, such

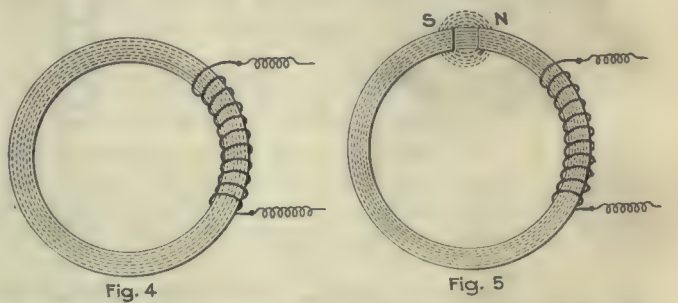


FIG. 4. A RING IN WHICH MAGNETIC FLUX, THOUGH PRESENT, IS NOT MANIFEST. FIG. 5 THE SAME RING CUT APART TO INTERRUPT THE MAGNETIC FLUX AND DEMONSTRATE POLARITY

a magnetic circuit would be "leaky." Placing another coil at *A* would relieve the tendency to leak, provided the second coil was wound the right way, because the magnetic current induced by the second coil would be added to that produced by the first. Both currents would then be impelled to pass through the centers of both coils, and no magnetism would be apparent in the iron frame. If the second coil was

wound in the *opposite* direction the lines of force would be opposed; currents from both coils would jump the gap from *B* to *C* and the frame would have become an electromagnet with what is called "consequent" poles at *B* and *C*.

It will be observed from the foregoing that if more than one coil is used in the construction of a magnet it is quite essential to make sure that the windings

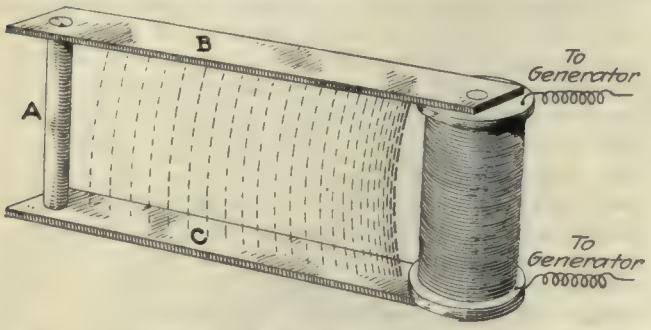


FIG. 6. LEAKAGE OF FLUX BECAUSE OF WRONGLY DESIGNED CIRCUIT

of each pair do not mutually interfere and that the magnetic currents induced by them are not interfered with by currents from any other pair of coils. A thorough understanding of this fact has helped materially in the development of the magnetic chuck.

A very common form of electromagnet is shown in Fig 7. If such a magnet with coils correctly wound were to be straightened out into a bar as at *A* it would be found that both coils were wound in the same direction, but when viewed from the end of the cores, shown at *B*, they appear to be wound oppositely.

Energy of the Magnet

The energy of a magnet is apparently manifested as a desire to contract its circuit to the shortest possible path. A piece of iron laid across the poles of the magnet shown in Fig. 7 would resist a pull tending to separate it from the magnet with a degree of strength proportionate to the amount of electrical energy delivered to the coils, but it would interpose little resistance to a movement that did not tend to

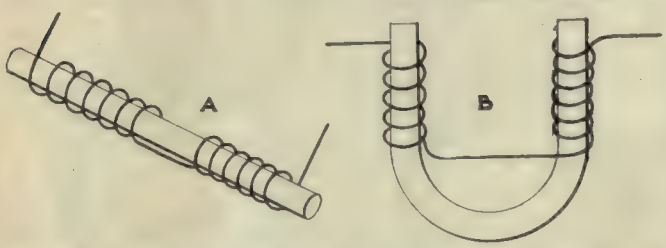


FIG. 7. A COMMON FORM OF ELECTROMAGNET SHOWING DIRECTION OF WINDING

increase the length of the circuit or diminish the number of the lines of force passing through the iron.

There is no reason to believe that a magnet is less "strong" at the center of its poles than at the edges of them, but it is easy to see that a piece held by the magnet cannot approach the edge of a pole without diminishing the number of lines of force passing through it; a fact of which advantage is taken by the builders of the magnetic chucks, and which gives rise to the expression "magnetic edge," which term will be encountered in descriptions of this tool.

(*To be continued in the next issue.*)

Pipe Dreams of a Tramp Machinist—The Day of the Great Race

By Glenn Quharity

Twenty years may be a long or a short time, according to the standard of comparison. When, in these times of priceless gas and conscienceless garage pirates, I think of the good old days of the year "naughty-naught," and remember the wide park-like spaces surrounding the Brookdell shops—now almost completely covered with benzine buggies—I think it is a very long time indeed.

In those far away days, when the apprentices came to work in the morning with tin dinner buckets instead of tin Lizzies, there worked in the machine room two young and progressive machinists, who prided themselves upon keeping up-to-date and knowing a little something about whatever was new and strange in the realm of mechanics.

In the year 1900 automobiles were emphatically to be included in this category. Indeed, the word automobile had hardly come to be recognized as meaning anything in particular. There were "autobats," "electrobats," and "horseless carriages" that we used to read about in the *American Machinist* and other periodicals, but if you should ask a Brookdell man if he had seen an "auto-



mobile," he would probably look puzzled or else reply: "Oh! you mean a buzz-wagon, don't you?"

I don't remember just when the first one came to town, or by whom it was owned, but it was not long afterward that first Morty and then Jim had each possessed themselves of a peripatetic junk-pile bought from some dealer in scrap-iron; the prototype of the modern garage proprietor.

Morty's machine was founded upon the same principles as the buggy of a country doctor. It had comparatively high wheels (when considered in the light of present day automobile construction) with solid rubber tires. It had a regular buggy top located about amidships, and the body leaned over to the right, as if it had been for years in the service of a corpulent doctor who always drove alone and always sat in the same place.

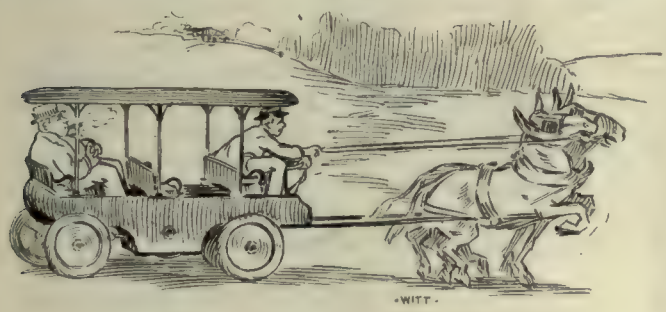
The engine was a "one-lunger" horizontally disposed under the midship section of the craft and pointed "fore and aft." It was not any too well balanced, so that when it stood by the roadside with the engine running (this sometimes happened) the whole machine would rock and "teeter" back and forth like a fat man with heart disease.

Morty was some fat himself, but he had a stout heart; else he would never have been drawn into a wager with Jimmie to race him over to the city and back, a round trip of twenty miles, on that beautiful Sunday morning

in June. Jimmie's "kerosene boat" had a little more style to it, and it stood up proudly on four little wire wheels with "pneumatics" on them. It had three seats, and a flat roof supported by stanchions at each corner, and looked somewhat like a family "carryall" of fifty years ago with the dingus that you hitch the horse into, left off. Its vital organs were disposed in much the same place as in Morty's machine, and were about equally out of balance, but Jimmie proudly boasted that it had a "double-opposed-motor," (whatever that was) and "could lick anything on wheels," including the train on the branch line that ran to the city.

Morty and Jimmie were alike in only one respect: their progressiveness. Jimmie was a slight wiry fellow who forgot all about himself when interested in the machinery and after a bout with the "innards" of his wagon, getting her ready to run, he was quite apt to resemble the stoker of an ocean liner just coming off from a particularly tedious watch. Morty on the other hand was pussy and fussy about his personal appearance.

You may be sure that there were few faces missing from the Brookdell circle when we assembled that Sunday morning at the "horse-garage" where the machines were kept, to witness the start of the great race. The start was set for an early hour, for the distance was great (twenty miles) and might take all day. (Remember! we are talking of the automobile of twenty years ago.)



Of course the machines must be "tuned up" before starting. Morty won my lifelong admiration for his talent as a mechanic; for, appearing on the scene arrayed in garments that would have put Solomon to blush, he removed coat and waistcoat, collar and tie, donned a huge pair of driving gloves, and without other protection to his razor-edged mauve trousers and immaculate beruffled and bestarched shirt bosom, proceeded to tear the interior economy of that gas-buggy limb from limb; carefully depositing each greasy fragment upon the grass until he had literally surrounded himself with junk and resembled a sunny, smiling, Olympian god, hedged about by the bones of his enemies.

(Note: I never saw an Olympian god under these circumstances but I am sure that if I had, he would have looked that way.)

Having taken out all of the "works" that were not welded or riveted in, Morty then carefully wiped off each piece, oiled it—whether it needed it or not—and put it back where it belonged (I suppose); anyway he had comparatively few parts left over when he finally completed the job, slapped down the floor boards, drew off his gloves, dusted his finger tips, resumed his apparel and announced that he was ready for the fray. He hadn't a spot or a blemish on him.

Jimmie, who in the meantime had been behaving in a a similar manner, only he had donned overalls, now appeared from the inner recesses of his "cab," took off his overalls, and proceeded to the horse-trough where he washed the grease out of his eyes and hair—incidentally leaving the trough full of soapy water for an indignant old Dobbin who shared the garage—donned coat and hat and was "all set."

Each machine "cranked" on the starboard side with a huge removable crank that in these days would come in handy to kill highway robbers and automobile bandits with, and all hands contended for the honors of "cranking 'er up." After many futile attempts the engines finally started and the machines were trundled out into the road and lined up abreast ready for the start.

Morty and Jim, sitting erect upon the seats of their respective machines, grasping the steering wheels and looking as determined as a freight brakeman piloting a runaway car "over the hump" in a switching-yard, waited for Tom Jones to utter the word "GO" in stentorian tones that were to disturb the Methodist minister who, in his study down on the next street, was making a final survey of his morning sermon.

They were off!! The machines faded gradually—but not silently—down the elm-lined street until they were lost from view by turning the bend about a quarter of a mile away. All hands who were left behind disappeared in the direction of their homes to prepare for church, knowing full well that it would be time enough to think about welcoming the returned wanderers after Sunday School.

But the afternoon waned without any sign of the racers. Telephones were gotten busy and more or less encouraging reports were received from along the line. About dusk Jimmie's machine appeared around the bend propelled by a motor that was double, but not opposed. On the front seat, holding grimly on to the steering wheel, was a colored looking person who answered surlily to the name of Jimmie. On the rear seat, smoking a fat cigar, sat a fleshy young gentleman who had every appearance of having just stepped out of a band-box.

This was Morty. His car was "on its uppers" (literally) in the gutter about six miles back. He had "sold her as she lay" to an enterprising junkman for the sum of ten dollars, and with the ten spot had settled his wager with Jimmie, who had won because he got back in his own car, even if he did have to borrow a pair of mules.

Making Master Grinding Cams

By James McIntosh

The generation of the profile of a master cam to produce a given engine cam is clearly defined in the instruction books supplied by the makers of the standard grinding machines in use. I shall therefore consider that part outside of the scope of this letter and shall describe my method of making a multiple master camshaft and determining the location of the several cams.

We will assume the engine to be a 90-deg. eight-cylinder unit using sixteen cams with the opening period and profile of the inlet and exhaust cams the same.

There are shown in Fig. 1, sixteen master cam blanks (profile not to scale). The cams in the upper row are for grinding the right-side cams and the lower row for grinding the left-side cams. Cams 2, 8, 10 and 16 are alike in that the keyway is located on the center of the cam lift and they operated at 90-deg. intervals. Cams 4, 6, 12 and 14 are alike in that the keyway and centerline of cam are 108½ deg. apart and they operate at 90-deg.

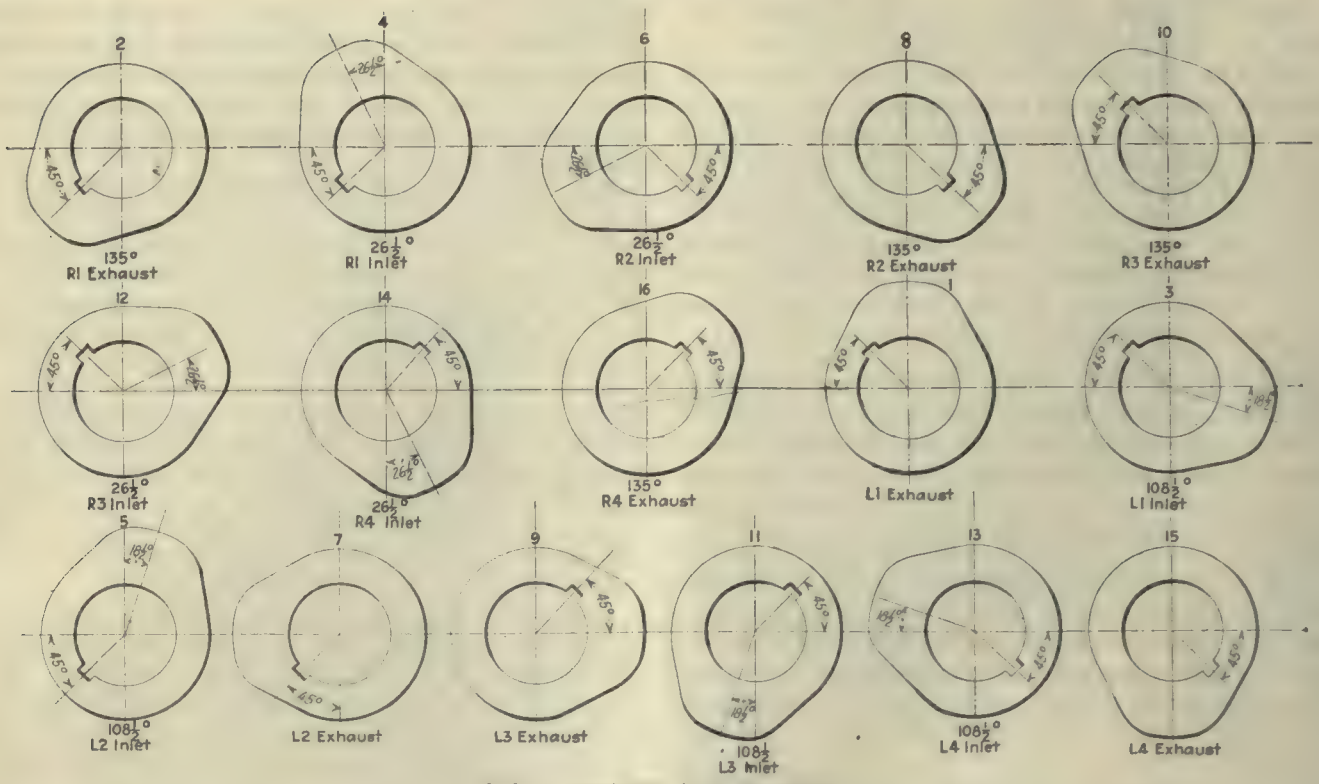


FIG. 1. MASTER CAM BLANKS

intervals. This means that we have two kinds of cam blanks on the upper row.

In considering the lower row we find a similar result. Cams 1, 7, 9 and 15 are alike with keyway and center of cam crown 45 deg. apart, and 90 deg. the interval of operation. Cams 3, 5, 11 and 13 are alike with keyway and cam crown 153½ deg. apart and 90 deg. the interval of operation. The keyways in every case are 45 deg. above or below a horizontal line and the same distance to the right or to the left of a vertical line. Therefore, we have only four kinds of cams, which can be made in sets of four, roughed out on a milling machine from data furnished by the engine camshaft drawing as to profile, lift and timing.

We have four kinds of cams, four of each kind, or sixteen cams (roughed out and hardened) to finish by grinding and we desire the profiles to be exactly alike as to time-lift and diameter. There is just one right way to make all alike which is to grind all as if grinding a single cam. To do this make a special mandrel to grind them as a unit. As indicated in Fig. 2, cut one keyway for cams 2, 8, 10 and 16 and another keyway 108½ deg. from it in a counter-clockwise direction for cams 4, 6, 12 and 14. The two keyways will bring all the cams on the right side of the engine, or those of the upper row, in line.

Taking the first keyway as the starting point and measuring in a counter-clockwise direction, cut a third keyway 153½ deg. from it to bring cams 3, 5, 11 and 13 in line and a fourth keyway 45 deg. from the first to bring cams 1, 7, 9 and 15 in line. All measurements, of course, are taken from the center-lines of keyways.

With the sixteen cams all in line they may be ground as a unit to any desired degree of accuracy from a known master cam or generated from an engine cam of known value. There are only four kinds of cams, of four each. The similar cams (as to keyways) are 90 deg. apart. A spindle with four keyways 90 deg. apart will give this set the proper locations for interval of operation. The other three kinds of cams are located on the four keyways and as a result we have a line of master cams arranged on the master cam spindle of the grinding machine, all alike as to profile and conforming with the drawings as to sequence. This solution will simplify the seemingly complex problem, I am sure. It is all a question of key location. Get it?

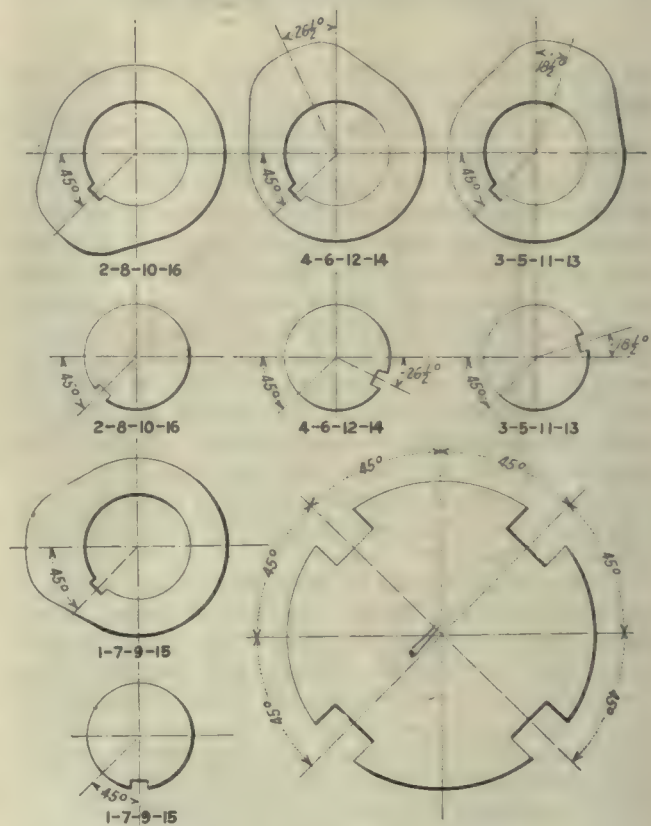


FIG. 2. LOCATIONS OF KEYWAYS IN GRINDING MANDREL AND MASTER CAM SPINDLE ON GRINDING MACHINE

Thrift

By Entropy

It is just as trite to say that thrift is commendable as it is to say that sunshine is good for crops. We should, however, remember that rain is also good for them. When we preach thrift to workmen we sometimes make the mistake of forgetting to tell them that it is not the saving itself that counts but the use of their savings. It is the easiest thing in the world to start a shop campaign for saving money, but it is very much another thing to keep it up. The average workman, like everybody else, must have an objective, and it must not be very far away. Thrift plans show a very decided tendency to go to pieces when the hundred dollar mark is reached. Many begin to draw out their savings at fifty dollars, a few only stick to it as permanent investors.

Now it is hardly worth while in the eyes of a shop manager to start a thrift campaign if a hundred dollars is to be the limit. That is more in the class of Christmas clubs run by banks and department stores. The works manager usually has some thousands of his own and his perspective is warped by that fact. He thinks everybody ought to have as much as he has. But people think mostly in terms of tangible things. We have come to look on a ten-dollar bill as something of value. The fact is it has no value in itself. It is just a promissory note, or a certificate that some silver dollars are located some particular place, or something of that kind, but we find by experience that a ten-dollar bill is readily exchangeable for things that we want so we treat it as a commodity itself. The same with other things. If we buy a phonograph we have something that we can use and we realize that it has a value. We can sell it second-hand. Money in the savings bank does not have any such appeal. It requires a rather high type of mentality to appreciate that a pass book at the savings bank means anything real. If we can only get that fact firmly in our minds we have made a step toward solving the problem of getting other people to be thrifty. What we must offer is an investment in something that produces returns and yet which can be in the possession of the investor and which he can touch and handle.

The Object of Investment

This is not so very difficult. The object of investment is to create a return for the use of money. Whether it is in the form of interest or something else makes little difference so far as the object of thrift campaigns is concerned. The man who buys his wife a washing machine and saves her paying out three dollars a week for a washwoman to do the family laundry is an investor and is exhibiting thrift just as much as the man who saves an equal sum of money and puts it in the bank. In fact he is more sensible, for he gets larger returns for his investment. The same applies to purchases of foods and supplies. Under normal conditions the man who buys flour by the barrel is an investor and his investment pays better than savings bank rates. The same is true of the winter's supply of coal, buying a house instead of renting it, etc. A man who saves a hundred or two hundred dollars without any objective is more than apt to take it out and buy a phonograph, much more likely than to buy the washing machine. The phonograph looks to him like an investment because he owns it and can keep it in his possession, but instead of an investment it is a source of more expense because he has to buy records to supply it and it does not save him anything. On the other hand a man who is induced to buy a washing machine on easy payments is committed to a good investment from the start and he is not at all likely to trade in his machine, second-hand as it is, for a phonograph because no one will trade.

Cultivation of Thrift an Art

Cultivation of thrift is just as much an art as is cultivation of crops. It should be gone at with comprehension of the mental processes of the man who is to be made thrifty. If a hundred dollars is all that he would save in a thrift club, get him to buy something that will cost that much, will be worth the money and will save him more money each year than the savings bank would pay in interest. It is better than the savings bank account, for the bank will let him take out the money for any foolish whim at any time, whereas if he has it in an investment that will only save him expense from time to time he cannot cash in on it and spend the money foolishly.

A man who has bought something worth while in this way for a hundred dollars is ready for something a little larger; by and by he is ready to buy a house, and then he is taking a step toward becoming a stable part of some community. Very few men who once live in a house of their own can reconcile themselves to living in a hired house, much less an apartment. The independence which normally comes with ownership is worth a great deal to most people. The interest, taxes and payments on the principal may be more than the rent would be but it is gradually becoming more and more the property of the purchaser; the same payments make a larger and larger inroad on the net debt and pretty soon he is where he can raise a savings bank mortgage on it and stop paying on the principal if he wishes. Then he is ready for more investments. Possibly then he is ready to lay up a few baby bonds or something less tangible, but we may be sure that at the present time there are not a great many people who really want to save and invest their savings in stocks and bonds except those who already have done so.

Shylock Profit Should Be Eliminated

There is not much use in trying to initiate them by jumping them directly into the investment field. In order to get them in the other way, however, there must be honesty. The ordinary installment plan will only drive them away forever. It must be possible for them to make their investments without paying more than the market rate for money. Any scheme that promises small interest and really charges large rates under the guise of investigations, credit ratings, expenses, etc., drives people away. The only profit allowable is the merchandising profit. The Shylock profit should be entirely eliminated.

The expense of the extra bookkeeping is really negligible. It is legitimate, however, to make the delinquent debtor pay the cost of collections from himself. It should not be saddled upon any of the people who make their payments without expense to the company. A scheme by which people who come upon unexpected financial difficulties can be carried over at actual cost if they make a clean breast of the circumstances is legitimate, but the man who tries to evade his responsibilities should not add anything to the expense of other people.

Electric Seam-Welding Machines

Types for Circular and Longitudinal Seams—Intermittent Action Prevents Oxidation at Welding Point—Welding Bottoms in Iron Drums and Small Containers

By DR. ALFRED GRADENWITZ

IN CONNECTION with the electric seam-welding process, as so far practiced, electrode rollers having continuous rotation and traversed by current throughout the duration of the operation are used. The seam to be welded passes through the welding zone at a uniform rate. Now, inasmuch as the material, after leaving the welding zone, is not cooled down immediately, there always remains a certain length of seam (depending on the thickness of the material and the rate of welding) at a high temperature and, accordingly, in so soft a condition as to be liable to be torn during the feeding. Moreover, the hot material, on coming into contact with the air, will be oxidized immediately, so that defective seams cannot be gone over again lest they be burnt through.

In the case of point welding machines, the current, while lifting the electrodes from the weld is, of course, switched off, otherwise holes would be burned in by arcing. In connection with the ordinary seam-welding process, there is also a permanent chance of arcing and accordingly, of holes being burned in the material.

Advantage of Intermittent Welding

These drawbacks are avoided by an intermittent process designed by a firm of Berlin engineers (*Gesellschaft für elektrotechnische Industrie*). The rollers have an intermittent motion, turning abruptly through a certain angle, stopping afterward for a short time. At the moment the rollers are stopped, a switch controlled by the shaft which transmits the intermittent motion will close the welding current. The seam is then raised to the operating temperature and welded while the electrodes are at a standstill, after which the current is immediately interrupted again by the automatic switch. Instead of starting again the roller for a short time remains on the portion just welded, thus allowing the latter to cool down under the pressure of the water-cooled electrodes, covering the weld and keeping any stresses as well as contact of air away from it. The next forward motion (with no current passing) will not be commenced before the cooling has been completed.

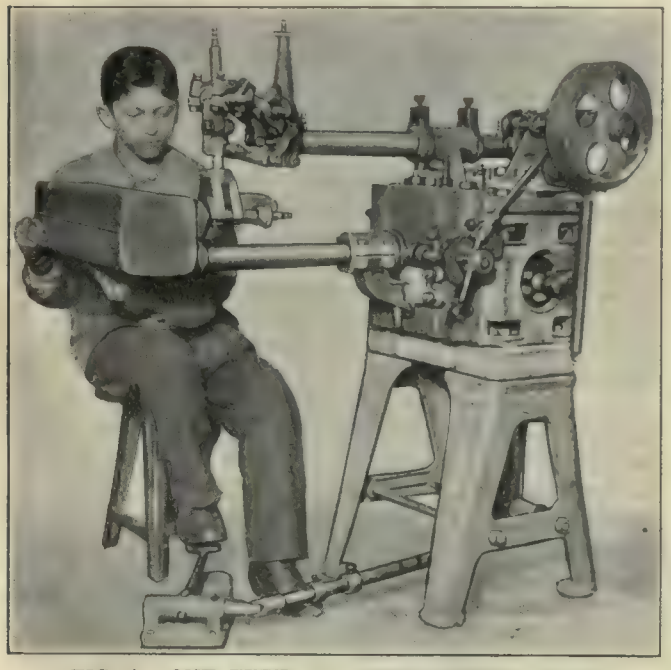


FIG. 1. ONE TYPE OF INTERMITTENT SEAM WELDING MACHINE

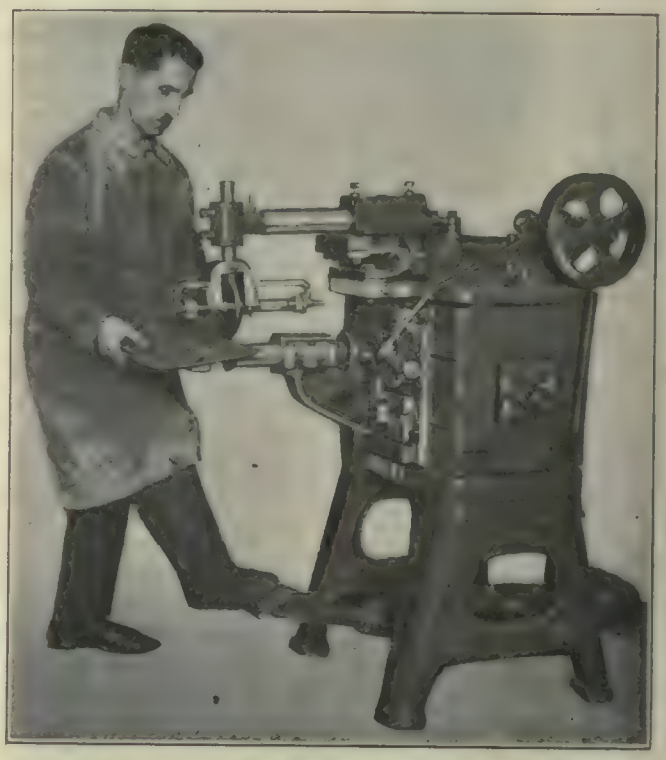


FIG. 2. ANOTHER TYPE OF INTERMITTENT SEAM WELDING MACHINE

No Oxidation of Seams

On account of the efficient protection from any contact with air during welding there is practically no oxidation, so that even tin-plate can be welded without burning the tin layer. Inasmuch as the seam, previous to being released by the rollers, has been allowed to solidify, even thick plates (that is plates from 0.12 to 0.16 in. thick) can be welded according to this process, substantial and neat seams being obtained. Another point of importance is that the electrode rollers, even in case of many days' uninterrupted service, are kept absolutely clean, the wear and tear being reduced to a minimum. In fact, the rollers at most require some slight retouching from time to time to compensate for the immaterial deformation of the working surfaces due to pressure, as they are made of soft copper.

The same safety of operation can, of course, be insured by substituting for the rollers an intermittent motion directly imparted to the work. The new process allows resistance welding to be applied even to such cases as the welding of tubes, annular and curved seams, etc.

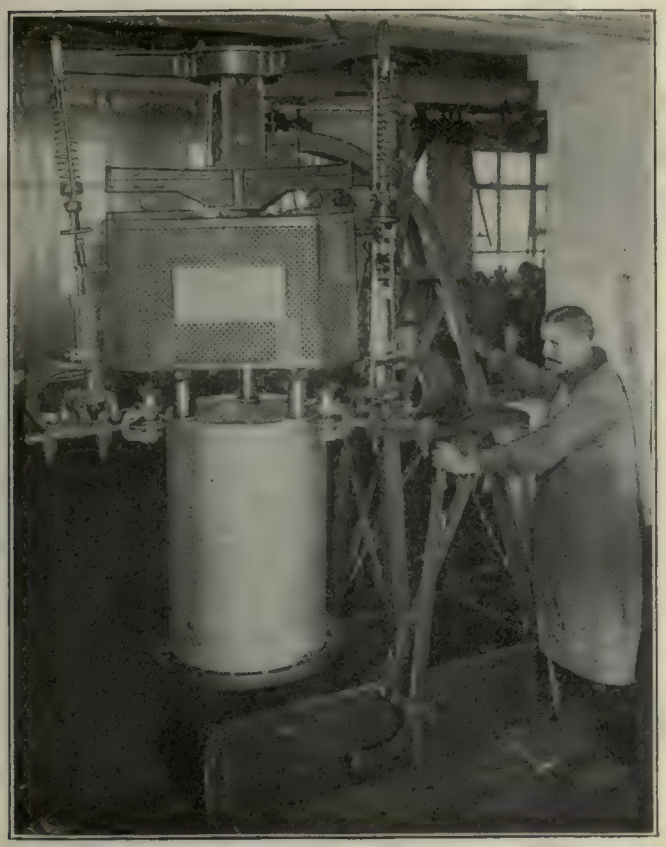


FIG. 3. MACHINE FOR WELDING BOTTOMS IN STEEL DRUMS

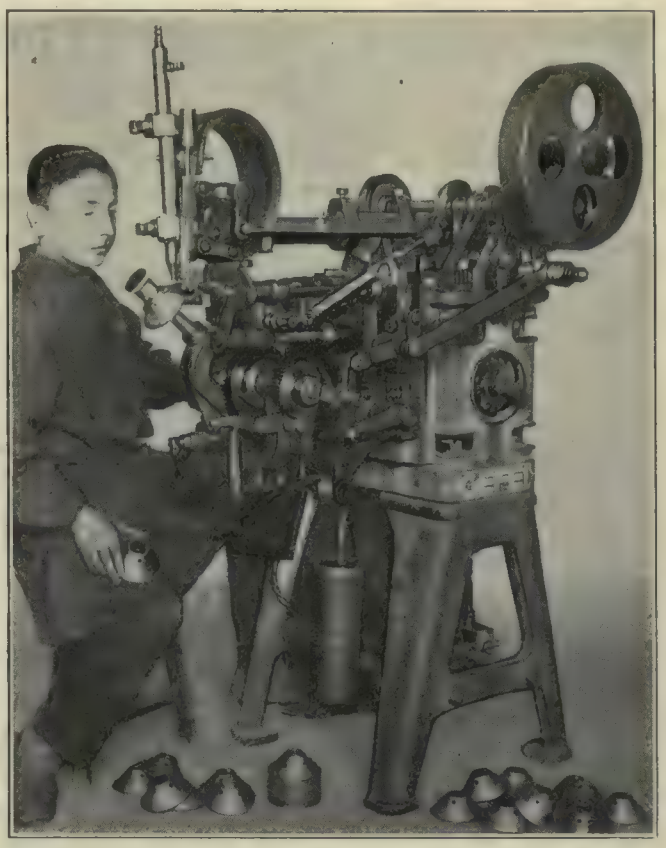


FIG. 4. AUTOMATIC MACHINE FOR WELDING PARTS OF CREAM SEPARATORS

A number of welding machines of this type have been designed, some of which are universal machines allowing the most varied sort of work to be dealt with, while others are special machines intended to combine the highest output with a minimum working expense.

In Figs. 1 and 2 are shown some varieties of the fundamental type of welding machine for use in the intermittent seam welding process.

The machine represented by Fig. 1 has a consumption of 12 kw. and is intended for the welding of round or straight seams of any length, and has electrodes about 13¾ in. in diameter. A foot lever, adjustable in a longitudinal as well as transverse direction, is used to control the electrode pressure.

The machine shown in Fig. 2 has a consumption of 20 kw. and is to be used for a large variety of round seam work, as in the manufacture of electrically welded sheet-iron radiators. The electrodes are about 6 in. in diameter.

Welding Bottoms in Cylindrical Vessels

Fig. 3 represents a special machine for welding bottoms in iron casks. This machine, which is just being adopted by German cask manufacturers, is provided with three pairs of electrodes working simultaneously.

Fig. 4 represents a special automatic machine used in the manufacture of cream separators for point-welding the spacing disks to the separating funnels. This machine will weld the spacing disks in two rows on to the separating funnel, the latter being rotated after each weld. The funnel is moved along after each complete rotation when the disks are placed in welding position. All functions are entirely automatic.

Fig. 5 represents a bottom-seam welding machine of a special type, used in welding bottom disks into cylindrical vessels. This machine will flange the edge and weld it to the bottom in the same operation. Bottom seams can be welded to vessels of different diameters, corresponding to the diameters of the step-gage, by using electrodes of proper diameters.



FIG. 5. MACHINE FOR WELDING BOTTOMS IN SMALL CYLINDRICAL VESSELS

When You Arbitrate

By CHESLA C. SHERLOCK

The Meaning of Arbitration—Its Use as an Instrument for the Peaceable Settlement of Disputes—The Three Kinds of Arbitration

IN RECENT years we have heard a great deal about arbitration. It has been advocated not only for the settlement of private disputes, but for international disputes as well. It has been discussed, urged, talked about, even joked about, until we have come to feel that it is some new device arising out of the spirit of the times.

As a matter of fact, arbitration is as old as the law itself. Few of the devices known in our law run back of the English common law, which is so old "that the mind of man runneth not to the contrary." But arbitration was not only known and recognized in Old England, but long years before that. It was one of the favorite instruments of the Roman civil law.

Justice Story points out the favor with which the idea was received under the Roman law. "Arbitration, called compromise, was the mode of terminating controversies favored by the civil law. It was entered into by reciprocal covenants or obligations, with a penalty or some other certain or implied loss, and the award partook of the character of a judicial proceeding and had a conclusive effect similar to that of awards as treated under the common law."

Arbitration has always stood as a peaceable means of settling disputes in a quick and speedy manner, at a minimum of expense or delay. And the constituted legal authorities in all ages and climes have been disposed to treat it with favor, as a rule. It is true that there have been times when the courts were jealous of it, largely because it permitted the parties to select laymen to act as spcial judges over their disputes, but that dislike has been worn away with the passage of the years.

The impatience which litigants have today with the delay and the expense of trying their differences in regularly constituted courts, has always been present to a marked degree. The Romans loathed their courts in much the same manner that we do today, so we find them bringing forth the principle of arbitration, or compromise, as they called it, as a substitute for the slower processes of the law.

What Is Abritration?

Arbitration, as it exists today, is defined by one authority as follows: "In its broad sense it is a substitution by consent of the parties, of another tribunal for the tribunals provided by the ordinary process of law; a domestic tribunal as contradistinguished from a regularly organized court proceeding according to the course of the common law, depending upon the voluntary act of the parties disputant in the selection of judges of their own choice. Its object is the final disposition, in a speedy and inexpensive way, of the matters involved, so that they may not become the subject of future litigation between the parties." (Corpus Juris.)

Under the earlier idea and until comparatively recent times, it was thought that arbitration could never take place, except with the consent of the parties to the dispute. This consent was absolutely necessary, for arbitration was a contract and all the elements of a valid contract had to be present in order to make the proceeding binding upon the parties, as we shall presently see.

This idea has been changing, especially in so far as arbitration is related to labor and industrial disputes. The thought has come upon the people at large and, indeed, upon the courts, that there are instances where arbitration should be forced upon one or all of the parties, in the interests of the people at large. So we have had a new idea, compulsory arbitration, brought forth with the change in opinion.

Arbitration Does Not Deny the Rights of Common Law

Compulsory arbitration, however, cannot be blindly forced upon the parties disputant, unless the right of the parties to a trial by the processes of common law is affirmed and preserved, as guaranteed in the constitution.

Says one authority: "In the absence of statute, a court cannot impose upon parties litigant before it arbitration as a condition of justice, although it may suggest such a course. So a statute which provides for compulsory arbitration and makes the decision of the arbitrators final and conclusive, infringes the constitutional guaranty of trial according to the course of the common law; but if the statute gives to the parties the further right by appeal from the decision of the arbitrators, or other procedure, to carry the case before a regular judicial tribunal and have the issues there tried, it does not operate to deprive the parties of any constitutional right, and is therefore valid."

In a New York case, it was shown that the statute provided that all claims against the City of New York must be submitted to arbitration, and the court said that "where parties agree to submit to arbitration any matters in controversy such arbitration can be sustained, because it is the voluntary act of the parties; but when the law compels a party to arbitrate upon a claim which properly should be the subject of an action, without his assent, such law deprives him of the right which is secured by the constitution, of a trial according to the course of the common law."

In Ohio, a statute providing that the matter might be arbitrated at the instance of either party, with the right of the other party appealing to the court of common pleas, it was held "that such statute was valid because, although the arbitration was compulsory, the dissatisfied party had an appeal to the common pleas, where the matter could be determined by due course of law."

A similar statute in Pennsylvania was held constitutional. In Kansas, the court said: "Here the successful party has not only the advantage of the determination of the disputed questions, but an easy and expeditious method of placing that determination in a position where the law will enforce it. That was the aim and scope of the statute of William III—to put controversies out of court on the same footing as those

in court. The statutes in the United States differ, but, as a general rule, they are bottomed upon the statute of William III and look to the same end."

In a Georgia case, common law and statutory arbitration were distinguished as follows: "The difference between a statutory award and a common law award is that the latter affords only a basis of an action; 'it is binding on the person submitting, but it can only be made the foundation of an action, and is not entitled to be made the judgment of the court.' "

Practically all of the quasi-judicial tribunals which we are in the habit of using in the settlement of industrial disputes are based upon the theory of arbitration. The industrial commissions may be cited as an example in point. They are, in reality, nothing more than a board of arbitration set up by the statute to decide disputes which may arise under the statute itself, between interested parties. Like a board of arbitrators, the industrial commissioners have powers partaking both of court and jury. They may not only decide the law, but the facts also. And it is well to remember that even in their case, it has been necessary to provide for appeal from their decisions to the courts, in order to safeguard the constitutional guaranty of trial according to the process of the common law. In actual practice, appeal is seldom, but the right is there just the same.

Compulsory Arbitration

Much objection is voiced in many quarters to the idea that arbitration should be compulsory, especially in settling wage disputes between employers and their employees, or other industrial considerations which may become the subject of a general strike or walkout affecting the public at large. The objection is based upon the false assumption on the part of those making it, that arbitration, in some way, defeats their rights under the law and deprives them of the due process thereof.

As a matter of fact, arbitration does not accomplish this end. It merely sets the machinery of the law in motion and is a means of bringing to settlement, in an orderly manner, disputes which might otherwise be prolonged indefinitely and work untold hardships upon the parties and upon the public at large. The parties to an arbitration *lose none of the rights* guaranteed under the law; the truth is, an additional right is acquired, a right to a preliminary adjudication of the issues in dispute which may become final upon the motion of the parties, or not, as they choose.

The real objection to arbitration, if we may be so bold as to state it in plain words, is that those holding back do not care to adjust their differences by amicable methods. They prefer to use rather the appeal to force, to the club, as exemplified in the strike, and to force their side of the controversy irrespective of the justice or merit of it.

And, indeed, the charge cannot be laid at the door of labor alone. The employer has been quite as guilty in the past as labor is today. He, too, has hung back and failed in many instances to lay his disputes open to arbitration or adjudication on the part of the courts, when he fancied that he had the power to carry his point. People do not refuse to go to court when they really wish a "fifty-fifty" settlement, or because they fear that justice will not be done. They refuse to go to court or to arbitrate when they do not care particularly to have the matter settled on its merits.

The very first thought that should be fixed in mind concerning arbitration, then, is that it does *not*, in any sense, operate to deprive anyone of any rights offered under the law or under the orderly processes thereof. It cannot operate to do that and stand the tests of the courts, for the constitution is written and its provisos are entirely too plain and too well settled to offer any room for doubt on that score.

Kinds of Arbitration

There are three kinds of arbitration recognized by the law. Briefly stated, they are:

(1) Where the matter in dispute is submitted by the parties to mutually chosen arbitrators, in the absence of, or in spite of, statutory provisions.

(2) Where a specific statute gives the parties to a dispute authority to submit the same to arbitrators and have the submission entered as a rule of court and the award enforced, or entered as a judgment of a designated court.

(3) Where a court sends a matter pending before it to arbitrators, with the consent of the parties, the arbitrators either being chosen by the court or by the parties.

Chief Justice Mansfield of the Pennsylvania court has said that "the courts have sometimes been very strongly inclined against awards, as carrying away causes from their own jurisdiction to the decision of private persons, but they now give these instruments a more liberal construction."

The Vermont court points out that a board of arbitrators is not a "court" or "judicial tribunal" in any proper sense of those terms. It has none of the powers that appertain to the courts to regulate their proceedings or enforce their decisions.

It is, nevertheless, true that the decisions of arbitrators may, by agreement of the parties in advance, have the full effect and force of a decision of a regularly constituted court, by agreement of the parties. Any agreement to arbitrate which does not provide that such shall be the case, by providing that the findings of the arbitrators shall be entered as a judgment in a designated court, is, in fact, powerless of enforcement, and may leave the parties where they were at the start.

"Submission" of Both Parties Necessary

There can be no arbitration of a dispute unless there is a submission of the matter to arbitrators. This expression "submission" is a legal phrase involving certain requirements which must be met in order to give the arbitration full legal effect.

"A submission," says one authority, "is a *contract* between two or more parties, whereby they agree to refer the subject in dispute to others, and to be bound by the award of the latter."

The essential thing to keep in mind is that a submission of a matter in dispute to arbitrators is a contract and that it must have all the essential elements of a valid contract, in order to be binding upon the parties.

This involves, first of all, the implication that the parties have the legal capacity to contract between themselves and that if they do it by representatives, that these representatives shall have the power to bind their principals by their agreement. Otherwise, the award made by the arbitrators can have no effect as to binding the parties and they may disregard the findings, if they so desire.

The important essential, according to a Missouri case, is that the minds of the parties must meet in an agreement to do a specific thing. If this is not present, there is no submission, and the arbitration fails to have any legal effect.

Broad Interpretation of Law

The court in a case arising in the District of Columbia has held: "In the absence of statutory prohibition, or other conventional disqualification, the right to submit to arbitration is as broad as the right to sue or be sued."

Any person, partnership, corporation or association of individuals having the power to bring suit in a court, then, have the broad right to submit their differences to arbitration, in the absence of special statutory prohibitions. The persons who are disqualified, for one reason or another, for bringing actions in the courts, have no right to submit to arbitration. And the legal right to contract, the legal capacity to contract, is likewise essential in the parties.

A Federal case points out that "where there are several persons jointly interested in the same matter, those only who join in the submission to arbitration are bound by the award. One cannot bind the other by the submission, except by special authority."

Education and Personal Interest

There is a right to revocation to the submission existing in the parties, as there is a right to revoke a contract before acceptance. As a general rule, however, revocation cannot be exercised after the award has been made and published, but either party has a right to revoke the submission at any time prior to the finding and decision of the arbitrators. But where the award has been made, it cannot be revoked by one party without the consent of the other. The right to revoke is then deemed to have been waived. Revocation, when made, can be made only by one of the parties or his authorized agent, and within the time limitation mentioned.

Where there is bias or partiality existing in any of the arbitrators unknown to the other party, the award will be set aside upon that showing. The qualifications of arbitrators are subject to a long list of legal definitions, but the general ones are that there must not be personal interest in the subject matter in dispute, or close relationship to any of the parties unknown to the other party, or bias or partiality unknown to said other party.

The award need not essentially be in writing, unless required by the subject matter in dispute, or by statute, or by a provision in the submission of the parties. It is obvious, however, that it *should* be in writing, whatever the legal effect of an oral finding may be.

Taking Personal Inventory

By G. G. Weaver

Inventory in a well-managed organization is a process that receives close attention about this season of the year. It is highly essential that a factory take account of stock, in order to determine the amounts of materials on hand, before embarking on a new fiscal year. As a result of the data compiled, it is possible to act more intelligently—and profitably—in regard to future sales and purchases.

Appreciating, as we do, the necessity of inventory in a commercial organization, we should apply these same principles of efficient management to our own personal problems. As the "good old days" of awarding jobs depending on "pull" and relationships are fast disappearing, it is highly important that we take inventory of our stock of abilities and shortcomings, in order to open up the markets of future progress. By making such a personal analysis we have made a calculation of our own practical situation.

We have within us certain powers for doing things. These powers may be called raw materials. A certain refinement and remodeling of these powers is necessary if we hope to have our product, which is ability, accepted on the market. Although our ability has been sought in the past, it is, nevertheless, to our advantage to put out new models of this product, if we hope to withstand keen competition.

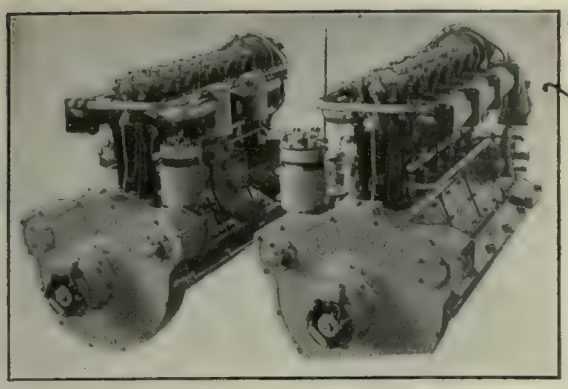
In taking this personal inventory, we must be sure to recognize the various raw materials in our human storehouse, such as: aptitudes, abilities, interests, ambitions, and traits of character. In case we are wanting in certain qualities which go to make progress and success, we must put them on our personal "short list."

Let us assume the following qualifications are essential to the maintenance of this personal enterprise:

1. Health—Are you enjoying health? If not, why not? Is it within your power to remove the source of trouble?
2. Interest—Do you take the proper interest in your work? Is your degree of interest as high as if the business were your own?
3. Initiative—Have you acquired ability to go ahead without a great deal of guidance? Do you study to increase that independence from being told how to do each little thing?
4. Application—Are you giving your job the best you have? Are you lazy, indifferent, and inconsistent?
5. Confidence—Have you developed that "I can" spirit or do you hesitate for fear of making a mistake? Has your will power gone back on you?
6. Concentration—Are you able to centralize your mind on your work? Are you persistent in accomplishing things or do you lack stick-to-it-ive-ness?
7. Knowledge—Are you thoroughly familiar with all the details of your work? Do you make an effort to know more about the company's business? Do you read and study along the line of your work?
8. Reliability—Is it possible for your superiors to place confidence in you? Do you work regularly or do you keep "tabs" on the boss and watch the clock? Can you work without being supervised?
9. Honesty—Is square dealing your slogan? Will you admit a mistake? Have you developed into an "alibi artist"? Are you willing to admit the facts regardless of the outcome?
10. Loyalty—Are you constantly finding fault with the company or fellow workmen? Do you speak well of your employers and promote their interests wherever possible?
11. Judgment—Do you use common sense in arriving at decisions? Are you fair in your dealings or do you use snap judgment, causing injustice?
12. Systematic—Do you employ a certain way of doing your work most efficiently and most economically, or do you handle your duties in a loose, slipshod way?

The improvement of the above qualities will certainly place one in the line of promotion, although the stage of perfection is not reached. Those points which are weak in design, should be sent to our chief engineer, "Will Power" who can correct the faults and make us a more efficient machine.

Try taking inventory and realize for yourself the advantage of transacting your personal business along more modern lines.



BUILDING MOTORS ON THE PACIFIC COAST

By Fred H. Colvin
EDITOR-AMERICAN MACHINIST

IV. Machining the Connecting Rod of the Hall-Scott Motor — Testing the Rod and Assembling It with the Piston — Inspecting and Weighing

MACHINING connecting rods is always of interest particularly when the rod is finished all over as in the case of those here described. The methods shown are such as can be adopted either in whole or in part, by any shop desiring high-grade production in moderate quantities.

The connecting rod of the Hall-Scott motor is finished all over, the first operation being to mill the sides of the large end as shown in Fig. 65. This operation is done on a Cincinnati vertical milling machine and the method of holding is of interest. The bolt bosses of the large end fit under the wedge *A* and are forced into position by the block *B*. It will be noted that the screw behind the block is at an angle so as to force the small end of the rod downward in clamping. The strap *C* insures the rod being held firmly in position. The group of machines shown in Fig. 66, is a special set-up, so arranged that one man can handle the three machines without difficulty. The Hole-Hog at the right is set up to drill both ends of two rods at the

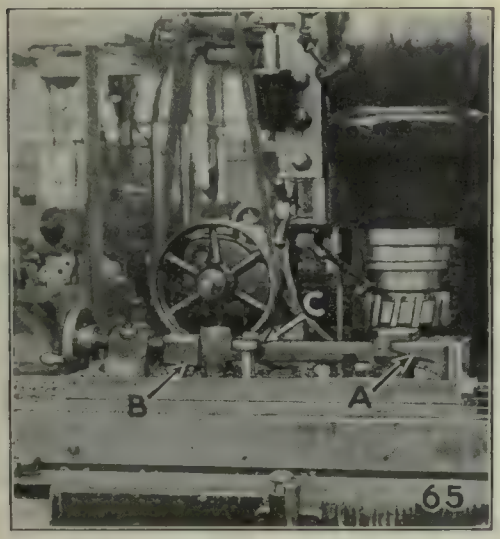


FIG. 65. FACING THE LARGE END OF ROD

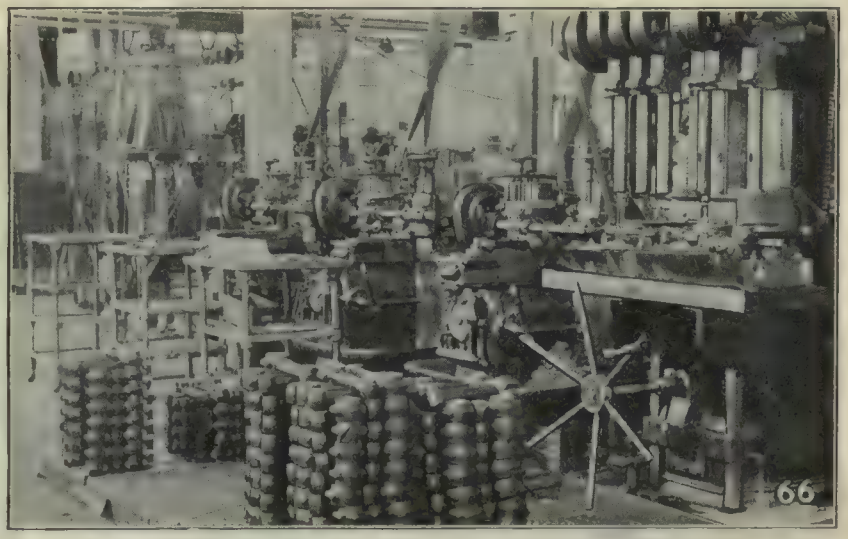


FIG. 66. DRILLING ROD AND MILLING BOLT BOSSES

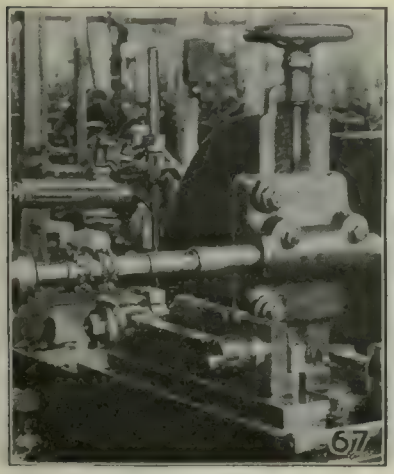


FIG. 67. FORMING OUTSIDE OF BOLT BOSSES

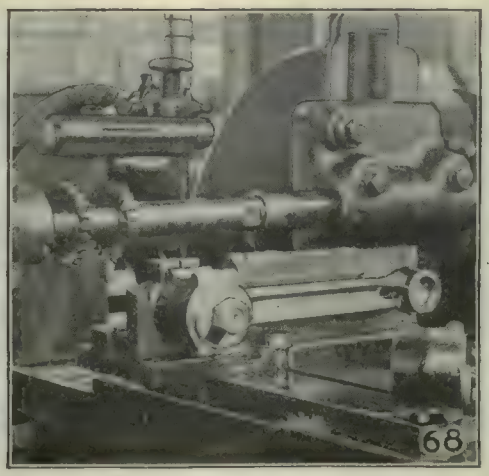


FIG. 68. STRADDLE MILLING BOLT BOSSES

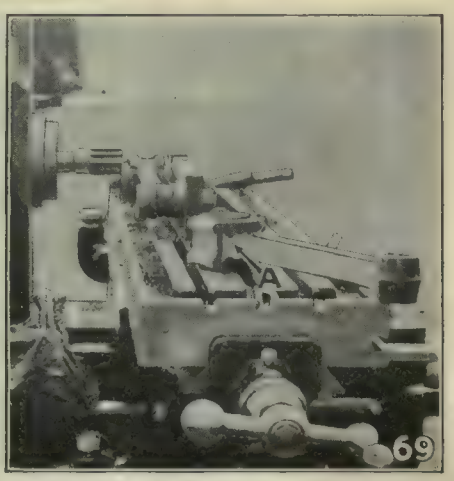


FIG. 69. MILLING RADIUS ON OUTSIDE OF ROD

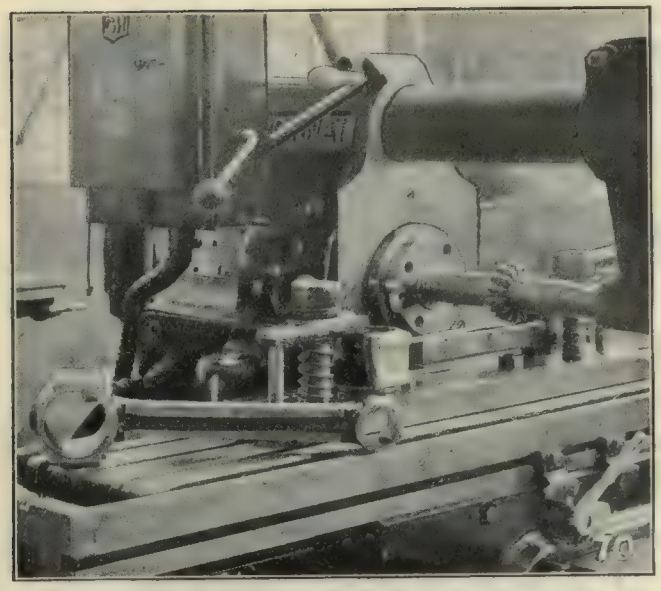


FIG. 70. ROUGHING OUT THE CHANNEL

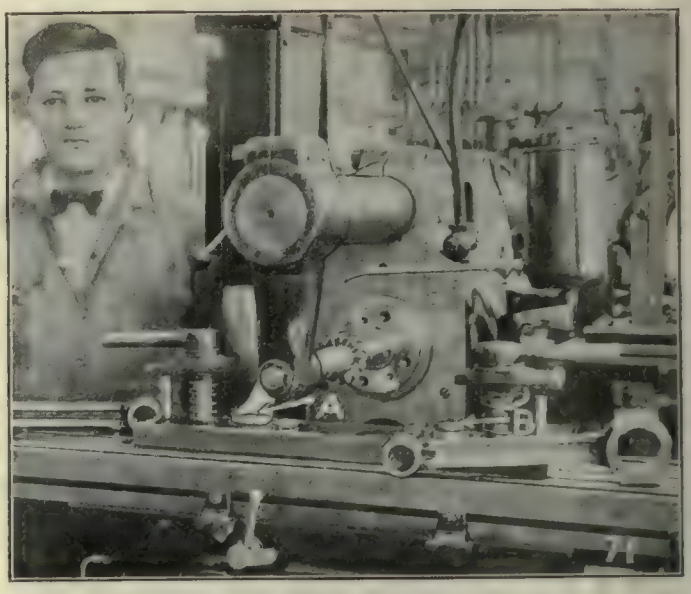


FIG. 71. THE MILLING FIXTURE

same time. It is expected to change this method somewhat and have this machine drill two holes and ream two holes, instead of its present arrangement.

While the holes are being drilled the operator has time to run both rods through the three Pratt & Whitney automatic milling machines at the left. The first machine mills the bolt bosses lengthwise and the second mills them to length, top and bottom. The time for drilling is seven minutes or sixteen rods per hour (two at once), and this time also covers the milling time which is done during the drilling operation.

In Fig. 67 is shown the straddle milling of a four-bolt rod which gives an idea of the type of fixture used. The small end of the rod fits over a suitable pin while

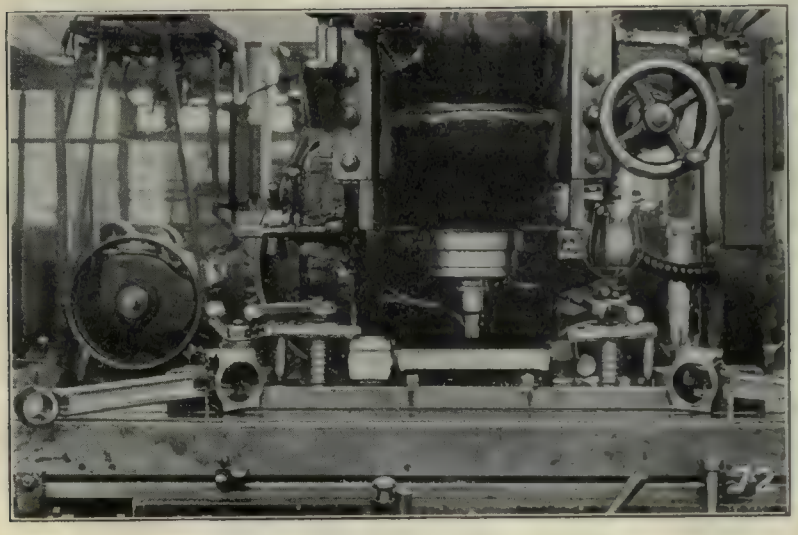


FIG. 72. FINISHING THE CHANNEL

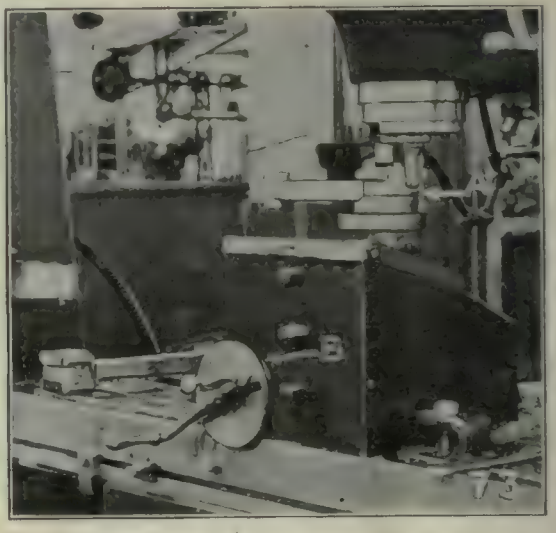


FIG. 73. PROFILING THE LARGE END

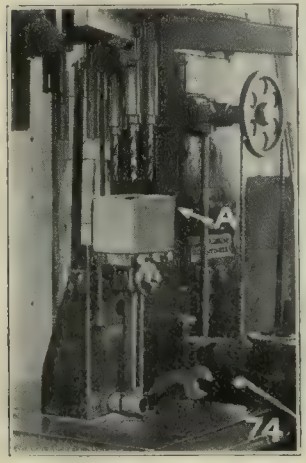


FIG. 74. DRILLING FOR BOLT HOLES

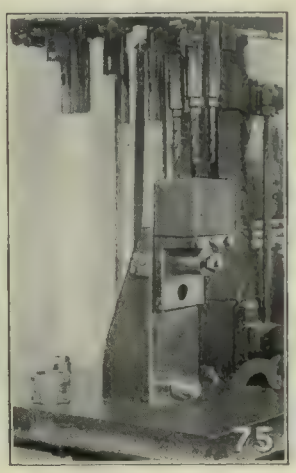


FIG. 75. THE DRILLING FIXTURE

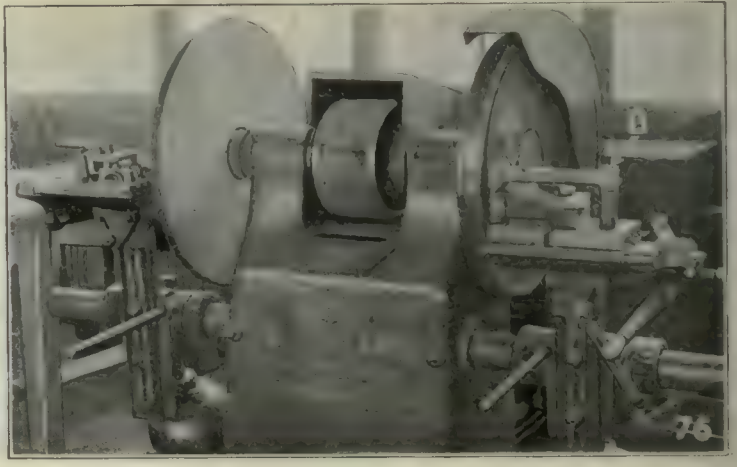


FIG. 76. GRINDING END OF ROD AND MAIN BEARING CAPS

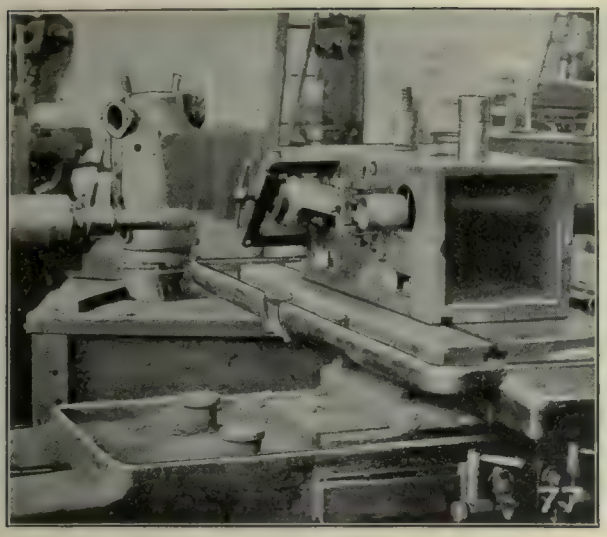


FIG. 77. GRINDING SMALL END OF ROD

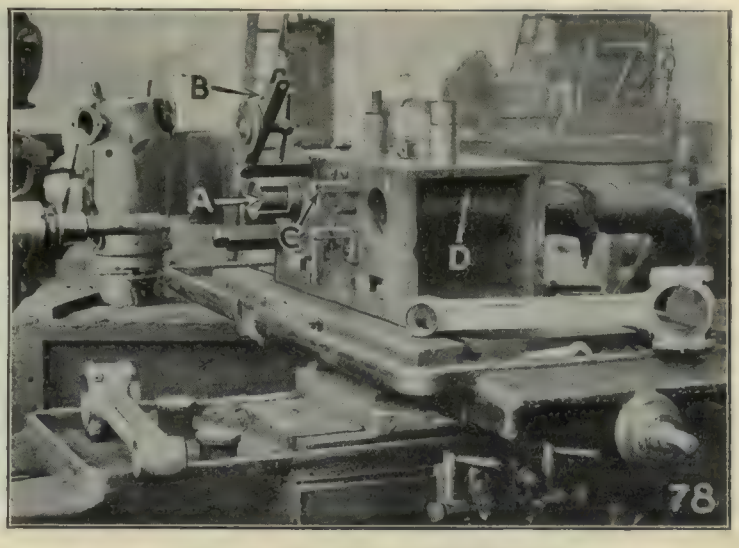


FIG. 78. THE GRINDING FIXTURE

the large end is clamped by a bolt and a slip-washer as shown. The milling of the bolt bosses to length is shown in Fig. 68, the same type of fixture being used.

Finishing the outside of the rod begins in Fig. 69 where the radius *A* is being rough-milled on the Cincinnati machine shown. The channel is milled as shown in Fig. 70 in a simple fixture with the small end of the rod located over a pin and both ends clamped as shown. A rod is shown on the table before milling. The details of the milling fixture will be seen in Fig. 71, the novel feature being the use of short studs or buttons *A* and *B* for positioning both ends of the connecting rod. These short buttons make it easily possible to put rods on and take them off without difficulty and at the same time to have a closer fit than would be the case were long studs used.

The channels are finished with an end mill as shown in Fig. 72; the type of fixture is the same as in previous operations. The large ends of the rods are profiled with the device shown in Fig. 73. Here the large end of the rod is fastened on the spindle at *A*, which is controlled by reduction worm gearing through the indexing mechanism at *B*. This index enables the operator to limit the movement of the rod with regard to the bolt bosses and to secure duplication without difficulty. This detail is one of the helps in preserving uniformity in the weight of connecting rods which is an important feature of well-balanced motors.

The method of drilling the bolt holes in the rod is shown in Fig. 74, a Pratt & Whitney multiple-spindle drilling machine being used. The fixture is of the usual type, the novel feature being in the use of the reservoir for cutting lubricant at *A*, which makes it easily possible to keep the drills flooded at all times. Details of this fixture are shown in Fig. 75, the rod having been removed for this purpose.

After the rods are sawed so as to remove the cap, the flat surfaces are faced on the Besly disk-grinding machine shown at *A*, Fig. 76. It will also be noted that the work holder at the opposite end is fitted for grinding the ends of caps for the main bearings of the crankshaft. The rods are held on a stud at *B*, the other end being supported on a suitable block as can be seen.

The piston-pin end of the connecting rod is finished on a Heald grinding machine, as shown in Fig. 77, after the cap has been bolted into place on the crank end. This is not a usual method and the details of the fixture shown in Fig. 78 are of interest. The fixture is of the box type in which the large end of the rod is secured at *A* by means of the swinging clamp *B*. This clamp holds the side of the bearing at the large end squarely against the surface of the fixture so that the piston-pin hole will be ground parallel with the hole in that end. The support at *C* is for steadying the rod near the small end to prevent spring or vibration. The fixture

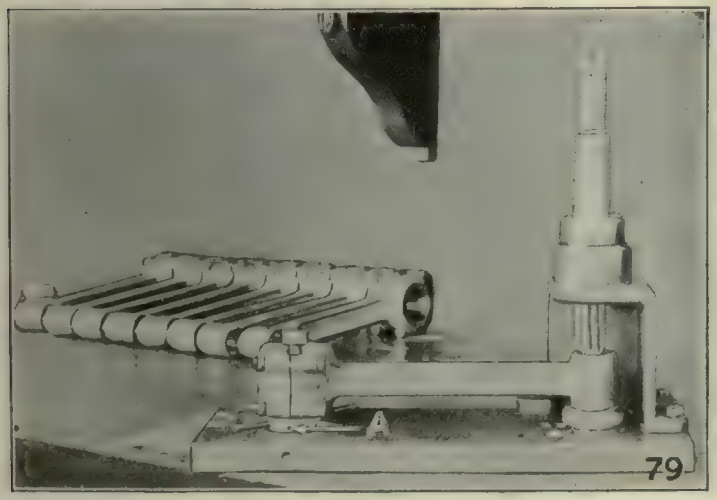


FIG. 79. REAMING PISTON-PIN BUSHINGS

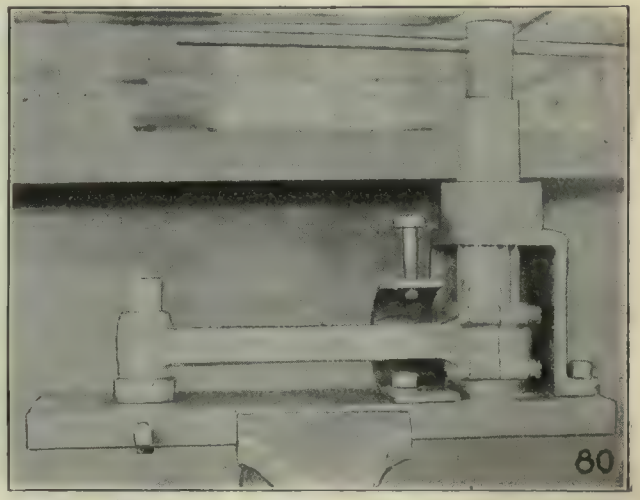


FIG. 80. REAMING THE LARGE END

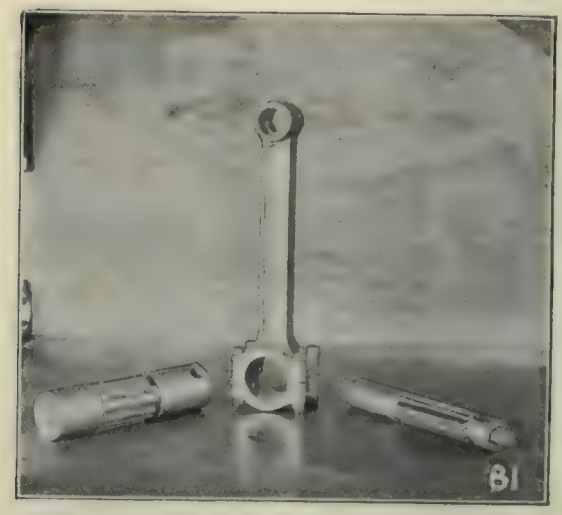


FIG. 81. A ROD AND ITS REAMERS

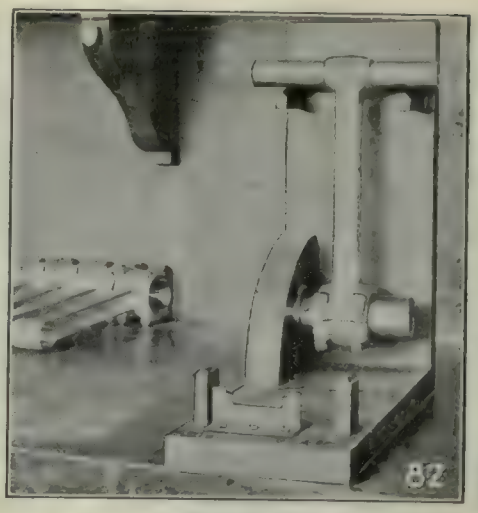


FIG. 82. TESTING RODS FOR PARALLEL

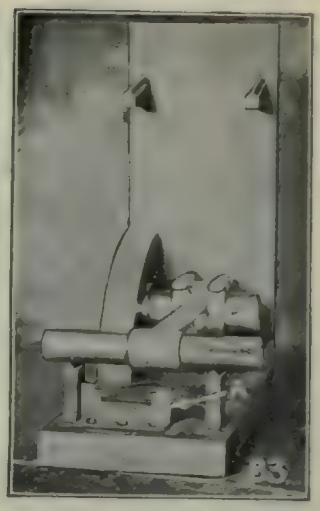


FIG. 83. TESTING FOR "WIND"

has been built with special reference to removing the dust of grinding as can be seen by the exhaust pipe which comes through the fixture at *D*.

The piston-pin hole is then bushed and the bushing reamed in the fixture shown in Fig. 79. This fixture is provided with a spoked nut *A* to assist in removing the large end of the rod from the stud which holds it during the reaming operation.

A somewhat similar fixture is used in reaming the babbitted bearing in the large end of the rod as may be seen in Fig. 80. Both these fixtures are clamped in a vise when in use. A rod and the reamers are shown in Fig. 81.

Inspection Fixtures

The fixture used for inspecting the rod is shown in Figs. 82 and 83. This is constructed somewhat after the usual manner but is particularly useful in its application. As shown in Fig. 82, the holes are being tested for parallelism, while Fig. 83 shows whether the holes are in the same plane or not. The form gage at *A* shows whether the length of the small end boss is correct and also whether it is correctly positioned with regard to the large end bearing. For this test, it is of course necessary for the large end of the rod to be moved to the left so as to be in contact with the shoulder on the stud over which it fits.

Fig. 84 shows the complete rod assembly with the piston, piston pin and piston-pin retainers at each end. They are very carefully weighed so as to secure uniformity and to be sure that the same weight of assembled units goes into the same motor.

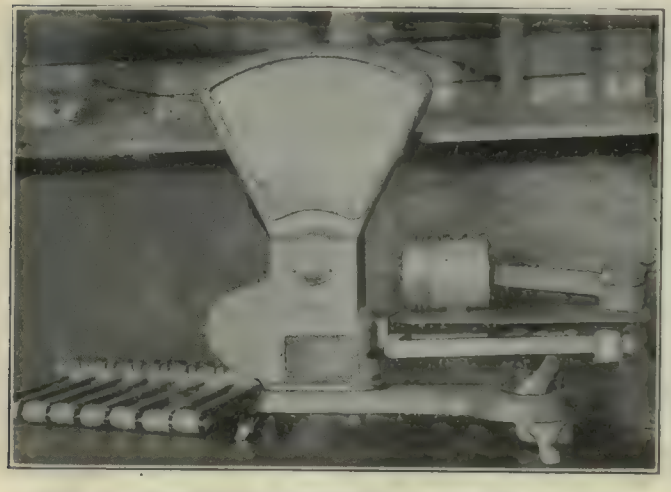


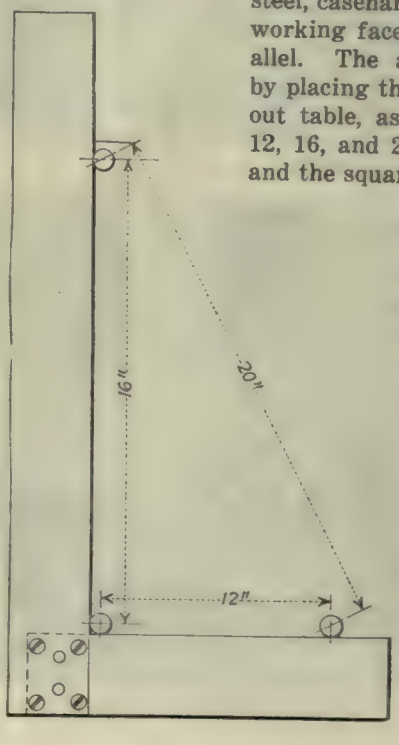
FIG. 84. WEIGHING ASSEMBLED PISTON AND ROD

Setting a Big Square with Buttons

By Charles Canec

"The square of the hypotenuse of a right-angle triangle is equal to the sum of the squares of the other two sides;" says Euclid. The converse of this is also true; that is, if the sum of the squares of the short sides equals the square of the long side, the triangle is right-angled. A handy rule to remember is that if the sides measure 3, 4 and 5 units respectively, or multiples thereof, then the triangle is right-angled because $5^2 = 3^2 + 4^2$.

An interesting application of this rule occurred in making a big square. The blade was 24 in. long and was finished perfectly straight and parallel. The stock was 16 in. long, 8 in. wide, and was made of machine steel, casehardened, ground, and the working faces lapped true and parallel. The adjustment was made by placing three buttons on the layout table, as shown in the sketch, 12, 16, and 20 in. between centers, and the square placed so as to touch them as evenly as possible. When the adjustment was obtained the screws were tightened, the dowel holes lapped true and the dowels inserted.



SETTING A BIG SQUARE WITH BUTTONS

Casting and Machining Oil-Engine Pistons, Piston Rings and Cylinders

Selection of Materials—Vertical Casting Preferable—Heat Treatment After Rough-Machining—Fitting the Piston Pin—Assembling Rings—Reaming vs. Grinding Cylinders

BY SAMUEL ROSSWELL

AS ONE of the fundamental requirements of a successfully operating machine is the use of suitable materials, the following is written with the intention of conveying to some of the newer organizations, who have recently engaged in the manufacture of internal combustion engines of the Diesel type, some practical information regarding the selection and treatment of suitable materials for making pistons, piston rings and cylinders.

It should, first of all, be remembered that the necessity of keeping friction between the moving parts reduced to the lowest possible limit cannot be overemphasized in the determination of the kind of materials to be used; as the amount of fuel consumed is to a large degree conditional upon how well this factor has been taken care of, not only in the design and character of the machine work and fitting but in the selection of the materials as well.

One of the laws of physics teaches us that the coefficient of friction between the surfaces of various materials subjected to slidable contact is largely dependent on the condition of the surfaces in contact and the character of the materials used. It is, therefore, important that the materials used in all parts subject to sliding contact be the best possible for the purpose. This is especially true of such materials used on oil engines as are exposed to the high temperature generated by the burning gases, which not only subjects these parts to distortion but to actual disintegration.

The piston, regardless of size or type, is subject not only to distortion due to the excessively high temperature to which it is exposed but to the danger of being damaged beyond repair by wear caused by excessive friction.

The piston casting should be composed of hard, close-grained iron properly heat-treated, seasoned, and carefully machined. As the composition of the piston, piston ring, and cylinder should be of the same cupola mixture this will be discussed later.

The pattern from which pistons are to be cast should, whenever possible, be made so that the casting can be poured on end with the open end up. If it is not possible to make the pattern so that it can be molded in a vertical position vertical pouring can be accomplished by making the mold and setting the cores in a horizontal position and then tipping the mold up on end for pouring.

Especial care is required in setting the core supports and chaplets as well as in cutting the risers, but satisfactory results can be obtained with a little experimenting. Cast-iron flasks will be found to be time savers, as will cast-iron core boxes, as the resultant casting will be much more uniform and more than enough time will be saved in machining to offset the extra cost of the equipment. Casting pistons with the open end up insures denser metal at the closed end, where the heat and pressure is applied.

The piston casting should not be shook out until it is cold enough to handle with the bare hands; this will insure more uniform shrinkage while cooling. Cores for either pistons or cylinders should be made either soft or filled with coke so they will not offer too much resistance to the normal shrinkage of the casting.

After the casting has been cleaned it should be rough turned on all surfaces to be finished, including the ring grooves, and then heat-treated to relieve strains set up by the removal of the scale. Heat-treating should be at a comparatively low temperature. If a pyrometer is used the best temperature is from 700 to 800 deg. F. If no pyrometer is used a very dark cherry red is the color which will give the most satisfactory results.

The casting should not be exposed to a flame from either a gas, coal or oil furnace. A coke furnace appears to give the best results in annealing. If the casting is heated to too high a temperature or exposed to heat for too long a time it is quite apt to "grow," and to soften and lose its property of resistance to tensile strains and wear. The casting need not be kept in the furnace any longer than the time required to heat it throughout and then it should be removed and stood on end to cool gradually.

It should then be allowed to season at least twenty-four hours, or longer if possible, after which it can be finish turned, leaving from 0.008 to 0.015 in. for grinding. Finish grinding should be done slowly, using plenty of grinding fluid so the piston will not be out of round when finished from the heat due to grinding. Care should be taken to grind the outside as smoothly as possible. A coarse, open-grained wheel will give the best finish.

If the proper material is used and the piston is ground properly it will not show any grinding marks and the ground surface will have the appearance of being polished. It will be necessary to reduce the finish diameter of the closed end somewhat below that of the main body of the piston; the amount of this reduction, necessary to allow for expansion, will depend on the diameter, area of cross-section, thickness of the closed end, and to the extent the iron is inclined to "swell" when heated. The amount of clearance between the cylinder and piston will also, and for the same reason, have to be left to experiment.

The amount of clearance can usually be reduced to some proportion relative to the diameter of the cylinder, but it should be as small as possible, as the piston should be a close enough fit to the cylinder bore to enable it to assist the rings in holding and maintaining the necessary compression. With a properly fitted and lubricated piston, rings should not be necessary to hold the compression until both piston and cylinder are worn out of round.

Wear on machine parts in slidable contact is in a measure proportionate to the friction set up, and friction will be very much reduced if the lateral pressure of the

piston is distributed over as large an area of the cylinder as possible. Great care should be taken to bore the piston for the piston pin as nearly at right angles as possible, to cut the ring grooves accurately for width and clearance, to see that the side next to the open end is finished smooth without chatter or tool marks and that this side especially is at right angles to the sides of the piston.

The importance of a good fit and an even bearing between the ring and the ring groove should be kept in mind in machining, inspecting and assembling, as the smallest aperture between these parts will cause leakage which in a short time will cause the rings to gum up and stick to the groove. After the ring has stuck it will soon break and cut the cylinder walls.

A very small amount of fuel oil leaking by the rings will so dilute the lubricating oil as to greatly diminish its lubricating qualities and it is, therefore, necessary that all possible sources of leakage be reduced to a minimum. The piston should be provided with oil rings to carry the oil around the full circumference of the cylinder. A number of narrow, deep grooves will be found to be more satisfactory than wide, shallow grooves as they will be less apt to fill up with carbon.

The piston should be designed so as to leave one end of the piston pin free to allow for expansion and contraction as it will be found the steel piston pin will expand lengthwise in greater proportion than the piston and cylinder expand circumferentially, thus causing the piston to bind at the sides unless the pin is free at one end. An area equal to approximately twice the area of the piston pin should be finished at least 0.008 in. under the outside surface of the rest of the piston all around each end of the pin hole in order to allow for expansion at these points.

Lubrication

The piston should not receive any more lubricating oil than is absolutely necessary as any surplus is just as bad in effect as not enough. Any lubricating oil not required for lubrication after the oil rings have become filled will be wiped off the piston and a part of it is sure to accumulate in the ring grooves under the rings, where it will be subjected to the heat of combustion. The heat will soon cause distillation of the lighter elements of the oil, leaving a sticky, gummy residue which later hardens, causing the rings to stick in the grooves.

The foregoing applies to both two- and four-stroke-cycle engines, but it should be remembered that owing to the usual method of using crankcase compression along with the fact that the exhaust outlet of the two-stroke-cycle engine is usually through ports in the sides of the cylinder itself a large percentage of the lubricant is carried away by the exhaust during the impulse stroke and drawn into the crankcase during the compression stroke, and this is one of the reasons why the cylinder of a two-stroke cycle engine requires about twice the amount of lubricating oil as that of a cylinder on a four-stroke cycle engine of equal horsepower.

There are, doubtless, other reasons why a two-stroke cycle cylinder requires more lubricating oil, among which might be mentioned the fact that ignition takes place with just twice the frequency as in a four-stroke cycle engine running at the same speed, and therefore more of the lubricant is broken down and exhausted with the burned gas resulting from the combustion of the fuel.

The piston ring should be composed of iron of at least the same degree of hardness as that of piston and cylinder, although it is preferable to have the rings harder owing to the fact that a much less area is exposed to wear in comparison to the cylinder wall. This is a characteristic difficult of attainment without some experimentation, for along with comparative hardness or density is required resiliency as the ring must above all else be capable of retaining its resiliency throughout its period of service, even when exposed to the combined heat of combustion and friction.

Along with the above mentioned requirements should be included that which will enable the ring to withstand distortion without permanent set, for without the latter quality it would be impossible to assemble the ring and piston or to remove the ring without serious damage. The best rings have been found to be those made up from a single casting on which the scale on the inner circumference is left intact, the sides and outer edges only being finished, step cutting being the better way to finish the joint. The ring should be slightly eccentric and re-turned to a true circle after milling the joint. It is recommended that the rings be re-turned rather than ground as a turned surface will work into a seat much sooner than a ground one.

The joint should be very carefully fitted and a gap allowed between the ends at the joint to allow for expansion. The proper amount of this gap can only be ascertained by trial and only the smallest amount of gap should be permitted as any excess will leave an aperture through which the gas will escape both at the compression and impulse strokes. Rings should be pinned in place with the pin on the side of the groove nearest the closed end, care being taken to see that the gaps in the ring are equally distributed around the circumference of the piston.

Before assembling the rings in the piston the under side should be rubbed very lightly over a good surface plate which has previously been charged with a light coating of prussian blue, and the high spots scraped lightly until a uniform bearing is secured. If the rings have the edges finished on a surface-grinding machine they will be found much easier to scrape to a good bearing. The lower or outer side of the piston-ring grooves should also be scraped in a similar manner, using a tool-steel gage made in the form of an arc of 120 deg.,

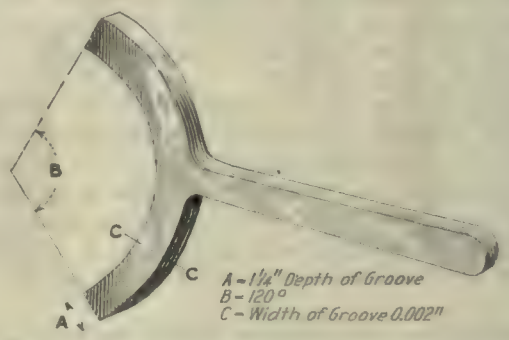


FIG. 1. GAGE FOR FITTING RING GROOVES

as shown in Fig. 1. This gage should be lightly covered with prussian blue and the lower side of the ring groove spotted to a good bearing. After scraping, the rings should be put in a container which will hold them on edge until ready to assemble.

When assembling the ring in the piston groove it should not be handled except with tongs, as shown in

Fig. 2. This will prevent distortion and will enable the rings to be fitted to the grooves in a few minutes' time with no danger of breaking the ring or mutilating the sides of the ring groove.

There is, doubtless, no other part of an oil engine on which greater care and skill is required in assembling than the piston and rings as the slightest leakage around the rings or piston will not only result in a waste of

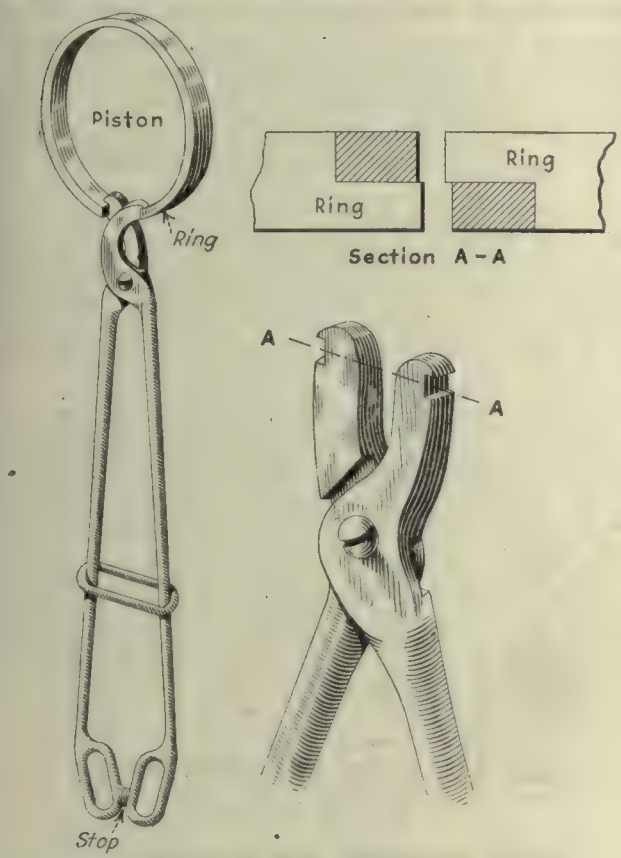


FIG. 2. TONGS FOR ASSEMBLING RINGS

fuel, but will seriously affect the proper functioning of the engine, which in turn will necessitate frequent cleaning of the cylinder head and piston, as well as frequent regrinding of the valves. Cylinders and pistons are often ruined by careless handling during the assembling operation.

Casting the Cylinder

Oil-engine cylinders, like the piston and piston ring, must be made of close grained, homogeneous iron containing a minimum amount of free carbon. Such material can be obtained only by using the right mixture in the cupola charge and by adhering closely to chemical as well as physical analyses. The chemical analyses of borings taken from the cylinder and piston castings of the older types of oil engines are very similar, although the cupola mixture varies somewhat.

The usual chemical analysis does not generally indicate the presence of free carbon and, therefore, is of little use in determining how best to eliminate this detrimental ingredient.

The cylinder casting, like the piston, should be cast on end. In no other way can a uniformly homogeneous structure be obtained. That this is of vital importance we realize when we consider the varying degrees of temperature to which the cylinder is subjected and the necessity for uniform expansion; a physical impossibility if the casting is cast on its side.

The cylinder should be cast with the head end downward and, if possible, with an extension, unless it be cast integral with the crankcase, in order that any loose sand either from the mold or the cores may be carried to this part of the casting. The extension can later be machined off. In a cylinder on which the crankcase is cast integral this can be taken care of by providing large risers.

What is known as semi-steel, made from a cupola mixture of high silicon pig iron with the proper amount of manganese, mixed with a high grade of machine scrap to which is added enough good, clean steel scrap in proportion to equal from 20 to 25 per cent of the entire charge, should result in a casting that would meet the foregoing requirements; provided the iron was poured at the proper temperature and that the molds were properly made. If pig iron does not contain enough manganese this ingredient can be added to the melted iron in the form of ferromanganese.

The steel scrap referred to may be good boiler plate, horseshoes or the flashings and scrap from a drop-forge shop. Whatever steel scrap is used must be free from rust, clean, and cut into small pieces and should be charged on the top of the scrap iron; the pig iron being charged first. Each charge should be carefully spread, using especial care to avoid piling of the steel scrap, as this will result in the steel coming down in "bunches" and causing the casting to be "spotted."

Some foundrymen find it good practice to stir the iron thoroughly before pouring. This is no doubt beneficial, but it is a disagreeable job and one not relished by the average foundry helper. The presence of steel in the molten metal can be readily noted by the sparks which are thrown off by the metal running out of the spout. It is good practice to use the first run of the iron for castings where the presence of steel is not important and not to use any of the metal for either pistons or cylinders until the presence of steel is indicated.

The proper temperature for pouring will vary somewhat, depending on the pig iron and scrap used. This can best be determined by experiment and after the right temperature has been found it should be carefully adhered to. The writer at one time had charge of a foundry where the proper temperature was determined by casting small chills at frequent intervals from metal taken from the bull ladle, the chills being about 1 in. square by 10 in. in length. As soon as they were cold they were broken and the structure was noted. The depth of the chill in each case indicated the proper temperature. This is more or less a rule-of-thumb method, but to a thoroughly experienced man it will prove quite satisfactory. The use of a pyrometer would be more satisfactory as far as ascertaining accurately the proper temperature to pour the iron is concerned, but the critical temperature appears to cover a wide enough range to make such an instrument unnecessary. However, after the proper temperature has been determined it should not be subject to any more change than necessary.

The coke used should be one that is as free from sulphur as possible as the sulphur in the coke is subject to absorption by the melted metal running through it. The presence of an excessive amount of sulphur in a piston, piston ring or cylinder casting is very detrimental.

In rigging up for casting cylinders and pistons arrangements should be made to bake all the molds used. This will add somewhat to the expense of prepara-

tion, but the saving resulting from good, easily machined castings will pay for the fixtures and offset the expense of baking. Castings made in baked or dry molds will be much easier to machine on account of the scale being softer. In a foundry where a large output is required the molds can be made up a day in advance and baked over night.

The following chemical analysis of clean borings will come very near to applying generally to the casting requirements:

Silicon	1.75 to 2.00
Sulphur	0.06 to 0.10
Manganese	0.40 to 0.55
Phosphorus	0.30 to 0.45
Combined carbon	0.50 to 0.60
Graphitic carbon	2.50 to 3.00

But unless the physical structure of the iron is very dense and close grained and capable of taking a fine, high-grade finish this composition will not be suitable, for regardless of chemical analysis, which can be only comparative, the piston, cylinder and piston rings must have the right physical characteristics to meet the exacting requirements.

Good Machine Equipment Necessary

A suitable casting for either cylinders or pistons is rather difficult to machine properly on account of its dense structure and it is, therefore, necessary that the machine-tool equipment for this purpose be of the best and that boring heads, reamers, drills, taps, etc., be of substantial proportion and that they be kept sharp and in good working condition if accurate and sufficient output is to be obtained.

A heavy, single-purpose, cylinder-boring machine with a bar of the largest diameter possible for the smallest bore cylinder will be found most satisfactory. Boring heads with a number of cutters, each taking a light cut of coarse pitch, will do better work than one with a few cutters taking a heavier individual cut. Cylinders should, if possible, be rough bored and allowed to season before finish boring. Better results are possible with a single tool for finish boring, followed by a reamer. The reamer should have left-hand helical flutes slightly tapered at the forward end with a relatively shorter taper at the rear end; and it should be at least one and one-half times the diameter of the cylinder in length.

The helix angle should be such that the cutters will overlap each other in operation. In this way chattering can be avoided and a smooth finish obtained. The reamer should be driven by a spline and backed up by a separate collar fastened to the bar. This will give the reamer a slight float and will enable it to follow the bore.

Careful Grinding of Piston

Grinding is not recommended on large cylinders because of the danger of small particles of the abrasive from the grinding wheel being forced into the pores of the iron, later to work out and start the cylinder and piston to cutting. If it were possible to wash these fine particles of abrasive away, as in outside cylindrical work, grinding would no doubt be a good way to finish the cylinders, although a reamed cylinder fitted with a ground piston appears to "work in" to a good bearing in less time than where both were either ground or turned. This is, doubtless, due to the fact that the bored cylinder has a rougher surface comparatively than the piston and that the shearing effect of the sharp corners of the rings passing over the inner surfaces of the cylinder tends to wear it into a very satisfactory bearing.

There will be, by this method, much less danger of scoring the piston owing to the water jacket carrying away the frictional heat in the cylinder. If both piston and cylinder are ground the piston will invariably overheat during the running test unless very carefully watched and the piston will, in almost every instance, require "pulling" and "spotting in" several times before the engine is ready to leave the testing department.

Scoring of the cylinders and pistons is in almost every instance due to distortion of the parts because of unequal expansion under the influence of heat. Scoring will take place in spite of how liberally lubricating oil may be used.

Another advantage gained by using a ground piston in a bored cylinder is due to the fact that invariably the piston will retain its smooth, glazed surface almost indefinitely, while the wear is distributed over the greater area of the cylinder. These parts will, for this reason, wear longer before having to be replaced on account of leakage.

There are a number of methods used to gage the bore of cylinders, but the old-fashioned inside micrometer will be found the most handy and reliable. The micrometer bar should be of the type having a stop collar for locating in the micrometer head in order to avoid danger of the bar getting out of adjustment.

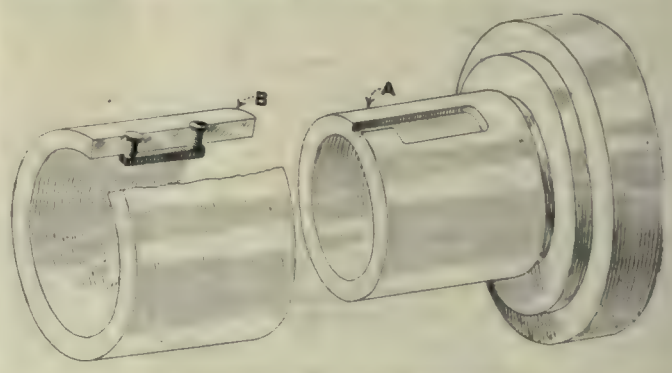
The cylinder had best be bored from the end farthest from the head if a riser extension has been left on the casting. This will enable the operator to set his "mikes" and to adjust the boring tools properly before he has cut into the cylinder proper.

Bar Lock for Slip Bushing

By W. Burr Bennett

The writer was recently called on to design a heavy lock for a slip bushing having an inside diameter of 1½ in. The jig was subjected to more or less abuse from unskilled labor, and, in addition, the bushing had to withstand a very heavy drag from chips.

After going over all the designs that we have employed in the past we decided that there were none heavy enough to stand the "gaff," so the writer borrowed a stunt from the machine-tool builders and made a key lock as shown in the sketch. The slip bushing *A* was made as usual except that the recess shown was milled out. The liner bushing *B* was drilled in two places to take the prongs of the key, which were left soft and riveted over to hold it in place. The retention of the slip bushing from rotating and withdrawing from the liner bushing may readily be seen.



BAR LOCK FOR SLIP BUSHING

Notes on Improvements in British Machines

Ten New Types Produced in Last Ten Years—Changes in Machine Details—Special vs. General Purpose Machines—An Unusual Planer Drive

By I. WILLIAM CHUBB
Editor, European Edition, *American Machinist*

LOOKING back ten years it may perhaps seem that the greatest advance has been made in grinding and gear-cutting machines. Broaching machines or appliances certainly were not nearly as common as today, while the applications of the milling machine, the turret lathe and the semi-automatic turning machine have naturally extended. But it will be difficult to find a new type of tool coming exactly within the period named. Special machines are not infrequently made by the engineering firms that will use them. But the British machine-tool builder as a rule prefers to put forward the general-purpose machine.

A machine which, though introduced rather before the ten-year period, has been steadily developed since that time, is the Pearn-Richards horizontal combined surfacing, boring, milling, drilling and tapping machine, supplied originally, the writer thinks, by or for a firm of pump makers for facing pipe flanges. Now at one setting of the job all the operations mentioned in the foregoing can be undertaken, and the machine is regarded as really of universal character. Fig. 1 shows the type, as made by G. Richards & Co., Ltd., Broadheath. At one end of the bed a column carries a spindle which can be driven as required and which will carry a chuck, etc., for tools, while the bed supports a table or tables on which the work is secured, and also a support for a boring bar. Usually some thirty-two spindle speeds are available, obtained through gearing and belt, the drive also being arranged direct to the facing head for large work. A screw raises or lowers the main spindle on the upright and the tool-slide can be fed across the facing head at roughing and finishing feeds. Screw-cutting gear can also be fitted, a swing frame with change gears being centered round the table screw and the reversing motion on the change-speed gear-box allows tapping operations to be undertaken. The facing

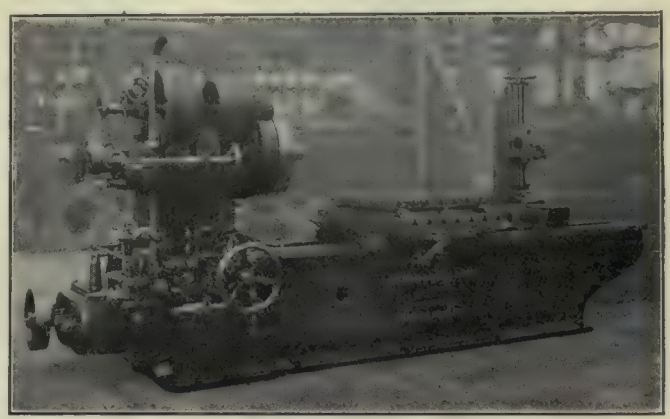


FIG. 1. PEARN-RICHARDS COMBINED BORING, MILLING, DRILLING AND TAPPING MACHINE

head can be removed and replaced by a milling cutter of practically any type; or a faceplate may be used and, a compound slide-rest being added to the table, the machine may be used for boring and turning pulleys. Two tables are usually supplied, the upper table being detachable and turning on a central pin which can be lifted by a lever in front, so that a job of considerable weight can be moved round without trouble. Quartering stops are fitted. Reversible rapid power traverses are provided for the longitudinal and cross motions of the table and the vertical motion of the spindle.

For work larger than the facing head of the machine an offset toolholder can be had.

Slotting Machines

In slotting machines for rapid production, perhaps the chief advance has been made in the puncher slotter of W. Muir & Co., Ltd., Manchester, shown in Fig. 2. In this machine in ordinary conditions 18 cu.in. of steel

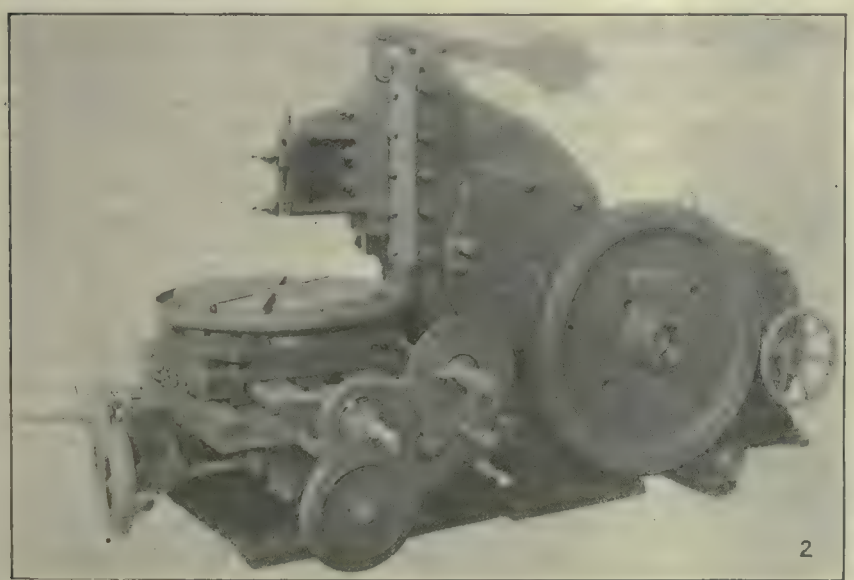


FIG. 2. THE MUIR PUNCHER SLOTTING MACHINE FOR RAPID PRODUCTION

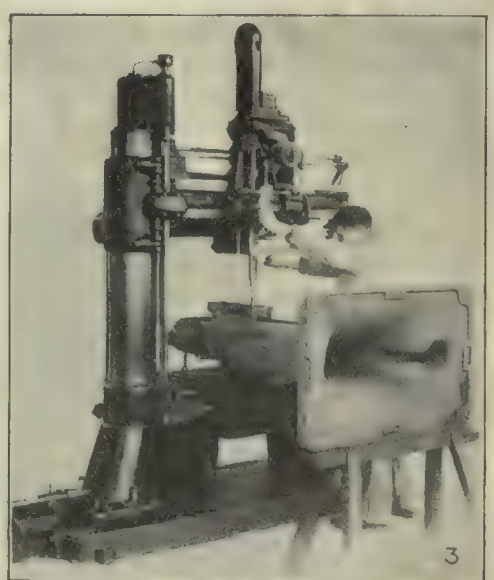


FIG. 3. ARCHDALE RADIAL DRILLING MACHINE

per minute can be removed continuously. The machine was, we believe, introduced for slotting out the webs in crankshafts and for machining deep work not reached by the milling machine. In design the machine is necessarily stout, the head and bed being in one casting. The moving ram is a solid casting without much projection from the machine frame, tee slots in fact being provided on the front face in order that toolholders may be bolted to it. The link driving the ram is a steel forging, case hardened and ground. An extension on each side of the slide forms a support under the edge of the table. The same machine is also made in duplex type. The largest single machine available has a stroke of 18 in. to admit 21 in. in height, the table top being 42 in. square and having traverses of 30 in. by 42 in.

Apart from the central thrust design, the most marked improvement in radial drilling machines is in the general idea of centralized control. Probably J. Archdale & Co., Ltd., Birmingham, have carried out the idea further than other British firms. Eight years ago it introduced the single-pulley drive with gear-box on top of the column giving a number of spindle speeds, the starting, stopping and reversal being controlled by a lever carried on the saddle. About the same time a spring balance compensation was introduced to reduce the weight carried on the saddle. Next the speed gears and levers were incorporated with the saddle, and an elevating arm instead of an elevating table was fitted. The latest machine has a combined saddle and arm-locking system operated by a lever on the saddle as shown in Fig. 3. The saddle may be moved and the arm swung and then both locked simultaneously by a lever. An interlock prevents elevating or lowering the arm by power until it has been unlocked from the sleeve, one lever only being needed. Without moving from his working position the operator can stop, start or reverse the spindle, change the speeds, lock and unlock the arm and saddle and attend to the feed changes. These machines are made in a number of sizes up to 4 ft. 6 in. radius, the 2-in. spindle having a travel of 15 in. and with capacity for drilling a 2¼ in. diameter hole in mild steel.

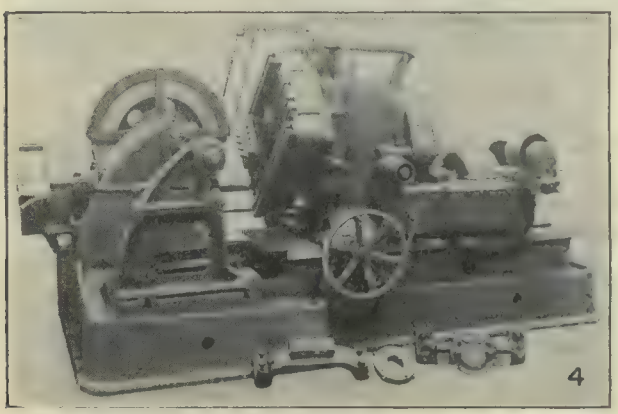


FIG. 4. THE SUNDERLAND GEAR SHAPER

Gear Generators

The Sunderland gear shaper, Fig. 4, manufactured by J. Parkinson & Son, Shipley, was first shown publicly ten years ago. Its capacity has been increased and the largest machine now made will cut gears up to 48 in. in diameter, 9 in. face and 1½ diametral pitch. The gears produced may be either spur or spiral. The machine can be arranged for double-cutting, that is, two cutter boxes may be mounted on the cutter slide, one operating at each direction of the stroke. The illustration shows the machine set up for spiral gears. The same design has been employed for the cutting of double helical teeth with the teeth continuous across the full width of the gear. Here two cutter slides work alternately to the apex, the teeth of the cutters being shaped to suit the angle of spiral and each cutter prepares the clearance for the other. The gears are generated by rack-form cutters which reciprocate across the face of the gear blank, being gradually fed in to the depth, the blank rotated intermittently.

Boring and Turning Mills

The duplex vertical boring and turning mill has been developed, particularly by Webster & Bennett, Ltd., Coventry, the originators of the type. The illustration (Fig. 5) shows a 42 in. mill, the left-hand table having a reversing motion so that when turning and surfacing the operator can work with tool near the tool-control



FIG. 6. HERBERT COMBINATION TURRET-LATHE

levers. For drilling, boring and reaming the table is run in the reverse direction, standard tools being employed. Here control levers have been centralized. Positive feeds are used and can be instantly disconnected, a rapid power traverse being put into gear to bring the turret quickly to position. Trip motion enables repetition work to be rapidly sized. Each turret head is balanced by a spring, with wire cable over a fusee to maintain constant leverage. The machine shown admits 46 in. diameter by 31 in. under the turret or 21 in. under the cross-slide. The vertical feed of the turrets is 26 in. and the horizontal feed 24 in., the machine having 12 speeds and 9 feeds.

The combination turret lathe, Fig. 6, is a tool of a type that has for the past ten years been closely associated with the Coventry firm of Alfred Herbert, Ltd. Such a machine can be used for bar work but is intended in the first instance for chuck work on single pieces, either castings or forgings. The machine illustrated will swing 28 in. over the saddle and is the largest of the line. The turret slide moves along the bed and has rapid power traverse in each direction, and the turret also can be revolved by power. By means of a chasing saddle internal and external screws can be cut. Both longitudinal and cross-feeds are provided. The machine has been largely used on aero and similar engine details, a special example being in connection with gas engine pistons, which can be turned, grooved, and faced at the convex end; a special profiling slide being carried by means of the square turret, with a

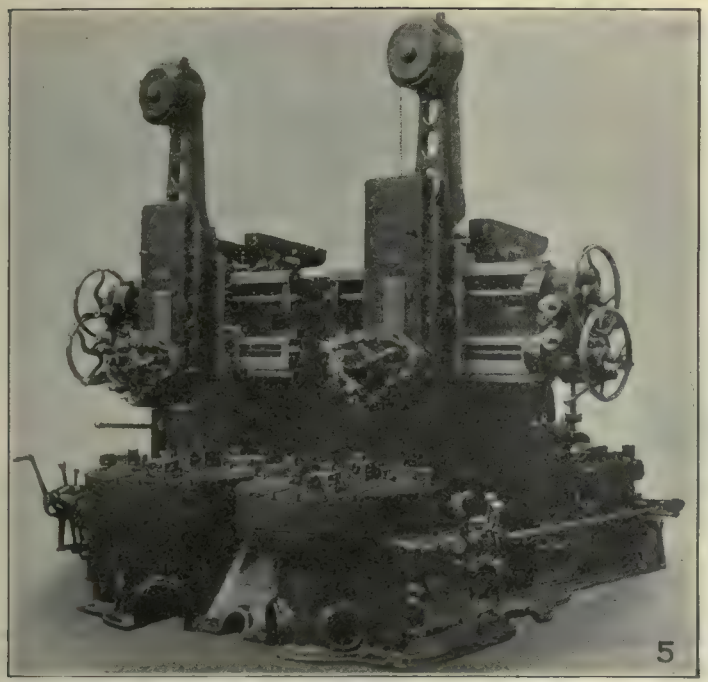


FIG. 5. WEBSTER & BENNETT TWIN VERTICAL BORING MILL

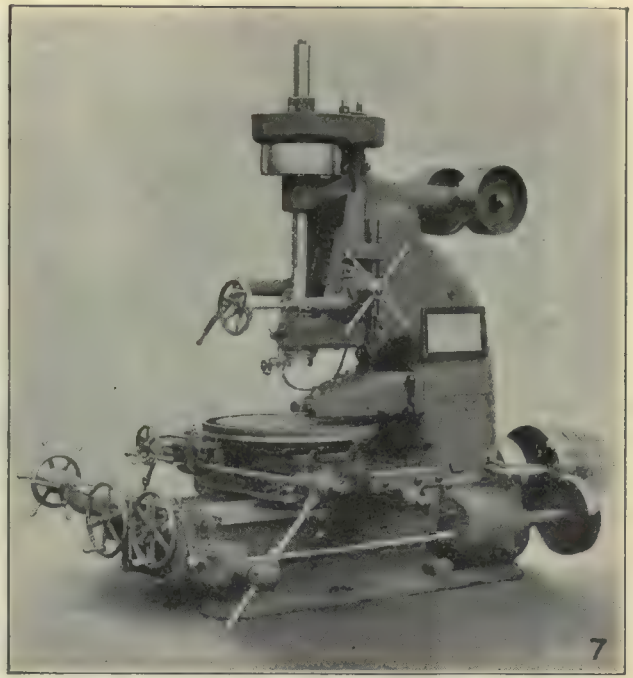


FIG. 7. HERBERT VERTICAL MILLING MACHINE

former cam on the hexagon turret. For repetition work the two stop bars for the turret and saddle slides can be adjusted in unison along the bed so as to compensate for variations in thicknesses of the articles turned. The feeds and chasing gear are interlocked and both automatic and dead stops are provided for the feeds. The taper attachment is for either internal or external tapers, while taper threads can also be cut. The tool holes in the main turret are relieved for about half their circumference, preventing jamming of bushings and tools and facilitating removal. The auto lathe described and illustrated in the issue (European edition) of this journal for Sept. 23, 1920, may be regarded as the latest in the firm's lines in this direction.

Vertical Milling Machines

The same firm has markedly developed the vertical milling machine, Fig. 7, which illustrates the machine with profiling attachment and circular table. The sliding head has both quick and slow vertical adjustment and, the control being at the front, the machine is thought to be specially convenient for irregular work, including die-sinking. Thus drop forge dies can be produced from a former cast from a wooden pattern, the former being secured to an angle plate placed on the rectangular table and the guide pin following it. The illustration shows a circular table but sectional tables, one for each side, are also provided and are employed when long straight cuts are to be made, as with the round-ended links and connecting rods. A radius-milling attachment is provided for such jobs as reversing links for locomotives, marine engines, etc., two such edges being milled at one setting.



FIG. 8. STIRK PLANER WITH REVERSING-MOTOR DRIVE

A marked change in the control and driving of planers was introduced ten years ago by the Lancashire Dynamo Co., Ltd., Trafford Park. The motor takes current, either direct or alternating, from the supply and drives a dynamo, the shunt field being reversed at each stroke of the planer, while the field of the actual driving motor thus supplied with current is constant. Its armature current is, however, reversed, giving reversal of direction of rotation. In this way ranges of speed up to 8 to 1 have been obtained, 4 to 1 by variable voltage of the generator, and 2 to 1 by shunt regulation of the driving motor field. The firm named do not make planers, but their system was applied to the machines manufactured by J. Stirk & Sons, Ltd., Halifax, and other firms. The Stirk firm introduced quick power traverses for the tool heads, electrically-driven, and have lately supplied its split-field electric drive, the illustration (Fig. 8) showing a 5 x 5 x 16 ft. machine as in position at Olympia, London, W., during the recent Machine Tool and Engineering Exhibition. The control of the table is by push button, and an accelerator speeds up the movement across gaps in the job being tooled. Power traverse is provided for the heads. The maximum return speeds are 240 ft. per minute for a 5-ft. machine, the standard machine being geared for cuts at 15 ft. to 60 ft. per minute and return at 60 to 120 ft. per minute for extra heavy duty, with 30 to 120 ft. per minute cut and 120 to 240 ft. return for medium and light duty. These speeds are claimed to be the highest in the world for planers. In the split-field drive provided for the machine illustrated the main reversing motor is of 40 hp., with maximum speeds of 500 and 1,000 r.p.m. for the cut and return strokes respectively.

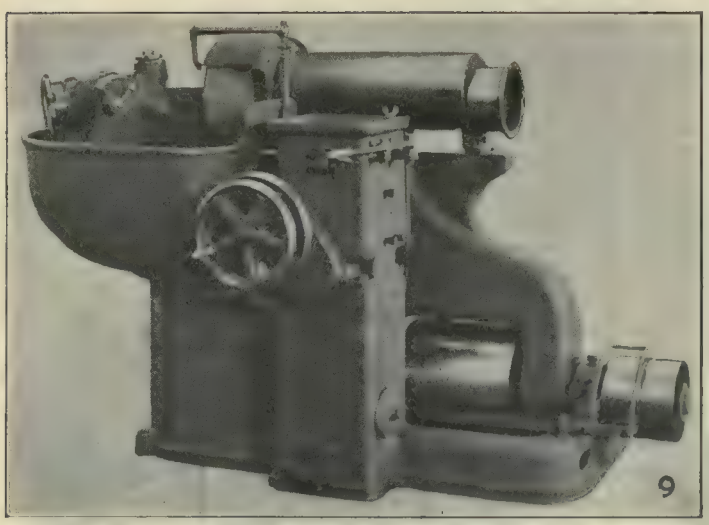


FIG. 9. LUMSDEN TOOL GRINDING MACHINE

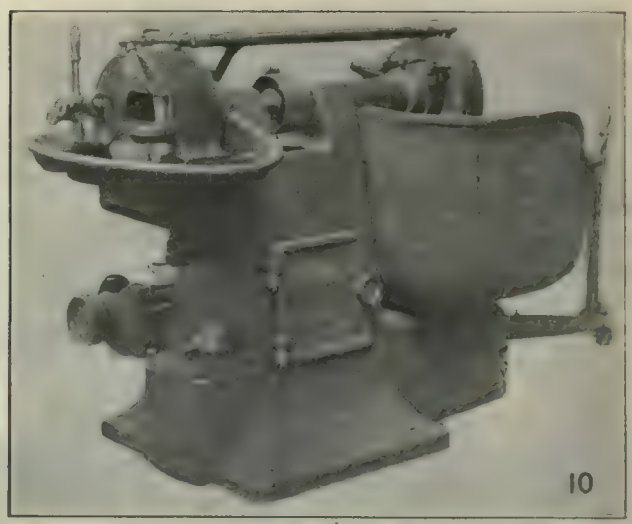


FIG. 10. LUMSDEN DOUBLE-END TOOL GRINDING MACHINE

By independent regulators these speeds may be reduced by 75 per cent. To reverse and speed-up for return two contactors are actuated by a master switch. The master switch and contactors control the quick-return reverse. The shunt field windings, both of dynamo and final motor, are divided into two sections. In the generator these sections oppose each other, and the polarity of the machine varies with the alternate excitation of the field sections. The sections in the motor field are connected so that the one supplements the other, one being permanently excited. The second section is excited only during the cut stroke, thus giving slow cutting speed and quick return. The range of speeds can be extended by variation of the generator voltage, two shunt regulators being supplied to enable cutting and return speeds to be varied independently.

Tool Grinding Machines

The tool grinding machine, Fig. 9, made by the Lumsden Machine Co., Ltd., Gateshead, was introduced during the ten-year period, and has done much towards standardizing forms of cutting tools for a given shop. The grinding wheel, of conical cup-shaped form, oscillates in front of the tool to be ground, the frame carrying it moving on trunnions below and the oscillation being obtained from a variable eccentric. The toolholder is adjustable to suit the shape and angle required without the use of auxiliary fittings, and the grinding wheel can be fed, being adjustable in the frame for that purpose. Two handwheels enable the operator to move the wheel sideways and to and from the work while the frame oscillates, the latter motion being controlled by lever at hand, while a pedal stops or starts the machine. The toolholder will rotate on its own axis for the grinding of top and side faces of tools; it swivels in order to give rake or clearance; and swings on a turn-table vertically so as to bring both side and front faces against the wheel. For the production of hollow curved top cutting faces an attachment is provided, a swivelling toolholder being fitted to a slide that is operated by lever, the device being carried in the toolholder of the machine. Recently a special double-ended grinding machine, Fig. 10, has been brought out for this purpose. For producing the curved lips a horizontal slide is pivoted on a column with vertical adjustment, swinging to any angle in the horizontal plane. This slide carries a cross-slide with swivelling vise, the base of the latter being at an angle of about 40 deg. to the slide. The other end of the machine carries a 12-in. cup wheel, toolrest and wheel dresser, this end being used for re-touching tools after hardening.

Precision Grinding Machines

In no branch of machine tools has Great Britain made steadier advance during the last ten years than in the production of precision grinding machines; here the work of the Churchill Machine Tool Co., Ltd., Broadheath, is predominant. Its surface grinding machine is illustrated in Fig. 11. A table of planing machine type reciprocates and a vertical spindle with cup wheel is carried on a cross-rail which may either be fixed or have vertical adjustment on uprights. The spindle head has variable motion along the cross-rail, operated at each reversal of the table, and the latter has the usual automatic reverse for length of stroke. The balanced wheelhead has vertical adjustment with fine hand motion and quick motion, the former having a definite stop which does not interfere with the control of the quick hand motion. An automatic down feed with automatic trip operates when the full width of the work has been covered. The wheel spindle runs in ball bearings. The table reversing motion and cross reversing motion to the wheelhead are independent so that surfaces at right

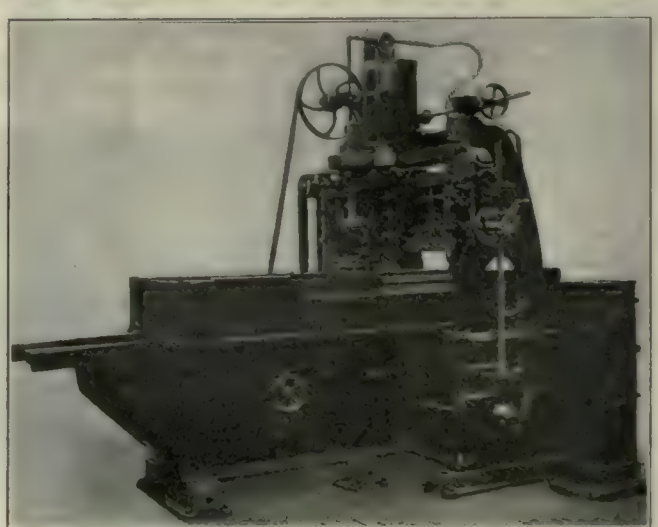


FIG. 11. CHURCHILL SURFACE-GRINDING MACHINE

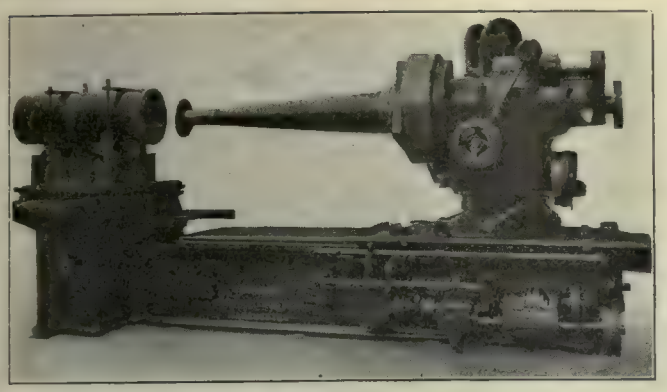


FIG. 12. CHURCHILL CYLINDER-GRINDING MACHINE

angles to the length of the job can be ground by operation of the head on the cross-rail only, the work being stationary. An attachment is also provided by which a wheel on a horizontal spindle can be carried, this being fixed on the wheel slide and used where the job prevents employment of a cup wheel. For supply of coolant to the latter the spindle is hollow. The illustration shows the machine with levelling devices, motor drive, etc., the capacity being 96 in. long by 27 in. wide and 24 in. high.

An internal cylinder grinding machine by the same firm is shown in Fig. 12. This particular machine is for grinding holes up to 24 in. diameter and 6 ft. long, though a machine of the same type is in the shops for grinding 32 in. in diameter by 7 ft. long.

As this machine is for jobs of regular outline, the table has cross adjustment only and is supported on a base that reaches direct to the ground; or the table may be detachable, being carried on an extension of the baseplate. The grinding wheel has planetary motion, the head being vertically adjustable on a column that has longitudinal motion along the bed, this being controlled by adjustable reversing dogs according to the length of hole to be ground. Usually there are four speeds, but in some cases an additional quick traverse is provided, in order to move the head between chambered portions in long holes. The main spindle also has four speeds independent of the longitudinal movement speeds. A large range of adjustment is provided in order that the wheels may be considerably smaller than the holes to be ground, with reduction in arc of contact.

Chance Versus Scientific Education

By John C. Fisher

It is interesting to consider how much the element of chance enters into our business lives. I am a consulting engineer—at least that is what is on my writing paper—and in my opinion a man who takes up such work should have a large circle of acquaintances, from whom he must obtain clients. First, however, he must have experience, not simply the knowledge which others have obtained and set down. Yet I am safe in saying that the experience of others has often guided me in my work and, knowing this to be so, I am relating an experience which I believe may aid someone else.

Not long ago a friend wrote to me that he was in a mechanical trouble and wanted me to come to his aid, so I went. He introduced a man who had built for him a new paper-bag making machine, the design of which was beautiful in every way and about perfect in fits and finish. But, as the inventor frankly told me, it would not make paper bags for any length of time. It would make bags for about two hours, then something that was not salable. It looked as if my friend had lost his money, and to try and save himself had sent for me. The inventor had been over a year building the machine and had done a large part of the work himself. He said he had lost forty pounds in the last month and was discouraged; he looked it.

At seven next morning he started the machine; it made good bags for one hour and fifty-one minutes, after which it made scrap. The trouble was that in that time the paste got spattered about various parts of the machine, and stuck up everything, which the inventor could not stop. By the end of the day I had suggested four changes, each of which the inventor had previously tried without success. We cleaned the machine and I ran it for one hour and twenty minutes before trouble began. Next morning I made a two-hour-and-twenty-minute run and thought I was on the right road, only to find that the following morning I fell back to the original time.

I worked for fully a week without any real gain. I kept records of all I did and upon examination of these began to wonder why the afternoon runs were never so good as those of the morning.

It was the middle of October and was getting cold in the mornings. I came to the works each day at seven o'clock, and as I mounted the steps on that eighth day the man in charge of the heating told me a pipe had given out and he could give me no heat that day; but I went in and, with overcoat on, started up the machine to try out a canvas sort of splashboard that I had put on the evening before. I made bags for one hour; then two hours passed, and still the machine made bags. At noon I had made a clean record, and all the afternoon I did the same same. I began to feel "chesty" and just before time to shut down I took a look at my splashboard, and almost fainted; there was not a drop of glue on it.

I thought it had been doing the trick for sure, but evidently it was not needed.

I had a bad night of it but walked to the shop in the morning feeling good. I found a recording thermometer in the storeroom and put it up in the room, which was again warm and comfortable. In one hour and twenty minutes I had begun to spoil stock, but by night I could make bags whenever I wanted. Next day at ten o'clock I had the inventor and my friend together in the latter's office and I laid several circular temperature records before them.

My friend asked, "What's all this?"

"It's the reason why the bag machine did not work," I replied.

"Did not work!" exclaimed my friend. "Do you mean that it does work now?"

"Sure thing. See these letters around these dials? Well, B. B. stands for bad bags while G. B. stands for good bags. Now you will notice that B. B. is opposite the temperature above 78 deg. while G. B. is opposite the temperatures of less that that, so all we have to do is to keep below, say 72, and we can make good bags."

The inventor began to look younger and my friend smiled. "Well," said the inventor, "I take my hat off hereafter to scientific education."

I said nothing, but next day as I sat in my parlor-car seat on my way home I pondered as to whether the bursting of the steam pipe did not have more to do with the solution of the trouble than my scientific education.

An Old Machine-Gun Patent

By E. A. Dixie

During my recent visit to England I ran across the machine-gun patent reproduced herewith.

In many ways it is remarkable. In general appearance the gun is quite similar to modern machine guns of the revolving type but there is, however, some obscurity regarding its actual mechanism.

The tripod does not vary greatly from those used with modern guns. Means are provided so that the gun can be elevated or depressed and swivelled in any direction in a horizontal plane, and by removing a pin the whole gun and tripod can be folded up convenient for transportation.

The individual chambers were evidently screwed into large plates, and were made in two styles; those to handle "round bullets against Christians," presumably non-protestant Christians, in support of which surmise refer to the couplet above the gun. The other style was for "square bullets to be used against Turks."

The only definite statement which would appear to be equivalent to a "claim" is where the inventor declares that the "machine is made of steel, iron and brass," and that "the trepied whereon it stands is wood and iron."

PORTABLE GUN

A.D. 1718——No. 418

Puckle's Specification

GEORGE, by the grace of God, of Great Brittaine, France, and Ireland King, Defender of the Faith, &c.

TO ALL TO WHOM THESE PRESENTS SHALL COME, greeting.

WHEREAS James Puckle, of our Citty of London, Gent., hath by his peticon, humble represented unto us that he hath at great expences invent "A Portable Gun or Machine called a Defence, thatt Discharges soe often and soe many Bullets, and can be soe Quickly Loaded as renders it next to Impossible to Cary any Ship by Boarding;" and haveing humbly prayed us to grant him our Royall Letters Patents for the sole makeing and vending the said gun in England & Ireland, dureing the terme of fourteene yeares: but that he thinks it not safe to specify wherein the new Invention consists; but proposes that soe soon as the Patent shall be passed, the same shall be by him ascertained, under his hand & seale, to be enrolled in our High Court of Chancerty, to which the Patent may referr, to make the grant therein certain.

KNOW YE, that wee, being willing to give encouragement to all arts and inventions which may be of publick use and benefitt, of our especiall grace, certaine knowledge, & meer mocon have given and granted, and by these Prescents, for us, our heires and successors, do give and grant unto the said James Puckle, his executors, administrators, or assignes, especiall lycence, full power, sole priviledge & authority, that he, the said James Puckle, his executors, administrators, and assignes, and every of them, by himselfe and themselves, or by his and their deputy and deputies, servants & agents, or such others as he, the said James Puckle, his executors, administrators, or assignes, shall at any time agree with, & noe others, from time to time and at all times dureing the terme of yeares herein expressed, shall and lawfully may make, exercise, work, vend, use, and enjoy his said new invented portable gun or machine called a defence, as aforesaid, with that part of our Kingdom of Great Brittaine called England, our Dmon, Town of Berwick-upon-Tweed, and our Kingdom of Ireland, in such manner and with such materialls as shall be ascertained to be the said new Invention, by writeing under the hand and seale of the sd James Puckle, and inrolled in our High Court of Chancery within three calender months from the date of these Presents, and that he, the said James Puckle, his executors, administrators, and assignees, shall and may have and enjoy the whole profitt, benifitt, comodity, and advantage from time to time comeing, growing, accreuing, and ariseing by reason of the said Invention, for and dureing the full terme of yeares herein menconed; to have, hold, exercise, and enjoy the said lysence, powers, priviledges, & advantages herein-before granted or menconed to be granted unto the said James Puckle, his executors, administrators, and assignes, for and dureing and untill the full end terme of fourteen yeares from the date of these Presents next and immediately ensueing, and fully to be compleat and ended, according to the Statute in such case made and provided.

The specifications continue at great length and in a verbose manner to grant the inventor the sole right to all benefits that may accrue by reason of his invention and to threaten dire punishment to all who interfere with his rights.

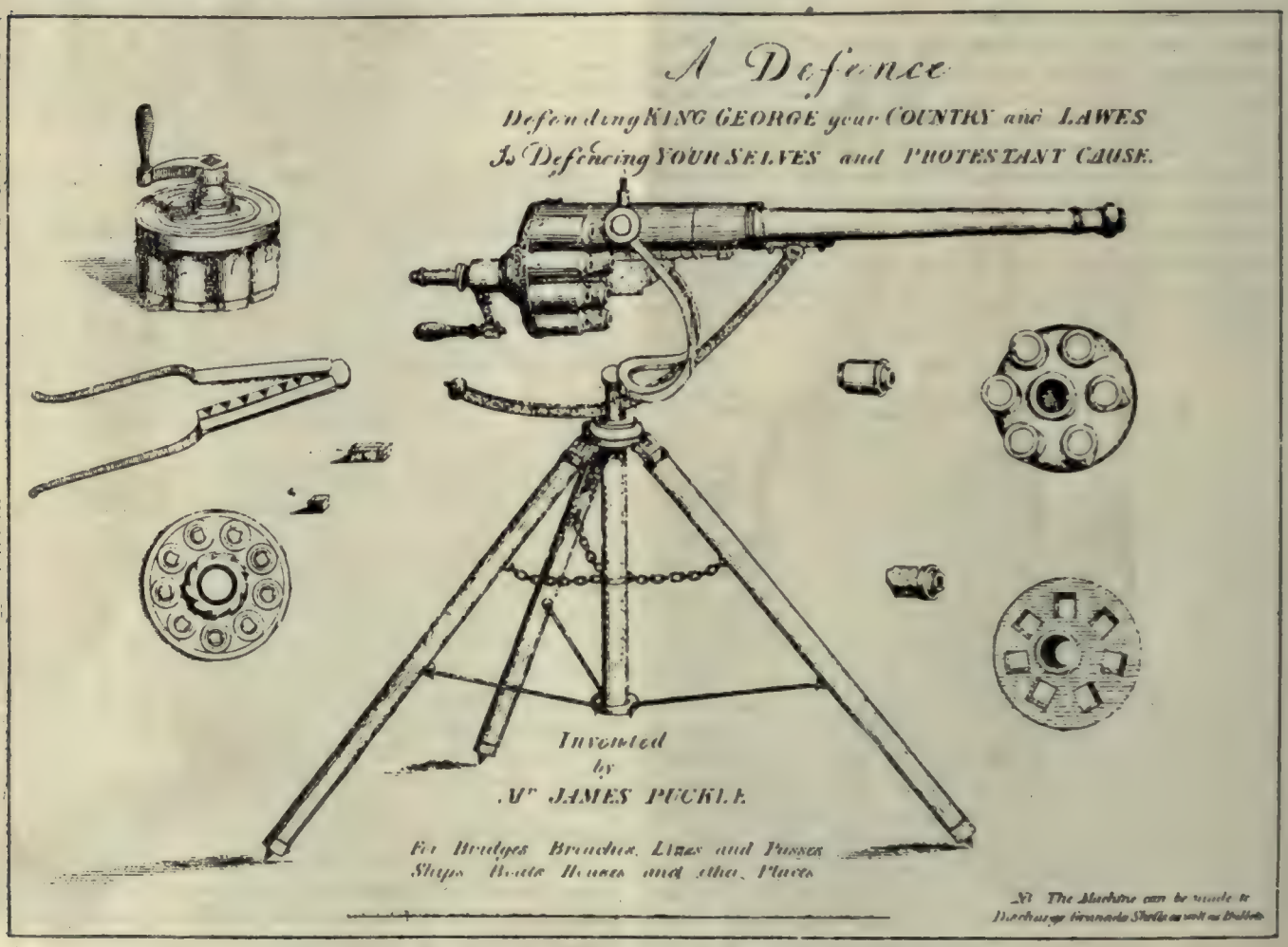


ILLUSTRATION ACCOMPANYING LETTERS PATENT FOR PUCKLE'S GUN



Built During Government Control of Railroads—All Departments Under One Roof—Equipment Nearly All New—Sixty Locomotives per Month Can Be Repaired

THE B. & O. Locomotive Repair Shops at Glenwood illustrated in the headpiece have been in operation about 18 months. They were constructed to relieve the shortage of repair facilities of the B. & O. system and to lessen the amount of heavy repairs which it was necessary to have done by locomotive builders. A smaller shop of the same general type was erected at Cumberland, Md., both the Glenwood and Cumberland shops being designed and erected by the same engineers, Westinghouse, Church, Kerr & Co., Inc., New York, since consolidated with Dwight P. Robinson & Co., Inc., New York, under the latter name. The output of the Glenwood shop, at full capacity, is 60 locomotives per month, about 75 per cent on classified repairs and 25 per cent on running repairs, twenty-one locomotives being handled at one time. About 1,200 employees constitute a full force. Building and new equipment involved an expense of more than $1,700,000. (We are indebted for these figures and for a part of the data contained in the remainder of the article to *Railway Mechanical Engineer*.)

The new building was erected practically without interfering with repair work done in the old plant although the old blacksmith, boiler and tank shops, occu-

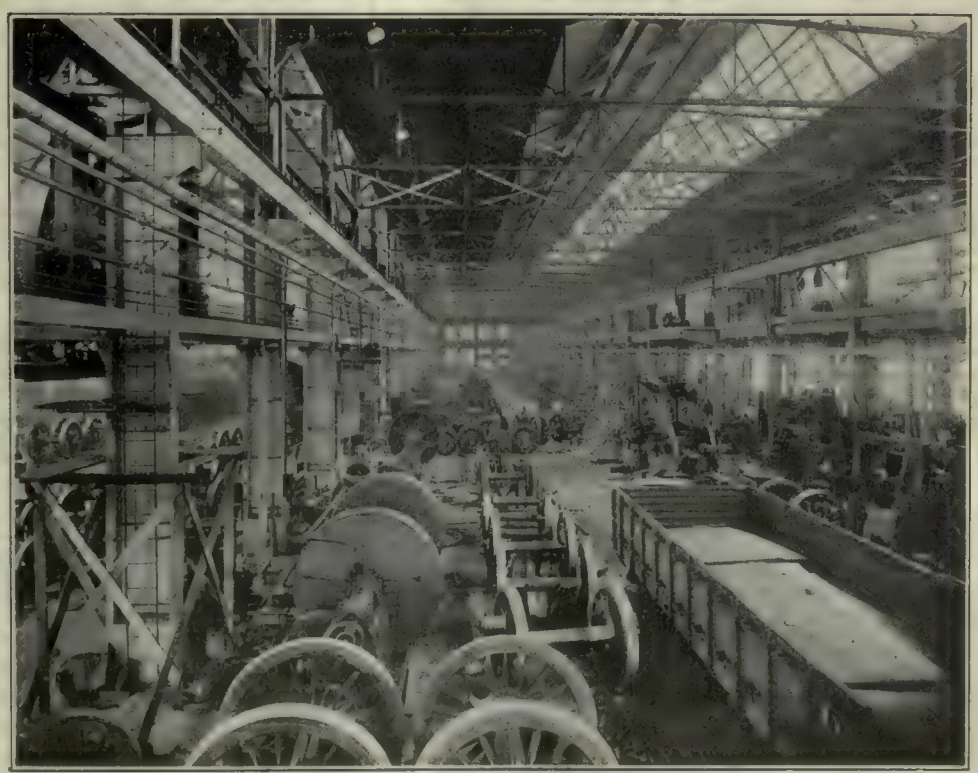


FIG. 1. PART OF THE HEAVY MACHINE SHOP BAY

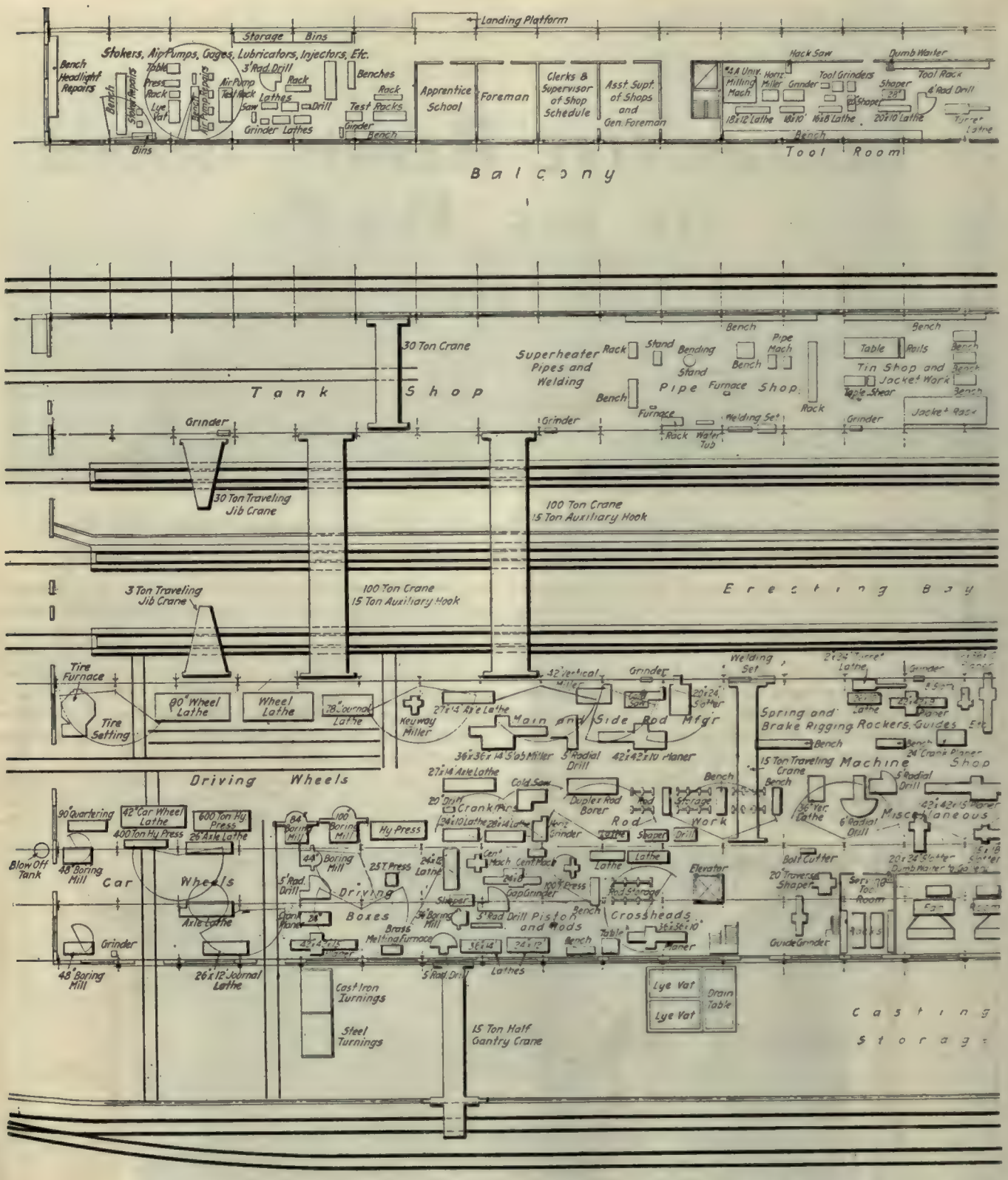
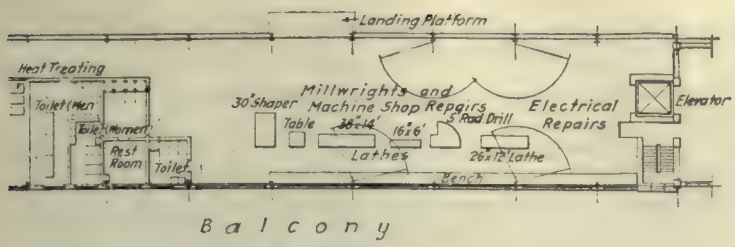


FIG. 2. PLAN OF THE GLENWOOD SHOPS

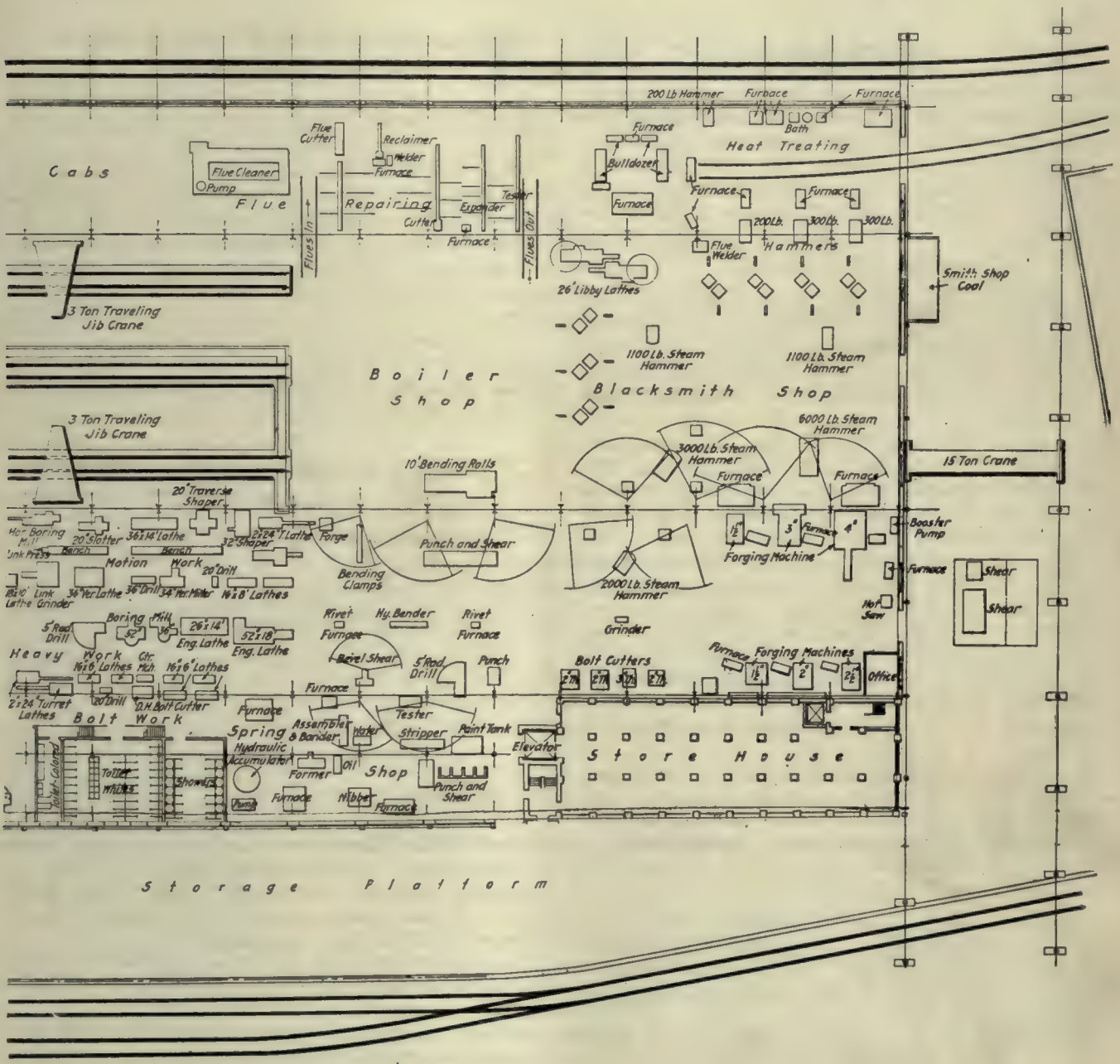
pying three steel-frame buildings, were on the site for the new building. After the new building was erected around them they were torn down and their equipment was properly arranged to conform to the new scheme.

Layout of the Plant

The Glenwood shop is 635 ft. long and 232 ft. 6 in. wide, is of steel-frame construction with brick curtain walls and is divided into four longitudinal bays, the monitor, the east, and two west, with respective widths of 90 ft., 42 ft., 62 ft. and 40 ft. 6 in. Four hundred forty feet of the north end of the monitor bay are occupied by the erecting shop. The east bay contains tank, pipe, tin, and cab shops and part of the blacksmith shop. The two west bays contain the machine shop and the outer one contains the five-story storehouse of reinforced-concrete construction, 120 ft. long. A balcony extends from the north end of the outer west bay to the storehouse and on it toolroom work, electric repairs, millwright work and other repairs are taken care of. It also provides space for offices, toilets, etc. A fifty-foot platform is provided for the whole



locomotive repair shop. Engine lathes: One 16 in. x 8 ft., two 18 in. x 10 ft., one 20 in. x 10 ft., one 24 and one 30 in. x 12 ft. Portable lathes: Two 18 in. x 10 ft. Axle lathes: Two 27 in. x 14 ft., one D. H. center drive. Vertical turret lathes: Two 30-in. Boring mills: One 84 in., one 44 in. Drilling machines: One 3-ft. radial, one 4-ft. radial, four 5-ft. radials, three 20 in., one 36 in. Milling



AND ARRANGEMENT OF MACHINE TOOLS

length of the building on the west side. A view of the heavy machine shop bay is shown in Fig. 1. The layout of the plant and the arrangement of the machine tools on both ground floor and balcony are shown in Fig. 2.

Machine-Tool Equipment

Much equipment was moved from the old shops and a great deal of new equipment was added. The following list of new machine tools installed when the plant was completed shows the kinds and sizes of tools required in a

machines: One slab, one 42-in. vertical, one keyseat. Shapers: Two 28-in. crank. Planers: Two 24-in. crank. Slotting machines: One 20 in., one 24 in. Grinding machines: One 12 x 36-in. plain, six grinding-wheel stands. Other machines: One 6-in. pipe-cutting and threading machine, one 100-ton hydraulic press, one 1½-in. forging machine, one 3-in. forging machine, one 300-lb. power hammer, one 6,000-lb. steam hammer, one D. H. rod boring machine. Almost all of the machine tools are driven by individual motor drive though there is some group driving.

Repair work on boilers and fire boxes is the function of the boiler shop. The equipment consists in part of one punch, 12-in. throat (5 hp.), one punch and shear, 48-in. throat (25 hp.), one 10-ft. bending roll, one bevel shear, one 5-ft. radial drilling machine, one hydraulic bender for ash pan work, one 12-ft. pneumatic flanging clamp, one flanging fire, one 6-ft. hand power bending roll, two rivet heating forges.

The Flue Shop

The flue shop is combined with the blacksmith shop. The equipment includes two motor driven flue cutters, one flue furnace with flue reclaiming machines, one welding and swaging machine, one expander, one expander furnace, one hydraulic flue tester, one flue cleaning machine, one flue welding machine, one furnace for superheater tube repairs, five steam hammers, three power hammers, four bolt threading machines, six forging machines, two bulldozers and one 26-in. turret lathe.

Cranes and Elevators

The plant was designed with a full knowledge of the work to be done and was so arranged that classified repairs take a regular and economical course through the shops. No attempt will be made in this article to describe in detail the movements of the various components.

A study of Fig. 2 will show that due regard has been taken to locate the heavy machines and the heavy work in general in positions where they may be served by the large cranes. The erecting shop is covered by two 100-ton bridge cranes, each with 15-ton auxiliary hook and by four 3-ton traveling jib cranes. The heavy machine shop bay is served by a 15-ton bridge crane. A 15-ton half-gantry crane is provided for loads on the platform outside the outer west bay and a 15-ton bridge crane is provided at one end of the building. A 30-ton bridge crane handles the loads in the east bay. Swinging jibs with hoist blocks are placed in positions where traveling crane service is not available.

Material is transported between machine shop floor and balcony in the storehouse by elevators. An automatic passenger elevator serves the four floors of the storehouse and the main office on the fifth floor.

Heating

A hot-air system is used for heating. Two 200-in. direct engine-driven fans are used, each fan supplying heat for half of the building. The air is heated before reaching the fans by 71-in. Ventostacks, two tiers high and six stacks wide.

The hot-air ducts are of concrete and the outlet boxes are placed at the columns and along the sides of the building.

Power and Lighting

Power for the night load is generated by the shop power plant. Power for the day load is purchased and transformed by the shop power plant. Lighting circuits are 110 volts, single-phase, alternating current. Machine tools and elevator motors operate on 440-volt, three-phase alternating current and crane motors require 230-volt direct current.

Seven hundred-volt, 400-volt and 200-volt incandescent lamps are used for lighting. Deep bowl and angle reflectors are used. Individual lights on machines are used as little as possible.

Welding

The shop is equipped with two Westinghouse constant voltage type electric welding sets with capacities for eight and five operators. Welding outlets are twenty-four in number, located along the sides of the monitor bay. Oxy-acetylene tank outfits are used for cutting.

Emergency Method of Cutting Thread

By Atol Maker

Under the above title on page 1233, Vol. 53, of the *American Machinist*, Richard H. Kiddle describes his exceptional method of cutting a thread.

I feel that it is essential that his article be supplemented by adding that if the thread is to be right-hand, the cut must be started at the rear of the piece and run toward the front end. If the thread is to be left-hand, the contrary must be done. In either case, the ordinary procedure must be reversed, otherwise someone will be surprised.

If all readers of the *American Machinist* were experienced at thread cutting, my offering would be quite superfluous. As it is, there can be hardly a day when someone is not cutting his first thread.

Strength of Butt- and Spot-Welds

By G. A. Hughes

The results of a series of tests on butt- and spot-welds made for the Truscon Steel Co., Youngstown, Ohio, were as follows:

Tests made on bars of soft steel, 1 in. square, butt-welded and machined to the size of the bar:

Test No.	Volts	Amps.	Kw.	Power Factor
1	220	220	40	91
2	220	220	40	91
3	220	210	39	84
4	218	210	39.5	86
5	220	210	39	84

All tension tests were pulled at a speed of ½ in. per minute. Nos. 1, 2 and 3 were pulled, while Nos. 4 and 5 were sheared. On the different tests No. 1 failed in the weld at 48,800 lb.; No. 2 failed in the weld at 52,300 lb.; No. 3 failed back of the weld at 50,100 lb.; No. 4 failed at 51,500 lb., and No. 5 at 50,300 lb.

These tests indicate that the ultimate shearing strength of such a weld closely approaches the ultimate tensile strength.

Pieces of soft steel, ⅜ in. thick and 5 in. wide, with an ultimate tensile strength of 56,150 lb., were butt-welded and pulled with the following results:

Test No.	Manner of Failure	Lb.	Per Cent
1	half-in. plate and half-in. weld	51,000	91
2	In plate just back of weld	52,000	93
3	In plate just back of weld	53,400	95
4	In plate just back of weld	52,600	93
5	In plate just back of weld	46,100	82
6	In plate just back of weld	51,900	93

On six samples of spot-welded single lap-joint sheets of 14-ga. steel, 3 in. wide, welded with a ⅝-in. spot, the average at which the welds pulled out was 4,480 lb. The ultimate tensile strength of a piece of plate of

44-ga. was 64,500 lb. per square inch. The ultimate shearing load per weld (two spots with an area of 0.0742 sq.in. each) averaged 8,942 lb. Approximate total welded area 0.1484 sq.in. This gives an ultimate shearing strength for 1 sq.in. of weld of about 60,200 lb. On steel ⅛ in. thick and 2 in. wide, welded with a spot having an area, measured with a planimeter, of 0.476 sq.in., the failure under pull was at 34,650 lb. Examination of the welds showed them to be under both a tensile and a shearing action. A piece of the same steel tested for ultimate strength, failed at 66,800 lb. per square inch. This shows that the weld was stronger than the original metal.

The final conclusions drawn from these tests are that, in general, the ultimate tensile strength of a properly made butt- or spot-weld, is about 93 per cent of that of the parent metal, and the ultimate shearing strength of butt- or spot-weld is also about 93 per cent.

Meeting the Present Emergency

By a Middle-West Machine Tool Manager

WE BELIEVE in building a good-sized stock of complete machines, and have done so, regardless of the times being dull during the last four or five months. We have reached the limit because of the doubtfulness of maintaining our prices, and this means we have reached a dangerous point. We always have many units of our machines built away in advance of the machines proper, the point being of course, not to have any delays on the assembly floors.

We certainly have maintained our organization of about one hundred men, some of them very important and others somewhat less important, but who have been with us for a number of years. If it came to a point where we were receiving no orders whatever for a few months, we would still maintain this organization and keep producing. We all know that to build up a good organization is an especially expensive proposition and we will keep these men employed regardless of the loss in dollars. Naturally we are on the alert and have been for the last three or four months, to reduce our overhead expense in the extreme. This is a natural consequence of good management. We have gone so far recently as to have many of our foremen producing because the number of men in their care is especially small at present. We have no trouble whatever in this respect because the foremen realize the true condition.

> Has built stock and is still building a little to keep men busy.
>
> Maintains a skeleton organization of key men, as it is cheaper to lose some dollars now than to lose more later when business comes back.
>
> Overhead expenses reduced to minimum. Production rate high, due to equitable bonus.
>
> No wage reduction in sight. Cost of living must reduce first. Sudden changes of policy undesirable.

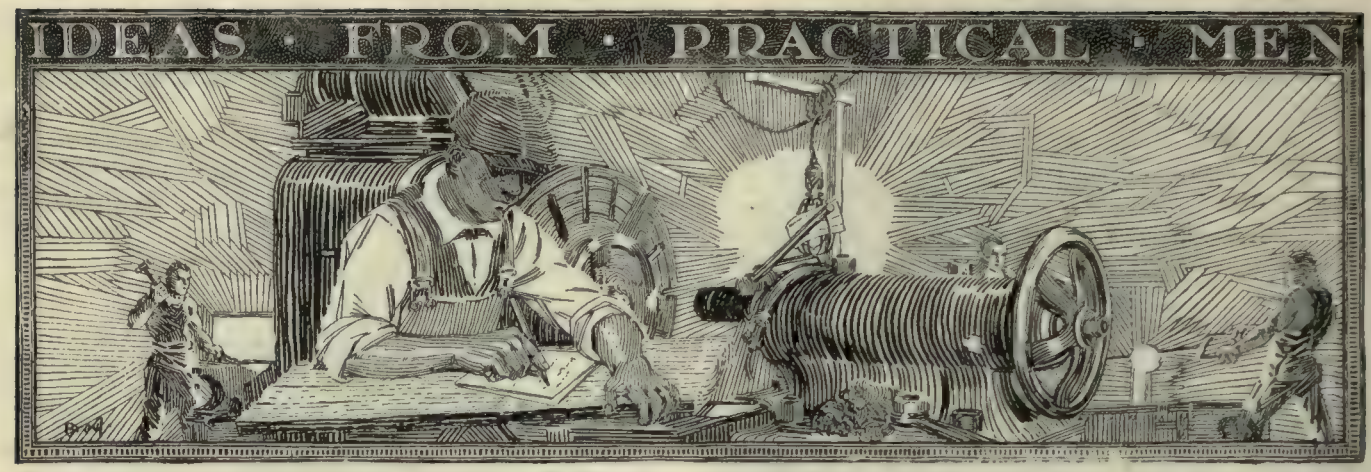
It is difficult to answer as to the automotive field, but we might say that the farmers and men of moderate means who are large purchasers of medium priced automobiles are not in the market at this time, owing to the scarcity of funds. We think the automobile business is in about the same class with the machine-tool builders and that they must expect their business to remain very bad until such time as the general business of the country improves.

There is no line of business that we know of at present that is anything like promising. This stagnation of business is nearly universal, and to state that you know of any particular line that is liable to improve in the near future would be only a guess.

As to production. For some years past, before the slowing up of business, we had a bonus system working in our plant in a very satisfactory manner and the natural consequence was that our production reached the maximum. For this reason, regardless of the times being dull, we are not able to improve over what we were previously doing in this respect. You can easily imagine that with a good bonus, where every man is doing all that is possible, it would soon reach the point of the very best that could be done in the way of output. For this reason we are not gaining anything in this respect because of the dull times. We are working nine hours a day and will continue to do so. Some factories are inclined to work short hours, keeping more men, but we are favoring those who have been with us for a great number of years. We are paying much attention to the every-day mechanic as far as hours are concerned, as, for instance, by working three days per week to give them all employment. We are under the impression that this is somewhat of a thankless thing to do.

As far as wages are concerned, we are going slow and have no thought of reducing the hourly wage until such time as we are forced into it. The high cost of living is only lessened in certain respects, and this has got to be considered. If we are forced to lower the price of our product, which is liable to happen, then we would naturally expect to have to reduce wages, but it should be done, in our estimation, slowly and carefully. For instance, if the time arrives where we could just as well reduce the wages of our employees 25 per cent and they would have to stand for it, our thought would be to drop 10 per cent or 15 per cent and allow this to continue for some time before further reduction would be made.

In the face of the whole proposition the returning to good times should be done on the easy plan and not be too rash. There is no necessity of going to extremes because you are in a position to do so. It upsets labor all through the country and very often is the cause of useless strikes. This is our opinion of the wage question.



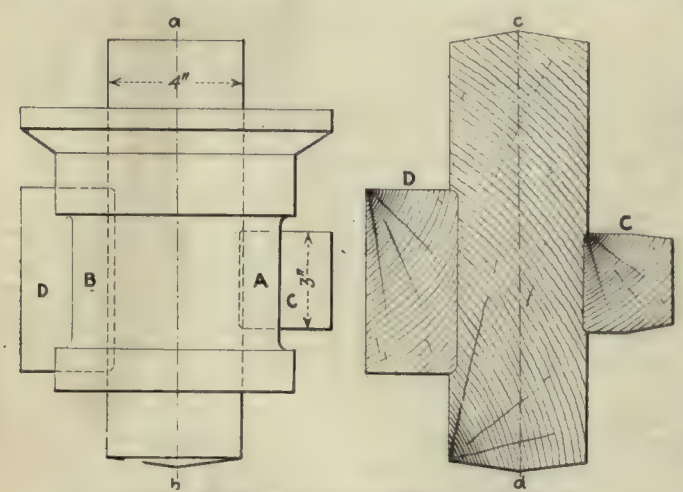
Right and Wrong Ways to Make a Simple Pattern

By M. E. Duggan

It is possible by faulty design of a pattern to so alter the shape of a casting in the operation of molding as to render it unusable for the purpose for which it was intended. The piece shown in the accompanying sketch was to be of bronze, finished all over except the parts *A* and *B*.

The pattern was made to part on the line *ab;* the coreprints *C* and *D* to be molded in cope and drag, respectively. The core was made in two parts joined on the line *cd*. The corepoint *C* was tapered for about half its length, at the suggestion of the molder, to guide in into place; otherwise both prints were left perfectly straight.

It is essential that the parts be diametrically opposite, and this, in the making of the pattern, was carefully done, but in making the core a careless workman, or perhaps several of them together, got these prints offset about ⅛ in. In setting the core the molder was, of course, working "in the blind" as the body core covered the lower half of the mold from sight. As a natural



THE WRONG WAY TO MAKE A PATTERN

result of the distorted core the sand of both cope and drag were so disturbed in closing the mold as to spoil the casting.

Making the pattern so that the parting would be through the port coreprints, thereby leaving half of both prints in cope and drag, would have obviated all the trouble.

Drawing and Swaging Dies for a Hub

By Hugo F. Pusep

In manufacturing parts for adding machines many dies are used, as should be apparent to anyone familiar with the intricate mechanism of such machines. However, new uses for dies are found almost daily, whereby the production cost of many parts is reduced 50 to 75 per cent. Such a case is illustrated herewith.

Fig. 1 shows a gear segment with the projecting hub *A*, the material being soft steel 1⅛ in. thick and suitable

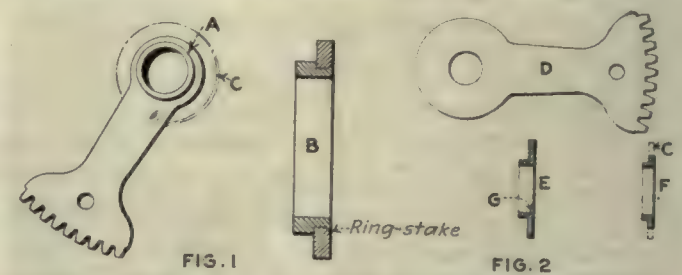


FIG. 1. THE GEAR SEGMENT MADE IN TWO PIECES.
FIG. 2. THE GEAR SEGMENT MADE IN ONE PIECE

for punching. Formerly the body of this segment was made from a punching, the hub *A* being a separate piece made in the screw machine. This hub was in the form of a ring with two diameters, the smaller of which was made to enter the large hole in the segment, being then ring-staked over on the other side to keep it securely in place. At *B*, Fig. 1, is an enlarged side view, showing how the hub was held in place. While this method of securing the hub to the segment is efficient, it was thought that the cost of producing the hub separately and the subsequent assembling and ring-staking operations should be reduced. Consequently a method of making the segment and the hub in one piece on the punch press was worked out and the tools built, thus cutting the production costs in half and turning out a first-class article in every respect.

The segments were blanked from strip stock in the usual way, using a progressive blanking and piercing die, the size of the large hole having already been determined by trial. As will be seen from the cross-section of the finished hub at *F*, Fig. 2, the flange around the hub is rather narrow. In this condition it would have been practically impossible to draw the stock preparatory to swaging; therefore some extra stock was left around the hub part of the blank as shown by dotted lines *C* in Figs. 1 and 2. This extra stock was trimmed off after the swaging operation.

After blanking the segment it appeared as at *D*, Fig. 2. It was then necessary to draw up the stock for the hub somewhat higher than the finished dimension, so that the swaging operation could be sucessfully performed. Fig. 3 is a perspective view of the die shoe.

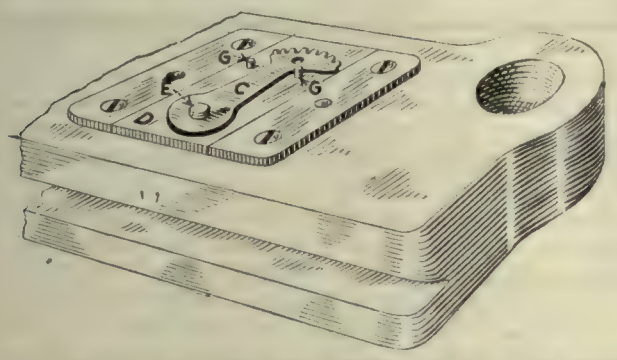


FIG. 3. PERSPECTIVE VIEW OF THE DIE SHOE

Figs. 4 and 5 show the cross-section of the drawing dies. In Fig. 4 the dies are shown before the drawing operation and in Fig. 5 the press ram at its lowest position. Reference letters on all three sketches being the same wherever practical, it is easy to follow the drawing operation proper.

The blank *C* is placed on the pressure pad *D*, being held centrally by the pilot *E* on the hub end, while the locator pins *G* hold the gear end of the blank in its proper position. The pilot *E* also serves another purpose: as the press ram descends, the pilot comes in contact with knockout *F* which is quite free to move upward, thus keeping it clear of the hub as it is drawn.

As the upper die *H* continues downward, it grips the stock *C* between its lower face and that of the pressure pad *D*, the latter being supported from below on pressure pins *I* which rest on a pressure plate and strong springs under the bed of the press. On further downward movement of the upper die, the stock around the hole of the blank is forced upward by the drawing punch *J*, which is a sliding fit in the pressure pad. When the ram of the press is ascending, the drawn blank is stripped off the drawing punch by the pressure pad. The upper knockout *F*, which is actuated by the knockout pins *K* and the rod *L* through the press ram, pushes the blank out of the upper die just before the press ram reaches its highest position.

The cross-section of the drawn hub as it comes from these dies appears as at *E*, Fig. 2, the hub being considerably higher than that of the finished blank. Also

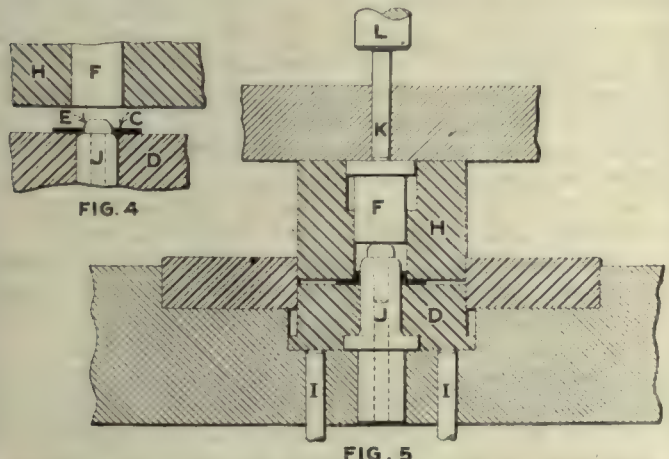
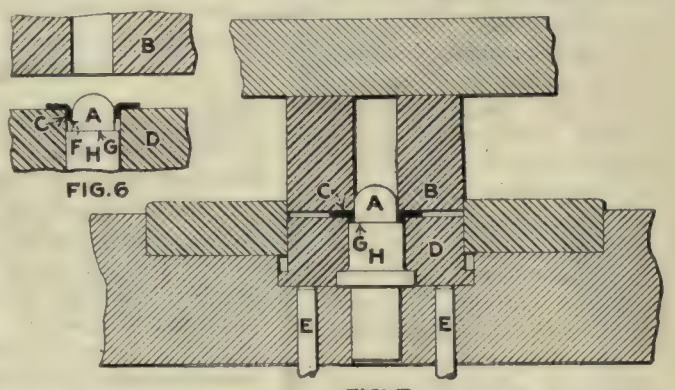


FIG. 4 FIG. 5

FIGS. 4 AND 5. CROSS-SECTION OF THE DRAWING DIES

there is a round corner at *G*, which must be filled out by the swaging operation.

Swaging dies are shown in Figs. 6 and 7, and they are somewhat similar to the drawing dies. There is, however, no upper knockout, as the blank is reversed for this operation. The pilot *A* of the swaging punch is a good slip fit for the hole in the upper die. The diameter of this pilot also corresponds to the finished size of the hole in the hub. The operation of the swaging dies is as follows: The drawn hub *C*, Fig. 6, is placed over the pilot *A* and, as the press ram descends, it causes the upper die *B* to carry the blank down over the pilot of the swaging punch *H*, the blank being held securely by the pressure pad *D* which has a strong spring pressure exerted from below through pins *E*, Fig. 7. On its downward course, the edge *F*, Fig. 6, of the hub comes into contact with the shoulder *G* of the swaging punch. As this punch is of fixed nature, the continued downward movement of the press causes the metal in the hub to compress and fill out the round corner left by the drawing operation and likewise to



FIGS. 6 AND 7. CROSS-SECTION OF THE SWAGING DIES

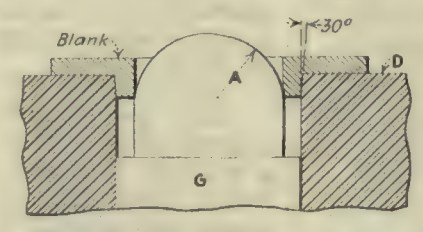


FIG. 8. ENLARGED SECTION SHOWING TAPER OF PRESSURE PAD AND RADIUS OF PILOT

size the hub for height. Thus, when the press ram has reached the lowest position, the hub will have been swaged as shown at *C*, Fig. 7. The hole in the hardened pressure pad *D*, which forms the outside of hub, is tapered about 3 deg. at its mouth, as shown in the enlarged section of Fig. 8, in order to make it easy to pick off the finished blank from the pressure pad at the completion of the stroke. This leaves the outside diameter of the hub tapered, but as this diameter fits no other part in the completed machine, its tapered form does not cause any inconvenience. Another interesting feature in this form of swaging die is to have the center of radius *A*, Fig. 8, somewhat below the edge of the finished hub when the pressure pad *D* is up, so that the pilot of the swaging punch *G* offers no resistance to the withdrawal of the swaged hub.

The drawing and swaging dies were built first, by using a temporary pilot in the drawing punch and keeping record as to the size of hole in the trial blank, till just the right amount of stock was drawn to fill the swaging dies properly; then the blanking dies were built.

IN THIS ISSUE

IN this issue we give the first part of the promised series on magnetic chucks. It is the first thing that you will see in the editorial pages. Sheldon had so much to say in his first installment that we were obliged to split it into two parts. However, so doing will not delay the second article of the series, scheduled for February 10, as the continuation of part I is to be in the issue of February 3. In the current installment you will learn some interesting facts in regard to early magnetic chucks, the principles of magnetism, lines of force, polarity and the energy of the magnet.

A firm of Berlin engineers (you'll find the name when you read the article) has introduced a process of intermittent welding, said to avoid the chance of arcing, a frequent cause of holes being burned in the material. On page 128 Dr. Alfred Gradenwitz describes electric seam-welding machines which this firm has brought out for welding circular and longitudinal seams and for welding bottoms in iron drums and small containers.

All of us have felt the effects of arbitration. We have seen arbitration at times bring about some very keenly desired results. And we have upon occasion been disappointed at the results of arbitration. In all cases how we feel about it depends somewhat upon whose leg is being pulled. The point we are making is that arbitration has been pretty well exploited and we therefore feel that we know a whole lot about it. We wonder, though, just how many can correctly answer these several questions: What is arbitration? How old is it? Is it necessary to have the consent of both parties to the dispute to arbitrate? How many kinds of arbitration are there and what are they? These questions and others are answered by Chesla C. Sherlock in his article "When You Arbitrate," page 130.

You may have noticed that Fred Colvin is strong for the idea of letting pictures tell the story. He has followed that system in his fourth story on building motors on the Pacific coast, page 133, wherein he tells how the Hall-Scott connecting rod is machined, of its assembly with the piston and of the inspection given.

Samuel Rosswell's article, "Casting and Machining Oil-Engine Pistons, Piston-Rings and Cylinders," is very well introduced by its title. But in order that you may fully understand just what you are going to find, note what the author says: ". . . the following is written with the intention of conveying to some of the newer organizations who have recently engaged in the manufacture of internal combustion engines of the Diesel type, some practical information regarding the selection and treatment of suitable materials for making pistons, piston rings and cylinders." With those words as an introduction he gets right down to business.

I. William Chubb, editor of our European edition, gives some notes on improvements in British machines, page 141. He says that progress in the British machine-tool industry during the past ten years has been mainly by way of details and then proceeds to describe a number of them. A dozen of the improved machines are illustrated. As only a word in regard to improvements on machine tools is needed to start the average reader's interest, we'll pass on without further comment.

Locomotive repair work is well into the limelight at present. A question that is causing some unrest in certain quarters is whether the repair work should be given out to such firms as locomotive builders or performed in the railroad shops. Judging by the reports we have heard and read concerning the large amount of railroad equipment that is out of order, it would seem that the railroad shops might have a fairly big job to do all of the repair work. We want to help if we can, and so we have been publishing railroad shop articles. Up to date they have been concerned chiefly with methods. In this issue, page 147, we vary the program by running a story on the layout and equipment of the locomotive repair shops of the B. & O. at Glenwood, Pa. Probably the most interesting part of this article is the drawing showing the plan of the shops and the arrangement of machine tools.

Last week we ran an article, "Meeting the Present Emergency," and said that we should, in all probability, have something further on the same subject. We do —page 151—and there will be more in later issues.

Of universal interest in the news section (two extra pages this week) are the report on business conditions in England and the report regarding the opposition to his tractor plans met in Germany by Henry Ford.

Coming Features

Before getting down to the pleasant task of writing the advance notices for next week's issue, we want to look a little farther ahead. The magnetic chuck series, the foremanship stories and the series on metal cutting tools are to come along as previously announced, on alternate weeks. Our railroad articles are by no means exhausted. Stanley and Hunter have written some good ones and we have scheduled them for several weeks ahead at the rate of one per week. We have not forgotten the reader who prefers mathematical treatises and we are bearing in mind the man with a craving for automotive stories. On the whole, a good outlook, we think.

In the issue of February third, there will be the second of Colvin's stories on the foreman and his job, the third part of DeLeeuw's series, taking up standard planer tools, and the fourteenth part of Basset's series on modern production methods, which is devoted to analysis of labor costs. Among the one-part articles are "Shop Politics" by L. J. Vorhees, "The Use of Special Fixtures in Grinding Operations," by Sheldon, and a railroad shop article by Stanley.

EDITORIALS

Start Buying Now

A PANIC due to a fire in a public hall comes of a fear in the mind of each individual that he may not be able to get out alive. In most cases there is ample time for all to get out if they will go in an orderly manner.

The same state of mind exists at present regarding business. Fear of the present and future is delaying the return of normal buying.

We have had an orgy of spending to carry on the most costly and wasteful occupation in the world—war. The billions which we borrowed so easily must be paid back in the form of taxes. The sooner we realize that this is the case and get down to work, the better.

We have bought extravagantly and at abnormal prices in many cases. But to stop buying altogether, is just as bad as to buy extravagantly. Without buying no business can be carried on.

The surest way to start business toward its normal volume is to begin buying judiciously at the earliest possible moment. Now that the excuse of inventory is out of the way, there should be no further delay. If everyone waits for the other fellow, there will be no resumption of business.

If you have faith in the future NOW is the time to show it. Buy the machines you need now. Begin to fill up your depleted stock of materials and supplies, if they can be bought at a fair price. Waiting for panic prices invites disaster to many—perhaps you may be one of the victims.

Various slogans have been devised to bring home to business men the need for doing intelligent and immediate buying. Most of them are too long to fit the little white space at the top of the right-hand pages in the *American Machinist* and so we have boiled them down to a short slogan that should be adopted with a full understanding of all that lies behind it.

Preach it! Practice it! Push it!

Buy Now—for Better Business

Our Greatest Expense Burden

WHEN a business concern is confronted with the problem of having expenses in excess of income, the first step is to study the items which go to make up the expenses. If it was found that one item formed 90 per cent of the total expenses, we would certainly study the item very carefully to see if it was all necessary, or if some of it could not be eliminated. There might be opportunities for economy in the remaining 10 per cent, but it would not be good business to spend much time on these items until we had studied the larger one.

If we found that this 90 per cent of our expenses was devoted to our private police force, in training new men, in buying arms and equipment which was constantly getting out of date, in paying pensions to those who had served us in the past, and all because we feared the manufacturers of some other town might come over to capture our plant, we would be apt to think the matter over pretty seriously in many ways.

Knowing how quickly arms and armament get out of date and have to be replaced, would we not consider the advisability of storing up, not arms, but the capacity for making them rapidly when the necessity arose? This would need some experimental work at all times, but many of those engaged on the force or in making their arms, could go on to really productive work.

Would we not also consider the possibility of getting together with the manufacturers of other towns with a view of cutting down some of this 90 per cent of our expense items? Suppose they agree to cut their police force in half if we would—wouldn't it be a nice healthy saving in our expense list? And are we so much more honest than all the rest of the world that we can say —"*They* wouldn't do it."

The millennium is still several days in the future. The desire and greed for the other fellow's possession has not yet passed away. But self interest shows that we cannot afford to pay too much for the so-called victories. The time has come when the cost of armament is more than can be borne. Self preservation against its burdens demands that some way be found of lessening this load in all countries.

Let us consider that if we can reduce our expenses in this direction by only ten per cent, it about equals all the rest of the cost of government.

This is not a question to be decided hastily. It needs the careful judgment of the best minds who can weigh all sides of the question. The jingoes and alarmists who see wars around the corner, and the extreme pacifists are equally dangerous at this time. The former are too often interested financially in the wars they foment, and the latter greatly underrate the extent of human passions.

It is pre-eminently a time for the sane and conservative element to exercise their valuable function of counterweight to the extreme factions on either side and to get us started on the path to "normalcy," as the President-elect puts it.

It Depends Upon Whose Ox Is Gored

THE Supreme Court decision forbidding combination for secondary boycotts hits the organized labor activity in this field severely. The Machinists' International Union offices in Washington have taken a public stand on this in a statement of V. S. Gauthier, an official of this union. The labor organizations feel that they must now seek the repeal of the Clayton act since it applies the anti-trust regulation to trade unions as well as to corporate organizations.

Mr. Gauthier says: "The latest decision virtually nullifies all the good of the Clayton act. It was passed as beneficial to labor. It now stands in a position forbidding labor to seek assistance of its friends in carrying on a peaceful campaign against non-union or antagonistic corporations." In this statement it is clear that the labor leader quoted does not object to the interpretation of the court but rather to the continuance of an act which labor advocated, thinking that it was effective only against organized corporate agencies. The court is bound in its decision to interpret what the law says, not what the proponents of the law thought the legislation would do if adopted.

It is not worth while to discuss here the merit of combinations either of labor or of capital as regulated by the Clayton act. Whatever one may feel is for the best public interest, the decision of the court leaves no ground for doubt as to what must be regarded as the legal practice.

Such efforts as have frequently been used through the secondary boycott must cease so long as the Clayton act remains upon the statute books; the decision of the court is clear and final on this point.

Personnel Work—Now

ONE of the fundamentals of economical production and of sound and safe government is a unity of purpose, a spirit of co-operation, in the shop and in the community. We have been preaching that the welfare of the workers was identical with that of their employers. We have installed more or less elaborate "Personnel Departments" to aid in securing greater co-operation and better understanding.

With all that has been done in this line, and much of it has been highly commendable, it is disheartening to find that some of the larger firms are emasculating, if not abandoning, their personnel work. This is, we believe, a great mistake, for now is the time when it could be of greatest value in welding the bonds of unity which are so sadly needed.

The abandoning of personnel work as soon as labor becomes more plentiful is an acknowledgment that its main purpose was to get men, not to improve their relations with the plant. Dropping this work, as an unnecessary "frill" shows at once the true light in which it was considered by the management.

And this is sure to be noted and remembered by the men.

Times of stress and adversity draw men closer together when they have a common interest. A little human sympathy and understanding go a long way in securing the best kind of interest and co-operation. And this feeling of co-operation will be of the greatest value when the wheels of industry begin to assume their normal pace.

A little *more* attention to personnel work now—instead of less or none—is pretty sure to pay big dividends in the months to come. Men whose interest has been sustained and strengthened will take hold with much better spirit than men who have been cast adrift and then recalled without regard to what has happened to them in the meantime. Those who keep their personnel work going will reap the reward in the days to come.

SHOP EQUIPMENT NEWS

SHOP EQUIPMENT NEWS
A weekly review of modern designs and equipment

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

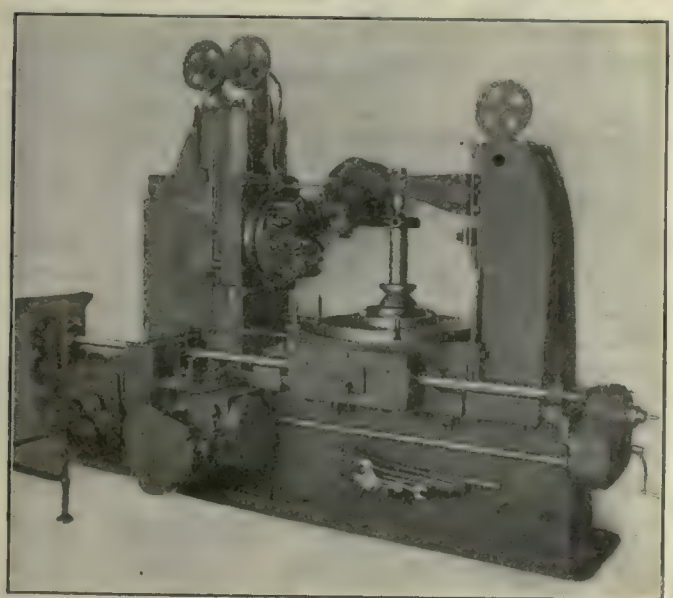
CONDENSED CLIPPING INDEX
A continuous record of modern designs and equipment

Newark No. 5 Automatic Gear-Hobbing Machine

The Newark Gear Cutting Machine Co., Newark, N. J., has added a No. 5 automatic hobbing machine, shown in the illustration, to its line of gear-cutting machines. The machine is stated to be intended primarily for the rapid production of accurate helical gears, being fitted for cutting street-railway and electric-locomotive gearing, herringbone gears for mill drives, and a large range of general industrial gearing. Wormwheels and straight-tooth spur gears can, of course, also be hobbed by the machine.

The machine, when belt driven, receives power through constant-speed tight and loose pulleys, not to be seen in the illustration, no countershaft being required. A flywheel is mounted on the pinion shaft of the cutter spindle, thus permitting the use of a light flywheel. Ten changes of cutter speed are provided by means of gears.

Feed motion is controlled by one lever, so as to connect with the indexing train for feeds governed by the revolutions of the work, or with the constant-speed driving train for feeds in inches per minute. The latter feeds are used with ordinary disk-cutters for cutting helical gears for which no hob may be available.



NEWARK NO. 5 AUTOMATIC GEAR-HOBBING MACHINE

Specifications: Face capacity, 18 in. Diameter capacity, 28 in. with outside arbor support in place. Minimum centers between work and cutter arbors, 2⅜ in. Hob capacity, 7⅜ in. in diameter by 9 in. long. Cutter arbor, 1¼ or 1½ in. in diameter. Work arbor, 2⅜ in. in diameter. Motor drive, when furnished, requires constant-speed, 7½- to 10-hp., 1,100- to 1,200-r.p.m. motor. Weight, 14,000 lb.

This is a semi-automatic operation, the indexing being done by hand with a special attachment.

Fifty-five changes of feed are provided. The feed can be changed at any time, even while cutting, no extra calculation being required. If, after beginning to cut a blank, the material is found to be softer or harder than estimated at the start, an increased or decreased feed can be obtained without re-figuring the lead gears.

The cutter carriage has a quick-return motion, so that hobs can be returned to the top of the gear blank for a second or finishing cut, if found desirable, and again passed through without any special resetting of hair lines or zero marks. That is, the machine automatically holds the hob in the work, in the proper helical path. The clutch lever, controlling the vertical feed screw, is locked in the operative position when set for cutting helical gears, so that accidental disconnecting by the operator of the helical train is avoided.

The work table is arranged to take solid pinions, where the teeth are directly cut on a shaft. Such pinion shafts up to 10 in. diameter can be accommodated. Regular taper-shank work arbors are held in a rigid flanged bearing or adapter, which sets in the work table. For the cutting of pinions and wide-face gears up to 28 in. in diameter, a heavy outside-support bearing is provided for the upper end of the work arbor. The support is of box section and has an arm mounted on it which grips the work arbor through an adjustable sleeve. It is stated that gear blanks can be mounted or removed without disturbing any of the vertical adjustments of the support, the support arm being simply unclamped and swung to one side. After mounting a fresh blank, the arm can be swung back in place and again tightened. Larger gears, up to 60 in. in diameter, can be supported by eight blocks and jacks.

The machine is provided with automatic trips for the vertical movement of the cutter and for the horizontal movement of the work. The vertical trip always operates to stop the entire machine. The machine is rated for cutting 2½ diametral pitch in steel or 2 diametral pitch in cast iron at a rapid production rate, and with a minimum grinding of hobs.

The chief feature emphasized is that the machine is able to hob helical gears of comparatively fine angle. It is stated that helical gears with teeth at angles of 3 to 5 deg. with the axis may be hobbed with the same facility as gears with teeth at angles up to 90 deg. with the axis. To obtain true bearing between helical gearing running on parallel shafts, differential gearing is introduced in the ratio or dividing train before the drive passes through the indexing change gearing. Thus the motion for the "one-tooth lead" in

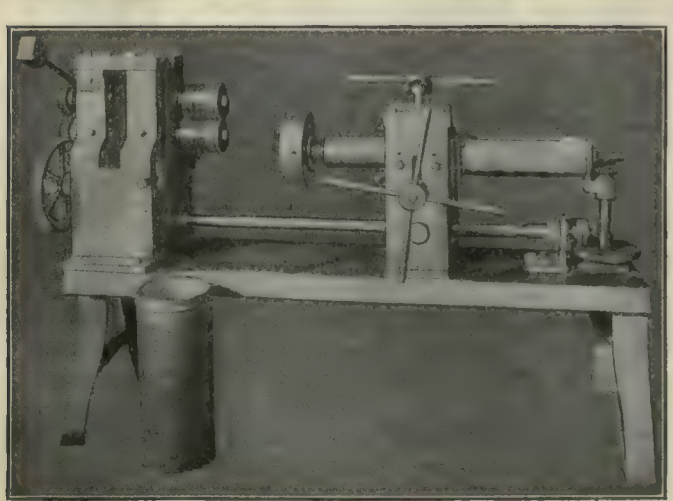
the ratio train is multiplied in proportion to the number of teeth desired in the finished gear.

When cutting gears with different numbers of teeth to run together on parallel shafts, the machine is said to be geared up for the one-tooth lead of the train, and the lead gearing remains constant during the cutting of the whole train, thereby producing the same angle and, consequently, a true bearing along the teeth of all the gears in the train. A chart is furnished with the machine, which gives the one-tooth lead change gearing for most of the commonly used angles and normal diametral pitches. With the chart, it is stated, the choosing of lead gears is just as simple as choosing the indexing gears, and no calculation is required on the part of the operator. A chart is also furnished in which the one-tooth lead change gearing is arranged numerically.

Merey Rotary Embossing Machine

Julius Merey, 2842 N. Maplewood Ave., Chicago, Ill., has recently placed upon the market a machine for embossing letters in sheet metal, either flat or bent in cylindrical shape. It is especially intended for embossing the legends in ice-cream and milk cans, a sample of the work being shown near the machine in the accompanying illustration. Thus, the articles can be marked as desired after being made up in the complete form, instead of embossing the letters in the flat sheet before shaping the can.

The machine consists primarily of two heads mounted on a heavy cast-iron table. The head at the left carries the embossing rolls, the shaft of each being mounted in two phosphor-bronze bearings. The rolls or dies are made of interchangeable segments, so that any combination of letters or figures can be put in place. The shafts carrying the dies are driven by gears through a positive clutch from a 16-in. pulley back of the headstock. The bearings of the lower shaft can be moved vertically, so as to allow of opening and closing the space for the work. The gears on the ends of the shafts are driven by worms mounted vertically. The shaft of the upper worm slides in the lower worm, being splined to it, so that separation of the rolls does not affect the relative positions of the figures on them. The machine is automatically stopped at the completion of each embossing operation, at the same time the rolls being automatically moved $\frac{3}{8}$ in. apart, so that the work can be removed.

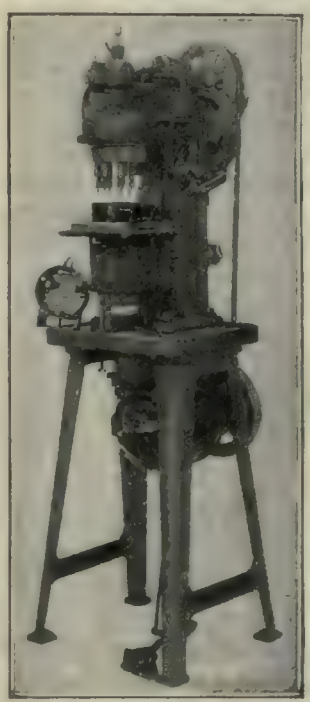


MEREY ROTARY EMBOSSING MACHINE

The head on the right is for the purpose of holding the can or article to be embossed, a chuck gripping the work. Both longitudinal and horizontal movement are provided for the chuck, so as to provide for the handling of work of different sizes. The chuck is rotated by means of power derived from the head on the left, a friction plate being incorporated, so that the speed of the work can be suited to the speed of the embossing dies. The machine can emboss three rows of letters at the same time in 16-gage sheet steel, 3 hp. being required. It weighs about 2,000 lb.

Langelier Semi-Automatic Multiple-Spindle Tapping Machine

The Langelier Manufacturing Co., Arlington, Cranston, R. I., has placed on the market the semi-automatic tapping machine shown in the illustration. The machine, which is similar to some previous designs made by the company, is provided with a number of spindles; and, as illustrated, is fitted for tapping simultaneously nine $\frac{1}{4}$-in. and two $\frac{5}{16}$-in. holes in a meter case, the production being stated as six cases per minute. The machine is started by depressing a treadle, the round leather belt from the motor under the table being moved onto the forward driving pulley. The main spindle of the tapping head is thus set in motion through gearing. The spindles in the multiple tapping head are crank driven, and are secured with fixed center distances in bronze bearings. The tapping heads are interchangeable, so that different layouts of holes can be handled. Each spindle is provided with an arrangement which permits the tap to follow its own lead independent of the other taps. Taps of different pitch can thus be used simultaneously, and it is claimed that clean-cut threads are produced by this method.



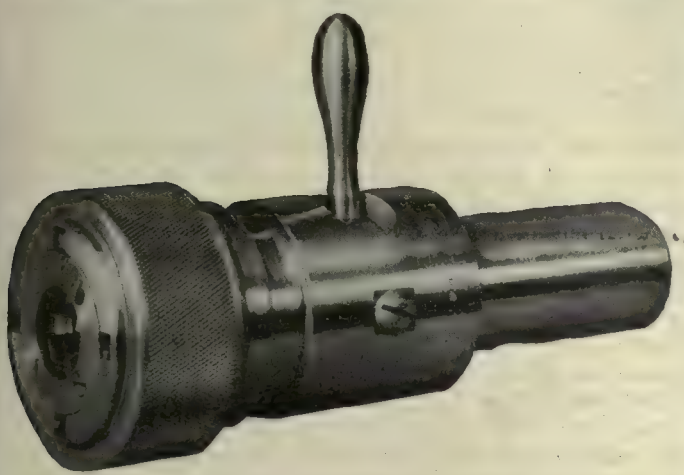
LANGELIER TAPPING MACHINE

The work is carried on a table which is raised mechanically at the same rate that the taps enter the work. When the taps have penetrated to the desired depth, the belt is automatically shifted to the reverse pulley, thus reversing the taps and lowering the table at a speed about twice that used for tapping. When the table reaches the loading position, the belt is automatically shifted to the loose pulley so as to stop the machine.

Victor Style "E" Self-Opening Die Head

The Victor Tool Co., Inc., Waynesboro, Pa., has recently placed on the market the Style "E" self-opening die head, the tool being the redesigned Style "D" head formerly made by the concern. The illustration shows the head, which is intended for stationary use, in the closed position. The same tool adapted to rotary use, as in a drill press, is known as the Style "R" head.

It is stated that the tool is simple in design and positive in operation. The chasers are provided with slots in which fit tongues on the ring controlling the positions of the chasers. They are the same in style as those used in the collapsible taps. The chasers, when in the cutting position, are supported along their entire



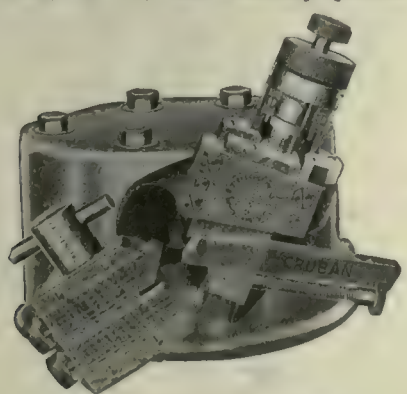
VICTOR STYLE "E" SELF-OPENING DIE HEAD

length back of the cutting edges. The tool can be adjusted for size to enable the cutting of tight or loose threads by turning the large knurled, graduated collar, a range of about $\frac{1}{16}$ in. both under and over size being obtainable. A locking screw holds the collar in place.

The standard shanks are hollow, thus permitting the threading of long rods. For cutting close to shoulders, the chasers can be extended through the cap. Special shanks can be furnished. Heads can be provided either with an internal tripping device, of or the regular pull-off type, whereby they automatically open when the carriage slide is stopped. The head can also be opened by means of the handle. One strong coil spring is used in the head, which is made entirely of steel and said to be very sturdy and durable. At present the head is made in only two sizes, one with a capacity from $\frac{1}{8}$ to $\frac{1}{2}$ in. and the other from $\frac{1}{4}$ to $\frac{3}{4}$ in.

Cruban "Micro" Box Tool

The Cruban Machine and Steel Corporation, 63 Duane St., New York, N. Y., has recently placed upon the



CRUBAN "MICRO" BOX TOOL

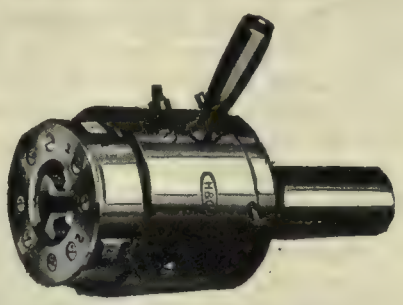
market the box tool shown in the illustration. It is intended for use on screw machines and automatic lathes, is provided with a 1-in. shank, and can handle bar stock up to 1 in. in diameter. The toolbit can be adjusted to or from the work by means of the knob shown at the top, a dial being provided so that the movement can be read directly in thousandths of an inch. By means of the small screw on the end of the adjusting knob, the micrometer screw can be locked in place.

The "V" guides are controlled by spring pressure. They can be held in place by the locking stud, after their proper position has been determined by allowing them to spring against the stock. In order to lock them in position, the screws back of the guides are provided, thus preventing slippage. A bushing plate can be furnished that will hold bushings of any size within the range of the tool, so that either the V-guides or bushings can be used.

The high-speed steel toolbit is provided with a notch at the end, into which an adjusting nut is placed. The tool is thus prevented from slipping while in use, and can be readily removed or regulated by this means.

H & G Die Heads

The Eastern Machine Screw Corporation, New Haven, Conn., has recently placed on the market several additional sizes of the H & G line of self-opening die heads. The heads are made in three principal styles. Style "A" is for automatic screw machines, such as the Cone or Gridley. The added sizes in which the head is made are $2\frac{1}{2}$ and 3 in., with capacities of $1\frac{1}{2}$ to $2\frac{1}{2}$ in. and of



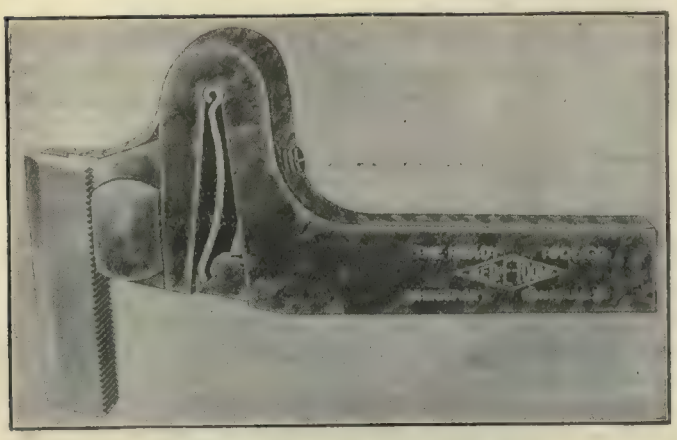
H & G STYLE "C" DIE HEAD

2 to 3 in., respectively. The other sizes range down to $\frac{1}{4}$ in.

Style "C," which is illustrated, is intended for use on machines such as turret lathes, where the die head does not rotate. The added sizes are 2, $2\frac{1}{2}$ and 3 in., having capacities of 1 to 2 in., $1\frac{1}{2}$ to $2\frac{1}{2}$ in. and 2 to 3 in., respectively, the other sizes being smaller. The third head is intended for use with Brown & Sharpe machines, a $\frac{7}{16}$-in. size being added. It is stated that the heads can meet practically all requirements in thread cutting.

Ready Spring Threading Tool

The spring threading lathe tool shown in the illustration has recently been placed on the market by the Ready Tool Co., Bridgeport, Conn. The tool has a gooseneck, so as to allow the cutting of smooth threads and the elimination of chatter. The cutter is made of high-speed steel and held at an angle of 15 deg. from the vertical. The side angles are so ground as to cut a 60-deg. thread. Only the top surface of the cutter is ground when sharpening the tool. The cutter is secured on the left side of the holder by means of a dove-tailed joint, so that threads can be cut close to a shoulder. There are teeth in the back of the cutter and in the front of the dog holding it in place. The dog is clamped to the holder, so that the cutter is prevented from slipping.



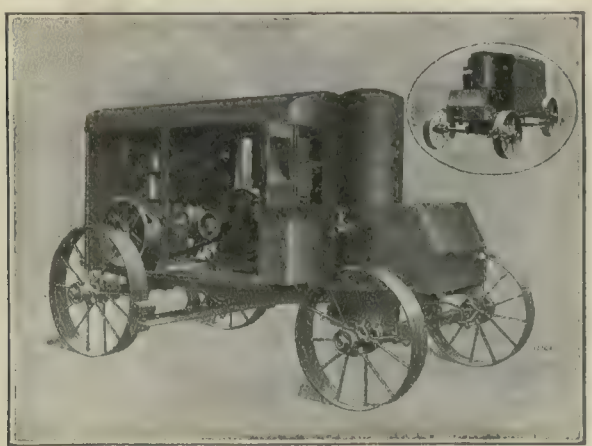
READY SPRING THREADING TOOL

In order to vary the resistance to bending of the goose neck, a curved auxiliary spring is provided. When cutting fine pitches, the spring does not come into use, but for heavy pitches the auxiliary spring can be tightened, so that more pressure is required on the cutter to bend the neck. V-shaped cutters, as well as U. S. Standard chasers, are carried in stock. The tool is made with right-hand offset, and is ½ x 1 x 7 in. in size.

Ingersoll-Rand "Imperial Type-14" Electric Portable Air Compressor

The portable air compressor shown in the illustration has recently been added to the line of the Ingersoll-Rand Co., 11 Broadway, New York, N. Y. It is known as the "Imperial Type-14," electrically driven compressor, being similar in general characteristics to the gasoline-driven compressor described on page 736, Vol. 51, of the *American Machinist*.

The motor, which can be furnished for either alternating or direct current, is fastened to a sub-base bolted to the cast-steel main frame. The compressor is driven by a belt and has two cylinders cast en-bloc. Plate-type air valves are used for both intake and discharge. The compressor is cooled by means of a thermo-syphon system, a radiator and fan being provided. The equipment includes air receiver, pressure gage and drain, service and safety valves. A light steel housing is provided, so that the motor and compressor can be entirely inclosed.



INGERSOLL-RAND "IMPERIAL TYPE-14" ELECTRIC PORTABLE AIR COMPRESSOR

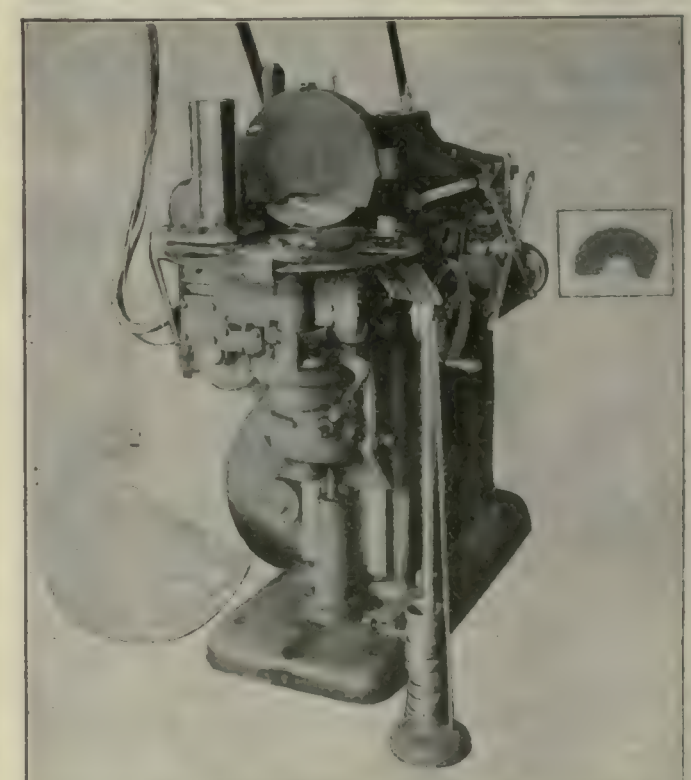
Specifications: Capacity, 118 cu.ft. of free air per minute. Pressure, 100 lb. per square inch. Compressor: two cylinders, 6 x 6 in.; speed, 525 r.p.m. Motor, 25 hp. Receiver: capacity, 8 cu.ft.; size, 1¾ ft. diameter x 5 ft. high. Wheels: front, 30 in.; rear, 36 in.; face, 6 in. Tread, 4 ft. 8 in. Weight, about 4,450 lb.

Persons-Arter Piston-Ring Grinding Machine

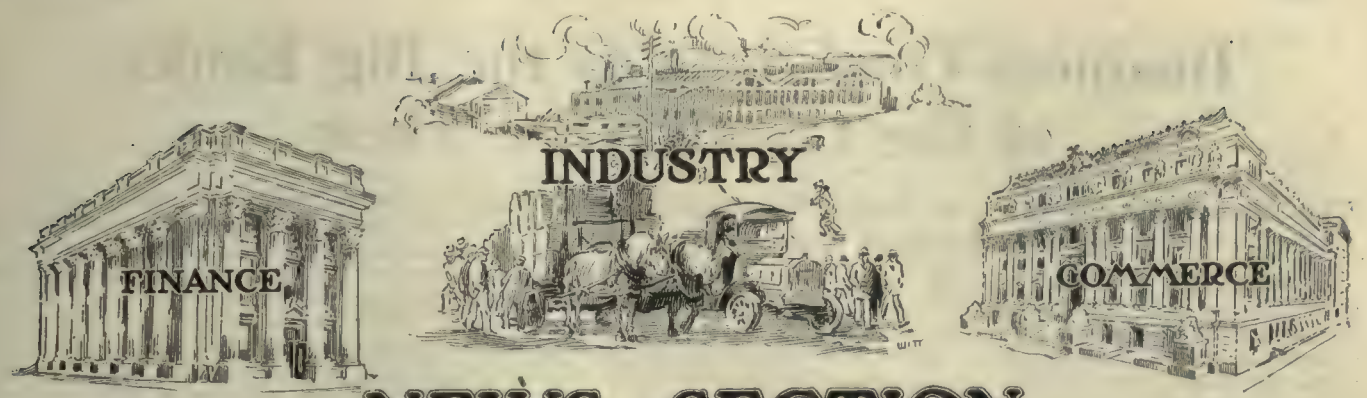
The Persons-Arter Machine Co., 72 Commercial St., Worcester, Mass., has recently placed on the market an attachment for its standard rotary-table grinding machine, that enables the automatic grinding of piston-rings. The illustration shows the attachment in place on a machine constructed especially for this purpose, single-speed chain drive to the work table being used instead of the usual belt on three-step cone pulleys.

The attachment feeds piston rings on and off the work table automatically, is operated by compressed air taken from the air lines of the shop, is a complete unit in itself, and depends upon the machine of which it thus becomes a part only for the timing of its movements. The device consists primarily of the following parts: A bronze plate mounted upon the upper end of a short vertical shaft and having six openings equidistantly disposed about the center, each being suitable to receive a piston ring; a ratchet and pawl and indexing plate provided with a locking pin to accomplish the intermittent rotative motion of the bronze plate, and thus to properly position the work on the magnetic chuck on the work table; an air cylinder with the proper mechanical connections to the piston to supply the power for producing the movements mentioned, a pressure above 25 lb. per square inch being required; and an automatic demagnetizing switch.

In the illustration, the guard has been removed from the rotating plate feeding the rings, and also the cover from the box on the pilot-wheel shaft containing the demagnetizing switches. The air cylinder is underneath the work table, a balanced D-valve being used, and the piston rod being provided with rack teeth which engage the gear to be seen on the vertical shaft. It is stated that the movements of the mechanism are quick, but without shock.



PERSONS-ARTER PISTON-RING GRINDING MACHINE



NEWS SECTION

Detroit Machine Tool Company to Make Automotive Parts

The Detroit Machine Tool Co., Detroit, Mich., in addition to manufacturing machinery has announced that it is going to specialize in the manufacture of ten automotive parts for which it is especially well equipped. At present the company manufactures a semi-automatic drilling machine and a centerless cylindrical grinder. The manufacture of automotive parts was one of the company's lines up until 1918 when the demand for its drilling machines and grinders became so heavy that it was decided to give up the manufacture of parts temporarily and supply the demand for machinery.

H. W. Holmes, the president, however, felt that the manufacture of parts should be taken up again as soon as possible and after consultation with the directors in the early part of this year, it was decided to increase the capitalization from $150,000 to $300,000 and build a larger factory. The new building gives a total floor space of 37,200 sq.ft.

The ten parts to be manufactured all call for centerless grinding operations, as well as occasional drilling operations. The parts to be made are piston pins, valve roller pins, roller clutch pins, straight push rods, oil-pump plungers, roller bearing rolls, differential gear pins, headless king bolts, short gear shafts and straight dowel pins. These parts will be made in both large and small quantities and wherever a prospect for the centerless grinder does not feel his production will warrant the purchase of a machine, the parts will be made for him.

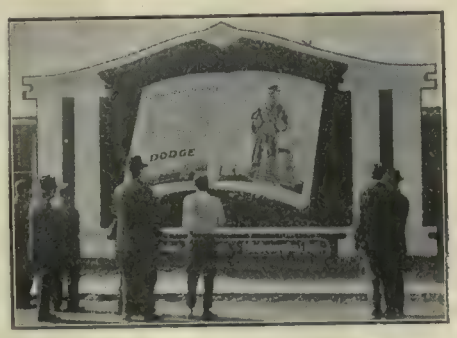
A New Prosperity Campaign

A national "Buy-Now-and-Put-the-Men-Back-to-Work" campaign is announced by the National Prosperity Bureau, which has opened headquarters in the Masonic Building in New York. The bureau originated with a group of business men who have sensed danger in the closing of factories and mills and the increasing army of unemployed.

They aim to drive home to every person in the United States that when people stopped buying the necessaries of life men were thrown out of work. To impress this message upon the nation resort will be freely had to posters. Already several artists who created Liberty loan posters are at work on a series of posters which should aid in clearing away the depressing atmosphere and inspire confidence.

Selling the Product to the Men

One of the main essentials in maintaining the quality of any product is to instill the workers with a sense of personal responsibility concerning it. With this in mind the Dodge Manufacturing Co., Mishawaka, Ind., includes its own men in the company's advertising campaign. The billboard shown in the accompanying illustration is just outside



SELLING THE PRODUCT TO THE MEN

the entrance of one of the Dodge plants and is a constant source of interest to the employees. This brings home to the men the claims of the company regarding quality and service and puts it up to them to make good.

New Jersey to Have Safety Museum

New Jersey's State Industrial Safety Museum at 571 Jersey Ave., Jersey City, said to be the only one of its kind in the country, will open about Feb. 1. The museum is an official clearing house for the standardization in New Jersey of accident prevention, fire protection, industrial sanitation and stabilizing of labor. The museum was established through the co-operation of chambers of commerce and manufacturers. On the top floor of the building are models of dangerous machinery, showing how it should be safeguarded.

The American Railway Association and the Metric System

The metric propaganda, whose aim it is to force on this country the compulsory use of the metric system while studiously ignoring its permissible use under the existing laws (act of July, 1866) has made strenuous efforts to gain the support of the American Railway Association to its program.

At the meeting of the "engineering division" of the A. R. A. held in March, 1920, at Chicago, resolutions were passed in opposition to the use of the metric system.

Again in June, 1920, similar resolutions were passed at a meeting at Atlantic City by the "mechanical division" of the A. R. A.

Under date of Nov. 24, 1920, a communication has been received from J. E. Fairbanks, general secretary and treasurer of the A. R. A., from which we quote:

"On the recommendation of the executive committee the American Railway Association, at its session on Nov. 17, 1920, adopted the following resolution:

Resolved, That the American Railway Association hereby ratifies the action taken by the Engineering and Mechanical Divisions in opposition to the adoption of the Metric System of Weights and Measures to the exclusion of the English or American system at present in general use and desires to express its hearty approval of the effort which is now being conducted to combat the propaganda being waged throughout the country urging the enactment of legislation whereby the Metric System would be made the sole standard of weight and measure.

American Welding Society Has New Section

Another section—that of Schenectady, N. Y.—of the American Welding Society was organized at a meeting held in the Engineering Societies Building, 29 West 39th St., New York, on Jan. 18, by W. E. Simonds, of the Metropolitan Section. Much interest was shown and over thirty members enrolled despite the very inclement weather.

Cleveland, Chicago, St. Louis and Seattle members and those of a number of other cities have signified their intentions of organizing these sections.

The society is endeavoring to further the interests of all classes of welding and give its respective clien tele the best service.

Business Conditions as the Big Banks of the Country See Them

The First National Bank of Boston Reports Some Revival in New England Business

December bank clearings were only about 10 per cent less than for the similar month of 1919, and lower values of goods account for much of this moderate shrinkage. Retail trade, good during the holidays, continues in healthy volume and is responding remarkably well to price reductions which are steadily being made, as stocks are replenished with cheaper goods. While retailers are buying for their immediate needs only and apparently propose to adhere to this policy during the period of unsettled prices, the aggregate of their purchases is large. This demand has gradually placed the jobbers in much stronger position, and orders are now reaching the manufacturers in larger volume. In New England it can fairly be said that there is a marked improvement in business sentiment, based primarily on two developments. In the first place, the peak of the credit strain is believed to have been passed. While too much importance should not be attached to the lower New York call rates, evidencing more plentiful money in that center, nevertheless they are symptomatic and, coupled with small increases, week by week, in the Federal Reserve percentages, point to gradual relaxation in money. Secondly, in at least three major industries there is actual increased activity. The cotton mills have made a sincere attempt to establish prices which would produce orders and give their employees as many days' work per week as possible. It is evident that several large interests have started up their mills on orders taken at prices below reproduction costs even assuming full-time operation, low cotton and the new reduced wage schedule. To be sure, these prices have in most instances been withdrawn and slightly higher ones substituted. The fact remains that a few mills have gone on full schedule and many have increased materially their running time. A large volume of cotton goods has been sold in the last three weeks. In the shoe and leather industries there is a more buoyant feeling, due to larger sales, and here and there an improvement in price. Wool merchants report moving their commodity in larger amounts, especially in the last ten days. Prices remain without much change except, perhaps unexpectedly, in the finer grades, which have improved slightly in response to the recently developed dress goods demand.

All these changes, while favorable, are of small proportions, but they account for the opinion in this section that a slow and gradual recovery from the business depression is under way. It is becoming clearer that the complete readjustment of price trading levels will take a long time. Good business, that is, the free interchange of commodities, cannot be expected so long as the relative values of goods remain so far out of balance. An analysis of the commodity indexes shows some materials below pre-war prices, some at the latter figures, and some, including labor, at approximately double pre-war levels. The average is perhaps 65 per cent above 1914 prices. Obviously much remains to be done to restore the natural relations—a task of many months.

The price reaction in cotton and cotton goods appears to have reached its low level for the time being. Mills are operating more machinery on lower cost levels, following the wage reductions now in effect, and there appears to be a firm promise of more efficient production.

Guaranty Trust Company of New York Comments on Business Conditions and Government Economy

At the opening of the new year most résumés and forecasts of business conditions are sounding an optimistic note. It may be observed that practical men of affairs who are acquainted with an understanding of the underlying conditions in this and other countries are confident that a turn for the better will soon disclose itself.

Reduced to its simplest terms, the situation is that most other countries, and particularly those of Europe, need the things which America produces, but are unable to pay for them at the present time, an inability which increases as prices rise, and which cannot be overcome entirely until they fall. So long as prices remain at high levels, therefore, both the foreign and domestic demand for American goods will be curtailed. When these prices return to a level that reflects the relation of the demand for goods to the supply of goods, and only that relation, we shall have normal buying and selling again and, considering the losses of the war years and the long time it will take other countries to re-establish their productive and distributive processes, there can be little doubt that the results will be advantageous to us.

In appearing again before the Senate Committee on Finance, Secretary of the Treasury Houston urged the utmost economy, opposing the revival of the War Finance Corporation, the enactment of a soldier bonus law, and the extension of a $1,000,000,000 credit to Germany. He declared that "unless every unnecessary expenditure, such as the proposed appropriation for the payment of soldiers' bonus, be avoided; unless every official or other estimate or request for appropriations be reduced to a minimum, no sound plan of tax revision can be carried out, and the successful financial conduct of the government during the next three years will be seriously imperiled." In discussing his recommendation that the revenue from taxation be maintained after this fiscal year and until the close of the fiscal year 1923 on a level of at least $4,000,000,000, the Secretary urged the reduction of the extreme income surtaxes, "not to exempt the rich, but to tax the rich"; the replacing of the excess profits tax, primarily because it is losing its productivity and "promises in the near future to become a statute of exemptions rather than an effective tax"; and the retention of a simple system of specific sales or consumption taxes. With respect to replacing the excess profits tax, Secretary Houston said:

"I recommend that it be replaced—not merely repealed—with a simpler and more certain tax upon corporation income or profits. I suggest in this connection for the consideration of the Congress either a flat additional tax on corporation profits, such as has recently been adopted in the United Kingdom, or a tax upon the undistributed profits of corporations under which, if adopted, corporations should be expressly authorized to pay taxes through their stockholders, as partnerships are now taxed through their members. By either of these proposals the income tax on corporations could be made a fair equivalent for the income tax as now applied in effect to individuals, partnerships and corporations."

Price recessions and curtailment of industrial output marks the turn of the year. The immediate effect of the close of the holidays is, of course, greater economy than usual on the part of the buying public. This influence upon business and prices this year is augmented by the growing amount of unemployment. Conditions in the labor market have made it possible to reduce wages in many instances, but, as evidence of the new spirit which marks the relations of employer and employee in our time, it is reported that reductions are being made slowly and in conformity with the dictates of the business situation. In a number of cases the reductions have occasioned offers by employees to run plants and these offers have been accepted, with a growing appreciation of the difficulties of profit making resulting. The larger industrial and financial leaders are confident that no prolonged period of depression need be feared.

World-Wide Decline in Prices Continues

The price toboggan is working in every part of the world and in a very large share of the articles forming international trade. Of the seventy-five principal articles of our import trade, for which the average import price is stated by the official records of the Government, all but four, says a statement by the National City Bank of New York, are lower in the November, 1920, import record than in earlier months of the year 1920. The articles in the official list which "refuse to come down" are newsprint paper, wood pulp and bananas.

These official figures of the average monthly import price of the principal articles entering the country are an especially valuable index of world prices. The laws of the United States, which are unique in this respect, require persons in foreign countries who are exporting merchandise to the United States to state in writing and under oath before a consul of the United States the quantity and value of the articles being sent to the United States, or in case of the absence of such statement the consul is required to report the shipment and state the value per unit of quantity in the wholesale markets of the country or city from which the merchandise is sent. These statements, which become the basis of the official valuation of the merchandise imported, are distinctly the prices in the country of production or exportation to the United States, and thus present an exceptionally accurate picture of world prices from month to month.

The unanimity with which prices the world over have already "come down" is evidenced by the fact that 72 out of the 76 articles included in the import price list show a lower valuation per unit of quantity in November, 1920, than in earlier months of the year. Raw cotton, for example, is valued in the November, 1920, imports at 28.7 cents per pound against 69 cents per pound in August of the same year; raw silk $6.34 per pound against $12.28 in March; clothing wool 27.4 cents per pound against an average of 60.4 cents in May; Manila hemp $245 per ton against $377 per ton in July; flax $872 per ton against $2,648 in August; cattle hides 20.6 cents per pound against 33.6 cents in February; goat skins 62.8 cents per pound against $1.20 in May; pig iron $30.60 per ton against $95.28 in September; coffee 15.3 cents per pound against 22.1 cents in January; cocoa 10.2 cents per pound against 17.9 cents in March; fresh beef 13.6 cents per pound against 17.9 cents in May, and rice 5 cents per pound against 11 cents per pound in February. These are only a few of the more important items.

British Exchange Situation Improving—United Kingdom Big Gainer from War

Recent improvement in the exchange position of the pound sterling, although its immediate effect on trade may be of a negative nature on account of the hesitancy of buyers abroad and although the gains registered since the first of the year may be in part due to temporary influences, is sufficiently encouraging to warrant optimism in any consideration of Great Britain's ability to increase her buying power for American goods, according to the Guaranty Trust Co.'s international trade survey, "American Goods and Foreign Markets." The undertone of the British exchange market continues firm, and, despite fluctuations by which recent transactions have been marked, there are indications that the upward trend may have a decided salutary effect on the United Kingdom's foreign trade.

Significant in considering Great Britain's outlook are the figures recently issued by the Savings Banks' Association of the State of New York, which show that the British Empire profited more in a monetary way as a result of the war than any other nation, her estimated wealth now being approximately 230 billion dollars, as compared with 130 billions when the war started. This gain of 100 billion dollars is attributed to the wealth added by the Mesopotamian oil fields, African territory taken from Germany, and elimination of Germany as a trade competitor, and will serve as an important asset in the recovery and expansion of foreign trade.

Government-Sold Machine Tools

All machine tools sold prior to Jan. 1 as surplus property by the War Department brought in $10,689,360.79. This does not include machine tools transferred or sold to government departments or agencies.

Convention of New England Foundrymen's Association

The New England Foundrymen's Association, whose membership includes representative foundrymen throughout New England, assembled in convention on the afternoon of Wednesday, Jan. 12, 1921, at the Exchange Club, corner of Milk and Batterymarch Sts., Boston, Mass.

Officers for the ensuing year were elected as follows: President, C. S. Lovell, Walker-Pratt Co., Watertown, Mass.; vice-president, E. H. Ballard, General Electric Co., Lynn, Mass.; treasurer, George H. Gibby, Gibby Foundry Co., East Boston, Mass.; secretary, Fred F. Stockwell, Barbour-Stockwell Co., Cambridge, Mass. Appointments on the executive committee were Charles A. Reed, Reed, Fears & Miller, Boston, Mass.; George A. Ray, Taylor-Fenn Co., Hartford, Conn.; L. M. Sherwin, Brown & Sharpe Manufacturing Co., Providence, R. I.; Harry T. Welch, Milford Iron Foundry, Milford, Mass.; John Bush, Chapman Valve Co., Springfield, Mass.

Dinner was served in the banquet hall of the club to about 300 members of the association and guests. A musical program was rendered during and after the dinner.

Surplus War Planes Sold

The Aëromarine Plane and Motor Co. has taken over $4,000,000 worth of surplus naval aircraft and engines. This marks the first step in the retirement of the Government's surplus aëronautic stocks.

Rolls-Royce Production Started

The American works of the Rolls-Royce Co. has reopened at Springfield, Mass., on a full production schedule. About 600 workers are employed and more will be added.

To Establish Technical School

Officials of the Brown-Lipe-Chapin Co., of Syracuse, N. Y., are to establish a technical school for employees. Employees will not be compelled to attend the school but every one will be given a chance to make himself better fitted for his job and the one next higher. A large reference library was established some time ago and is working out well, officials say, as it provides sort of a preparatory school for the technical workshop which it is planned to operate soon.



LARGE WOOD-TURNING LATHE FOR TURNING SHIP MASTS

The lathe shown in the illustration with the forty-four men lined up at the back was built for the Government by the Oliver Machinery Co., Grand Rapids, Mich. It is understood that this lathe, with its two feeding carriages, is now in use turning spars and ship masts. It will be noticed that there are two steadyrests for supporting the long and heavy work. The bed of the lathe is 62 ft. long. The lathe will swing work 32 in. in diameter.

Business Conditions Generally Bad in England but There Are Several Bright Spots

By I. William Chubb, London Correspondent

The winter of our discontent remains with us. Unemployment and underemployment grow. Dividends are being passed by some few firms, these including Vickers, the Austin Motor Co., the Edison Swan Co. and the (Silvertown) India Rubber and Gutta Percha Co. The reasons are various and the failure to pay out is not necessarily because there are not profits to be divided. Thus in the cases of the Edison Swan Co. and also the India Rubber Co., both of course electrical concerns, the capital is wanted in the business and dividends are therefore withheld from the shareholders. Generally speaking the latter have been warned that, though trade may be expected to revive in due course, industrial concerns may prove disappointing for another year or so.

One of the banks has issued a return showing the amount of the new capital issues for 1920. Borrowing by the British government, shares issued to vendors, allotments arising from the capitalization of reserves, etc., and municipal and county loans were excluded in the calculation, except where a specified limit was placed to the total subscription. The result for the year exceeds £384,000,000. The total is, in fact, considerably more than 50 per cent in advance of 1919. The largest amount for a given month appears to have been subscribed in March; namely, more than sixty-nine millions; and the lowest, naturally in December, about eight and one-half million pounds. Of the total, 309 millions went into industrial undertakings.

Motor Trade in Worst Condition

While the whole of industry is depressed in the engineering world the motor trade is in the worst condition. This is shown in the cases of the two latest firms to announce the appointment of receivers. It is understood that Angus-Sanderson & Co., Ltd., of Birtley, is putting its business in the hands of the receiver. The same has been done by the Sheffield firm of W. S. Laycock, Ltd., which apart from railway carriage work, etc., has manufactured airplane-engine parts. This firm issued at the middle of 1919 £220,000 in 5 per cent debenture stock guaranteed as to interest, etc., by Charron, Ltd., the motor concern. The decline in the motor industry naturally has its effect on other branches, particularly machine tools. The ball-bearing industry may be instanced as one which, passing from the stage of pressure to short-time employment, will have to search for the possibilities of other applications, with a view to the discovery of further markets.

In answer to a question in Parliament a return has been made showing the British-made rail-locomotive exports from the United Kingdom for eleven months of last year. During that period 545 main-line engines were sent abroad and 201 contractors' and other light engines. Some 428 main-line engines and 126 light engines were sent to the British dominions and dependencies, largely to India, the rest going mostly to South America; though Portuguese possessions in India received twenty-eight main-line engines and Siam twenty-two.

India Thought To Be Recovering from Its Financial Troubles

India, by the way, is thought to be recovering from its financial troubles and those who are interested in Sheffield report that steel makers are beginning to look in that direction again. This industry is naturally feeling the effect of the cancellation of shipbuilding orders. The Clyde shipbuilding output last year amounted to a gross total of 672,500 tons, 8,000 tons more than 1919, though about 84,500 tons below the 1913 record. Speaking of metals, it has been stated that "one or two important American firms, including one of the largest metal concerns in the world," have of late been applying for loans in London, financial conditions on the United States side being described as exceedingly tight, the applications being made even at the high-dollar exchange and the high rate of interest. At the last London iron and steel exchange the tone is reported officially as decidedly more cheerful, although actual business did not show material expansion. Carriages, it was reported, have been ordered lately by English and Siamese railways. Further than this, a British group, including three Sheffield firms, will undertake the repair, etc., of the Roumanian state railways and extend and equip the workshops concerned, with great advantage, it is thought, to the British toolmaker.

The Unemployment Problem

In order to mitigate the evil effects of unemployment the government has appealed to industry, both employer and employed, to extend the short-time system of working. Of course this system is exceedingly well-known in the cotton trades, the boot and shoe industry and, in the past, in the steel and engineering trades. The government dockyards and state factories are being placed on short time and, according to present orders, many of the men in the ordnance factories of Woolwich are to stand off one week in six.

As regards the building trades, of course, the government is endeavoring to persuade trade unions to admit some 50,000 ex-service men into the ranks of building workmen. The proposal has been discussed for a very considerable time. While on more than one occasion the government had apparently been firm in insistence on a definite decision being given by the unions on a given date, up to the present an excuse has always been found for putting this off.

In regard to the short-time scheme the fear of the worker is that this may imply a rate of wages which is not near subsistance limit. It looked at first as if the scheme had been accepted on its merits by most workers, except perhaps in the government shops, but suspicion seems to be arising. Apart from unemployed it was officially estimated that about a quarter of a million insured persons were working short time at the end of last year. Since then both unemployment and short-time working have grown, and the registered unemployed have increased in number by more than 100,000 since Christmas and now exceed 700,000, this of course apart from those who have not registered.

Depression Shown in All Trades

The depression shows itself in trades of every kind, including the chemical, woolen and worsted, and cotton, the shipbuilding industry, where orders have been steadily cancelled. In shipping the latest report states that Scandinavian ship owners are to withdraw certain of their vessels and lay them up, this arising from American competition. American vessels are engaged in the transfer of coal from America to Norway and Sweden "to the detriment," it is stated, "of Scandinavian ships that have for years traded to the [English] northeast coast ports in the coal and timber trade." In addition, a number of cancellations of shipbuilding orders have been sent by Scandinavian owners. But in shipbuilding one bright spot shows: it is Belfast. Here the latest report says there is no slump in the shipyards, a record tonnage being in hand; a full year's work is assured and much reconditioning.

More Coal Being Delivered

The miners have been delivering more coal, and here, it might be thought, is a sample of the much-quoted "rare and refreshing fruit." But the worm of doubt appears to have entered, for the increased tonnage available implies both a rise in wages of some 3s. 6d. a shift, and also increased profits for the mine owners. Unfortunately, with the decline in industry the demand both at home and abroad has fallen away; in particular, export prices are much lower. Therefore, if the pool from which, say, the owners' profits must be taken is to be maintained, it follows that the price to the home consumer must be increased and the estimate, not necessarily final, has been made that this extra cost will be of the nature of 3s. 6d. to 4s. a ton.

Passing over the increased charges pending for telephone service the loss reported on the running of the railways, the doubts arising as to the ability of British engineering on the 47-hour week to meet continental competition in the near future, and the discouraging effects of the seasonal income and other tax demands, let us endeavor to count our blessings.

Toward the end of last year, for the first time for many a month, the gen-

eral cost of living showed a definite decline, and this may be expected to continue. Wholesale prices have led the way for some time; retail prices are beginning to follow. The January sales are reported to have attracted armies of womenfolk and others, the price reductions being so marked. But there is a strange unanimity about the reports, and sometimes one is tempted to believe that the daily newspaper, like the lady, protests too much. Even for the motorist there is some balm in Gilead for, although under the new taxation scheme he will pay more for the right to run a car—£1 per horsepower—yet, the duty being taken off, the price of petrol has been reduced by about 7d. a gallon. Consequently he can, by running his car long enough, spend enough money to save the extra cost of his license.

German Manufacturers Slow to Accept Changed Conditions —Ford Meets Opposition to Tractor Plans—Fate of Diesel Motors Built for Submarines

By H. O. Herzog, Berlin Correspondent

The news that the Ford Motor Co. intends to open up business in Berlin for the manufacture of agricultural tractors has produced considerable stir.

Larv Jacobsen, the special representative of the Ford company, is staying at present in Berlin and will make the necessary preparations in conjunction with Messrs. Ehrich & Graetz, manufacturer of metal goods. Mr. Jacobsen gave the writer the following brief outline of the scheme:

It is proposed to form a German Ford company furnished entirely with American capital and to build or acquire extensive shops. The activities of the shops however will be restricted to assembling work only, while the actual manufacture of all parts will be carried out by contract in other shops. It is intended to build the Fordson tractor only, in large quantities up to 50,000 a year. The company will have headquarters in Berlin and a manufacturing site nearby, but the selling department will extend its operations over nearly the whole continent of Europe.

German Engineers To Be Employed

German engineers, who will receive a special training in the American Ford Works, will be employed. Special machinery and tools will come from America, but will later on be duplicated in Germany. It has been figured out that the Fordson tractor, at present priced at $790 in the United States, can, if manufactured in Germany, be sold for 20,000 marks, equal to about $300.

The Ford company is of the opinion that this low price will open to the tractor a large field, even among the small farmers who cannot possibly afford to buy German makes which at present are priced from 75,000 to 200,000 marks. It is believed that by introducing a low-priced tractor, animal labor, which costs Germany 17 per cent of its total food produce, can in the course of time be relinquished and thus the food situation considerably improved, apart from the possibility to speed the opening up of waste land, one of the great problems of the future. The Ford scheme will therefore be highly beneficiary to the population as a whole. It will, besides, procure employment for a large number of workmen and probably some 100 machine shops.

It was something of a surprise that Henry Ford had decided upon Germany as the seat of his contemplated European enterprise, as it was rumored that he had selected Denmark for this purpose. His reasons were, according to his representative, to help Germany by bringing capital and work into the country and indirectly to take his share in the solution of the extremely difficult food problem. Many appeals for help of such kind directed to foreign countries, chiefly America, have been constantly forthcoming during the last two years in public life. Henry Ford was the first to act on such appeals and he no doubt expected a warm reception which would speedily clear away the official barriers which might hinder such peaceful invasion.

Difficulties of the Venture

If such was his expectation he is evidently doomed to a severe disappointment. German factories making motor ploughs have, instantly on receiving the news of Ford's intentions, started to raise a hue and cry in the press and appeal to the government for protection. It thus happens that the Ford company has not yet received permission to import a set of eight Fordson tractors, two trucks and two motor cars, which have been sold to a German landowner at a nominal rate of marks 4.20 to the dollar, with the object to use them as samples and for demonstration purposes. The German rivals are spreading in one breath that their own makes are vastly superior, that the Fordson tractors are no good at all, and that they would be ruined if the government would admit the Ford Co. Such remarkable argumentation passes without finding the severe press criticism it deserves and very little comment at all. The agricultural society—a body of vast influence—when appealed to by Ford's representative, refused assistance on the ground that it would be detrimental to the German industry to admit the Ford Co. The grant of the import license for the few sample tractors is hung up although it cannot be declined on the principles repeatedly laid down for the admission of imports, no arguments of the bad exchange being applicable.

American manufacturers and business men intending to form plans similar to that of Mr. Ford on the strength of appeals emanating from Germany will do well to remember the Ford company's experience. It is at present not at all sure whether this company will be enabled to carry out its scheme, and if it is, as every true well-wisher of Germany will hope, it will only be after a strenuous fight.

Help from America a German Topic

Help from America is in Germany one of the chief topics today and declared to be most essential for her reconstruction. The experience of the Ford company gives an indication of what is understood by such help and what not. It seems that when such ideas are ventilated in certain German circles they invariably and inevitably take the shape of a one-sided proposition. Credit and raw materials would indeed be very welcome. The difficulty will be the question of what the country can and mainly what it will do in return. It is an open secret that the German industry is feeling very comfortable inside the double barrier of the import embargo and of the prohibitive exchange. The latter besides puts the industry in an exceptional position with regard to foreign competition. It seems that the German industry does not want to be disturbed within its precincts. If any American manufacturer would appear on the scene and attempt to start work, which, by introducing highly efficient management and labor-saving machinery, would undercut existing German prices, he would be faced by a most militant opposition.

Whether the Ford company will win its way or not and whatever the outcome of the present case will be, it certainly will be discouraging to any foreign business man desirous to establish works in Germany. It is also discouraging in another respect. What the whole world wants is increase of production and decrease of prices. If the Ford company is really able to produce in Germany 50,000 tractors a year at 20,000 marks apiece, compared with 75,000 marks of the German make nearest, in size and design, simply by reasons of economy, superior equipment and management, this would set an example, which, if followed, could not fail to benefit the German machine-building industry.

Economy Needed

Strictest economy is indeed necessary. Considering the situation of the industry as a whole, the insecure supply of raw material alone ought to be a strong incentive in this direction. The only line of supply which has materially improved is that of metals. The country possesses ample resources of zinc and lead, at least as long as Upper Silesia belongs to Germany. Copper, tin and other metals, which were so scarce during the war, can now be had in sufficient quantities, and at strictly world-market prices. Other supplies

for the machine building works are however still very scarce and prices are out of the normal. To give a few instances, it may be mentioned that good lubrication oil now costs 1,500 marks per 100 kg., compared with 40 marks before the war; leather belting 250 marks per kg., as against 4 marks in 1914. Substitutes invented during the war have had no lasting value and are more and more discarded in spite of the price of the real thing.

Iron and Steel Supply

Most serious however is the problem of the iron and steel supply. The iron and steel needed by the machine building industry are estimated by the German Association of Machine-Building Works at 2½ million tons a year, of which about one-half is cast-iron and the other half iron and steel of other categories. It must be remembered that the total production of iron and steel has, owing to the detachment of Alsace-Lorraine and Luxembourg, dropped by from 60 to 70 per cent since 1914. It was in 1919 only 6.3 million tons of pig iron and 7.8 million tons of raw steel. The 1.4 million tons of cast-iron produced is of course not totally available for the machine-building industry, which means that at the state of employment upon which the statement of the above-mentioned association is based, the amount of cast-iron is insufficient for the supply of the machine shops. Moreover, iron and steel production in 1919 has to a considerable extent drawn upon the scrap reserves which the war has created and which are fast diminishing. If thrown upon the country's own ore resources even this reduced production cannot be maintained, and to increase it iron ore has to be imported at world-market prices. The slight reduction in the price of iron and steel which has taken place lately is therefore considered to be only temporary. Better employment of the machine-building industry will automatically result not only in higher prices, but in a shortage of its iron and steel.

Manufacturers Will Have To Economize on Use of Iron

The German machine-building industry will have to recognize this fact. German designs have always been noteworthy for the generous use of iron. The buyers were in the habit of comparing prices of machines, especially machine tools, by their respective weights, which practice has tempted designers to throw in a good deal of unnecessary material. German manufacturers will have to adapt their designs to the changed conditions all along the line.

The German manufacturers are slow to take such consequences of the changed circumstances. Manufacturing is still going on as in times when iron and steel were in abundance and the cost of labor was no object. Not a single case has become known of a manufacturer revising his designs for superfluous weight, and the attitude toward labor-saving machinery and appliances seems even to have undergone a slight retrograde move. German manufacturers like their brethren all over the world are convinced of the necessity of a reduction of prices, but they are looking to the lowering of the cost of labor and material as a solution. The true solution however lies within their own shops and can only be achieved by radical improvements therein. The unique position which German manufacturers enjoy at present with regard to foreign competition is not based upon shop efficiency but on the uncertain and fluctuating exchange. It puts the German industry in the embarrassing position that it cannot honestly hope for an improvement of the exchange. No real progress can be made if manufacturers show fight as soon as someone attempts to open a window which would let in a whiff of fresh air like the Ford company intends to do.

Fate of Diesel Motor

The fate of the Diesel motors built for submarine service has lately created some—as it seems now unnecessary—excitement. During the war a type of fast rotating submarine Diesel motor was developed, and when the war came to an abrupt end a large number of such motors were under construction. They found ready use as power-producing units in the German industry, for which purpose they are admirably adapted owing to their small floor space, so that they have slowly but steadily replaced the low-motion Diesel engines. When the Allied Navy Control Commission came forward with the request that the submarine Diesel motors must be destroyed it was at first understood that this matter would not only comprise the Diesel engines obtained from dismantling the submarines, but all engines in existence of the same or similar types, which would practically amount to an embargo on building such motors in the future. Of course this would have been a heavy blow to the large number of works where such motors were installed as power-producing units. This has been done mainly in works which have difficulty to obtain other fuels, mainly on account of their remoteness from coal districts. In many cases such works would have been compelled to shut down. This danger has however now been averted by the Supreme Council in Paris having taken a broader view of the case and limiting the Diesel motors to be destroyed to such that are not at present being used in industrial enterprise.

National Conference of State Manufacturers' Association

The convention held in Chicago on Jan. 12, 1921, by the National Conference of State Manufacturers' Associations had as its prime motive the discussion of the open shop in its relation, at the present moment, to controversies between the railroads' management and labor. The association embraces affiliating state organizations from the states of Colorado, Connecticut, Illinois, Indiana, Massachusetts, Michigan, Minnesota, New Hampshire, New York, Washington, West Virginia and Wisconsin. There were about 300 delegates in attendance who represented in all twenty-two different states. The presiding officer at the sessions was William Butterworth, president of Deere & Co., Moline, Ill., and also president of the Illinois Manufacturers' Association.

The railroad employees as represented by the different brotherhoods and unions have lately gone before the railway labor board in an effort to perpetuate their control on commerce by asking the indefinite continuation of a national labor board. Feeling that the safety of the nation and business depends upon rendering all labor controversies as local as possible in scope, the state manufacturing associations are presenting a united front in opposing this move.

President Butterworth's Address

In his opening address, President Butterworth discussed the labor situation as a whole. He laid stress upon the issue between the railroad carriers and the national brotherhoods over the national boards of adjustment, and also upon the question of the open shop which is foremost in the thoughts of all the manufacturers of the country at the present time.

Referring to these issues he said in part: "If the attempt of the railway brotherhoods to impose national boards of adjustment upon the carriers is successful, the effect upon industry will be all enveloping. It will mean the closed shop for all railroads. To the manufacturing interests this means faulty and uncertain transportation methods, made possible by the lack of morale prevalent under government ownership.

"But a more serious menace is seen in the mental vistas of the future. If the railway brotherhoods fasten the closed shop on the carrier, what is more logical than the attempt gradually to force that un-American practice upon every branch of industry in the United States? From the wording of the law it would seem plain that the United States Railway Labor Board is without authority to impose National Boards of Adjustment upon the railroads, but in my judgment there is still a serious situation confronting the railroads.

"In the decision of the Labor Board last July, it declared the standardized rules, agreements, etc., affecting working conditions made during Federal control with the various crafts, should be continued in full effect until the board could have a further hearing on the subject.

"The hearing was held on Jan. 10 and the union organizations now affiliated in the 'one big union,' known as the Associated Standard Recognized Rail-

road Labor Organizations, made a determined effort to perpetuate, and the carriers earnestly opposed, the further continuation of these National agreements. It seems only fair that the shippers and the public should be given an opportunity to be heard so that the board might be fully advised by all parties affected.

"It is necessary and important that the manufacturers and other shippers forcefully indicate the effects upon them of the organization of the proposed Board of Adjustment and continuation of the agreement made by the United States Railway Administration and organized labor and acquaint the public with the facts for it is the public which also suffers. . . .

"The open-shop movement, well named the American idea, continues to progress in every section of the country, and it is probable that through the agitation of the railway brotherhoods the public will at last grasp the question's significance as it relates to the economic lives of every inhabitant of these United States.

Approval of Open-Shop Plan

"The open-shop or American plan has been approved overwhelmingly by the United States Chamber of Commerce; by the National Grange, consisting of practically one million farmers; by the American Bankers' Association, and by this association; also by the business interests of over 240 cities. It means liberty of action on the part of both the employer and employee.

"I feel that it is the duty of the employers to see that other employers recognize their responsibility and meet it. Either we must do it or the unions will."

Charles Piez, president of the Link-Belt Co., Chicago, spoke on the subject of "The Baneful Influence of National Adjustment Boards from the Public's Standpoint." In the course of his talk he said:

"During the war the governmental Department of Labor divorced itself from the consideration of problems from the standpoint of national welfare and operated on false theories. Whenever the question of wages has been taken before adjustment boards whether national or local the sole question of these boards has been, 'how much has the cost of living gone up' and then the problem was to add the determined percentage of increase to the wage whether the worker earned it or not, irrespective of whether the public suffered or not, and irrespective of whether the rest of the public were equally advanced in their compensation or not.

"Thus labor itself has become class conscious. Every man in the organizations felt that he was entitled to a return based on the cost of living, not on the cost of living of a certain standard that prevailed four or five years ago, but on an ascending scale and as far as each individual of the organized mass was concerned, he didn't care a rip what happened to the rest so long as he got his.

"We have got that to confront us in the readjustment of commerce that Mr. Reynolds pointed out, that labor shall accept the decrease based on the descent in the cost of living. Are they willing to do it? Not much. Many of the organizations who got to the present high peak have announced it as their policy that they are going to retain what they have got.

"I think wages is essentially a local issue, and I will go further and say that wages is a question with each individual shop. The question of wages is solely a function of each local shop for no shops have equal facilities or operate exactly alike. No board, national in scope, can go into a shop and analyze its needs fairly to the management, those working in the shop and the public outside who are dependent upon the product of the shop.

"I believe the labor problem is a problem between the men you employ and yourselves as employers and it ought to be maintained there. I think we ought to resent every effort to nationalize adjustments. It is to our interest and to the interest of the public."

Resolution in Open-Shop Plan

The committee on resolutions reported at the afternoon session and submitted the following resolution dealing with the open-shop problem:

"It is recognized as fundamental in this country that all law-abiding citizens or residents have the right to work when they please, for whom they please, and on whatever terms are mutually agreed upon between employee and employer and without interference or discrimination upon the part of others.

"We hereby express our purpose to support these fundamental principles of American plan of employment by the maintenance of the open shop.

"We urge upon our members to secure by discussion and education the active support of workers, merchants and professional men and all other elements of their prospective communities in favor of American ideals and the open shop."

When these resolutions were presented some discussion arose as to the exact meaning of the open shop. It was not clear in the mind of a few delegates as to whether this term should be applied to a strictly non-union shop or whether it means one in which both union and non-union labor was utilized.

G. M. Gillette, head of the Minneapolis Steel and Machinery Co., said he had found during the war that it was impossible for him to hire men regardless of union affiliation and had found it necessary to employ non-union men only.

R. R. Donnelley of the Lakeside Press Co., defined the union shop as one in which union men could be employed provided they kept their union tendencies to themselves. The mooted point was cleared up by A. J. Allen, secretary of the Associated Employers of Indianapolis, who read an excerpt from a speech he delivered at the Illinois Manufacturers' meeting and in which he described the open shop according to the definition given in United States Bulletin 46, made in the case of the coal miners' labor dispute a number of years ago. That definition is simple but covers a large field. It states that it is the right of the laborer to enter into any wage contract with any employer without regard for any union and that he may work in any plant without the use of a union card or working permit. It further states that any employer has the right to enter into a wage contract with any laborer without regard to the fact that he is a member or a non-member of any labor organization. Also that any employer has the right to discharge any worker from any position without considering any labor organization.

The question was brought up as to whether the members of the association were bound to stand by the resolution if it were passed. President Butterworth stated that the members were not bound to adhere to any resolution made by the association. He stated that all the members realized the situations in the various plants differed.

Other speakers at the convention included: George M. Reynolds, chairman of the Board, Continental & Commercial National Bank, Chicago, who spoke on "Existing Financial Conditions" and Charles Nagel, St. Louis, Mo., former secretary of Commerce, who spoke on "Immigration."

F. J. Haynes Elected President of Dodge Bros.

The election of F. J. Haynes to the presidency of Dodge Brothers at a directors' meeting in Detroit, Jan. 11, was greeted with great enthusiasm by Dodge dealers attending a show luncheon at the Waldorf-Astoria here. Announcement of the election was made by Charles W. Matheson, general sales manager, who was presiding at the dealers' meeting. Howard B. Bloomer, personal friend and attorney to John and Horace Dodge, was elected chairman of the board of directors.

Mr. Haynes has been with Dodge since 1912, beginning as factory manager and working his way to the vice-presidency and general managership. He was with Franklin from 1901 to 1912 and prior to that had been with the E. C. Stearns Co., Toronto, and the National Cycle and Automobile Co. Mr. Haynes was superintendent of the Hamilton plant of the National company and there first became associated with John Dodge.

Norton Co.'s Schedule of Working Hours

The Norton Co., Worcester, Mass., grinding-machine manufacturers, has adopted the following graded schedule of hours: 24 hours per week for single men, 32 hours per week for married men without children, and 40 hours per week for men with families.

Machine Tool Builders Discuss Accounting Methods

The executive committee of the National Machine Tool Builders' Association has sought to evolve some standard form of accounting system that would be acceptable to the whole membership. It has been the thought that such a method, properly worked out and adopted by all, would lead to a clearer understanding of those factors of overhead expense and administration burdens that should be distributed in determining the cost of a machine tool. Cost properly determined should have a stabilizing effect on the industry by preventing indiscriminate selling below actual cost of manufacture during temporary periods of depression.

The executive committee therefore arranged with the accounting firm of Scovell, Wellington & Co. to work out an analysis of the situation and determine the most feasible plan for creating a standard system of cost accounting for the industry. The success of such a system depends upon its being truly representative of the wishes and thought of the majority in the industry. In order to obtain a comprehensive survey of the members' wishes a series of local meetings and informal discussions was decided upon. Five preliminary local meetings will be held —one each at Chicago, Cincinnati, Cleveland, Worcester and New York.

The first of these meetings was held in Chicago on Tuesday, Jan. 11, 1920, at the Hotel Sherman. About fifty members were in attendance, representing possibly forty member companies. The meeting was opened by E. J. Kearney, of Kearney & Trecker, Milwaukee, who after a few remarks introduced E. F. Du Brul, the new general manager of the Machine Tool Builders' Association. Mr. Du Brul presided through both sessions of the meeting.

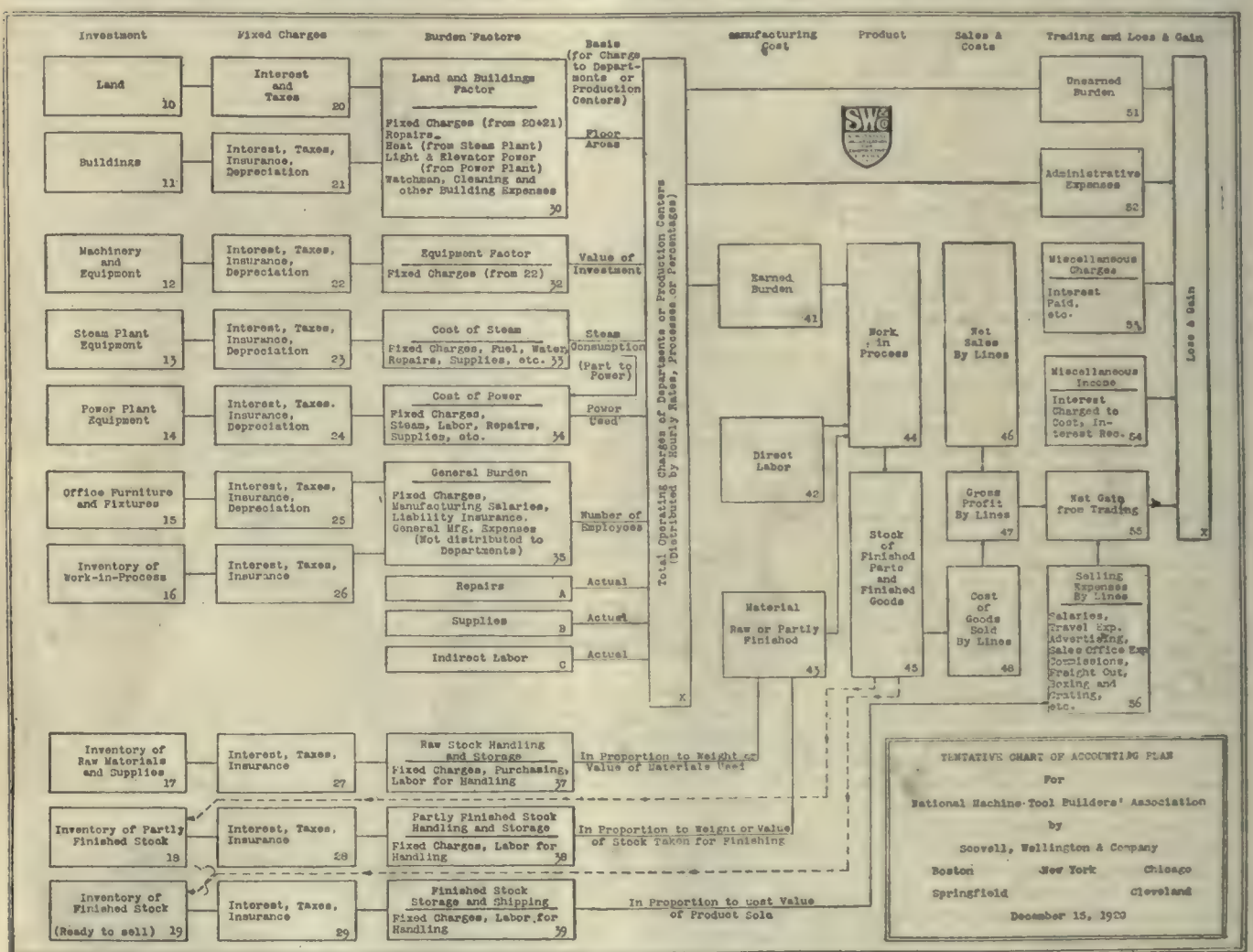
In his remarks introducing the desirability of a more uniform system of accounting among machine tool builders, Mr. Du Brul cited a certain instance with reference to a manufacturer of his acquaintance. This man declared he could build and sell machines cheaper than his competitors for he had recently bought his own buildings; and, therefore, in the future, need only figure labor and material into the cost of his machines as he no longer had any rent to pay. This example indicated one of the factors that tend to unstabilize the market which is becoming such that manufacturers never really know what their product is costing.

Clinton H. Scovell, of Scovell, Wellington & Co., Boston, then took up the preliminary analysis of the plans that he is developing for an accounting system applicable to the machine tool building industry. A tentative plan for handling in a comprehensive manner the various items that must be covered by an accounting system are shown in the accompanying chart. This outline will be subject to alteration as the meetings progress and other ideas are presented. The chart is largely self-explanatory and will not be enlarged upon until it has been subject to further analysis by machine-tool builders in other sections of the country.

The afternoon session was devoted in large part to various details of accounting systems. The members present were also called upon to express their views upon the subject of rates of depreciation of machine-tool building plants and their contents. It is the desire to obtain a minimum recommended rate of depreciation on all classes of equipment so that all will adopt at least the minimun rates and yet let all manufacturers exceed these if they desire to write off investment at a higher rate.

The Worcester Meeting

The Worcester meeting of the Machine Tool Builders' Association was held at the Hotel Bancroft on the



TENTATIVE CHART FOR GENERAL ACCOUNTING PLANS FOR MACHINE TOOL BUILDERS

morning of Tuesday, Jan. 18, for the purpose of hearing a talk upon cost accounting by Mr. Scoville, of the Scoville, Wellington & Co., Boston. The meeting was well attended by representatives of the various machine-tool building companies in Worcester and vicinity.

Worcester Fire Destroys Gear Works

In a large fire at Worcester, Mass., which took place on Jan. 19, the plant of the Worcester Gear Works was burned out. The plant made only gears, largely special, and was said to employ about twenty men. The loss was roughly estimated at $50,000 but this is not yet certain. Besides the gear works, the plants of Forbes & Myers and Steven Mackin also were burned out. Twenty or so buildings were either damaged or destroyed.

New York Steel-Treating Chapter Holds Meeting

A well attended dinner was held at the Machinery Club, Hudson Terminal Building, prior to the regular monthly meeting of the New York Chapter of the American Society for Steel Treating, Jan. 19, 1921.

A lecture illustrated by stereopticon views on "The Function of Insulation and Its Application to Heat-Treating Furnaces" was given by E. F. Davis, Celite Products Co., New York.

Elements of the Automobile Shown by Bray Movie Films

A step in "seven league boots" has been taken in the field of visual education with the completion of the twelve-reel picture, "Elements of the Automobile," which was shown for the first time on last Wednesday in the auditorium of the West Side Y. M. C. A., New York City.

The picture was produced under the direction of the Visual Education Institute, and under the personal supervision of J. F. Leventhal.

The pictures form part of a complete screen course for owners and operators of automobiles. They are presented in a simple and thorough manner. The various parts of an automobile are taken in order of their importance; each part is analyzed and its relation to the whole of the mechanism is shown.

Organize New York Section

The Industrial Cost Association held a meeting in the rooms of the A. S. M. E., 29 West 39th St., New York, on the evening of Jan. 20 and organized a New York Section. Officers elected were: Chairman, M. M. Moore, New York manager of Mesta Machine Co., Pittsburgh; vice-chairman, E. S. Schenck, auditor, Brunswick Refrigerator Co., New Brunswick, N. J.; secretary-treasurer, Fred G. Roberts, assistant controller, SKF Industries. The section is to meet the third Thursday of each month.

Merchants Association of New York Hears Hoover on World Economics

"The world is not suffering from *overproduction* — it is suffering from *underconsumption;* and fundamentally its first remedy must be economic. There are many remedies for this chaotic state of world affairs but obviously the big practical remedy is the *building up of the normal processes of business,* and in that alone lies the permanency and real recovery to the situation."

We quote above from the address of Herbert Hoover at the meeting on last Wednesday, of the Merchants Association of New York, held at the Hotel Astor, New York.

The meeting, and the previous announcement that Mr. Hoover would speak on the industrial situation of the day, brought out a gathering of business men that has never been equaled in the history of the Association. The subject of the meeting was "American Business and Foreign Credits." Two other speakers discussed this subject from different angles. John McHugh, vice-president of the Mechanics and Metals Bank, and chairman of the organizing committee of the Foreign Trade Corporation, spoke on the progress and aims of that corporation in building up our domestic industries by financing our foreign trade enterprises.

A. C. Bedford, of the Standard Oil Co. of New Jersey, and vice-president of the International Chamber of Commerce, discussed the evils of present business depression and gave a bright outlook for the near future.

In his address, Mr. Hoover covered all the evils of the present economic situation in a most thorough manner and gave a critical analysis of the causes and effects of the business depression which is now being felt throughout the world.

"We have to face this mass of economic ills," he said, "with the knowledge that today we are in a vicious circle of inability and lack of organization to extend credits with which to dispose of our surpluses, and that unless we can break that circle we can find no remedy but a continuously lowering standard of living in Europe that will yet pull our standards down to European level."

In urging the extension of long term credits to foreign enterprise he said: "Not only is this a question of the establishment of credit abroad, but it is a question of the character of credit that we establish. Nothing is more dangerous to the whole economic situation of the world than that we should continue to establish short term credits. The only solution is that we shall secure long term investments in reproductive enterprise abroad."

Mr. Hoover discussed the present employment stagnation at some length. He declared that if we would give full time employment to our farmers, our laborers and our business men, we must be prepared to invest abroad some part of the value of the surplus products that we have for sale.

His statement that we cannot build up our foreign investments until our government is prepared to give *protection* and *support* to Americans interested in the development of American enterprises abroad, drew forth a thunderous burst of applause.

The speaker lauded the Foreign Trade Financing Corporation as the only possible relief from the economic evils of today. He also touched on the work of the various charities organizations in their relief work in European countries. On this subject he said: "I do not know whether our business community has ever contemplated the economic importance of the continuation of that service: that here is the one, lone helping hand being extended to Europe; here are our real Ambassadors in Peace for three and a half millions of children, stretching from the Baltic to the Mediterranean, and here are the advance agents of good-will upon which American Commerce must be built.

I do not wish to burden you with this story, I only wish at this time to put before you the fact that here is a service which is a national service, which must be carried by every man and every woman in the United States if we would not only protect American honor and American credit, but if we wish to do the equal service of that people of comparative prosperity who can extend to helpless Europe that great service of relieving and maintaining human existence."

In discussing the objects of the newly formed Foreign Trade Financing Corporation, Mr. HcHugh said: "It is proposed that this corporation shall not in any way interfere with the business of our commercial banks. Indeed, on the contrary, it is proposed to aid and supplement them. While it may, under the law, purchase bills from exporters, manufacturers and others, its chief function will be to make long-time loans which the commercial banks should not undertake to do."

Mr. McHugh also announced that the presidency of this new corporation would be tendered to W. P. G. Harding, of Birmingham, Ala., governor of the Federal Reserve Board.

Mr. Bedford confined his remarks to an analysis of our domestic troubles. He predicted an early resumption of normal business conditions and concluded as follows: "If I did not believe that American business had within itself the energy, the resourcefulness, the intelligence and the power to work out successfully its inescapable part in restoring the economic stability of the world, I should be deeply concerned over the future of civilization. But, believing as I do, that American business will meet the situation, knowing, as I do, that American business can meet it, I have complete faith in the quick return to prosperity.

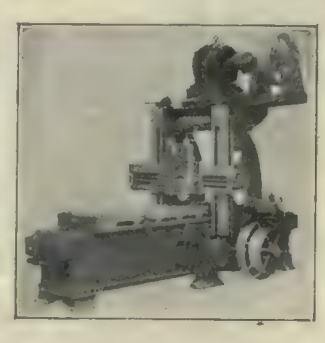
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Planer, Shoe and Wedge, 30-In.

Cincinnati Planer Co., Cincinnati, Ohio.

"American Machinist," Dec. 30, 1920

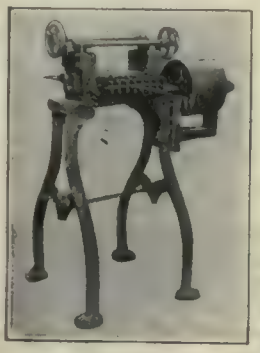


The machine is intended for heavy-duty work, and is made with large bearing surfaces, steel herringbone gears and forced lubrication. The bed is of box construction, and cast closed on the top for its entire length, except where the bullwheel meshes with the rack. The table is of deep box construction. The cross-rail carries but one saddle holding two heads. The heads must travel crosswise in unison, but provision is made for moving them vertically independent of each other, by either hand or power. The machine can be arranged for motor drive, either plain or variable speed, or equipped with a two-speed countershaft.

Straightening Machine, No. "A"

Kane & Roach, Niagara and Shonnard Sts., Syracuse, N. Y.

"American Machinist," Dec. 30, 1920.



The machine is intended for straightening hacksaw blades, file blanks, knife blanks, or strip material stamped out of flat sheets and requiring straightening cold both before and after tempering. Pieces as short as 3 or 3½ in. can be handled. It is a 4-roll machine, the upper rolls being adjustable and the upper rolls as well as the lower rolls being driven by gears. The first pair of rolls takes out the bends and irregularities and the last ones do the final straightening. In order to care for work of different thicknesses, the rolls are made with seven steps, increasing in size from one end. The machine requires only ½ hp. to operate it, and occupies a floor space of 24 x 36 in.

Shaper, Change in Feed Mechanism

Queen City Machine Tool Co., Cincinnati, Ohio

"American Machinist," Jan. 6, 1921.



The company has made a change in the feed mechanism of its shaper. The covers of the mechanism are removed in the cut to show the working parts. The feeding device consists of two units, the one on the bullwheel shaft regulating the amount of feed, and the parts on the rail screw the direction in which the table travels. The lever on the reverse box is used to start, stop or change the direction of the feed, toothed clutches being used. The feed of the table takes place on the back stroke of the ram. The moving parts are inclosed and run in oil.

Drills and Grinders, Electric, Portable

Wodack Electric Tool Corporation, 23 S. Jefferson St., Chicago, Ill.

"American Machinist," Jan. 6, 1921.

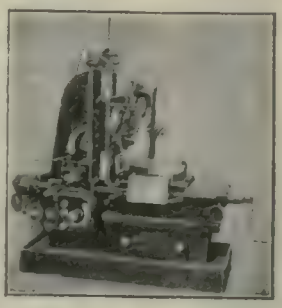


The drill is made in six sizes, the maximum capacities being $\frac{3}{16}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, and $\frac{3}{4}$ in., the $\frac{3}{8}$-in. tool being made in two speeds. The different sizes vary in length from 10 to 17½ in., and in weight from 6 to 16 lb. A portable grinder, shown at the right, has also been placed on the market, the general features, such as the motor and the control, being the same as used on the drill. The grinder is made in three sizes, to carry wheels 3 x ½ in., 4 x 1 in. or 8 x 1 in. respectively. It is especially intended for smoothing castings, buffing and polishing. The tool, using a 4-in. wheel, runs at 5,000 r.p.m. and weighs 13 lb.

Gear-Hobbing Machine, 24-In.

Hercules Machine and Tool Co., Inc., Broome and Lafayette Streets, New York.

"American Machinist," Dec. 30, 1920



The machine is intended for the quantity manufacture of medium-sized gears, either worm, helical or straight-toothed. The feed and the indexing mechanisms are connected by a differential, so that it is possible to change the rate of feed while the machine is cutting. Specifications: Capacity in steel, to 4 D.P. Maximum size of work: diameter, 28 in.; width, 12 in. Speed of drive pulley, 360 r.p.m. Hob speeds: number, 9; range, from 37 to 150 r.p.m. Feeds, headstock (vertical) and work table (horizontal); number, 8; range, from 0.005 to 0.100 in. per revolution of work. Power required, 3 hp. Floor space, 36 x 60 in. Weight; net, 4,000 lb.

Chuck and Collets, Quick-Change

Charles L. Jarvis Co., Gildersleeve, Conn.

"American Machinist," Dec. 30, 1920.



The device is intended for use where different operations, such as drilling, reaming, counterboring, tapping and stud-setting, are done with one spindle, especially when working on heavy castings with a radial drilling machine. It is adapted to lathe use also. Three sizes are made. The standard sizes of the chuck shank are from Nos. 2 to 5 Morse taper, the holes in the collets from Nos. 1 to 4 Morse taper, the diameters of the collets from 1 to 2 in., and the largest diameters of the chuck from 2 to 4 in. The chuck can be furnished with the type and size of taper required to fit the spindle of the drilling machine. The collets are short, have two radial bearing surfaces, and are driven by means of a pin placed close to the work.

Rod-Cutting Machine

Scully-Jones & Co., Chicago, Ill.

"American Machinist," Jan. 6, 1921.

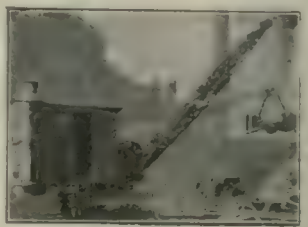


The machine is intended for use wherever metal rods are to be cut. It is operated by compressed air, a minimum pressure of 60 lb. per square inch being required. Steam also can be used to operate the machine, no change being required. Two sizes are made, one to cut rods up to ⅝ in. in diameter and the other rods up to ⅜ in. in diameter. The shearing cutters are circular, so that when the edges have become dull at one spot, they can be rotated; in this way ten sharp cutting edges are supplied by each cutter. It is claimed that the air consumption is low, because the travel of the piston in the small machine is only ½ in., while it is ⅞ in. in the larger machine.

Crane, Locomotive, "No. 2"

Brown Hoisting Machinery Co., Cleveland, Ohio

"American Machinist," Jan. 6, 1921.



In order to meet different working conditions, the crane is made to operate either by steam, by electricity, or by internal-combustion motor, and it can be mounted either on a railroad truck, traction wheels, or a creeper truck. It is adapted to use either a grab-bucket, bottom-block, or bottom-dump tub; and it is said that the changes from one to the other can be made in a few minutes. The crane is self propelling and, when mounted on railroad trucks, can be used for switching cars. It is built to handle a one-yard bucket, or hook-loads up to five tons.

Clip, paste on 3 x 5-in. cards and file as desired

Business Items

The Brown Flint Range Co., Huntington, W. Va., foundry and machine shop, has been incorporated with a capital stock of $250,000.

Work has been resumed at the Crawford & McCrimmon machine shops at Brazil, Ind., after a brief shut down during the Christmas holiday period.

The Parrish-Alford Fence and Machine Co., Knightstown, Ind., has increased its capital stock from $75,000 to $300,000.

The business hitherto carried on by R. S. Stokvis & Zonen, Ltd., Rotterdam, Holland, has been transferred to the Trading Company R. S. Stokvis & Zonen (Handelmaatschappij R. S. Stokvis & Zonen).

The American Power Shovel Co. announces the removal of its office from Chicago, inasmuch as its manufacturing facilities at Milwaukee render it essential for the company to have its office there. The new address will be at 238 Oregon St., Milwaukee, Wis.

The Arrow Pump Co., manufacturer of pumps for automotive machines and machine tools, announces its organization with executive and sales offices at 318 Park Bldg., 1438 Washington Blvd., Detroit, Mich. The personnel of the company is made up of F. M. Cobb, R. G. Conley, H. E. Henry, W. B. Sparks and R. B. Huyett. Mr. Cobb is well known in the pump world and has for several years been president and general manager of the Fulflo Pump Co.

The Automatic Products Corporation, Long Island City, N. Y., has succeeded the Tock Screw Machine Products Corporation and has taken over its assets and assumed its liabilities. There will be no change in the personnel of the officers or employees, and the business of the company will be carried on as heretofore.

The Black & Decker Manufacturing Co., Towson Heights, Baltimore, Md., announces that in spite of general conditions in 1920, it was the most successful year in the history of the company, net sales being 40 per cent greater than the highest previous year, which was 1919.

Announcement is made by the Sundh Engineering and Machine Co. of its successful establishment in its new location, 1105 Frankford Ave., Philadelphia, Pa. The company manufactures finishing machinery for brass mills and hot and cold rolled steel strip. The officers are G. R. Rebmann, president; A. Sundh, vice-president, and H. F. Winters, Jr., secretary and treasurer.

The McCartney Machinery Co., Youngstown, Ohio, has been chartered with a capital of $50,000 to manufacture and deal in machinery of all kinds.

Obituary

WILLIAM H. SAYRE, president of the American Abrasive Metals Co., died suddenly at his home in Glen Ridge, N. J., on Jan. 6, from a severe heart attack. Mr. Sayre was among the first to apply electric welding commercially, organizing the Federal and the Anthracite Electric Welding companies.

Personals

H. S. WALLIN of Superior, Wis., has been appointed general superintendent of the Mahoning Ore and Steel Co., succeeding Ralph N. Marble, resigned, effective on Jan. 1.

S. G. PORTER and E. I. PORTER, for many years associated with the D. Nast Machinery Co., Philadelphia, have resigned. Together with J. R. Richards, formerly with the Fairbanks Co., they have organized the Porter-Richards Machinery Co., with offices at 19 South Seventh Street, Philadelphia, Pa., for the purpose of serving the trade with high-grade machine tools and accessories.

JAMES T. WHITTLESEY, for the past eight years engaged in general consulting practice in California, has been appointed director of a Pacific Coast branch of the Engineering Business Exchange, recently opened in San Francisco.

A. A. RACKOFF, Wilkinsburg, Pa., has been engaged in private practice as a consulting engineer since Jan. 1, specializing in ladles for purifying molten steel, reversing gears for coke-oven batteries, and special machinery and labor-saving devices.

HARRY A. LEDOYT has been appointed manager of the Williamsport Machine Co., Williamsport, Pa., a branch of the American Woodworking Machinery Co., succeeding the late Frederick H. Sweet.

IRA T. HOOK is now assistant professor of strength of materials in charge of the Materials Laboratory, Mason Engineering Laboratory, Yale University. He was formerly employed by the General Motors Corporation as expert on physical testing in the Detroit laboratory.

JOHN ROBERTS has been appointed superintendent of the Grand Trunk locomotive repair shops, Stratford, Ont. William Seeley has been appointed general shop foreman and J. B. Dunlop, of Fort Erie, superintendent of the erecting shop.

L. M. BITTERMAN, for the past four years sales manager for the Potts Manufacturing Co., has severed his connection with that company and has opened offices in Mechanicsburg, Pa., for the continuance of a similar line of business, the manufacture of fire escapes, iron cellar doors, wrought-iron fence, ornamental iron and light structural work. This firm will be known as the Mechanicsburg Iron Works Co.

The American Society of Mechanical Engineers has announced the election of William B. Gregory, professor of experimental engineering in Tulane University, New Orleans, and irrigation engineer, United States Department of Agriculture, as vice president of the society to succeed the late John R. Allen of Pittsburgh. Mr. Gregory will serve until December, 1921.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

An engineer in Italy desires to secure an agency for the sale of engineering supplies, machinery, and mechanical lines in general. Correspondence should be in Italian. Reference. No. 34287.

A mercantile company in Norway desires to secure an agency for the sale of machinery, automobiles, accessories, and electric specialties. Quotations should be given c.i.f. Norwegian port. Payment to be made through banks in Norway and in New York. References. No. 34299.

A trading company in the Netherlands desires to secure an agency for the sale of motor cycles, bicycles, bicycle frames, and accessories, sewing and knitting machines, and similar articles. Quotations should be given c.i.f. Amsterdam or Rotterdam. Payment to be made upon receipt of goods. Reference. No. 34294.

Forthcoming Meetings

The Cleveland Section of the American Society of Mechanical Engineers will hold a meeting in the Cleveland Engineering Society's Rooms on Feb. 1. R. R. Abbott, of the Peerless Motor Car Co., will speak on the "Uses of Alloy Steel in the Machine Tool Industries."

The Society of Automotive Engineers will hold a meeting in Chicago on Feb. 2 at the Hotel Morrison in connection with the Chicago Automobile Show; also one in Columbus on Feb. 10 at the Winter Garden, New South Hotel, in connection with the Tractor Show.

The Engineering Institute of Canada will hold its thirty-fifth annual meeting in Toronto, King Edward Hotel, on Feb. 1, 2 and 3.

The National Civic Federation will hold its twenty-first annual meeting at the Hotel Astor, New York City on Feb. 14, 15 and 16, to discuss International, European and American labor problems.

The National Foreign Trade Council will hold its eighth annual convention in Cleveland, Ohio, on May 4, 5, 6 and 7. J. G. Hammond, care of the Council, 409 Park Bldg., Cleveland, is secretary.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The Spring Convention of the National Machine-Tool Builders' Association will be held on Thursday and Friday, May 19 and 20, at Hotel Traymore, Atlantic City, N. J. The general manager is Ernest F. DuBrul, 817-818 Provident Bank Building, Cincinnati.

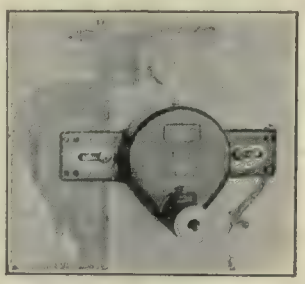
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Milling Attachment, High-Speed

Brown & Sharpe Manufacturing Co., Providence, R. I.

"American Machinist," Dec. 30, 1920



No auxiliary fixtures are required for this attachment. The bracket and spindle support is a single casting designed to protect the mechanism from dirt and injury. The attachment is built in two sizes, No. 1 for the smaller, and No. 2 for the larger milling machines. The only gearing is the large ring gear that fits on the tapered spindle nose of the machine and the pinion on the attachment spindle. The front end of the spindle has a taper hole to receive cutters, the smaller attachment having a No. 7 and the larger one a No. 9 taper hole. The cutter is held in position by the taper in the spindle and is driven by a tenon. Cutters are removed by a releasing bolt which is a part of the attachment and which remains in the spindle.

Steadyrest, Lathe

McCrosky Tool Corporation, Meadville, Pa.

"American Machinist," Dec. 30, 1920

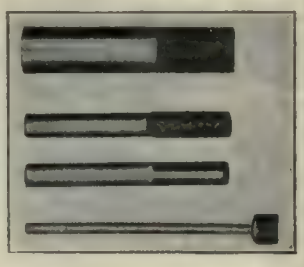


This rest is especially intended for use in operations performed on the end of a piece in a lathe. The rollers move toward the center simultaneously upon closing the jaws, the work having been inserted from the top with the jaws open. The handle end of the screw is then dropped into the slot in the front jaw and the device tightened by turning the screw. The device can be easily attached or removed from the lathe, but when once adjusted for the position of the centers on the lathe on which it is used no readjustment is required. Size 1 is intended for use on lathes having about 12 to 18 in. swing, and it handles work from $\frac{5}{8}$ to $3\frac{3}{4}$ in. in diameter. It weighs about 60 lb.

Abrasive Wheels, "Finger"

Dawsearl Tool and Machine Co., 390 Forest St., Arlington, N. J.

"American Machinist," Dec. 30, 1920



These wheels are intended especially for regrinding button dies, and are applicable to such work as grinding small bushings. The one at the top is $1\frac{5}{8}$ in. overall, the cutting surface being $\frac{3}{8}$ in. in diameter and $\frac{5}{8}$ in. long. The one below it is similar except that it is $\frac{3}{16}$ in. in diameter. It can be seen in section in the next view. The wheel at the bottom is 2 in. long overall, $\frac{1}{4}$ in. in diameter and $\frac{3}{16}$ in. long on the cutting face, and $\frac{3}{32}$ in. in diameter on the shank. The wheels are intended for use on small high-speed portable grinding machines.

Ruling Attachment, Parallel, "Precise"

New York Blue Print Paper Co., 102 Reade St., New York

"American Machinist," Dec. 30, 1920



The attachment is applicable to drawing boards of any size, and need not extend the full width of the board. One end of the straightedge carries a single pulley and the other a double pulley, a silk cord extending across the board at each end of the straightedge. When a straightedge shorter than the board is used ink and drafting tools can be placed on the bare space without interfering with the action of the attachment. The straightedge may be quickly adjusted to any angle. The metal parts are made of aluminum. Straightedges can be furnished in lengths of 24, 30, 36, 42, 54 or 60 inches.

Grinding Machine, Internal, "No. 80"

Heald Machine Co., Worcester, Mass.

"American Machinist," Dec. 30, 1920



This machine is intended to grind comparatively long holes of small diameter. Specifications: Swing, 6 in. inside of water guard; 10 in. with water water guard removed. Length that can be ground, $3\frac{3}{4}$ in. Diameter that can be ground, from $1\frac{1}{4}$ in. to 2 in. Wheel table has two traverse speeds, 34 and 78 in. per min. respectively. Workhead has three rotative speeds, 180, 325 and 590 r.p.m. The work spindle has a $\frac{1}{16}$-in. hole clear through. The center line of the spindle is 46 in. from the floor. Front bearing of work spindle is $1\frac{5}{8}$ in. and the rear bearing $1\frac{1}{8}$ in. in diameter. The countershaft runs at 600 r.p.m. and has a pair of tight and loose pulleys 10 in. in diameter by $2\frac{3}{4}$ in. face. Floor space, 28 x 56 in. Net weight, 1,300 lb.

Core Making Machine, Pneumatic, "Cappell"

E. J. Woodison Co., Detroit, Mich.

"American Machinist," Dec. 30, 1920

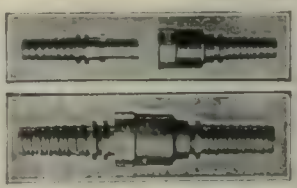


This machine is operated by compressed air, a pressure of 80 lb. per square inch being recommended. It is intended for use in making sand cores, particularly those of complicated shape. The coreboxes are placed on the table, which has a manual adjustment, vertically, of 18 in. The sand pot is 8 in. in diameter and holds about $\frac{1}{2}$ cu.ft. of sand. When the operating handle is turned the sand is allowed to fall from the hopper into the sand pot. The corebox is forced tightly against the sand pot by means of the air cylinder under the table. When the lever is returned to its original position, the sand is forced into the corebox by air pressure, the top of the sand pot being then opened again. It is claimed that the machine consumes but little air and operates rapidly.

Coupling, Hose, "Little David"

Ingersoll-Rand Co., 11 Broadway, New York

"American Machinist," Dec. 30, 1920



The main features of the coupling are said to be sturdiness and simplicity. It is claimed that the parts are made of a metal not subject to ordinary rusting or corrosion. The female end is fitted with a V-shaped rubber gasket to provide an air-tight joint. The coupling may be connected or disconnected by a quarter turn. A groove in the hose end of each part allows the use of a clamp to attach it to the hose. The coupling is manufactured in $\frac{1}{2}$- and $\frac{3}{4}$-in. sizes, which are interchangeable; that is, a $\frac{1}{2}$-in. male piece may be used with a $\frac{3}{4}$-in. female end or vice versa. Gaskets are also interchangeable between the different sizes.

Crane, Portable, Gasoline-Motor-Driven

Universal Crane Co., Swetland Bldg., Cleveland, Ohio

"American Machinist," Dec. 30, 1920



This crane, operated by a 40-hp. gasoline engine, can be mounted upon a railroad truck, motor truck, or trailer, or upon a pedestal if desired for stationary service. The crane swings through a full circle. It has high speeds for hoisting and rotating, and, when suitably mounted, for traversing. The lifting capacity is up to 4 tons. The dimensions of the crane unit exclusive of boom and mounting are: Length at level of operator's platform, 8 ft. 6 in.; width, 7 ft.; height from mounting line to top of cab, 8 ft.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Conn., Bridgeport—H. O. Fletcher, 170 Norland Ave.—small engine or bench lathe, (used).

Mass., Boston—The Amer. Metal Parts Corp., 28 Brighton Ave.—one 14 in. x 6 ft. and one 16 in. x 6 ft. lathe for production work, (new).

Mass., Boston—Davie Bros., 828 Board of Trade Bldg., 131 State St.—1 die punch shear with single cropper, at least ¾-in. capacity and 15-20 in. throat traversing head type shaper.

N. Y., New York (Borough of Brooklyn) — Estate of A. Starke, Columbia and Sigourney Sts.—No. 2 back-geared or No. 2 Garvin tapping machine or equal, (used).

N. Y., New York (Borough of Manhattan) —The Lord Constr. Co., 105 West 40th St. —one 10 or 12 ft. vertical boring mill, arranged for a. c. drive.

N. Y., Buffalo — Hoover & Strong Inc., 119 West Tupper St.—one small turret lathe, No. 00.

Pa., Philadelphia—Brehm & Stehle, Trenton and Allegheny Sts.—20-24 in. back geared drill press, (used).

Pa., Philadelphia —The Cambria Steel Co., Widener Bldg.—gate shear for shearing steel slabs 3 in. x 20 in. wide, also machine for cutting material cold, 40 in. between houses, (for Johnstown plant).

N. C., High Point—The High Point Motor Co.—equipment for motor plant.

N. C., Raleigh—W. S. Fallis, State Highway Engr., Commercial Nat'l Bank Bldg.—lathes, shapers, milling machine and special tools for motor work.

W. Va., Logan—Guyan Machine Shops, B. Shell, Mgr.—One punch shear and roll for ¾ x 48-in. plate.
One 3-ft. radial drill.
One 6-in. cold saw.
One 20-in. or larger shaper.
One keyseating machine.
Turret lathes for manufacturing brass bushings 2-6 in. in diameter.

Ill., Chicago—The A. F. & S. F. Ry. Co., Railway Exch. Bldg.—one modern heavy duty type double car axle lathe, motor driven 220 volts direct current machine of largest capacity possible.

Ill., Dixon—The Taylor Motor Car Co.—20-24 in. drill press and 8 in. x 10 ft. lathe, (new or used).

Mich., Detroit—Mack Ave. Auto and Eng. Co., 2510 Mack Ave., manufacturers of automobile parts — miscellaneous machine shop equipment with motor drive.

Mich., Kalamazoo—The Reed Fdry. & Machine Co., Tulford St.—general equipment for making gasoline engines.

O., Cleveland — The Armature Coil and Equipment Co., 3202 Scranton Rd.—18 in. swing lathe and 26 x 30 in. drill press.

O., Toledo—The Natl. Supply Co., St. Clair and Washington St., manufacturers of mill supplies—machines for lapping in iron plugs.

Wis., Milwaukee—The City Water Dept., City Hall, F. J. Murphy, Supt.—small punch press.

Wis., Milwaukee—The Oilgear Co., Sentinel Bldg., J. A. Diedrich, Purch. Agt.—machinery for the manufacture of oil transmission and gears.

Wis., South Milwaukee—School Board, J. Kozlowski, Secy.—sheet metal working machinery for manual training department.

Minn., Minneapolis—The Rohne Mfg. Co., 2434 25th Ave., S.—manufacturer of electrical machinery—on No. 3 punch press.

Mo., St. Louis—Central Y. M. C. A., 9th and Carr Sts.—E. F. Wheat, Dir. machine tools for automobile mechanics school.

Mo., St. Louis — The Continental Boiler and Sheet Iron Wks., 4389 Duncan Ave.—one high-speed power hack saw, one emery grinder, and one drill press, (used).

Tex., Mexia—F. A. Grimes—equipment for automoible repair shop.

Cal., Los Angeles — Los Angeles R.R., Pacific Electric Bldg.—machinery for repairing cars, (new).

Machinery Wanted

Mass., Springfield — Kellogg Bros., 91 Woodside Terrace—Lane, Chase or American saw mill, used, in good condition, and 42 or 44 in. saw.

D. C., Washington — The International Shoe Heel Corp., Continental Trust Bldg., C. H. Merrow, Purch. Agt.—specially made machinery for the manufacture of shoe heels and shoes also standard made machinery, for their plant at Rockville, Md.

Md., Baltimore—W. C. Briddell Co., Inc., Continental Bldg., manufacturers of rails and track equipment, etc., W. C. Briddell, Pres.—one 20 ton, 8-wheel locomotive crane, 50 ft. boom, complete with drop for bucket attachment, but without bucket, and also with boiler large enough to operate a generator set for magnet operation, but not including generator set.
Stiff leg derrick, steel, or tower derrick.

Md., Smithburg — The Blue Mountain Food Products Co., Inc., J. E. Freese, Purch. Agt. — machinery to make apple butter, jelly and vinegar.

N. J., Trenton—Royal Brock, Inc.—8 or 10 ton stiffleg derrick.

N. Y., New York (Borough of Brooklyn —Riebel Bros., Inc., Glenmore Ave. — ice making machinery.

N. Y., Ogdensburg — The W. J. Pooler Lumber and Mfg. Co., Inc.—woodworking tools.

Fla., Marianna—The Marianna Ice Co.—manufacturers of ice, ice cream, etc., C. G. Kimbell, Purch. Agt.—
One 40-qt. brine freezer, belt driven, also same direct expansion.
One small power ice-breaker.
One rotary brine pump, such as would supply brine to one freezer.
One small babcock milk tester.
One old-fashioned ice and salt freezer with extra can, dasher and tub.

S. C., Camden — J. H. Anderson — pony planer, wood saw, shingle mill and well-drilling machinery, (new or used).

Wis., Cedarburg—Wetzel Art Furniture Mfg. Co.—one jig saw and one trim saw.

Wis., Stevens Point—The Pfiffner Lumber Co., 229 Franklin St. — woodworking machinery.

Mich., Lamb — M. P. Shanahan — crane with 30 or 35 ft. boom ¾ yd. clam shell, mounted on caterpillar truck, (used).

Mich., Munising — The Munising Paper Co.—2 locomotive cranes.

Tex., Ranger — Chestnut & Smith — machinery for reducing gas to liquid gasoline.

Que., Montreal — M. A. Bradshaw Co., Chateaubrand St. — $5,000 worth of machinery for box factory.

Metal Working

NEW ENGLAND STATES

Conn., Thompsonville—The Standard Oil Co. of New York, 26 Bway., New York City, is having plans prepared for the construction of a 1 story garage, oil storage tanks, office building and various storage sheds, here. Estimated cost, $75,000. Private plans.

Mass., Cambridge — G. Lawrence Inc., 24 Cambria St., manufacturer of auto springs, will build a 1 story, 90 x 110 ft. foundry and garage on Greene and Lansdowne Sts.

Mass., East Walpole—Bird & Sons, Inc., will soon award the contract for the construction of a 1 story, 50 x 200 ft. factory for the manufacture of roofing material, etc. C. T. Main, 201 Devonshire St., Boston, Engr.

Mass., Springfield—T. C. Cordner, 433 Bay St., is having plans prepared for the construction of a 6 story, 100 x 170 ft. garage on Railroad St. Private plans.

Mass., Worcester—H. Glick, 36 Portland St., will soon award the contract for the construction of a 1 story, 60 x 135 ft. garage addition. Estimated cost, $40,000. E. T. Chapin, 310 Main St., Archt.

N. H., Exeter—A. E. McRell has awarded the contract for the construction of a 2 story, 60 x 140 ft. garage. Estimated cost, $50,000.

R. I., Providence—The Pub. Bldg. Dept. is having plans prepared for the construction of a 1 story, municipal garage. Estimated cost, $25,000. Private plans.

MIDDLE ATLANTIC STATES

Md., Baltimore—A. E. Christhilf, Highway Engr., City Hall, plans to build a machine, blacksmith and repair shop and garage. Estimated cost, $17,000.

N. Y., New York (Borough of Manhattan) —A. Dowe, 194 Bowery, will build a 1 story, 20 x 100 ft. garage at 325 East 122d St. Estimated cost, $20,000.

N. Y., New York (Borough of Manhattan) —W. Lowe, c/o L. A. Hornum, Archt. and Engr., 405 Lexington Ave., will alter his 2 story garage and build a 1 story addition to same at 535 East 70th St. Estimated cost, $30,000.

N. Y., New York (Borough of Manhattan) —The Pub. Serv. Comn., 49 Lafayette St., will soon award the contract for the second addition to its Lenox Ave. shop. Estimated cost, $200,000.



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	Current	One Year Ago
No. 2 Southern	$38.50	$36.60
Northern Basic	34.50	34.00
Southern Ohio No. 2	34.00	36.55
NEW YORK—Tidewater Delivery		
2X Virginia (Silicon 2.25 to 2.75)	40.41	39.40
Southern No. 2 (Silicon 2.25 to 2.75)	44.26	41.40
BIRMINGHAM		
No. 2 Foundry	34.00	33.00
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25-2.75 sil.	36.00	38.10
Virginia No. 2	40.00	39.10
Basic	34.00	34.60
Grey Forge	34.00	34.60
CHICAGO		
No. 2 Foundry local	35.00	36.25
No. 2 Foundry, Southern	40.60	38.00
PITTSBURGH, Including Freight Charge from Valley		
No. 2 Foundry	36.96	28.15
Basic	31.96	34.40
Bessemer	33.96	35.40

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.58	$3.80	$3.47	$3.58	$3.32	$3.58	$3.47
Soft steel bars	3.45	3.70	3.52	3.34	3.52	3.48	3.52
Soft steel bar shapes	3.45	3.70	3.52	3.48	3.82	3.48	3.52
Soft steel bands	4.18	4.65	4.22	6.25	....	....	....
Plates, ¼ to 1 in. thick	3.78	4.00	3.67	3.78	3.62	3.78	3.67

Add .10 for trucking charge to Jersey City and .15 to New York and Brooklyn from warehouse.

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$2.60	$3.50
Warehouse, New York	4.75	3.52
Warehouse, Cleveland	3.52	3.42
Warehouse, Chicago	4.12	3.52

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55	4.68	5.50–6.00	4.50	4.68
No. 12	3.60	4.73	5.56	4.60	4.83
No. 14	3.65	4.78	5.92	4.65	5.03
No. 16	3.75	4.88	6.02	4.75	5.13
Black					
Nos. 18 and 20	4.20	4.58	6.80 7.80	5.30	5.80
Nos. 22 and 24	4.25	4.63	6.85 7.85	5.45	5.85
No. 26	4.30	4.68	6.90–7.90	5.50	5.90
No. 28	4.35	4.78	7.00–8.00	5.60	6.00
Galvanized					
No. 10	4.70	6.13	6.50	5.95	5.30
No. 12	4.80	6.23	6.60	6.05	5.40
No. 14	4.80	6.23	6.60	6.05	5.40
Nos. 18 and 20	5.10	6.53	6.90	6.35	5.70
Nos. 22 and 24	5.25	6.68	7.05	6.50	5.85
No. 26	5.40	6.83	7.20	6.65	5.0
No. 28	5.70	7.13	7.50–9.00	7.95	6.00

AUTOMOBILE SHEETS—Patent level stock for automobile bodies and fenders. Prices in cents per pound for 100 lb. lots at warehouse, New York and Chicago—No. 16, 7-48; No. 18-20, 7-53; No. 22-24, 7-58.

To these prices .10 must be added for delivery in Jersey City and .15 for New York and Brooklyn.

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.50	$5.80	$4.84
Flats, square and hexagons, per 100 lb. base	6.00	6.30	5.34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55
Special Nickel and Alloys			
Malleable nickel ingots			45
Malleable nickel sheet bars			47
Hot rolled rods, Grades "A" and "C" (base)			60
Cold drawn rods, grades "A" and "C" (base)			72
Copper nickel ingots			42
Hot rolled copper nickel rods (base)			52
Manganese nickel hot rolled (base) rods "D" — low manganese			64
Manganese nickel hot rolled (base) rods "D"— high manganese			67

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb lots sells as follows, f. o.b. New York: 5/32, 8½c. per lb.; ¼, 8c.; 5/16 to ½, 7½c. Domestic iron sells at 1 2c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	9.00
Spring steel (light)	10.00	7.00	12.00
Coppered bessemer rods	9.00	8.00	7.00
Hoop steel	4.65	4.04	4.18
Cold-rolled strip steel	9.50	8.25	9.25
Floor plates	5.75	4.80	6.03

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

	Steel Black	Steel Galvanized		Iron Black	Iron Galvanized
	BUTT WELD				
⅛ to 3	54–57½%	41½–44%	⅛	15½–25½%	+1½–11½%
			¼	19½–29½%	1½–11½%
			⅜ to 1¼	24½–34½%	8–18½%
	LAP WELD				
2	47–50½%	34½–38%	1¼		
2½ to 6	50–53½%	37½–41%	1½		
7 to 12	47–50½%	33½–37%	2	20½–28½%	6½–14½%
13 to 14	37½–41%		2½ to 6	22½–30½%	9½–17½%
15	35–38½%		7 to 12	19½–27½%	6½–14½%
	BUTT WELD, EXTRA STRONG PLAIN ENDS				
⅜ to 1¼	52–55½%	39½–43%	⅜ to 1¼	24½–34½%	9½–19½%
2 to 3	53–56½%	40½–44%			
	LAP WELD, EXTRA STRONG PLAIN ENDS				
2	45–48½%	33½–37%	1¼		
2½ to 4	48–51½%	36½–40%	1½		
4½ to 6	47–50½%	35½–39%	2	21½–29½%	8½–16½%
7 to 8	43–46½%	29½–33%	2½ to 4	23½–31½%	11½–19½%
9 to 12	38–41½%	24½–28%	4½ to 6	22½–30½%	10½–18½%
			7 to 8	14½–22½%	2½–10½%
			9 to 12	9½–17½%	5½–+2½%

Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv	Chicago Black	Chicago Galv.
⅜ to 3 in. steel butt welded	44%	28%	42½%	33½%	57½%	44%
2½ to 6 in. steel lap welded	39%	24%	44½%	29½%	53½%	41%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 45%. Cast iron, standard sizes, plus 5%.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	15.00	15.00	19.50
Tin in 5-ton lots	34.25	34.25	62.75
Lead	5.375	5.375	8.75
Zinc	7.00	7.00	9.55
ST. LOUIS			
Lead	5.25	6.25	8.575
Zinc	6.75	6.75	9.225

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

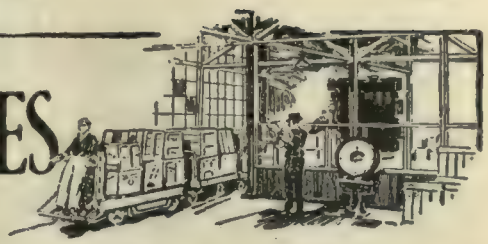
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	21.50	22.50	29.00	23.50	31.00	26.50	36.00
Copper wire (carload lots)	16.00	17.00	28.25	19.00	29.50	24.00	27.00
Brass sheets	18.75	20.25	25.50	24.00	29.00	30.00	27.00
Brass pipe	23.50	25.00	32.00	25.00	34.00	23.25	35.00
Solder (half and half) (case lots)	27.75	27.25	35.00	26.00	40.50	21.00	38.00

Copper sheets quoted above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill, 1000 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	18.25	23.75
New York	16.75	23.75
Cleveland	20.00	29.00
Chicago	21.25	26.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f.o.b. mill + ess 8% for carload lots..... 11.50

	Warehouse			
	—In Casks—		— Broken Lots —	
	Current	One Year Ago	Current	One Year Ago
Cleveland	13.70	14.50	14.30	15.00
New York	14.00	13.50	14.50	14.00
Chicago	14.50	15.00	14.95	15.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	6.25	10.25
Chicago	6.25	10.50
Cleveland	7.50	11.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	*New York			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	11.50	18.50	10.00	10.50
Copper, heavy, and wire	11.00	16.50	9.50	10.00
Copper, light, and bottoms	9.00	14.50	9.00	9.00
Lead, heavy	4.00	7.25	4.00	4.00
Lead, tea	3.00	5.25	3.00	3.50
Brass, heavy	7.00	9.50	7.00	10.00
Brass, light	5.50	8.00	5.00	5.50
No. 1 yellow brass turnings	6.00	9.50	5.50	5.50
Zinc	4.00	5.00	3.00	4.25

*These prices nominal because of dull market

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.10	24.50	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	28.00	34.00
Chicago	24.50	29.00
Cleveland	22.00	32.00

BABBITT METAL—Warehouse price per pound:

	—New York—		—Cleveland—		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	70.00	90.00	46.50	68.50	40.00	70.00
Commercial	30.00	50.00	15.50	17.25	9.00	15.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York we quote the best two grades, although lower grades may be obtained at from 16.00 to 20.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	— New York —		— Cleveland —		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+$3.00	List	List net	$1.00	+1.15	1.45
Hot pressed hexagon	+ 3.00	List	List net	1.00	+1.15	1.45
Cold punched hexagon	+ 5.00	List	List net	1.00	+1.15	1.05
Cold punched square	+ 5.00	List	List net	1.00	+1.15	1.05

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	70–5%
Chicago	40%	50%
Cleveland	50%	60–10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	25%	50%	40%
Larger and longer up to 1¼ in. by 30 in.	25%	40%	30%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York..... $2.00 Cleveland..... $3.00 Chicago..... $2.50

For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:

New York..... $7.00 Cleveland..... $4.50 Chicago..... $5.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	+15%	40%	25%
Larger and longer up to 1 in. by 30 in.	+15%	35%	25%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	25%	30%	10%	30%
Chicago	net	10%	net	10%
New York	40%–5%	10%	net	10%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	40%	50%	30%
Tinned	40%	50%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York..... $5.13 Chicago..... $5.73 Pittsburgh..... $4.50

Boiler, same sizes.

New York..... $6.00 Chicago..... $5.83 Pittsburgh..... $4.60

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	25.00	27.00	29.00
Brass	24.00	24.00	28.00

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1 c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in. inclusive in rounds, and ⅛-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.95 per 100 lbs.

In Cleveland—$8.50 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
White	7.50@13.00	13.00	14.00	14.25
Colored mixed	7.00@11.00	9.00–12.00	10.00	12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.50	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.00	$2.00	$2.25
Philadelphia	2.75	2.75	2.00
Cleveland	4.00	3.00	2.50
Chicago	2.25	2.75	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.50	$3.50	$3.40
Philadelphia	3.65	3.65	4.625
Chicago	4.00	3.85	4.125

COKE—The following are prices per net ton at ovens, Connellsville:

	Current	One Month Ago	One Year Ago
Prompt furnace	$5.00@$5.50	$6.00@$7.00	$6.00@$ 7.00
Prompt foundry	6.25@ 7.00	7.00@ 8.00	6.00@ 7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

	—New York—		—Cleveland—		—Chicago—	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels, (5 bbl. lots)	$0.83	$1.80	$0.95	$2.00	$0.94	$1.98
5-gal. cans	0.90	2.00	1.20	2.25	1.19	2.23
1-gal. cans (6 to case)	1.05	....	....	....	....	

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	14.50	15.50	13.00	14 50
25 and 50-lb. kegs	13.25	14.75	14.75	15.75	13.25	14 75
12½-lb. keg	13.50	15.00	15.00	16.00	13.50	15.00
5-lb. cans	16 00	17.50	15.00	17.50	16.00	16.50
1-lb. cans	18.00	19.50	16.00	18.50	18.00	17 50

500 lb. lots less 10% discount. 2,000 lb. lots less 10–4% discount. 10,000 lb. lots less 10–7½% discount.

N. Y., Carthage—The Northern Development Syndicate plans to build a commercial size ore reduction plant and electric smelting furnace.

Pa., Collegeville—The Freed Heater Co. plans to build a plant on Main St. Estimated cost, $15,000.

Pa., Philadelphia — H. Goldman, 1739 South 4th St., has awarded the contract for the construction of a 1 story, 85 x 115 ft. garage, at 411 Moore St. Estimated cost, $13,000.

Pa., Philadelphia—G. W. Hynes, 8 North 21st St., is having plans prepared for the construction of a 1 story, 17 x 60 ft. garage on 20th and Arch Sts. Estimated cost, $10,000. H. L. Reinhold, 1513 Walnut St., Archt.

Pa., Philadelphia — H. T. Potts & Co., Inc., 316 North 3d St., does not plan to build a foundry on D and Erie Sts. This item incorrectly noted in our issue of Jan. 13.

Pa., Pittsburgh — The Pittsburgh Malleable Iron Co. has awarded the contract for the construction of a 2 story, 54 x 100 ft. factory on 35th St. and Spruce Ave. Estimated cost, between $20,000 and $25,000. Noted Jan. 13.

Pa., Pittsburgh—Zang-Fisher Co., Penn. Ave., has awarded the contract for the construction of a 1 story, 75 x 125 ft. factory for auto repairs. Estimated cost, between $30,000 and $35,000.

MIDDLE WEST STATES

Ill., East St. Louis — The Dependable Truck and Tractor Co., 231 Collinsville Ave., is having plans prepared for the construction of a 1 story, 100 x 600 ft. factory on Park and Washington Sts. Estimated cost, $100,000. Reister & Rubach, Murphy Bldg., Archts.

Mich., Battle Creek—The Amer. Stamping Co., Burchard St., will receive bids until Feb. 25, for the construction of a 1 and 2 story, 100 x 150 ft. office and factory building. Estimated cost, $100,000. J. C. Llewellyn, 38 South Dearborn St. Chicago, Archt.

Mich., Detroit — Mundus Products Co., 1736 Howard St., is having plans prepared for the construction of a 1 story, 60 x 200 ft. garage on Howard and 3d Sts. Estimated cost, $60,000. L. Kamper, 752 Book Bldg., Archt.

Mich., Flint — The Durant Motors Corp., c/o Flint Chamber of Commerce, plans to build a 3 story automobile plant. Estimated cost, $500,000.

O., Cleveland—P. Priesz, 1850 West 24th St., has awarded the contract for the construction of a 1 story, 50 x 75 ft. garage, at 1925 West 24th St. Estimated cost, $25,000. Private plans.

O., Cleveland—The Reynolds Motor Co., 8811 Miles Park Ave., has had plans prepared for the construction of a 2 story, 40 x 165 ft. garage and salesroom, on Miles Park Ave. and Bway. Estimated cost, $100,000. H. T. Jeffery, 7024 Classon Ave., Archt.

O., Cleveland—M. Weinberg, 7807 Cedar Ave., is having plans prepared for the construction of a 1 story, 30 x 60 ft. garage at 7807 Cedar Ave. Estimated cost, $10,000. M. Altschuld, 5116 Woodland Ave., Archt.

O., Cleveland — F. Ziehm & Sons, have awarded the contract for the construction of a 2 story, 32 x 40 ft. garage at 6016 St. Clair Ave. Estimated cost, $15,000. Private plans. Noted Jan. 13.

Wis., Edgerton—G. T. Simmons, R. F. D. 8, Janesville, plans to construct a 4 story, 70 x 181 ft. factory on Janesville-Edgerton Rd., near here, for the manufacture of spark plugs. Estimated cost, $100,000. Architect not selected.

Wis., Milwaukee — The Milwaukee Grey Iron Fdry., 39th and Mitchell Aves., has awarded the contract for a 1 story, 30 x 60 ft. pattern shop, on 39th Ave. Estimated cost, $6,000.

WEST OF THE MISSISSIPPI

Minn., Albert Lea — The Central Fdry. Co., Marshalltown, Ia., plans to construct a 1 story, 100 x 200 ft. factory, here, for the manufacture of light gray iron castings. Estimated cost, $50,000. Engineer not announced.

Minn., Moose Lake—P. W. Perkins, Pine City, will build 2 story, 48 x 60 ft. addition to his garage, here. Estimated cost, $25,000.

Tex., Fort Worth—The Peden Iron and Steel Co., Main and Daggett Sts., is having plans prepared for the construction of a steel roller mill and fabricating plant. Estimated cost, $1,000,000. D. R. Luce, Ft. Worth, Engr.

WESTERN STATES

Cal., Los Angeles—J. J. Rosen, 415 Central Bldg., has awarded the contract for the construction of a 1 story, 80 x 100 ft. garage, on 8th and Merchant Sts. Estimated cost, $16,000.

General Manufacturing

NEW ENGLAND STATES

Mass., Natick—C. W. Dean & Co., North Main St., manufacturers of shoes, has awarded the contract for the construction of a 2 story, 40 x 210 ft. plant. Estimated cost, between $60,000 and $70,000.

MIDDLE ATLANTIC STATES

Md., Baltimore — Western Maryland Dairy, Linden Ave. and Dolphin St., is having plans prepared for the construction of an addition to its dairy. Estimated cost, $100,000. I. D. Baxter, Prop.

Md., Cumberland—The Queen City Brick and Tile Co., Evitts Creek, is building additions to its plant. Estimated cost, $150,000.

N. J., Bloomfield—The Clark Thread Co., Clark St., Newark, is having plans prepared for the construction of a 1 story, 74 x 377 ft. bleach works, on Broad St., Brookdale Section, here. Estimated cost, $100,000. Salmond, Scrimshaw & Co., 5826 Elmo St., Arlington, Archts and Engrs.

N. Y., New York (Borough of Brooklyn) —The General Laundry Inc., 835-837 Myrtle Ave., will alter its laundry and build a 35 x 43 ft. boiler house, 30 ft. high. Estimated cost, $75,000. Shampan & Shampan, 50 Court St., Archts. and Engrs.

N. Y., New York (Borough of Brooklyn) —Rubel Bros., Glenmore Ave., will build an ice plant on Tilden Ave. between Flatbush and Bedford Aves. Estimated cost, $500,000. Private plans.

N. Y., New York (Borough of Brooklyn) —W. Scandor Paper Box Co. will build a 2 story, 40 x 100 ft. factory at 150 Skillman St. Estimated Cost, $35,000.

N. Y., Carthage—The Northern Oil & Fuel Corp., Watertown, plans to construct an oil station here, to include tanks, pumps and service station. Estimated cost, $60,000.

N. Y., Olean — England, Walton & Co., Inc., plans to rebuild its six tannery buildings which were recently destroyed by fire. Estimated loss $200,000.

SOUTHERN STATES

Fla., Orlando—United Markets Inc., has awarded the contract for the construction of a 6 story ice plant and refrigeration plant, here. Estimated cost, $15,000. N. Rosenblatt, Tampa, Genl. Mgr.

Ga., Gainesville—The Georgia Mfg. Co. plans to rebuild a 2 story, 50 x 200 ft. spinning plant. Estimated cost, $100,000.

N. C., Greensboro — Robertson-Strader Co., manufacturers of box shooks, plans to rebuild and re-equip its factory on Watson Ave., which was recently destroyed by fire. Estimated cost, $30,000.

Va., Richmond — The Liggett & Meyers Tobacco Co. has awarded the contract for the construction of a 5 story factory. Estimated cost, $400,000.

W. Va., Round Bottom — H. J. Booth, 1675 Beechwood St., Pittsburgh, Pa., has purchased a site here and plans to build a glass plant.

MIDDLE WEST STATES

Ill., Chicago—The By-Products Coke Corp. is enlarging its plant on 112th and Torrence Ave., additions include three 1 story, 28 x 33 ft., 30 x 33 ft., and 17 x 38 ft., transfer houses, and two 37 x 74 ft. and 30 x 106 ft. steel coke screening houses. Estimated cost, $560,000.

Ill., Chicago—The Turner Mfg. Co., 1444 Sangannon St., manufacturers of picture frames, has awarded the contract for the construction of a 2 story, 100 x 180 ft. factory on 42d and Ogden Sts. Estimated cost, $200,000. Noted Dec. 9.

Ind., Ft. Wayne — The Eocnomy Glove Co. plans to build a 2 story, 100 x 200 ft. factory, at 309 Wallace St. Estimated cost, $75,000. Private plans.

O., Cleveland — The City Ice Delivery Co., Cadillac Bldg., has awarded the contract for the construction of a 1 story, 65 x 140 ft. and 65 x 170 ft. ice plant on Saranac Rd. Estimated cost, $75,000.

O., Waynesburg—The Natl. Fireproofing Co. will soon award the contract for rebuilding its 1 story factory. Estimated cost, $6,000. Private plans.

O., West Carrollton — The Amer. Envelope Co. is having plans prepared for the construction of a 2 story, 60 x 110 ft. paper factory. Estimated cost, $50,000. E. J. Mountstephen, 803 U. B. Bldg., Dayton, Archt.

Wis., Clintonville — Sheboygan Dairy Products Co., 936 North Water St., Sheboygan, plans to build a 4 story, 60 x 200 ft. dairy, here. Estimated cost, between $75,000 and $80,000. Architect not selected

WEST OF THE MISSISSIPPI

Col., Grand Valley—The Harrison Petroleum Co. is having plans prepared for the construction of a 1,000 ton shale oil refinery. H. C. Wolf, Oklahoma City, Engr.

Mo., Joplin — The New System Bakery Co., 1121 West 6th St., will soon award the contract for the construction of a 1 story, 42 x 74 ft. bakery. Estimated cost, $15,000. C. Sudhochter, West 9th St., Archt.

N. D., Grafton — The State Home for Feeble Minded plans to construct a group of buildings, to include power house, workshop and milkhouse. Estimated cost, $583,500. A. R. T. Wylie, Supt. Architect not announced.

S. D., Pierre—State Cement Comn. plans to build cement plant. Estimated cost, $100,000.

Tex., Hillsboro—The Shear Co. is having plans prepared for the construction of a cold storage plant. Estimated cost, $25,000.

Tex., Ranger—Chestnut & Smith are having plans prepared for the construction of a gasoline plant. Estimated cost, $500,000.

Tex., Ranger—The Humble Oil & Refining Co., Goggan Bldg., Houston, is having plans prepared for the construction of a topping plant in connection with oil refinery, here. Estimated cost, $500,000.

WESTERN STATES

Cal., El Segundo—The General Chemical Co. is building a 4 unit contact sulphuric acid plant.

Cal., Los Angeles—The Atchison, Topeka & Santa Fe R.R., Kerckhoff Bldg., will soon award the contract for the construction of a 4 story, 85 x 275 ft. ice plant, at Hobart Station. Estimated cost, $500,000. W. H. Mohr, Kerckhoff Bldg., Archt.

Wash., Millwood — The Inland Empire Paper Co. has awarded the contract for the construction of additions to its paper mill on Park and Concord Sts. Estimated cost $85,000.

CANADA

Ont., Kenora—Lake of the Woods Pulp & Paper Co., Ltd., plans to construct a paper mill.

Ont., Port Arthur — The Kaministique Pulp & Paper Co., Ltd., plans to construct new pulp mill, to have 250 tons daily capacity.

Ont., Thorold—The Interlake Tissue Mills Ltd., plans to build a new mill for the manufacture of tissue papers.

Que., Cornwall—H. Smith Paper Mills, Ltd., 138 McGill St., Montreal, plans to enlarge its sulphur plant, here, increasing output to 50 tons daily.

Que., Montreal — M. A. Bradshaw Co., Chateaubrand St., plans to build a 2 story box factory. Estimated cost, $15,000.

Que., St. Angele de Laval—The Brown Pulp & Paper Co. is having plans prepared for the construction of a pulp and paper mill. Estimated cost, $1,500,000.

Que., Verdun—City Council plans to construct an ice plant and an incinerator plant. Estimated cost, $150,000.

February 3, 1921 American Machinist Vol. 54, No. 5



The Use of Special Fixtures in Grinding Operations

By Ellsworth Sheldon
ASSOCIATE EDITOR AMERICAN MACHINIST

Use of Abrasive Material To Perfect Bearing Surfaces—Necessity of Fixtures for Grinding Operations—Examples of Fixtures in the Fellows Gear Shaper Plant

THE use of special fixtures upon the grinding machine is quite as logical as the use of similar fixtures upon a milling machine or planer, and there is no reason why they may not have as wide a range of adaptability for the operations that are performed by grinding, as for operations upon which steel cutting tools are used. A few examples of the use of such fixtures in well-known machine-tool shops will be presented from time to time under this heading.

Twenty-five years ago the use of emery or other abrasive material upon surfaces that were to form a bearing was considered very bad practice indeed, and many superintendents, master-mechanics and others having responsible charge of the construction of machinery would not allow a workman to use a grinding wheel or piece of emery cloth upon such surfaces. Even with parts of hardened steel, upon which no other means of finishing was possible, the most elaborate precautions were deemed necessary to prevent grains of the abrading material from becoming imbedded in the metal to destroy, in a short period of operation, the bearing which the workman had exercised so much care to make perfect.

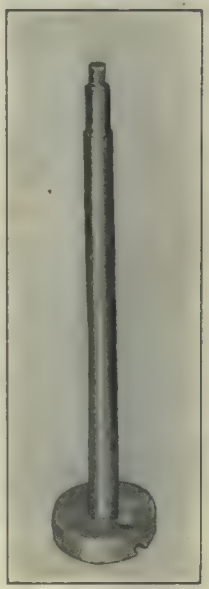


FIG. 1. FELLOWS' GEAR SHAPER MAIN DRIVE SHAFT

Today, there is no process of machining more depended upon where the requirements are rapidity of production, accuracy of fit, and perfection of bearing surface, than grinding. Even upon such soft and porous materials as cast-iron and brass, when the amount of material to be removed is small and the working tolerances close, the grinding wheel has every advantage over steel cutting tools.

Where wide wheel faces are permissible and the wheel or work may be traversed the wheel holds its shape and size well, and when redressing is necessary the manner in which the diamonds are mounted in modern grinding machinery renders the process at once simple and expeditious; the redressing of a wheel requires much less time than the average resetting of a steel cutting tool in lathe or planer.

Not only upon parallel surfaces, but upon form grinding the wheel is becoming a recognized factor, and though sharp corners are always to be avoided, many simple forms are regularly finished, especially on round work, by feeding the wheel in toward the center of the work without traverse.

As a matter of course where grinding is carried on as a regular manufacturing operation, fixtures are as necessary on the grinding machines as they are upon the milling machines for similar purposes, and in the shops of the Fellows Gear Shaper Co., of Springfield, Vt., may be found many interesting examples.

The main driving shaft of the Fellows gear shaper, shown in Fig. 1, is finished all over by grinding. The parallel work is done upon centers in a standard ma-

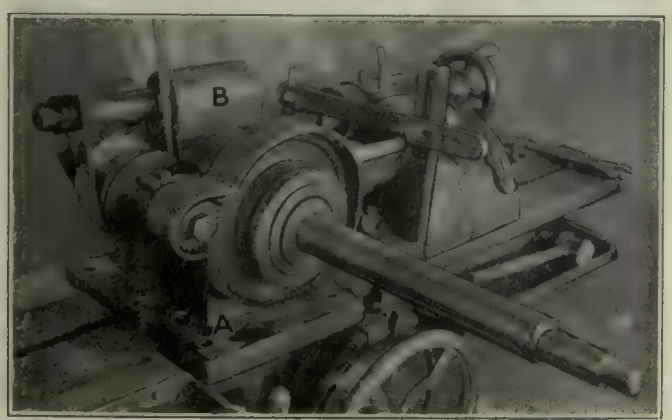


FIG. 2. FIXTURE FOR GRINDING FACE OF DISK ON MAIN DRIVE SHAFT

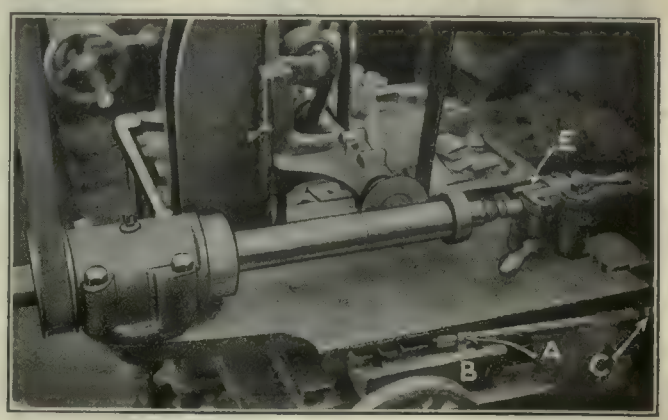


FIG. 3. FIXTURE FOR GRINDING UNDER FACE OF SHOULDER ON CUTTER SPINDLE

chine, but for finishing the face of the disk a special fixture shown in Fig. 2 is provided that holds the shaft at right angles to the axis of the grinding wheel. The casting *A* is bored to receive a large hollow spindle the center line of which is in the same horizontal plane as the center line of the wheel spindle of the grinding machine. The spindle in the fixture shown is driven through spur gearing by a belt from the small drum that ordinarily drives the work-head of the machine, but the fixture was designed and several others have been constructed with the drive through a worm and wheel, the worm being enclosed in the housing *B* which is a part of the main casting.

A bad feature of the spur gear drive, avoided by the use of the worm and wheel, is the quarter turn belt, necessarily out of line with the drum, and the stud shown in the place of the worm shaft is to keep it on the pulley. With the worm drive the driven shaft is parallel with the drum and there is no trouble with the belt.

The hollow spindle of the fixture is fitted with spring collets at either end, and a piece of work held by these collets is rotated true and in proper relation to the grinding wheel.

Loading and unloading is necessarily done from the back side of the grinding machine, the table being run out far enough after the grinding is finished so that the work will clear the wheel guard.

This fixture makes it possible to perform quickly, easily and accurately an operation that by ordinary methods is both tedious and uncertain. Similar pieces of other sizes can be handled in the same fixture by providing spring collets of the required inner diameter. Another part of the Fellows machine for which a special fixture has been provided adapting it to be ground on a standard machine is shown in Figs. 3 and 4. The part is the cutter spindle and it is to be ground upon both faces of the enlarged portion near one end.

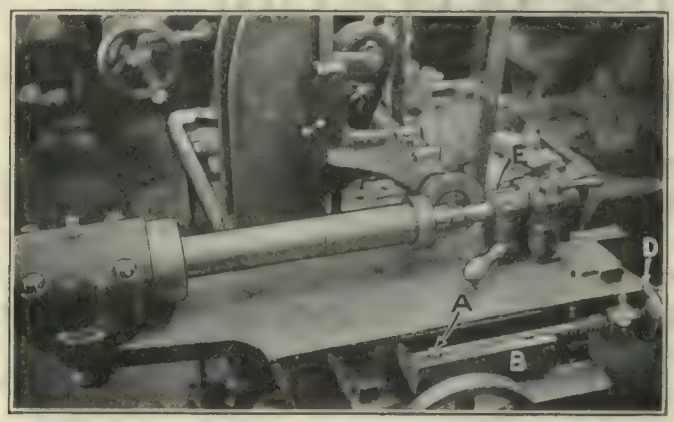


FIG. 4. SAME AS FIG. 3, IN POSITION FOR GRINDING UPPER FACE OF SHOULDER



FIG. 5. LOWER INDEX WHEEL OF FELLOWS GEAR SHAPER

The table of this machine is moved to and from the wheel by means of the small handwheel shown in front and may be traversed in a direction parallel to the axis of the work by a larger handwheel below it. The traverse may be locked in either of two positions by the ingenious latch shown at *A* in both Fig. 3 and Fig. 4. The block *B* is rigidly secured to the cross-slide of the machine, and has no longitudinal movement. The latch *A* is threaded through the swivelling stud *C* and the table can be accurately adjusted to position relative to the wheel by turning the micrometer dial *D*.

The shoulder of the latch *A* fits a correspondingly shaped depression at either end of the block *B*. In Fig. 3 the latch is shown in position to grind the under face (spoken of as under face for the reason that when the cutter spindle is in its proper place in the gear shaper its position is vertical with the larger end down) bringing the wheel into position to pass across the surface.

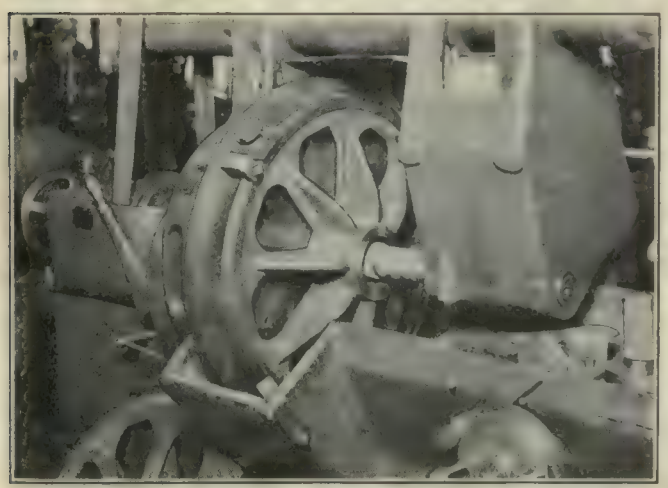


FIG. 6. THE INDEX WHEEL MOUNTED ON SPECIAL FACEPLATE IN THE BRYANT GRINDER FOR GRINDING THE BORE



FIG. 7. THE SAME FACEPLATE AS SHOWN IN FIG. 6 IN USE ON OTHER WORK

Fig. 4 shows the work nearly but not quite in position to grind the upper face of the shoulder, the movement of the table having been stopped just before the shoulder on the latch-bar dropped into the depression at that end of the block. To shift the work from one position to the other it is needful only for the operator to lift the latch with his forefinger and traverse the table until the latch drops into place at the other end of the block.

A cup-shaped wheel is used, held by a flat nut which sets entirely within the recess on the face of the wheel thus permitting the latter to advance until its face touches the spindle if necessary, though actual contact at this point is avoided by undercutting the corner in the work at the time it is roughed out on the lathe. The under surface of this shoulder of the cutter spindle must be an accurate flat and exactly at right angles with the center line of the spindle; for it furnishes the actual support of the gear shaper cutter and any inaccuracy at this point would be reflected in the product of the gear shaper.

The work is held in spring collets, and its free end supported by a dead center. The rotating member is mounted in a swivelling bearing. To take out the work the collets are released, the work pushed back through the spindle until it clears the center and then swung forward until it can be withdrawn. Two diamonds are mounted in the holder at *E* so that the wheel may be redressed both on its face and periphery by a few simple and quickly performed movements of the table.

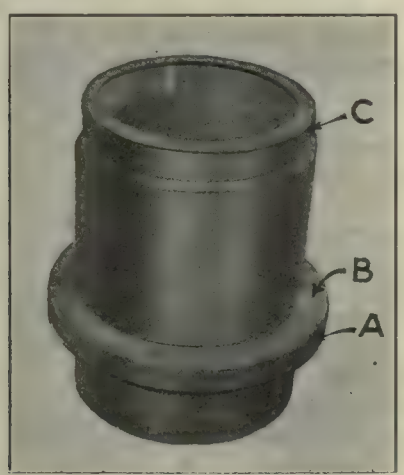


FIG. 8. HELICAL GUIDE LOCATED FROM OUTSIDE TO GRIND BORE

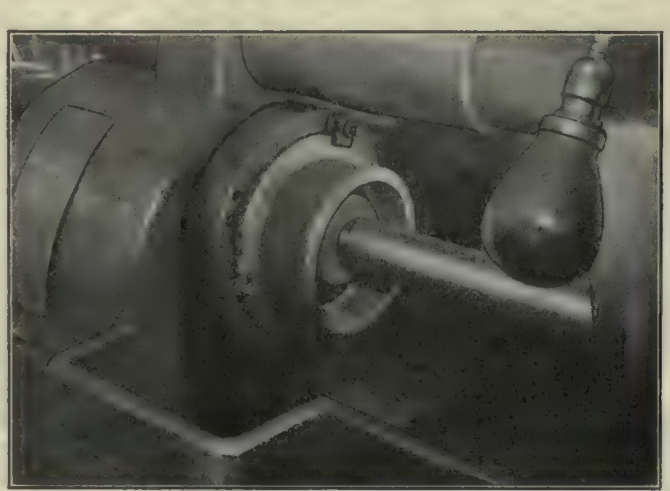


FIG. 9. THE CHUCK USED TO HOLD THE HELICAL GUIDE WHILE GRINDING THE BORE

Usual Process Reversed

It has always been, and still is, the almost invariable custom in finishing round work to finish the hole first and mount the piece upon a true-running mandrel to perform succeeding operations. Mr. Stubbs, superintendent of the Fellows Co., believes in reversing this process; finishing the larger diameters first and from the surfaces thus obtained boring, or rather grinding if possible, the hole, thus reducing instead of exaggerating any possible error or inaccuracy existing in either work or machine. An illustration of this application is given in the case of the piece shown in Fig. 5.

Anyone at all familiar with the gear shaper and its product knows that inaccuracies in its construction are simply out of the question. Every part having to do with the actual shaping of the gear, and that is practically every working part, must be as near mechanical perfection as is humanly possible to attain. The part shown in Fig. 5 is known as the lower index wheel and when in position in the gear shaper its office is to rotate the gear blank in unison with the cutter. It is not, properly speaking, an index wheel at all, for it has no locating notches and its movement is continuous instead of intermittent.

The part is a worm gear of cast iron and, as shown in Fig. 5, is practically finished except that the teeth are not cut and the hole is not yet up to standard size. The bore is finished by grinding while the piece is strapped to a special faceplate shown mounted upon a Bryant chucking grinder in Fig. 6.

A large cast-iron faceplate of rather light construction is mounted upon the spindle of the machine and in its face is driven three hardened steel plugs spaced equidistantly apart and at the correct radial distance to bear upon the finished rim of the index wheel. Clamps located over these plugs serve to hold the work in place. It will be seen that the truth of the work depends not upon the faceplate itself but upon the exposed ends of the plugs which project about $\frac{1}{8}$ in. above the iron, and it is but the work of a moment to sweep the grinding wheel over the ends of the plugs; an operation that can be performed between each setting if necessary, and when from continued redressing the plugs are ground down flush with the surface of the plate, they can be driven out and new ones substituted.

A gear blank is mounted on this special faceplate, trued up diametrically by means of a sensitive indicator that will indicate error to a small fraction of a thousandth, and the bore ground to size. In this way any possible error in the machine, or that might be caused by driving a mandrel, is avoided; and there is no opportunity for distortion that might follow the removal of metal from the periphery after the hole is finished.

Other Applications of This Method

The same faceplate is used for similar operations upon other parts by removing the hardened studs that form the bearing spots, and setting in others properly spaced to receive the new work. Fig. 7 shows the set-up with a smaller piece in position.

Another application of the principle of holding by the larger diameter while finishing the smaller one is shown in Figs. 8 and 9. The part to be finished, Fig. 8, is of cast iron, and has been rough-turned and bored and

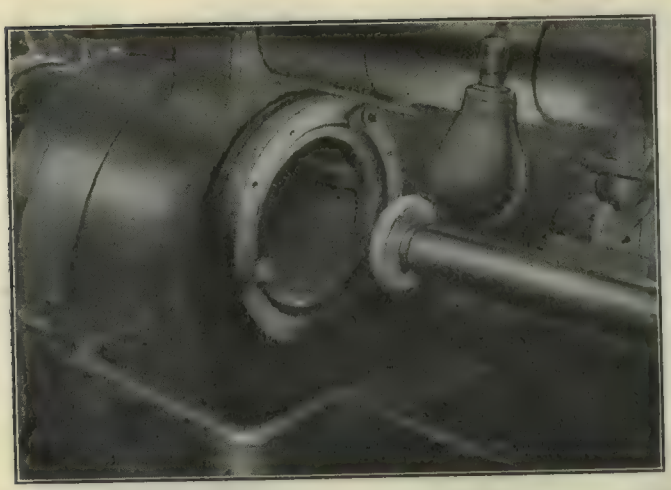


FIG. 10. THE HELICAL GUIDE IN PLACE FOR GRINDING THE BORE

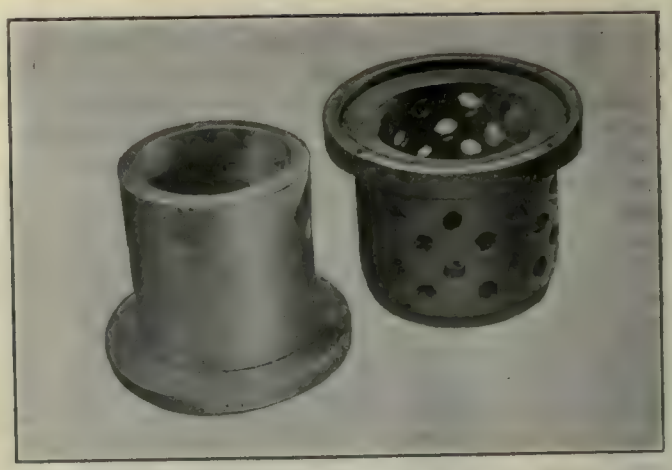


FIG. 11. ANOTHER PIECE GROUND IN SAME CHUCK BY USING PERFORATED ADAPTER

the outer surface finish-ground at *A*, *B* and *C* before coming to this operation. The remaining outer surfaces are not finished at all. It is essential that the bore be concentric with *A* and accurately at right angles to *B*. The fixture is shown in Fig. 9.

The fixture, which may be called a pot chuck, is mounted upon a Bryant grinder and provision is made for a flow of water into and out of the body of the chuck, thus keeping the piece to be ground immersed in the cooling fluid without allowing any of the latter to reach the wheel. In the back of the chuck is a spring supported follower plate upon the face of which a rubber gasket is cemented. When the work is put in, the end bears upon the gasket, pushing the follower back against the action of the spring and thus forming a water-tight joint at that end. The shoulder upon the outer part of the work fits the recess in the face of the chuck and holds back the water from coming out at this end. Water is introduced through the hollow spindle of the machine. Fig. 10 shows the piece in place for grinding.

A similar piece shown in Fig. 11, somewhat smaller in diameter, is ground in the same chuck, using the adapter shown in the same figure to compensate for the difference in size. The adapter is a bushing of cast-iron with perforated walls to allow free circula-

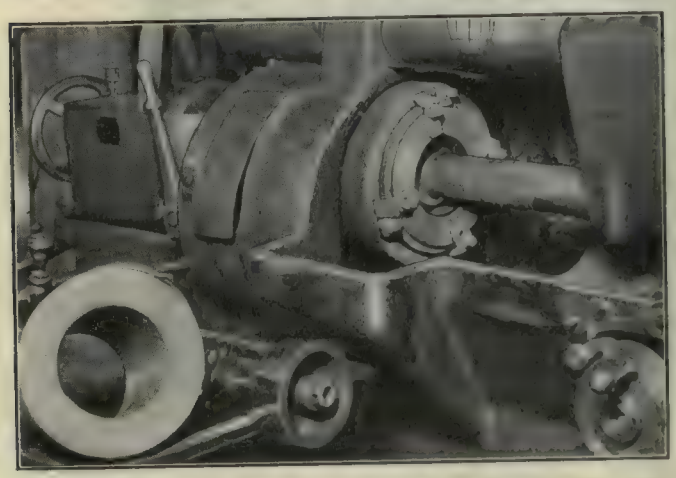


FIG. 12. ADAPTER AND BUSHING SET UP READY FOR GRINDING. WATER HAS ACCESS TO OUTER WALL OF BUSHING BUT CANNOT REACH THE GRINDING WHEEL

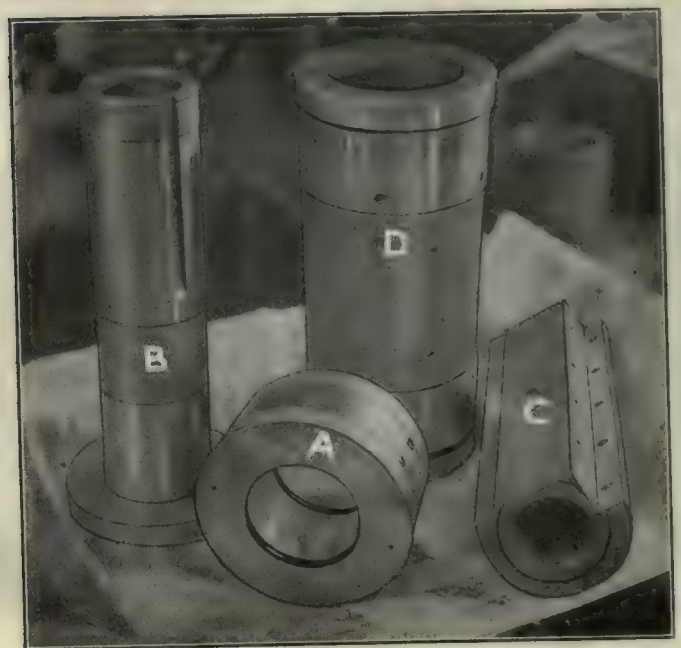


FIG. 13. THREE PARTS OF CARBONIZED STEEL, ALL OF WHICH ARE GROUND ON THE INTERIOR AFTER THE OUTER SURFACES ARE FINISHED

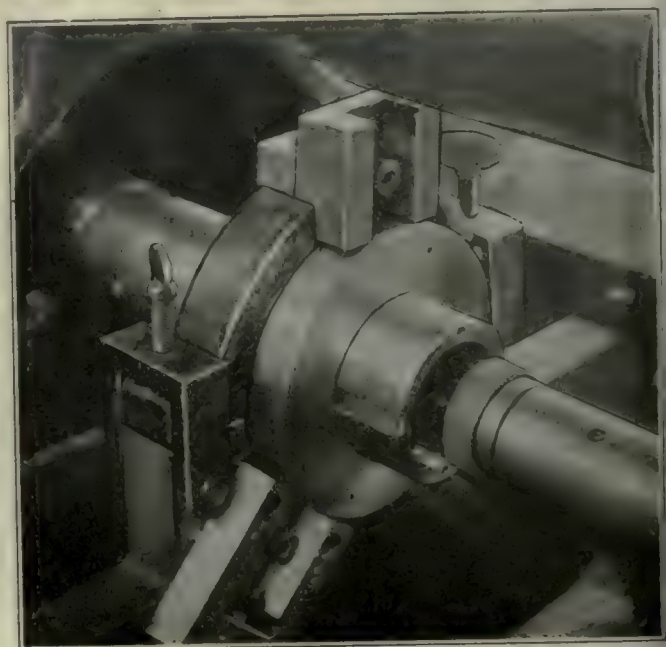


FIG. 14. SHOWING THE METHOD OF HOLDING ONE OF THE PARTS BY MEANS OF A "CAT" AND STEADYREST

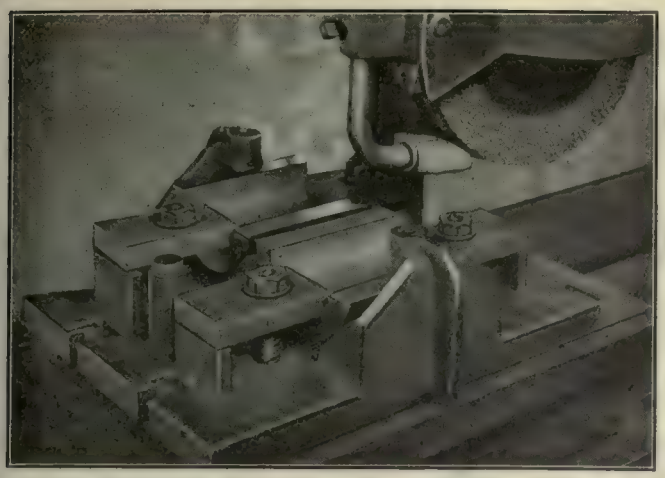


FIG. 15. A FIXTURE, BUILT FOR A MILLING MACHINE, IN USE ON A GRINDING MACHINE

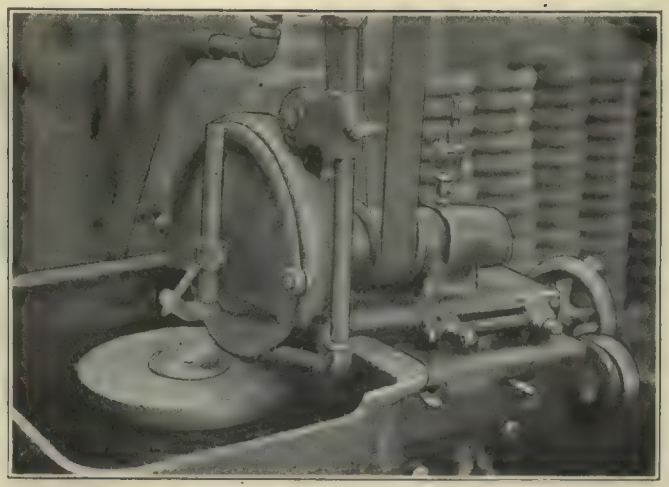


FIG. 16. A SPECIAL PURPOSE GRINDING MACHINE

tion of the cooling medium between itself and the work. The parts are shown mounted in the chuck in Fig. 12.

Other parts that are finished on their outer surfaces before the bore is finally brought to size are shown in Fig. 13. The piece *A* is what in the old-fashioned machine shop would have been called a "cat," only it is a very carefully constructed tool, whereas the "cat" was any old scrap collar or bushing with eight set-screws in it.

This cat consists of a hardened and ground steel collar enclosed by a split bearing of bronze and confined against endwise movement by two machine steel collars pinned to the bronze bearing. It is used to carry the outer end of the part *B* in a steadyrest as shown in Fig. 14 the inner end of the work being held and driven by a spring collet in the spindle of the grinding machine.

The steadyrest itself is quite as carefully made as the outer parts. The yoke encloses the bronze bearing of the holder, the bearing remaining stationary while the steel bushing revolves inside it. A steady-pin in the inner bushing enters the keyslot in the work insuring that no rotative movement occurs other than in the place provided between steel collar and bronze bearing.

A similar holding piece, adapted to the peculiar shape, is provided to carry part *C*, Fig. 13, while part *D* takes its bearing directly upon three bronze jaws with which the steadyrest is provided. The channels for these jaws may be seen in Fig. 14, but the jaws themselves are removed when other pieces of work are being ground. The piece shown in place in Fig. 14 is the work-holding spindle of the gear-shaper; part *B* in Fig. 13.

The application of a standard milling machine fixture to a grinding operation is shown in Fig. 15. The split bushing shown in place in the fixture has one of its edges at a slight angle to its center line and one of the seats of the fixture is, therefore, tilted to bring this edge parallel to the table travel of the grinding machine. A complete bushing is thus ground at each setting except the first and last ones; the parallel edge being ground while the half bushing is in the position nearest the operator, after which it is placed in the other position to grind the angular edge and a new piece placed in the first position.

Though this fixture was made to be used on a milling machine, no trouble at all was presented in adapting it to the grinding machine. It was necessary only to set it on the magnetic chuck, line it up, and turn on the current. Its use in this manner is, however, but a temporary makeshift. A fixture is being constructed that will be attached by screws to the magnetic chuck and will hold the bushings by magnetism alone, leaving the working surface entirely free from clamps or other projections that might cause trouble by being accidentally run under the grinding wheel.

Where a certain hardened part has to be duplicated to such large numbers as to require the constant service of a grinding machine, it may be advisable to build not only special fixtures but a special machine. Such a machine is shown in Fig. 16 for grinding the bevel on the upper surface of the gear-shaper-cutter collar.

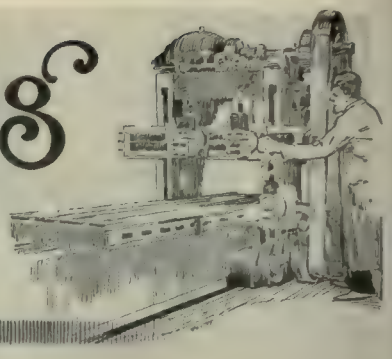
Instead of setting the work spindle to an angular position, as may be done with standard machines of this type, a machine was built having the ways of the wheel slide at the correct angle to give the desired bevel. As this bevel always remains the same, and there is no adjustment in this respect, the machine becomes strictly a single-purpose tool, but it is kept constantly busy on the job for which it was designed.





Metal Cutting Tools.

By A. L. DeLeeuw



III. Standard Lathe Tools*

Angles of Rake and Clearance—Setting the Tool—Round-Nosed and Cut-off Tools—Boring Mill Tools

A LATHE tool may be expected to be different from a planer tool, due to the fact that the lathe tool feeds during the cut, whereas the feed movement of the planer tool will take place between cuts. If we are turning up a 2-in. shaft and use a $\frac{1}{16}$-in. feed, then the tool will have moved sideways $\frac{1}{16}$ in. in the same time that a point of the work has made one revolution; in other words while it has traveled about 6 in. In order that the lathe tool shall make this sideways movement while it is in the cut it is necessary that it shall penetrate the work sideways. In order to do so it must have side clearance. Without clearance the tool will be compelled to crush the metal sideways and, as the metal is revolving, the tool would rub against the work under this heavy crushing pressure. When for some reason this happens the tool breaks down almost immediately. This condition may come to pass from a variety of reasons, such for instance as the breaking out of a small piece of the cutting edge or the wearing down of the cutting edge and it may even be caused by coarse grinding marks on the tool. The planer tools need a clearance in order to clear the work sideways.

Why a Lathe Tool Should Have Clearance

There are then two reasons why a lathe tool should have clearance: Because it must penetrate into the metal, and because it must clear the work while cutting. These two causes are cumulative, that is, whereas a certain amount of clearance might be sufficient if the tool had only to cut and did not have to penetrate, it must have a larger amount of clearance if it must also penetrate the metal. Reference to this matter was made in the previous article where it was stated that the round-nosed tool used for planing may have a somewhat less amount of side clearance than given in Mr. Taylor's tabulation which was made for lathe tools only. The additional amount of clearance required is a variable quantity, and changes with the amount of feed and with the diameter of work. For ordinary roughing and finishing cuts this variation is so small that, for all practical purposes, it does not need to be considered. But there are many cases where the variation is so great that special attention should be paid to it.

This sideways motion of the tool while in the cut does not affect the rake, for rake would not be a requirement of the tool for penetration only. In fact there would be no reason why a tool should not penetrate even with negative rake. If the tool should first penetrate, say, $\frac{1}{16}$ in., and the work should then turn one revolution, side rake would not be required during the period of feed, but only while the work is revolving. Fig. 44 shows a piece of work in section. The outside circle indicates the size before, and the inside circle after, turning. The short lines drawn between these two circles indicate the sections as they are split off. As a rule, at least for roughing, the depth of cut is greater than the feed, so that the greater part of the cutting is done as indicated in Fig. 44; that is, the line along which the chip splits off is practically radial. But the chip must also clear itself from the remaining part of the work; in other words, some of the splitting off is done along lines parallel with the axis. As the depth of the cut is greater than the feed the radial line will be longer than the axial line and for this reason it is even more important to have side rake than front rake. In order to accomplish both purposes the tool should be arranged as indicated in Fig. 44a.

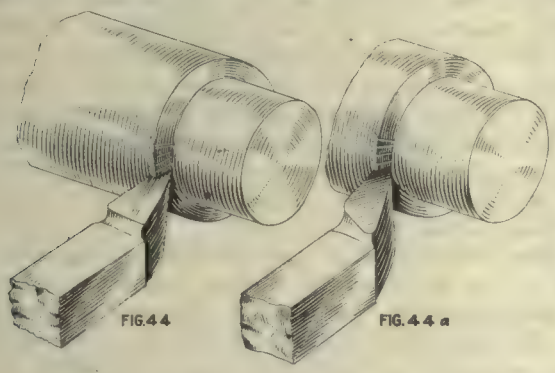
Modification of Side Clearance

Coming back once more to the modification of the side clearance to the axial feed while the tool is in work, we should remember that the same considerations which lead to the standard forms of planer tools also lead to standard forms of lathe tools; but that the angles should have the proper relation to the spiral which the tool describes over the work. For instance if a lathe tool should have the ideal form for taking a cut $\frac{1}{4}$ in. deep, $\frac{1}{8}$ in. feed on a 4-in. shaft, then this form will no longer be ideal if the depth of cut were anything else but $\frac{1}{4}$ in., if the feed were different from $\frac{1}{8}$ in. or if the diameter were anything but 4 in., because any of these changes would also change the angle of the spiral. To illustrate this with an extreme case let us take a shaft $\frac{3}{4}$ in. in diameter and let us take a cut $\frac{1}{4}$ in. deep and with a $\frac{1}{4}$-in. feed. This of course is a case which would not occur in practice but is taken here merely for the sake of illustration. After turning, the shaft would be $\frac{1}{4}$ in. in diameter, or practically $\frac{3}{4}$ in. in circumference. The spiral described by the tool point on the finished shaft would be the line *AC* (see Fig. 46a, in which *AB* is $\frac{3}{4}$ in. and *BC* is $\frac{1}{4}$ in.). At the outside of the work the circumference is practically $2\frac{1}{4}$ in. and the spiral in this case is shown in Fig. 46b. If we had reduced the feed to, say $\frac{1}{8}$ in., the spiral as shown in Fig. 46c would have been described at the finished part of the work, and a spiral as shown in Fig. 46d at the outside of the work. In all cases the angle *CAB* represents the addition to the side rake of a corresponding planer tool in order to make up for the penetration of the metal. In all practical cases of rough turning the variation in the angle

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is small. As the ratio between *CB* and *AB* expresses this angle it will be easy to show how small this variation is by taking some practical examples:

1.—Shaft 4 in. in diameter, cut $\frac{1}{4}$ in. deep, feed $\frac{1}{8}$ in.; outside circumference of work approximately $12\frac{1}{2}$ in.; angle of spiral $\frac{1}{8}$ in. to $12\frac{1}{2}$ in., or 1 to 100; inside spiral: circumference of work 11 in., angle of spiral $\frac{1}{8}$



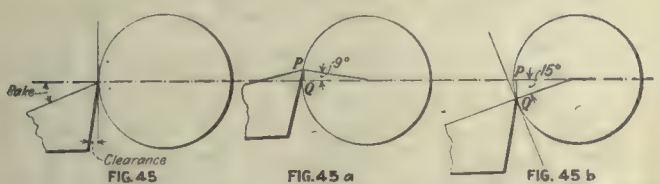


FIG. 44. TOOL WITH AND WITHOUT SIDE RAKE. FIG. 45. TOOL SET AT, ABOVE AND BELOW CENTER

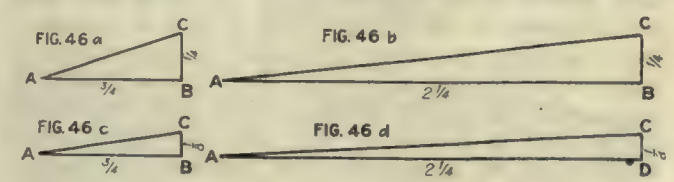
in. to 11 in., or 1 to 88. The first angle is about 35 min., the second angle about 39 min. Such a difference is less than the differences which are bound to creep in in the grinding of the tool even with accurate machinery and careful handling.

2.—Shaft 2 in. in diameter, depth of cut $\frac{1}{2}$ in., feed $\frac{1}{20}$ in. (a cut of this nature might be taken on a Jones and Lamson or a similar machine). Outside circumference approximately 6 in.; angle of spiral $\frac{1}{20}$ in. to 6 in., or 1 to 120; inside spiral: circumference of work approximately 3 in., angle of spiral $\frac{1}{20}$ in. to 3 in., or 1 to 60. The first angle is 31 in., the second angle 55 min. Though this difference is slightly greater—namely, 24 min.—yet it is not great enough to require any special precaution.

From the foregoing it will be seen that an addition of a side clearance of one to two degrees to the side clearance required in a planer tool would meet all practical requirements for roughing and finishing tools. However, for screw cutting, scroll turning, cutting of spiral oil grooves, etc., on a lathe the conditions are different. There the angle of the spiral may be quite considerable, and special precautions should be taken to insure a sufficient amount of side clearance. This matter will be further gone into in a subsequent chapter.

Lathes are not provided with means to set the tool accurately to the center of the work and it is left to the lathe hand to adjust this tool in such a way that it will work properly. Before tool grinders such as the Sellers or Gisholt grinder were commonly used, it was customary for each lathe hand to grind his own tools according to his own skill and his own notions; and one would find in the same shop two men side by side, one of whom would always set his tool above the center while the other would set his tool below the center, each believing that his own method was the right one. As far as the setting of the tool above or below the center was concerned it was probable that both men were actually right, for the first man had probably ground his tool in such a way that it could work only when set above the center, while the second man had ground his so that, in order to make it work at all, it had to be set below the center. Such a condition was almost unavoidable when there were no proper means for grinding the tool to standard angles, but now that we have such means there is no longer any reason why lathe tools should not be set to the center except the one important reason that the means for doing so are lacking. Lathes should have some provision for accurately setting the tool.

Suppose a shaft one inch in diameter were being turned up with a tool having a rake of 15 deg. and a front clearance of 9 deg. The front clearance is the angle between the front line of the tool and a vertical line going through the point of contact tangent to the circle. Figs. 45, 45a and 45b show the tool at the center, above the center and below the center. In Fig. 45a the point of the tool is set so far above the center that the tangent at that point corresponds with the front line of the tool. In other words, the clearance has been completely wiped out by setting the tool above the center. In the case of a 1-in. shaft with the tool having a clearance angle of 9 deg., the line *OP* would be $\frac{1}{2}$ in., and the line *PQ* would be $\frac{1}{2} \times \sin 9$ deg. $= 0.0782$. This means that if, under the above conditions, we should set the tool 0.078 in. above the center we would have no clearance at all and if we should set it more than 0.078 in. above the center we would have negative clearance; in other words, the work would rub against the front of the tool and no cutting could take place. If the shaft had been $\frac{3}{8}$ in. in diameter, a distance of 0.029 in. above the center would have wiped out the clearance. This shows that, for practical con-



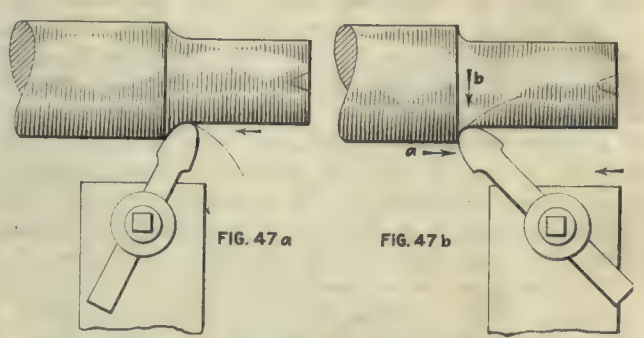


FIG. 46. SPIRAL ANGLES WITH LARGE AND SMALL FEEDS. FIG. 47. EFFECT OF SETTING TOOL AT AN ANGLE TO THE WORK

ditions, a lathe tool should be provided with more clearance when it is to be used for small shafts than for large ones. This is no hardship for it stands to reason that heavy cuts which, as we know, call for little clearance, would never be taken on a $\frac{3}{8}$-in. shaft. It also shows that the lathe hand should take particular care in trying to get the tool point exactly at the center when he turns small diameters. A small variation in that respect means a large amount of variation in

the angles. In Fig. 45b the tool is set below the center at such a distance that the rake is completely wiped out. Under those conditions it will be found that the line *PQ*, that is, the distance which the tool is set below the center, is 0.139 in. In case the shaft were a $\frac{3}{8}$-in. shaft, this distance would be 0.0485 in. It will be

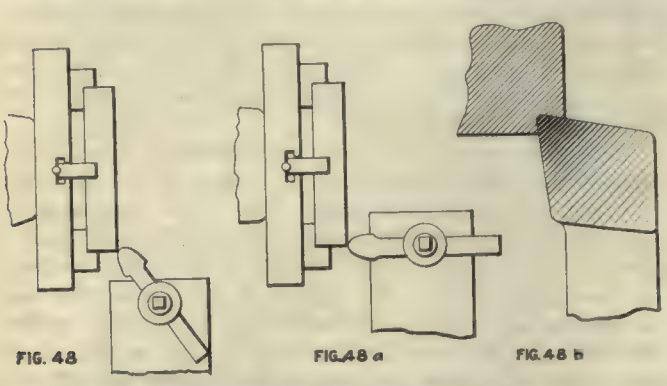


FIG. 48. ROUGH-FACING SETTINGS

seen therefore that the effect of a slight distance below the center is not so serious as a similar distance above the center. Nevertheless it is advisable to set the tool as close to the center as possible.

Effect of Angle Changes

The active angles of the tool are not only changed by setting it above or below the center, but also by setting it at an angle to the plane of the faceplate. Figs. 47a and 47b show such settings diagrammatically. If the tool shown in Fig. 47a is ground so that it will have the proper angle when set at right angles to the axis, then it must have different cutting angles when set as shown in the figure. This is true in regard to both clearance and rake. The effect of this change of angle is not serious as a rule. But this setting at an angle produces another effect of much more importance. If the tool is set as in Fig. 47a and feeds in the direction of the arrow, then the resistance it meets in trying to penetrate for feed has a tendency to turn the tool toward the right and away from the work. But if the tool is set as shown in Fig. 47b, this same resistance again turns it to the right, but this time into the work. Setting the tool this way is sometimes unavoidable on account of the necessity of reaching a point so close to the faceplate that the toolslide would interfere, or it may be that the work itself has projections which must be cleared by the toolslide. In such cases setting the tool as in Fig. 47b is a makeshift—undesirable, it is true, but also unavoidable. However, it is a fact that many lathe hands seem to have a preference for this way of setting the tool, even when there is no necessity whatever for doing so. This should be discouraged.

When taking a roughing cut the depth of cut is, as a rule, greater than the feed, so that the pressure against the tool in the direction of arrow *A* is greater than that in the direction of arrow *B*, and therefore the tool will turn to the right and take a deeper cut than was intended. This greater depth of cut will still further increase the tendency to turn and, if the tool is clamped securely enough, there will finally come a point where the spring of the tool will counteract this tendency to make it dig deeper into the work. If the shaft to be turned is out of round or rough so that the depth of the cut varies constantly, the side pressure against the tool will be subject to heavy fluctuations and it will be constantly jumping in and out of the cut. The result will be a short, broken-up chip which means an unnecessary amount of power consumed, a rough piece of work of uncertain diameter, more spring in the work than is necessary which means that in long shafts the diameter at the center will be considerably greater than at the end, and finally a short life to the tool. If a tool setting of this kind is used for finishing the work the results are equally unsatisfactory. Though the spring is not so great the jumping of the tool will have even greater effect, proportionally, for occasionally it may jump clear out of the cut, as the depth of the cut is very small, and leave a rough, uncouth-appearing job.

Another effect of this way of setting the tool is caused by the fact that this method means more overhang and this again means more spring in a vertical plane, and also more twisting of the tool. It should be kept constantly in mind that everything which will reduce the rigidity of the tool and its support must be avoided.

The operation of rough facing can be done in various ways. The tool might be set as in Fig. 48 or as in Fig. 48a, using a round-nosed tool; or a tool might be used as shown in Fig. 48b. The setting of Fig. 48 has the disadvantage of uncertainty in regard to the active angles, that of Fig. 48a has the disadvantage of the cut pressing in against the tool with a large leverage, while that of Fig. 48b has the disadvantage of the small round. There is no reason, however, why this round should not be made larger, in which case this last setting would be preferable because it requires the least overhang and because the main pressure of the cut is as direct as possible against the feed screw.

The Proper Set of the Tool

This matter of setting the tool and of its overhang beyond the toolpost has not yet received the proper amount of attention. It seems to be the case that the construction of the tool is a result of evolution, starting with the hand tool of a former period. Where we have to support a heavy load, we prefer to have it immediately over the posts of the building, rather than on a part of the floor away from the posts, yet in all engine lathe constructions we take the cut at the end of a cantilever, the tool. In some turret lathe operations we do better (at least once in a while) but even in the heaviest constructions of engine lathes we adhere to our standard construction of tools and toolposts. There seems to be no good reason for this except that it has become a matter of habit. We are so used to it that we no longer consider it. In Fig. 49 a piece of lathe work is shown in section. If it were established that the resultant of the various pressures on the tool were in the direction of the arrow then we should support the tool somewhat as shown. Fig. 50 shows that the tool should also have an inclination from left to right because of the side pressure. Except where a lathe is used for an unlimited variety of work we should be able to come to a fairly close determination of the direction of the resultant of all the forces acting on the tool and the axis of the tool should be held in that direction.

Such an arrangement should certainly be used for all lathes where the nature of the work is known beforehand. Provision might be made for some auxiliary toolholder to be used in those rare cases where the

regular toolholder would not be practical. Instead of doing this we are now providing all our lathes with a toolholder which is not practical for most of the work in order to meet the few cases where a logically constructed toolholder could not be used. As the direction of the resultant of all the forces would make an

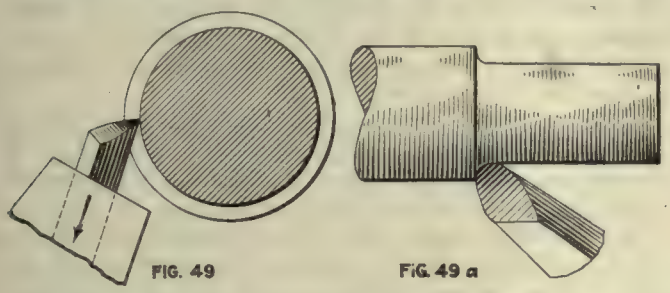


FIG. 49. METHOD OF SUPPORTING LATHE TOOL WITH RESULTANT PRESSURE AS INDICATED BY ARROW

angle with the faceplate and with the meridian plane of the lathe, as well as with a horizontal plane, and as the first two angles would probably not be very great, it would be possible to make a compromise by setting the axis of the tool in a slightly different direction from the resultant of the forces—but taking care that this resultant would remain in the body of the tool. Doing this it would be possible to set the tool in such a way that its setting forms the front and side clearance. Grinding the top to the proper front and side rake would then give a tool with all the necessary angles. For resharpening, the top only would have to be ground. A solid but adjustable stop could be provided under the tool. In order to give this tool still further rigidity, it should be ground on all four sides so as to fit in the holder. Its cross-section should preferably be a trapezoid, so that a couple of screws would force it against the taper sides and hold it rigidly. Tool steel could be used in the bar form in which it comes with the exception of cutting up and grinding to size. Such an arangement would also make it exceedingly simple to provide a gage or attachment by which the tool point can be set to the exact center. Such a gage is shown in Fig. 50. As the tool might be tightly wedged in the holder it would be wise to make provision for releasing the tool. Fig. 50C shows how this is done by means of a screw which can be brought to bear against the narrow side of the tool. Tools of this general nature are now being used quite commonly in turret lathe practice, but their support is not rigid so that the very reason for which they are being recommended here does not exist in turret lathe practice.

That this mode of supporting a tool gives much greater rigidity was shown by some experiments made by the writer a few years ago. The tools used were of a different shape and for a different purpose, but their essential requirement was rigidity of support as the contained angle was only 27 deg. Supporting such

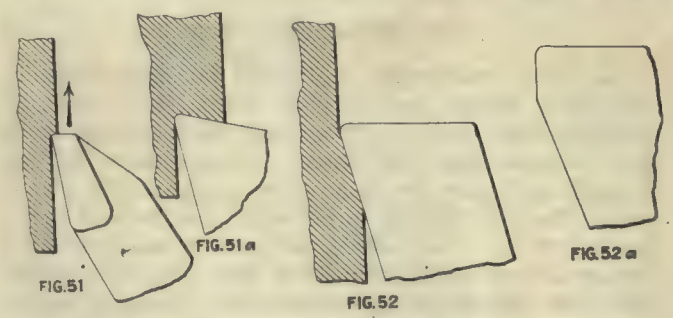


FIG. 51. TOOL FOR FINISH-FACING. FIG. 52. CUT TAKEN BY FACING TOOL

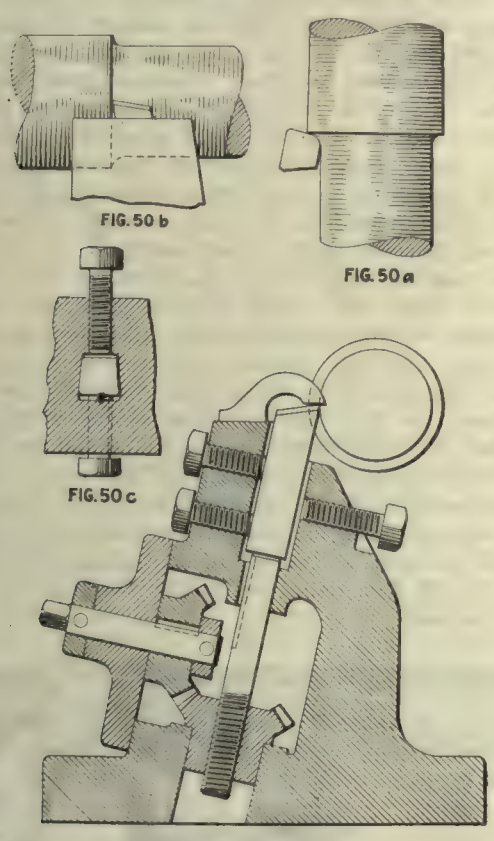


FIG. 50. A SUGGESTED TOOLHOLDER

a tool in the ordinary manner was not successful. The tool would break down at once as was expected. But placing it direct on the toolslide so that the resultant of the forces at work would go through the tool base made this tool a success. A description of this tool will follow later.

Front and Side Clearance

A facing tool may have to face from a larger diameter down to the center of the work. What is the front clearance in a cutting tool is side clearance in a facing tool, and vice versa. The penetration for the feed takes place in a radial instead of in an axial direction, so that the front clearance this time must be more than the corresponding front clearance in a planing tool, whereas the side clearance may be the same as for a planer tool. Furthermore as such a tool may come to within a very short distance of the center, or even to the center itself, it follows that a large portion, or maybe all, of its front clearance will be wiped out if the tool were set even a small amount above the center, and that it might get negative rake when close to the center if the tool point were set slightly below the center. As it is not possible, with the present arrangement, to set the tool quickly to the exact center, it is advisable to provide somewhat more rake and clearance than for a turning tool, even though the tool may be somewhat weakened.

For finish facing a tool is used as shown in Fig. 51, in which the arrow indicates the direction of feed. It has often been observed that reversing the direction

gives a better finish. The reason for this is that cutting in the direction as shown all the cutting is done with the front part of the tool as indicated in a larger scale in Fig. 51A. The side of the tool is not in action and does not smooth down the cut. If a cut is taken with a feed in the opposite direction as shown in Fig. 52 on a large scale, the tool takes a cut as if it were a broad-nosed tool, and the rounded portion of the front of the tool takes away the loose metal which may be left after the cut. The much wider chip taken causes the pressure at any one point of that chip to be much less than if the cut were taken in the direction of Fig. 51, and consequently the tearing action is much reduced. If in addition we should modify the tool somewhat and make it as shown in Fig. 52A, where a short land is provided between the bevel part and the point, a still smoother finish will result but care should be taken to make this land not too wide. How wide it may be made depends on the nature of the work. With a heavy, chunky piece of work, as much as $\frac{1}{16}$ in. or $\frac{1}{8}$ in. is permissible. For general utility, $\frac{3}{32}$ in. to $\frac{5}{64}$ in. is recommended. Such a tool makes a very presentable finish on cast iron as well as on steel.

The Broad-Nosed Tool

The true broad-nosed tool finds no application in lathe work except for faceplate work. If a piece of large diameter has to be faced and the facing does not have to come near the center, a broad-nosed tool can be used, and then the same rules apply as for planer tools. The chief points to be looked out for are again the following: The tool should be surface ground, it should be very smooth, it should have very little clearance and little rake (not more than 12 deg.), and it should be held in the spring toolholder (sometimes called the goose-neck holder). The broad-nosed tool is not suitable for ordinary lathe work because it must penetrate into the work while it is cutting.

The broad-cutting edge and its resultant heavy backward pressure cause such strains that the fluctuating pressure of the penetration for feed is very apt to cause chatter. As a matter of fact many men seem to think that nothing but a pointed or rounded tool will do for finish turning. This is not so. A small amount of land may be given but when that land exceeds $\frac{1}{16}$ in. great care must be taken to avoid chatter.

Use of Cut-Off Tool

The cut-off tool is nothing but a blade somewhat broader at the top than at the bottom, and of which top and front are ground in such a way as to provide rake and front clearance. As a cut-off tool must almost always penetrate to the center it is essential to have means to set it correctly. As a rule, cut-off blades are finished all over, but they must be held in the holder and therefore the holder should be arranged so that the tool point can easily be set to the correct height. One of the reasons why it is a difficult matter to cut off a large piece and do it rapidly is that the tool must be unsupported for a distance somewhat more than the radius of the work. The heavy pressure of the cut makes the tool collapse sideways, just as a beam will collapse by buckling if it is overhung and loaded at the end. To overcome this it is advisable to make the blade as deep as possible and to give it an additional support close to the work, or preferably over its entire length. This can easily be done where the depth is made sufficiently great.

Another reason why a cut-off tool will give trouble lies in the fact that a chip taken has a tendency to spread out sideways, in other words, to become broader than the width of the cut and to stick in the cut. The tool meets these chips from time to time and has to do additional work to make them jump out of the cut. This causes vibration with all its resultant troubles. It is for this reason that wherever possible two tools should be used for cutting off, one in front and one in the rear, the one with a round nose and the other with a square nose, and the one with the round nose to be set a small amount ahead of the squared-nosed tool, so that this latter tool does nothing but square up the groove left in the piece by the round-nosed tool.

Boring Mill Tools

Boring mill tools are in practically all respects the same as lathe tools. They have to meet the same conditions and should be constructed along the same lines. If there is any difference at all it is a difference of degree. As a rule work done on the boring mill is of larger diameter and of less length. The problems of spring of long work which one encounters so often in lathe operations are generally absent in the boring mill. There is also much less danger of vibration and chatter, due to the fact that the masses of boring mill table, spindle and bed are much greater than the corresponding masses in lathes. Besides, these parts are disposed in such a manner as to secure the greatest possible stability. On the other hand, there is a tendency to have more overhang of the toolholders and there is a greater chance for bending, due to the flexibility of the cross-rail. If a cut is taken on the outside of a deep piece of work a long overhang of the toolbar is unavoidable, and if the diameter of the work is relatively small the saddle will be relatively near to the center of the cross-rail thus causing a great deal of spring. For this reason it is even more important to use spring tools or goose-neck tools on the boring mill than on the planer. Where a boring mill is equipped with two heads the spring of the second head or boring bar will be away from the work, and this second head therefore does not require a spring tool. In a later chapter on form tools this matter will be brought up again and it will be shown that the left-hand head should always be used when forming operations must be done.



Making a Sheet-Steel Universal Joint Cover

Methods of Drawing and Forming Articles of Comparatively Thick Sheet Metal—Flanging and Closing-in by Means of Sectional Dies

By W. A. FLUMERFELT
Manager Planning Dept., New Britain Machine Co.

THE equipment and the methods employed in the manufacture of an article may vary with the local interpretation placed upon the physical characteristics of the article itself, the qualitative and quantitative requirements, and the ingenuity and resourcefulness of those whose duty it is to prescribe the methods and provide the equipment.

The method, here described, of making a sheet-metal universal joint cover offers grounds for divergence of opinion, but the writer does not desire to start a controversy, but rather to introduce for the readers' consideration the methods and equipment used by one manufacturer in producing such an article. This cover, shown in Fig. 1, is made from 0.062-in. hot-rolled pickled and limed sheet steel. Six operations are required for its completion. Graphic presentation of the sequence and result of each operation may be seen in Fig. 2.

The desideratum in planning the method was to produce the cone, which afterward formed the main body of the completed cover, as early in the progress of the shell as possible and leave it undisturbed throughout the succeeding operations. Attempts to produce this tapered shell at the first operation in a double-action

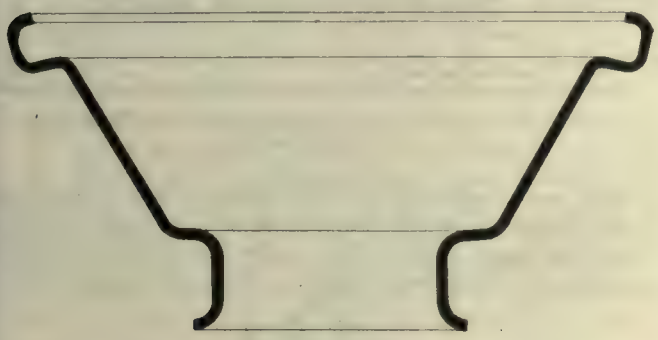


FIG. 1. THE PART TO BE MADE

press resulted either in wrinkled sides, or, when the tension was increased, a fractured end.

The first operation consists of blanking and making the first draw; accomplished in a double-action press by means of the die shown in Fig. 3. The second operation, in which the cone is formed, is carried on in a single-action press in the die shown in Fig. 4. In this die the knockout, at rest, does not come flush with the face of the die but stands below it a quarter of an inch, thus making the floor of a nest formed by the drawing edges of the die ring to locate the first operation shell for second forming.

In the third operation the edge of the shell is trimmed to size, the large end formed ready for closing, and the small end partially formed. This is accomplished in a single-action press with the die shown in Fig. 5, reference to which will make the operation of the die apparent. Scrap cutters take the place of a stripper for making possible the removal of the ring of scrap which is trimmed from the outside of the shell. These scrap cutters are merely square punches with 90-deg. chisel points whose function it is to separate the ring

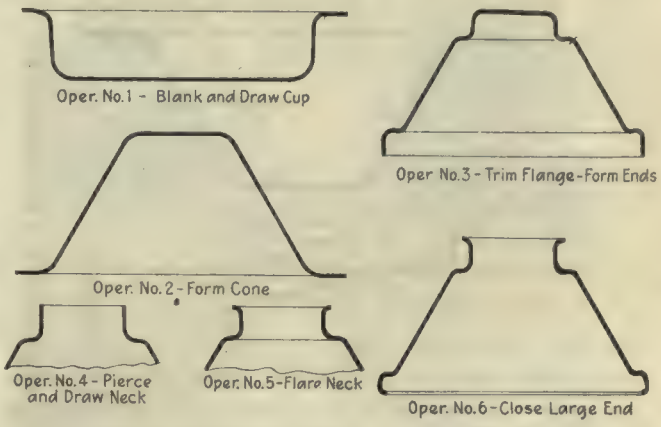


FIG. 2. THE SEQUENCE OF OPERATIONS

of scrap into two half circles by their chisel action on passing through the scrap and meeting the face of the die ring as shown.

In the fourth operation the small end of the shell is pierced and the neck increased in length by drawing or opening out the perforated end on a single-action press in the die illustrated in Fig. 6. In this die, as in the die used in the preceding operation, the work sticks to the punch and ejection is made by means of positive knockout.

Flaring the neck, Operation 5, is accomplished in a single-action press by the use of the die illustrated in Fig. 7. By way of explanation, it may be stated that the mechanical performance of this die corresponds to the manual act of placing a split ring about the external diameter of the neck of the shell, then intro-

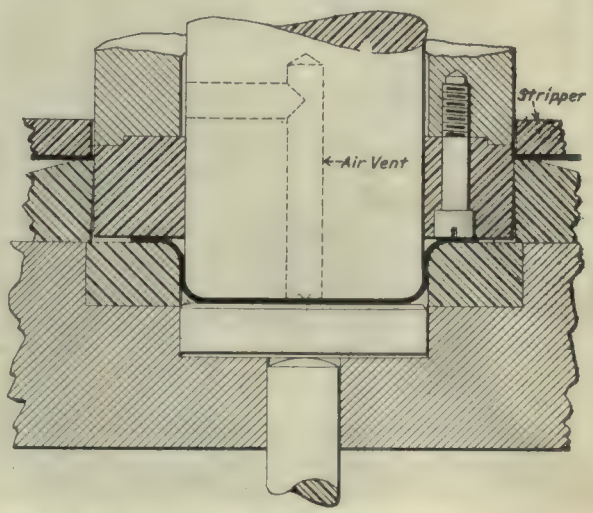


FIG. 3. BLANKING AND FIRST DRAWING TOOLS

ducing a flaring punch into the interior, withdrawing the flaring punch and afterward removing the split ring.

That such an action is obtained may be seen by referring to the illustration: Three sections *A*, having

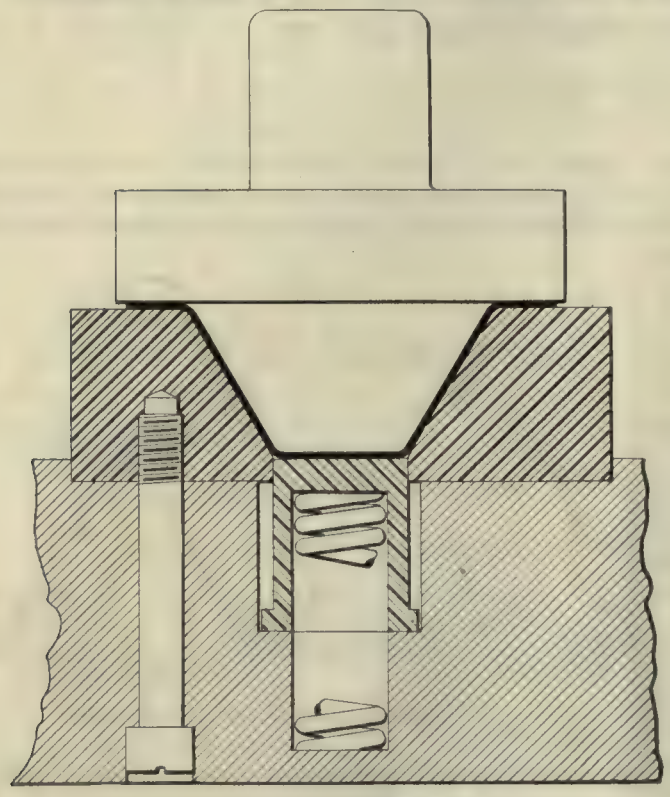


FIG. 4. TOOLS FOR FORMING THE CONE

on their inner end one-third of a circle of the same diameter as the neck of the shell, are dovetailed into a plate *B* which is mounted on springs and which

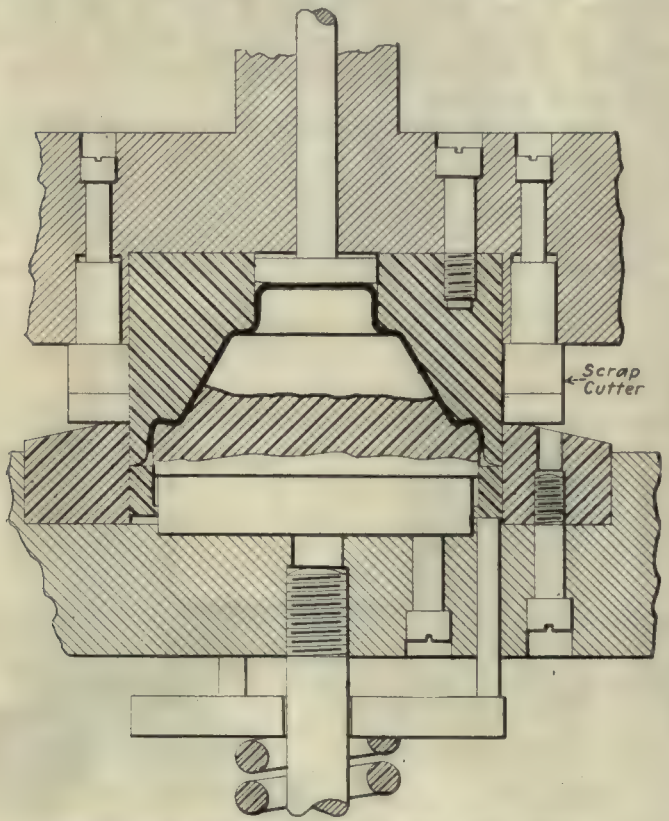


FIG. 5. DRAWING UP THE NECK AND FORMING LARGE END

at rest carries the sections *A* in advance of the flaring punch *C*. As the ram of the press descends, these sections, which are actuated by cams *D*, stand in the "open" position, as illustrated in Fig. 8, until by contact

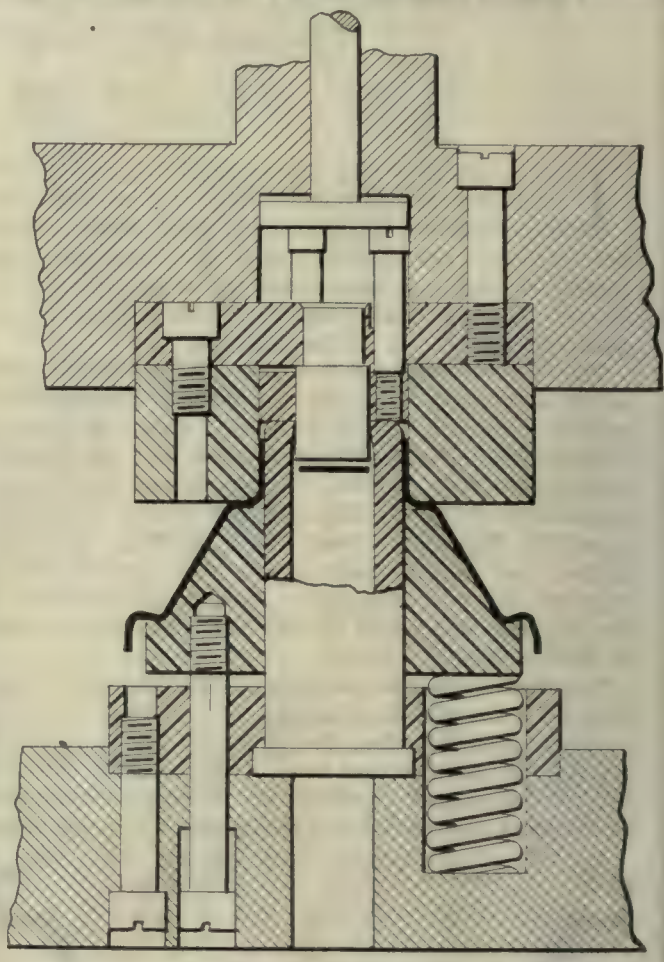


FIG. 6. COMPLETING THE NECK AND PIERCING THE CENTER

with posts provided for the purpose, the springs supporting the plate are compressed and the sections moved by the cams toward the center to form a complete circle at their inner ends. Since the cams are so

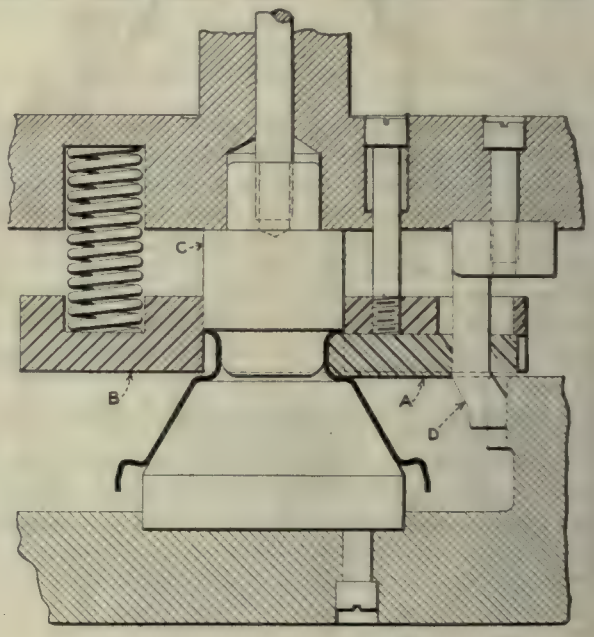


FIG. 7. FLARING THE SMALL END

proportioned to obtain a "dwell" there is no further motion of the sections while the flaring punch is acting on the neck of the shell.

On the return stroke of the ram, the flaring punch first withdraws during the period of "dwell" on the cams; then the sections open; and finally the entire unit lifts with the punch, and the shell may be removed from the die.

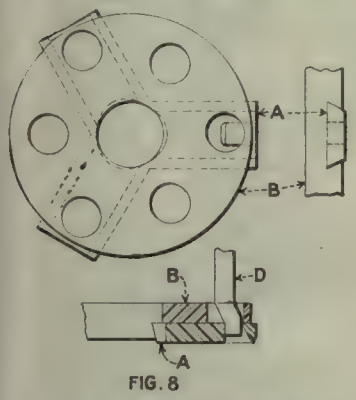


FIG. 8

FIG. 8. DETAILS OF SECTIONAL RETAINING RING IN FLARING TOOLS

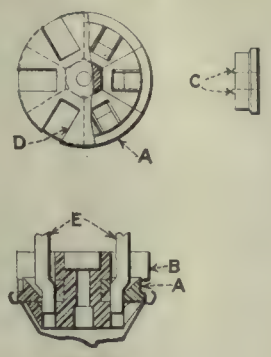


FIG. 10

FIG. 10. A DETAIL OF THE FORMING TOOLS

The sixth and final operation consists of closing the large end of the shell to form the recess, and is performed in a single-action press with the die shown in Fig. 9. This die is in reality an "outside-in" edition of the type just described and differs only in so far as there are six collapsing sections instead of three. These sections *A* are mounted in a carrier *B* and are guided radially by the integral keys *C* (Fig. 10) sliding in the slots *D* of the carrier. These slots are made wider than the cams *E* passing through them by an amount equal to the width of the integral keys.

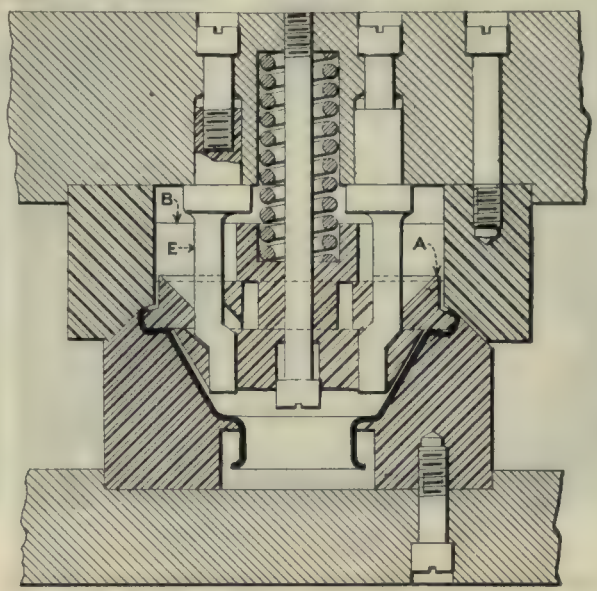


FIG. 9. FINAL FORMING OF LARGE END

Fig. 10 shows the collapsing section of the die, closed.

Machining the Ford Transmission Drum

SPECIAL CORRESPONDENCE

THE Ford transmission disk drum is a steel forging, as can be seen at *A* in Fig. 1. The drums are required at the rate of 4,250 per day and the main machining operations are done on the Bullard Mult-Au-Matic, as shown. This is a six-spindle machine, which drills, bores and reams the center hole, faces the hub, counterbores, rough- and finish-turns the outside diameter and faces the edges of the rim at the rate of 60 per hour.

Fig. 1 shows the tooling method employed on this job quite clearly and the adaptability of the toolslide to almost any cutting operation which may be necessary.

The holes are next broached on a Knowles keyseater, as in Fig. 2, a pull broach being used for this purpose. The job is handled very quickly, the production per machine being 180 an hour. The illustration also shows the chute *A*, by which the drums are rolled into a box.

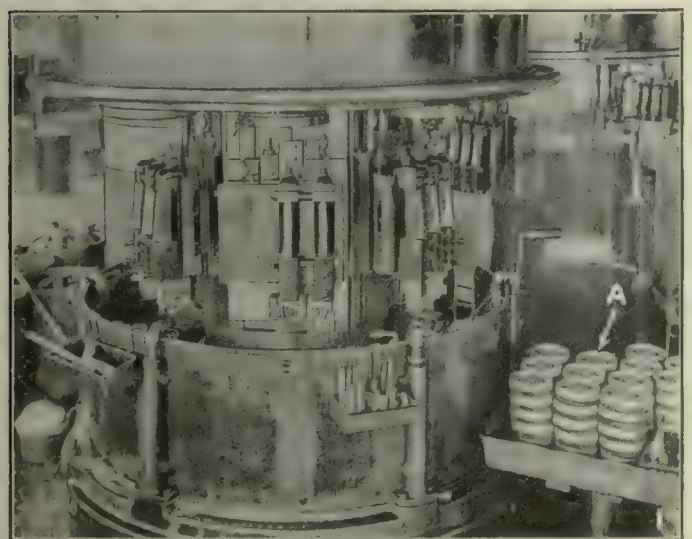


FIG. 1. TURNING AND BORING ON MULT-AU-MATICS

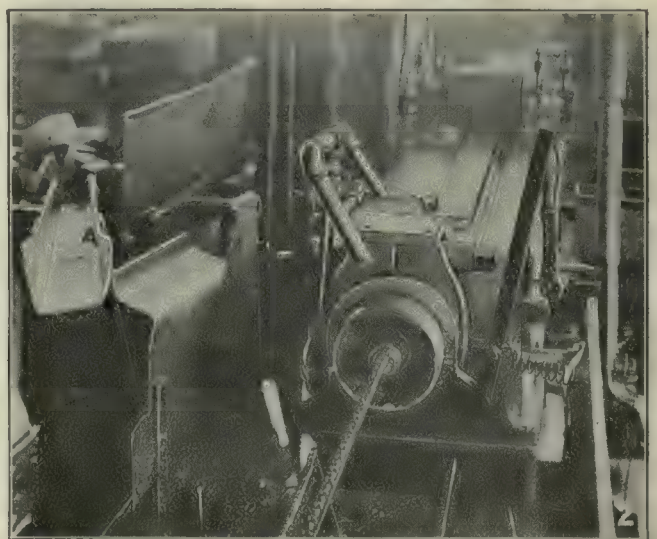


FIG. 2. BROACHING THE BORE

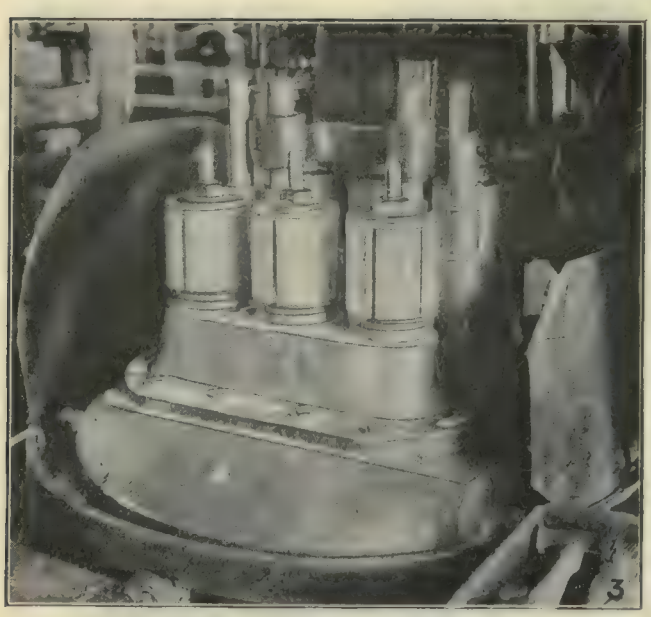


FIG. 3. MULTIPLE MILLING

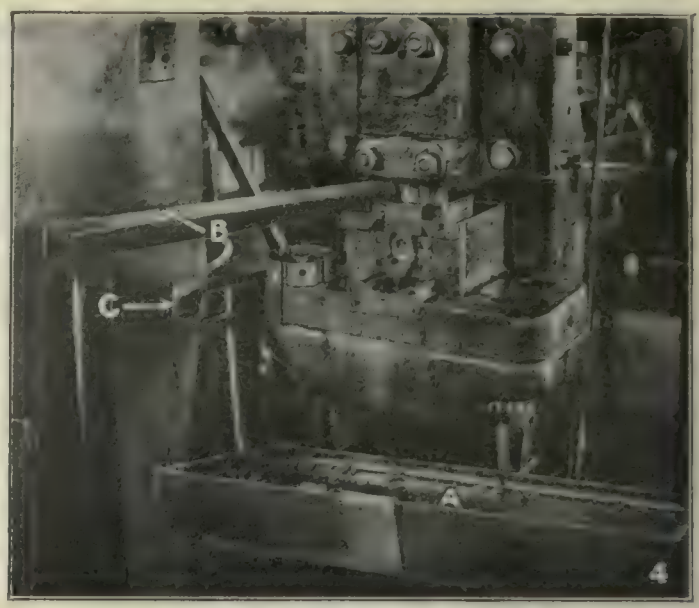


FIG. 4. PUNCHING HOLES IN RIM

After burring, a keyway is rough-broached, also on Knowles keyseaters at the rate of 130 per hour, when the drums go to Potter & Johnston machines to have the hubs faced at the rate of 260 per hour per machine. The keyway broaching is then finished at the same rate as the rough broaching. Next comes the milling of six slots for the projections on the inside of the clutch ring. Three drums are mounted on each of the six spindles, shown in Fig. 3, the fixture being a revolving one, so that one set of spindles can be loaded while the notching of the others is taking place. Each spindle is indexed and nine drums are slotted at one setting. These machines each handle 120 drums per hour. As in many other cases, machines are kept in reserve in case of breakdown, though not necessarily the same type of machine is kept for emergency.

Two $\frac{25}{64}$-in. holes are then punched on the Ferracute press shown in Fig. 4. This requires the special fixture shown, which unfortunately does not show the complete details of the punching operation. The type of conveyor used, as well as its construction from sheet metal by the use of oxy-acetylene welding, is clearly shown at the left. The work comes to the press on the chute *A* and after punching is placed in either *B* or *C*. After this comes counterboring and chamfering, tapping and machine filing, after which it is heat-treated and the whole ground and faced on Bryant grinding machines. The hub is then polished and faced, after which the final sizing is done by forcing a hard-steel ball through the bore on the power press shown in Fig. 5. This ball compresses the surface and has been found a very satisfactory method of sizing holes of this kind. The balls are, of course, carefully selected and measured.

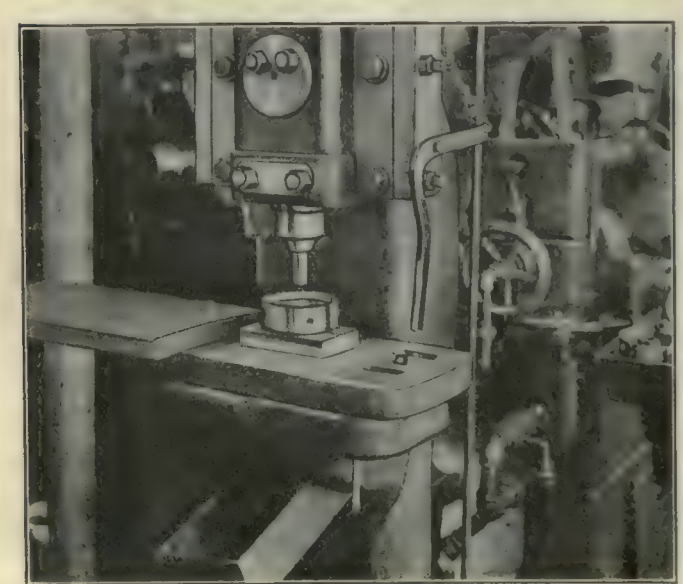


FIG. 5. SIZING THE BORE WITH A STEEL BALL

A Pair of Old Pulleys

By L. L. Thwing

There are three possible explanations of the groove in the old pulleys described by Mr. Bennett on page 1161, Vol. 53, of *American Machinist*, none of which may be correct. This may have been to make sure that the belt would not creep, and by asserting its right to run on the largest diameter, start the machine unexpectedly. As many old textile machines had no belt shifter at all, this would usually be easy. Many high-speed sensitive drills are made with the tight pulley larger than the loose, and this usually works satisfactorily, but occasionally if the machine is not set parallel with the lineshaft, or if the belt is not straight on the edge, it will run up on the tight pulley. The introduction of this groove would prevent this. In the old days when it took 40-lb. pressure to turn over the lineshaft, and the floors were far from being either level or flat, this difficulty may have been more common than it is today.

These pulleys may have been part of a cotton card, and if this is the case the groove may have been to drive the stripper brush, a practice that is still in use. The rope or band would of course have to be put on when the belt was on the tight pulley, and taken off before the machine could be stopped. Or if the pulleys when found were not in position so that Mr. Bennett was sure that the groove was next to the loose pulley, a rope might have run from this to the doffer comb box, as a similar drive is still used. The only objection to the assumption that these are card pulleys, is their small diameter, the average diameter of card pulleys being from 16 to 24 inches.



The Foreman and His Job

Suggestions for live foremen who wish to go up the ladder, and for firms who want better shop executives

By Fred H. Colvin
Editor, American Machinist

THE need for good foremen never was so great as it is at the present time. And because of this need the opportunities for the advancement of capable men from the ranks, and for those who are already foremen to bigger and better positions, is greater than ever before. The first thing is to know the general qualifications which are necessary to be a successful foreman. These qualifications of course vary according to the particular kind of work under consideration, as well as the condition of the shop and its employees, but there are certain underlying principles which must be understood. For the foreman of today is one of the most important factors in a successful business, and this, fortunately, is being recognized by those in authority so that the successful foreman is more sure of his just reward than was formerly the case. Broadly speaking it may be said that the foreman's job is to get out production. But this involves much more than appears on the surface.



. . . THAT THE FOREMAN MUST BE A DRIVER, CONTINUALLY NAGGING HIS MEN

In a large number of establishments the idea seems to prevail that the foreman must be a driver continually nagging his men to do more work. There may be cases where unskilled labor can be handled in this way but even there much better results can be secured by other methods.

In other shops the foreman is little more than a routing clerk who hands out job orders as the men need them.

Still others consider him as a time clerk while a few look on him as a watchdog whose duty it is to act as a buffer between the men and the management, to spy on the men if necessary and otherwise act as special secret emissary of the big boss. This notion is fast dying out and should be forgotten by any foreman who really wants to succeed.

The exact duties of a foreman depend largely upon the way in which the shop is organized. But the foreman who succeeds, or the man who wants to become a successful foreman, should have a good understanding of the fundamental principles which go to make up a modern business, whether he has the opportunity to utilize all his knowledge at the present time or not.

If the foreman is alive to the present situation he knows that men are a far more important factor than machinery, that the best machine equipment in the world will not produce satisfactory results without the co-operation of the men who operate it. The worker must be studied as a human being and his reaction, or response to various conditions, is a very important part of a modern foreman's work. The modern foreman must know how business is conducted, must understand the various factors that go to make up what is called "overhead" or "burden," the expenses outside of labor and material which sometimes eat up a large apparent profit. He must keep posted on the latest development in machine tools and shop equipment and their uses. He must be familiar with different methods of wage payments and other incentives to production.

In fact the more he knows of all the various factors of management, the better foreman he will be and the sooner he will be ready when the call comes to a bigger and better job.

And he must remember that the man who gets the bigger job is the man who has prepared himself for it before the opportunity arises. It pays to study the job above you after you have a fairly firm grasp of your own.

No one who is content to consider a foreman's job as that of a glorified errand boy who carries orders from above and passes them down the line, will find much of

value in these articles. In fact such men will not bother to read them. But general managers who desire foremen of the errand boy type will not always be in charge of successful institutions.

Men of this type seem to consider management as being a set of rules which are to be blindly followed under all circumstances. This has been one of the great mistakes of some of those who have tried to reorganize our industries on a scientific basis. But while rules are, of course, necessary for the general guidance of any business, the real manager is one *who knows when to break the rules* in order to secure results under unusual circumstances.

Unusual Happenings

If everything happened in regular order and according to prearranged plan, the manager could make a set of rules and spend most of his time playing golf. But unusual things have a way of happening at inopportune moments and something must be done at once in order to keep the work moving along through the shop. And here is where the really intelligent foreman comes into play, proving his worth and making himself really valuable to the firm. The real foreman figures out all sorts of contingencies in advance. He knows what he will do if a certain milling machine breaks down. He will shift the work to another machine, the change being already planned in his mind, if not on paper. If necessary he will shift two or three jobs in order to keep the most important job going through the shop on as near schedule time as possible. Perhaps he consults the planning department, but the real foreman should have all his plans made, as he knows the capacity of his machines and of his men far better than anyone else.



SOME CONSIDER LOYALTY A BLIND FOLLOWING OF LEADERSHIP . . .

The foreman must realize that he is part of the executive force, a lieutenant in the commissioned official force of which the general manager is the head. It might perhaps, be better to compare him with the sergeant because he makes direct contact with the men and also with the officers above him. And it is this direct contact which makes the foreman such an important factor in modern management which is, of necessity in many cases, out of personal contact with the rank and file of the workers.

The Foreman Is the Representative of the Men and Management

Being in direct contact with the men and interpreting the orders from above to them, he becomes their direct representative, and the way in which he deals with the men is interpreted by them as being the desires of those higher up.

It is for this reason that the personality of the foreman counts for so much in the maintaining of good relations, which play such a large part in the production secured from the plant. If the foreman is unfair or petty, if he allows himself to play favorites or to show personal bias or animosities, he can easily disrupt his own department and affect others as well. He must remember that he represents the management to the men and avoid any semblance of unfairness in his dealings. He must be impartial and open in all his dealings and be ready to listen to and to help every man under him, no matter whether he likes him personally or not.

Loyalty and Co-operation

If he does this he will secure the loyalty and co-operation of his men and they can be depended on to help him make a good showing in his department. But he must not expect loyalty unless he gives the men something to be loyal to, nor must he consider it disloyal for a man to hold different opinions regarding any subject whatever.

The foreman should not attempt to control, except by advice and suggestion courteously given, anything but the man's actions in the shop and the way in which he handles his machine or his work. The man whose vote or opinion can be delivered by his foreman or anyone else, is neither a good citizen nor a desirable workman.

The foreman must also remember that loyalty is not and cannot be a one-sided proposition. Loyalty is in fact a misused and misunderstood word. Some consider loyalty a blind following of leadership without questioning the motives or the destination, but such a loyalty is dangerous for all concerned, whether the leader be a good foreman or an agitator.

Loyalty to the Job

In a like manner the foreman must be loyal in its truer meaning. This does not mean that he must approve unfair methods or practices either on the part of the employer or of the men. He must support the management in carrying out its policy but he is equally obligated to protest against unfair treatment of the men. *His real loyalty must be to his job,* or to such principles of foremanship as he believes are best and right for all concerned. If the men resort to unfair practices or fail to give value received, he must point out their duty and insist on its being performed. If, on the other hand, the management insists on treating the men unfairly he must protest as diplomatically as possible, and, failing to secure what he believes is right, he must look for employment with some other firm with ideas more in accord with his own.

The foreman who cannot be loyal to his job will have little peace of mind and will not be able to do himself justice when it comes to getting out production economically.

The broad-minded general manager appreciates this kind of a foreman, and he will be more and more in demand as time goes on.

Magnetic Chucks—I

By ELLSWORTH SHELDON
Associate Editor, *American Machinist*

(Continued from last week's issue.)

THE magnetic chuck is simply a series of electro-magnets provided with a suitable shell or body, the magnets being so disposed that their poles form a smooth flat surface for the work to rest upon. As it would neutralize the magnetic effect to bring opposite poles into actual magnetic contact it is necessary to separate them with some non-magnetic material that will prevent such contact and at the same time form a rigid and continuous surface to exclude water, chips or dirt.

The material used to separate the poles exercises no effect upon the chuck so far as its magnetic properties are concerned and is necessary only as a part of the mechanical structure. Any non-magnetic material may be used, but practical considerations have so far limited them to brass or to some one of the many alloys of lead. As before stated, the top of the chuck must be water-tight and to secure this qualification most chuck manufacturers use for the separating material the alloy of lead, tin and antimony called type-metal, which possesses the property of expanding at the instant of solidifying and may therefore be poured into place while molten; expanding as its sets, and bringing about the desired conditions of tightness almost automatically.

Three Classes of Magnetic Chucks

There are three principal classes into which magnetic chucks, as they are now made, may be divided with reference to the manner in which their pole faces are disposed, and in order to get maximum service, or rather the maximum of adaptability, from a chuck the user must know in which class it belongs, for though there is little difference in holding power between them when large single pieces of work are considered, there is a vast difference in the way small parts or parts with irregular under surface must be distributed or "set up" on the surface of the chuck in order to get them to hold at all.

Many toolmakers are of the opinion that work cannot be satisfactorily held if any part is blocked away from the magnetic surface, but this idea is erroneous and not only deprives the user of many of the advantages that might otherwise be derived from the magnetic chuck, but is an injustice to the manufacturer as well.

It is quite possible to hold, practically without loss of efficiency, pieces of such shape that they must rest entirely upon blocking. By making suitable auxiliary plates for them, rough castings and forgings or pieces that have no flat surfaces to start with may be held for manufacturing operations. In a later article methods of holding various pieces will be discussed and descriptions will be given of fixtures and auxiliary plates that have proven successful in test under actual manufacturing conditions.

The term "singlepole," "multipole," "unitpole," etc., as used by various manufacturers, are susceptible to more than one interpretation; therefore to classify the various chucks on the market and at the same time avoid confusion that might arise from conflicting terms let us establish the somewhat arbitrary terms of "single-magnet," "multiple-magnet" and "independent-magnet." These terms may be cumbersome, but they do not confuse.

The principle of the single-magnet chuck is shown in Fig. 8. In this illustration *A* is the core about which the energizing coil *B* is wound. One end of the core is branched as shown at *N*, and each of these branches is of course of the same polarity.

To make the description more easily comprehended we will call this the "north-seeking pole." Whether it is actually north- or south-seeking depends entirely upon the direction in which the energizing current of electricity is flowing and makes no difference whatever in the holding power of the chuck.

The opposite or south pole would of course be naturally at the other end of the core, but in this case the core is a part of the shell casting and the lines of force in seeking the north pole are conducted through the iron of the shell, or chuck body, to the top plate.

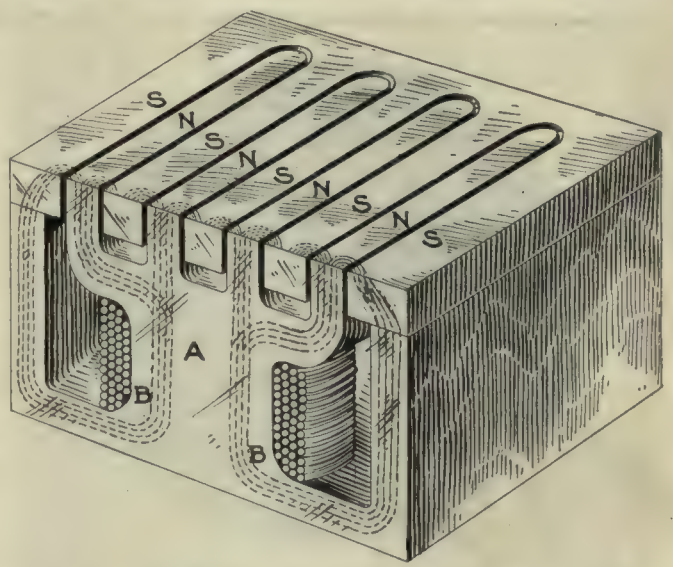


FIG. 8. PRINCIPLES OF THE SINGLE-POLE CHUCK

This top plate is made in the from of a grid with holes through which the branches of the north pole extend.

The space between these branches and the surrounding metal of the grid is then filled with non-magnetic metal and the top surface milled or planed smooth.

It will thus be seen that the entire top surface of the single-magnet chuck (with the exception of the dividers of non-magnetic material) is actively magnetic, the bars *S* of the grid constituting the south pole of the magnet, and that the body of the chuck is a part of the magnetic circuit. Fig. 9 shows one of the later chucks of the single-magnet type.

Single magnet chucks are not necessarily limited to one core; they may have two, six or a dozen, but this is merely extending the length or width of the chuck, and does not alter the principle; all of the coils are wound the same way, and the branches of the

many cores are all of the same polarity, the grid of the top plate furnishing the opposed pole common to all of them.

All of the earlier chucks were of this type. As has been explained in reference to Fig. 4 the iron of the magnetic circuit does not manifest magnetism, unless because of incorrect disposition of metal or a too protracted or too circuitious path being provided for the lines of force as in Fig. 6—in other words, unless it "leaks."

Because of an incomplete understanding of the laws governing the flow of magnetic currents, the designers of the first chucks did not fully meet the requirements in this respect. Some parts of the magnetic circuit were of ample cross-section and others were small, causing some part of the magnetic flux induced in the larger parts to go around, rather than through, the restricted area. In other places the lines of force were sharply deflected by abrupt corners, causing magnetic influence to be manifested at these points also.

Another mistake of the early chuck designer lay in making one part of the magnetic circuit of a different material than the rest, and failing to make due allowance for the different magnetic characteristics of the two metals.

The quality of iron known as "permeability" varies greatly between one kind of iron or steel and another.



FIG. 9. A SINGLE-MAGNET CHUCK

The permeability chart, Fig. 10, illustrates this difference by assuming that a certain quantity of electrical energy (measured in ampere turns) will induce a given number of lines of force per square inch in air, in cast iron, wrought iron, cast steel, etc., the number varying according to the material. The term "lines of force" is purely theoretical; nobody knows whether under given conditions there are fifty thousand or fifty million such lines per square inch, or for that matter whether or not there are any. It is merely an assumption to indicate the relative degree of what is called "density of flux."

The Ampere Turn

The unit of electrical energy in its relation to magnetism is the "ampere turn;" meaning a current of one ampere flowing once around a magnet core. The product, therefore, of the number of amperes that a coil of wire is carrying, multiplied by the number of times the wire is wrapped around the core will give the number of ampere turns of energy. If the exact nature of the material of which the core is made is known the theoretical number of lines of force per square inch established by a given number of ampere turns may be read directly from the permeability chart.

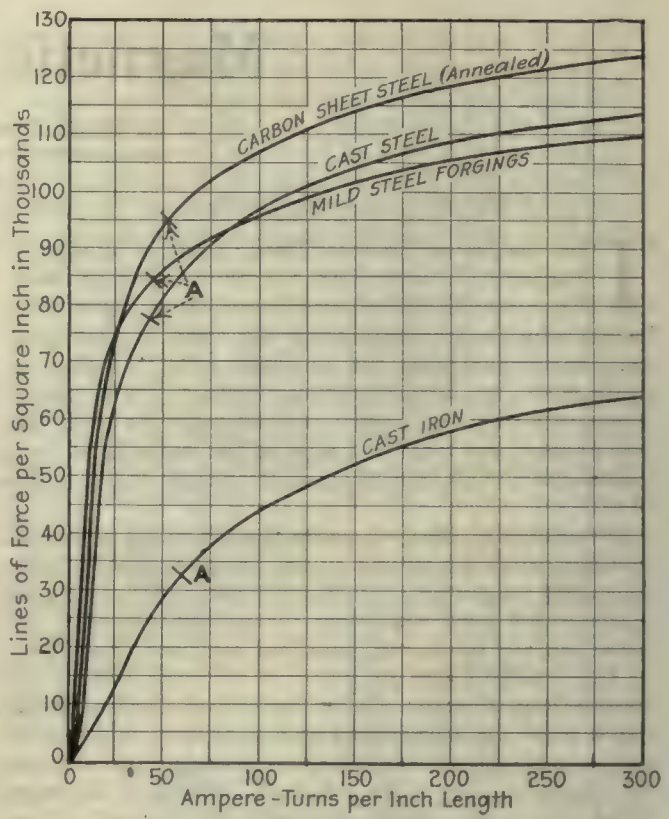


FIG. 10. THE PERMEABILITY CHART

The increase in the number of lines of force per square inch, which corresponds to strength of magnetism, is not, however, directly in proportion to the increase in the number of ampere turns, but, as the chart indicates, in a ratio that decreases with a fair degree of regularity for a given material up to what is called the "point of saturation," or the "knee" of the curve, shown on the chart by the letter *A*. There is no absolute saturation, but to carry the magnetic density above the "knee" by adding to the turns of wire or raising the

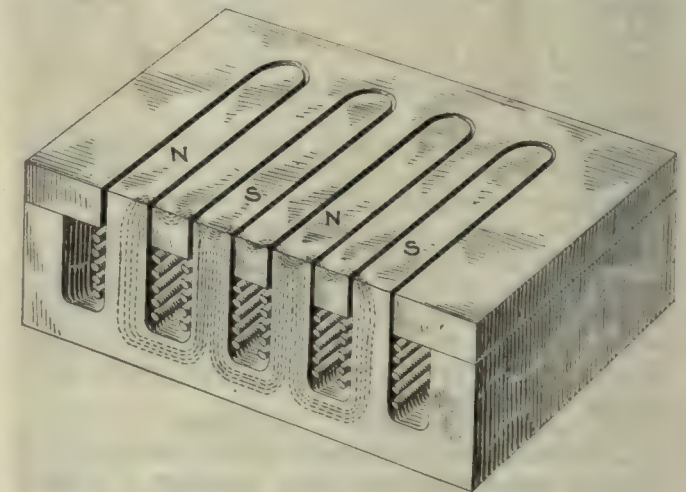


FIG. 11. PRINCIPLES OF MULTIPLE-MAGNET CHUCKS

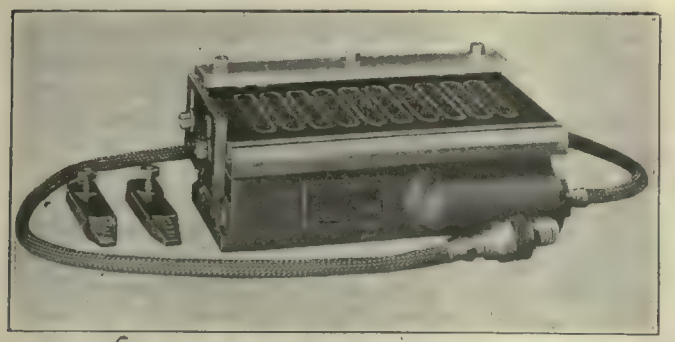


FIG. 12. A MULTIPLE-MAGNET CHUCK

voltage of the current supply would increase leakage much faster than it would increase strength of magnetism.

Defects in respect to the magnetic characteristics of the earlier chucks started investigations that not only led to the development of other forms of chucks but to a better understanding of the theories of magnetism, and this in turn enabled the manufacturers practically to eliminate magnetic leakage in all forms of chucks.

The first departure from the original form of single-magnet chuck came about by reason of the increasing sizes and weights of the parts, particularly the coils, as the value of this method of holding work was appreciated and the demand for bigger chucks had to be met. Instead of making one large core with one correspondingly large coil to cover it, two smaller cores and coils were made and enclosed in the same shell.

While this made the manufacture and repair easier it did not alter the electrical or magnetic characteristics. Though chucks six feet long and of corresponding width, containing several such units and weighing many hundreds of pounds, are made, they are still of the same appearance outside and, magnetically considered, are single-magnet chucks.

The multiple-magnet chuck differs from its predecessor in magnetic features rather than in mechanical construction; it is difficult to distinguish between them.

The drawing, Fig. 11, shows the characteristics, and in Fig. 12 may be seen a standard chuck of this type.

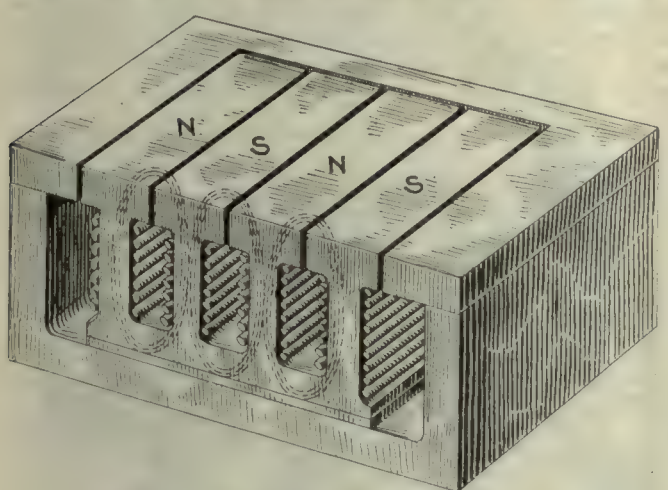


FIG. 13. INDEPENDENT-MAGNET CHUCK

Instead of having a single magnet with many branches to its one pair of poles, there are several magnets, each with its individual pair of coils and of poles not dependent upon any other pair.

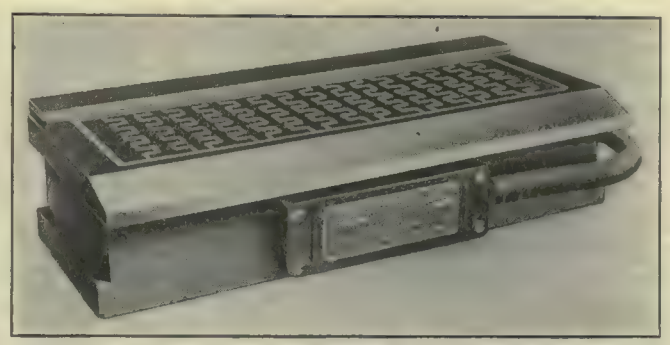


FIG. 14. THE INDEPENDENT-MAGNET CHUCK

The magnet cores are all cast in one piece with the shell and the base of the shell thus becomes a part of the magnetic circuit, but as indicated by the drawing, Fig. 11, the path of the lines of force is only from one part of the core to its mate, which is adjacent to it, and thus there is no reason for the current to invade the sides of the shell or the top plate.

The top plate of the multiple-magnet chuck is made in the form of a grid of very much the same appearance as in the single-magnet type, but, unlike the former, the grid is not magnetic. This leaves adjacent poles of alternate polarity, as indicated, with a neutral space between them. Each pair of magnets being complete in itself, the chuck may be made in any size by increasing the number of individual core pieces.

In the independent-magnet chuck the magnet cores are cast as a unit, each containing a certain number of pairs of poles entirely independent of the chuck body, or of any other unit. A chuck may be of any size, containing one or any number of units.

The units are magnetically insulated from the shell or body, and the entire top surface of the chuck, except a narrow frame of metal corresponding to the edges of the shell, is made up of active poles of alternate polarity. Because of the fact that the magnets are at all points insulated from the shell, there is no tendency for magnetic currents to enter the latter at all.

The drawing, Fig. 13, elucidates the principle of the chuck, and the halftone, Fig. 14, shows it as it is actually constructed. It must be borne in mind, however, that the term "magnetic insulation" is merely relative; that there is actually no such thing as a "magnetic insulator" unless a sufficiently attractive path for the magnetic current is otherwise provided.

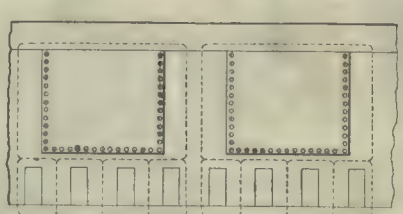


FIG. 15. BLANCHARD CHUCK

By eliminating the chuck body completely from the magnetic circuit the advantage is gained of being able to make it of material other than iron. Large chuck bodies of this type are regularly made of aluminum for the purpose of reducing weight.

Besides the three forms of chuck enumerated above there is another that the writer hesitates to classify, for it does not seem to conform to any of the foregoing types. It is built only as an adjunct of the

Blanchard grinding machine. While all of the other types are regularly manufactured both in the rectangular and the rotary form, this latter chuck is only made as a rotary chuck and its construction could not well be adapted to a rectangular shape. It is shown in section in Fig. 15.

Its construction will be taken up in detail in the proper place. Suffice it to say for the present that, magnetically considered, it consists of two pairs (in some cases two and a half pairs) of main poles, partially divided on their upper surfaces, by grooves cut into the metal to within a short distance of the tops of the main pole into many smaller poles. The flow of magnetic current is thus split up in several directions, in places seeming to traverse the same section of metal in opposite directions at the same time.

Whether or not this apparent contravention of known laws governing magnetism actually takes place is a matter for scientific rather than for practical discussion. The amount of electrical energy per unit of area is somewhat higher than in other forms of chuck, but is still an insignificant item when compared to the work done by the machine.

The reason for the higher current consumption is that by reason of the construction it is necessary to carry the magnetizing influence much nearer the point of saturation than is the case with other designs.

In the second article of this series the history and development of the magnetic chuck dating from 1873 will be considered; leading up to a detailed description of the several chucks now on the market together with illustrations of methods used in their manufacture.

Pneumatically Operated Clamps for Drilling Machines

Pneumatic Clamps Particularly Serviceable in Holding Irregular Pieces—Time Saved in Fastening Work—Devices Developed in a Railroad Shop

By J. V. HUNTER
Western Editor, *American Machinist*

NEARLY all of the drilling machines found in the locomotive shops of the Wabash Railroad Co., Decatur, Ill., have been equipped with some character of pneumatic device for holding the work during drilling. All of these devices were built in this shop, although some of the designs were borrowed from other railroad shops and modified to meet the particular conditions existing here.

The arrangement most commonly used is shown in Fig. 1, this device having been applied to the majority of the radial drilling machines in the shop. Its application is very general, as it serves for clamping all manner of irregular pieces to the table while they are being drilled. An example of some fairly simple work handled can be seen lying on the right-hand side of the table.

The device consists of a cylinder *A*, located below the table, and receiving air through piping controlled by the three-way cock *B*. The piston extends through the center of the table and terminates in the yoke *C*. The clamping bar *D*, having a forked end, is pivoted in the yoke, and is drilled with several holes for the pivot pin, so that its position may be adjusted for different sizes of work. The outer end of the bar is always blocked up by the bearing block *E*, usually a piece of wood, which can be easily changed for different heights.

The device was simply constructed from materials most easily available. A heavy piece of steel pipe faced off on the ends and fitted with cast-iron end-plates and gaskets, held together by four ¾-in. bolts, serves as a cylinder. The piston was made from parts obtained from an 8-in. air-brake cylinder, with an air-pump

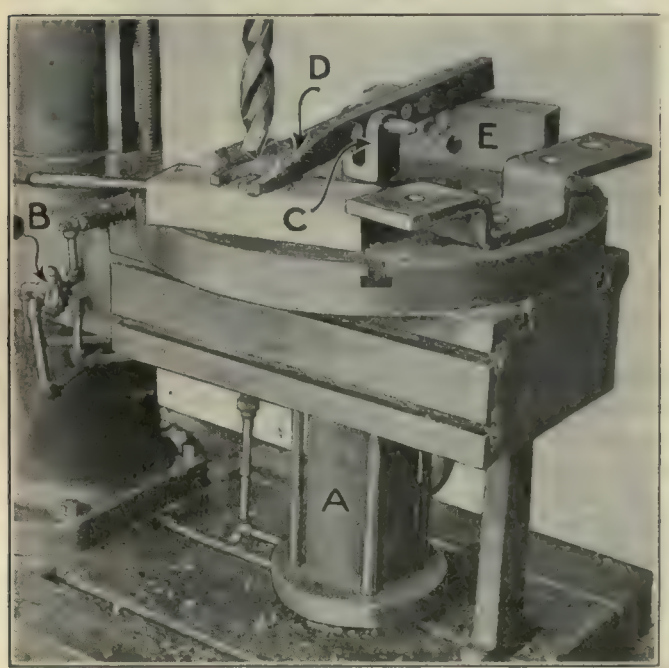


FIG. 1. PNEUMATICALLY OPERATED CLAMP TO HOLD WORK ON TABLE OF DRILLING MACHINE

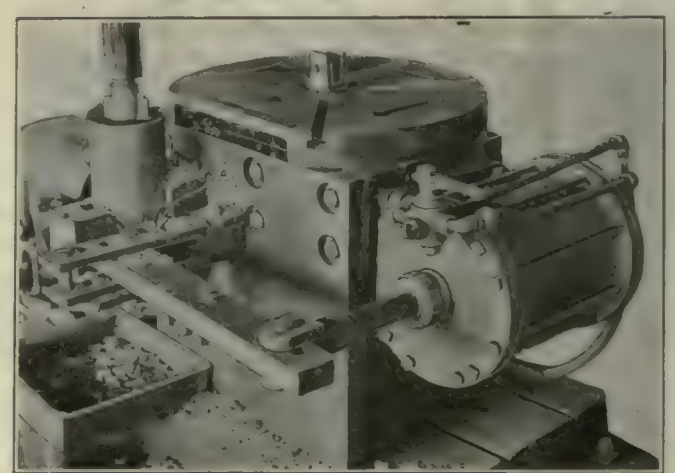


FIG. 2. CLAMP TO HOLD CRANKPINS ON THE SIDE OF TABLE

stuffing box surrounding the piston rod. The latter is threaded on the outer end to fit in the yoke that holds the clamping bar. Bolts passing through both cylinder heads secure the device to the lower side of the drilling-machine table.

In addition to the clamping device just described, the drilling machine shown in Fig. 2 has been fitted with a secondary clamping arrangement for holding crankpins in a vertical position for drilling and counterboring operations. A 10-in. cast-iron air cylinder furnishes the acting force, which is applied directly to the outer end of the clamping bar, a slot being provided in the latter to take care of longitudinal movement of the pin in the bar. The center of the bar is pivoted in a yoke *A*, which is made of sufficient depth to accommodate several pinholes, so that it can be readily adjusted for all sizes of work within its capacity. V-block jaws are used for clamping the parts in process of being machined.

A pneumatic clamping fixture with a slightly smaller air cylinder has been fitted on the table of the upright drilling machine shown in Fig. 3, and been especially arranged for drilling pinholes in bolts, pins and similar work. The air cylinder is similar to those already described, but it has been fitted with an unusual pair of jaws for holding the work. The base block *A* is slotted so that the stirrup *B* can slide up and down through its center; and when the work, such as the bolt *C*, is laid in the V-groove of the lower block, the stirrup can be closed down on it to hold it firmly in place. The lower jaw *A* is mounted on blocks that can be changed when it is desired to alter the position of the jaws with respect to the stroke of the piston.

It will be noted that the stirrup is so attached that the entire pull of the piston is applied directly to the work, which is bridged between two points. This subjects light pieces to the danger of being bent, or

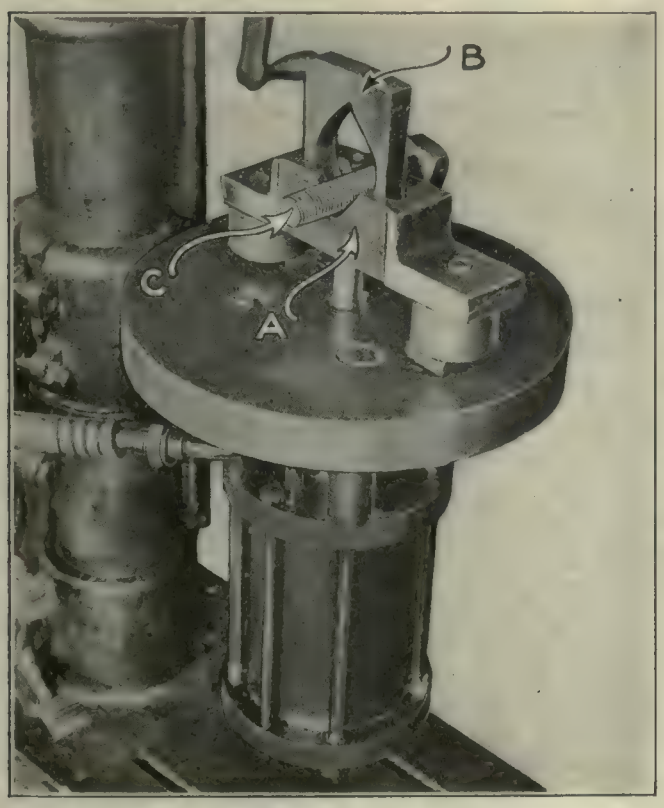


FIG. 3. BOLTS AND PINS CAN BE HELD UNDER THE STIRRUP OF THIS CLAMP

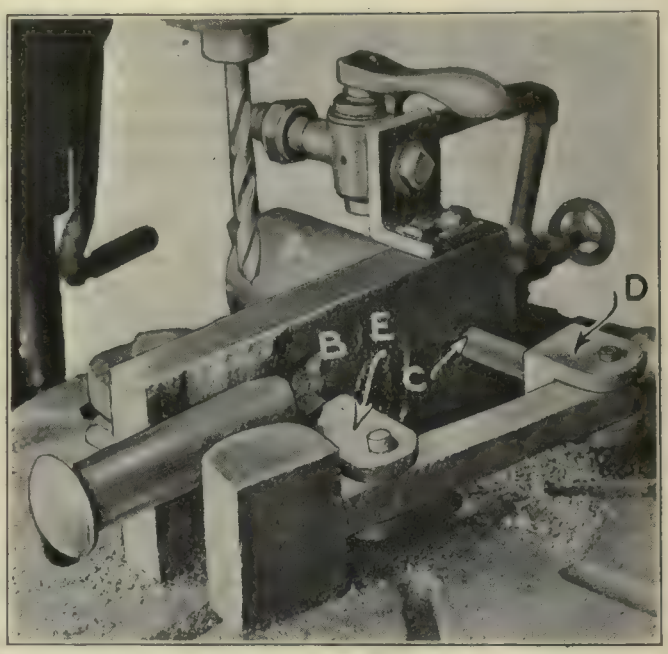


FIG. 4. SMALL AIR CHUCK TO FIT ON DRILLING MACHINE TABLE

threaded sections burred and damaged, if too heavy air pressure should be applied in the cylinder.

A much smaller air chuck is used on the upright drilling machine shown in Fig. 4. Its cylinder *A* has a 4-in. bore and is bolted to the rear of the plate *B*, through which the piston rod *C* passes and terminates in the yoke *D*. The pivot bracket *E* is bolted to the baseplate *B*, and, to accommodate different sizes of work, may be set up by placing spacing bushings on its threaded stem between the jaws and the plate. The device is really designed to hold work only in a vertical position; and when so used it holds more firmly than with the work horizontal, as shown in the illustration.

The Action of the Epicyclic Gear Train

By M. W. Davidson

The action of the epicyclic or planetary gear train is not clearly understood by many persons who are familiar with its construction and field of application. This should cause no surprise if consideration is taken of some of the rather vague explanations of the mechanism which are to be found in print.

In view of the increasing use of this type of gear, it is hoped that the following attempt to explain its action will be found of value.

Referring to Fig. 1, *R-R* represents a stationary track along which rolls the wheel *S*, to which rigidly and concentrically attached are the wheels *U* and *T*. The radii of the wheels *U*, *S*, and *T*, are to each other as 3, 2, and 1.

If the wheel *S* rolls toward the left with velocity *V* of its center *e*, then the velocity of the point *f* of wheel *T* will be *V*/2 in the same direction; that of the point *g* of wheel *S* will be *O;* and that of the point *h* of wheel *U* will be *V*/2 in the opposite direction. Since the velocities of these points about their common center *e*, are proportional to their respective radii, that of *g*, of course is *V*. These velocity relations will hold whether the track be straight or curved.

Thus it is seen that if *U*, *S*, and *T* are gears whose pitch circle diameters are to each other as 3, 2, and 1;

R-R a stationary rack; and *L-L* and *M-M* movable racks: *L-L* will move to the left with velocity $V/2$, and *M-M* will move to the right with velocity $V/2$, while the velocity of the center of the gears will be V to the left.

Now turning to Fig. 2, which represents a planetary gear train of the external type, the number of revolutions of the disk *P* for each revolution of the gear *Q* will be determined.

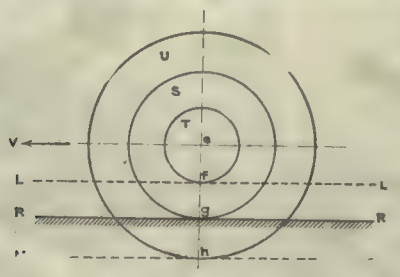


FIG. 1. ELEMENTARY DIAGRAM

The disk *P* carrying the rigidly connected planet gears *S* and *T* rotates around the shaft of the driven gear *Q*. The gear *R* is stationary. Gears *S*, *R*, *T*, and *Q* have respectively 40, 60, 30, and 70 teeth; so that the pitch diameter of each gear is represented relatively by the number of its teeth.

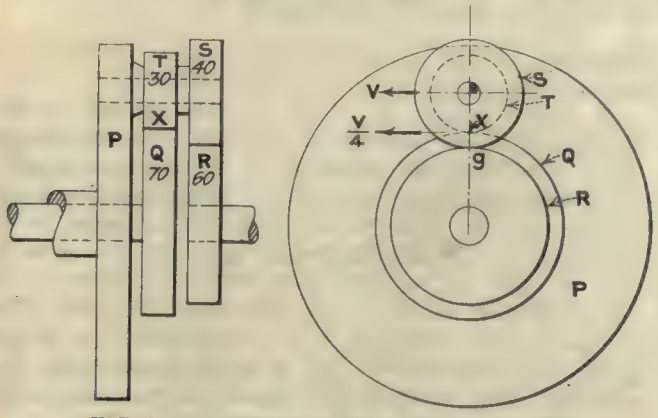


FIG. 2. PLANETARY GEAR TRAIN OF THE EXTERNAL TYPE

Here, as pointed out in Fig. 1, if the velocity of the center of the planet wheels with reference to the stationary gear *R* is *V*, the velocity of the point of tangency *x* of the pitch circles of *T* and *Q* with reference to *R* will be $V/4$ in the same direction, since this point has a velocity around the center of the planet wheels of $\frac{3}{4}V$ in the opposite direction. That is, a point on the pitch circle of *Q* has one-fourth the velocity of a point on the disk *P;* the distances from their common center of rotation being respectively 70 and 100.

Therefore with *D* and *N* representing, with the proper subscripts, the diameters and number of revolutions of *Q* and *P* for the velocities stated, a combination of the following equations will give their speed ratio:

$$\pi D_P N_P = V, \text{ and } \pi D_Q N_Q = \frac{V}{4}$$

Dropping π from both equations, and substituting their relative diameters, they become,

$$100\ N_P = V, \text{ and } 70\ N_Q = \frac{V}{4}$$

From which,

$$\frac{N_P}{N_Q} = 2.8.$$

If gear *T* be larger than gear *S* the motion of the two shafts will be in opposite directions.

Should the circular pitch of the pairs of meshing gears be different, or in other words, if the sums of the teeth of the pairs of meshing gears are not the same, then the numbers of teeth of the gears will not be proportional to their diameters throughout. Still as the center distance of each pair of gears is the same, the proportional diameters are readily obtained from the number of teeth.

As an illustration of a case of this kind, the conditions shown in Fig. 3 may be used: Here gear *S* has 100 teeth; *R*, 99 teeth; *T*, 101 teeth; *Q*, 100 teeth. The center distance being the same for both pairs of gears, the diameter of *S* may be represented by 100/199, that of *T* by 101/201. Giving these fractions a common denominator, *S* becomes 20100/39999 and *T* becomes 20099/39999; from which *T*/*S* is 20099/20100. So that if the velocity of the center of the planet gears with respect to the stationary gear *R* is *V*, then the velocity of *X*, the point of tangency of the pitch circles of *P* and *Q* is 1/20100 *V* in the same direction with respect to gear *R*. For its velocity about the center of the planet gears is 20099/20100 *V* in opposite direction to that of the center.

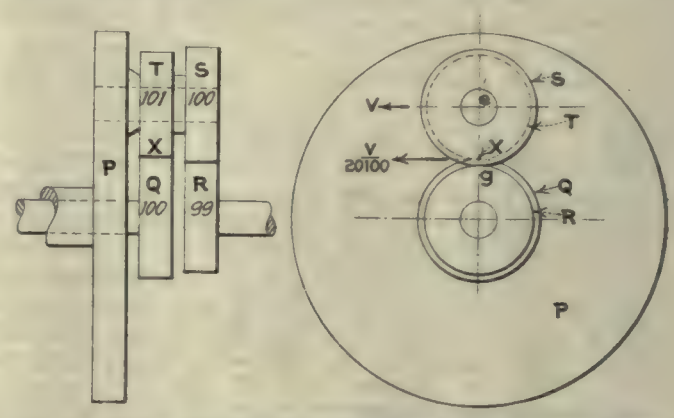


FIG. 3. TRAIN INVOLVING PAIRS OF GEARS NOT OF THE SAME CIRCULAR PITCH

Therefore with equations as given for Fig. 2,

$$\pi D_P N_P = V, \text{ and } \pi D_Q N_Q = \frac{V}{20100}$$

or,

$$201\ \pi N_P = V, \text{ and } 100\ \pi N_Q = \frac{V}{20100}$$

giving,

$$\frac{N_P}{N_Q} = 10{,}000.$$

Weight Table for Estimating

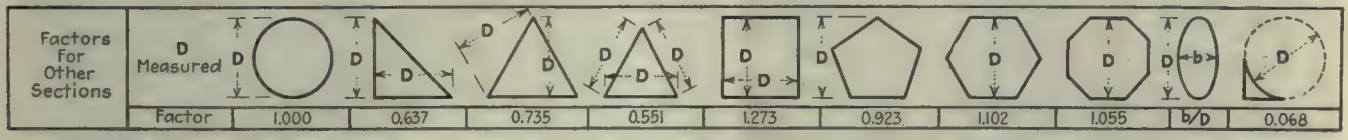
By F. W. Salmon

The quick and accurate compiling of cost estimates is particularly important to many firms now, as to secure the desired volume of business it is often necessary to bid on work on which they have no "cost sheets" or previous experience. To facilitate the estimating of weights of materials called for by the design the writer has found the accompanying table much better than any other that he has seen or tried. It has been made up for *steel* because that is the material most commonly required and by means of the "weight factors" at the bottom of the table the weight of a piece of any of several other metals and alloys of the same

WEIGHT OF ROUND STEEL BARS IN POUNDS PER LINEAR INCH. 0 TO 36¾-INCH DIAMETER

Specific gravity of steel = 7.85
One cu.ft. of steel weighs 489.6 pounds
One cu.in. of steel weighs 0.2833 pounds

Diameter	0	⅛	¼	⅜	½	⅝	¾	⅞
0	0	0.003	0.014	0.031	0.056	0.087	0.125	0.170
1	0.223	0.282	0.348	0.421	0.501	0.588	0.681	0.782
2	0.890	1.005	1.126	1.255	1.391	1.533	1.683	1.839
3	2.003	2.173	2.350	2.534	2.726	2.924	3.129	3.341
4	3.560	3.786	4.019	4.259	4.506	4.759	5.020	5.288
5	5.563	5.844	6.133	6.428	6.731	7.040	7.356	7.680
6	8.010	8.347	8.692	9.043	9.401	9.766	10.138	10.517
7	10.903	11.295	11.695	12.102	12.516	12.937	13.364	13.799
8	14.240	14.689	15.144	15.606	16.076	16.552	17.035	17.526
9	18.023	18.527	19.038	19.556	20.081	20.613	21.152	21.698
10	22.250	22.810	23.377	23.950	24.531	25.119	25.713	26.315
11	26.923	27.538	28.161	28.789	29.426	30.069	30.718	31.377
12	32.041	32.712	33.389	34.074	34.766	35.465	36.171	36.883
13	37.603	38.330	39.063	39.804	40.551	41.306	42.067	42.836
14	43.611	44.393	45.182	45.978	46.781	47.592	48.409	49.232
15	50.063	50.901	51.746	52.598	53.456	54.322	55.195	56.074
16	56.961	57.854	58.755	59.662	60.577	61.498	62.426	63.361
17	64.304	65.253	66.209	67.172	68.142	69.119	70.103	71.094
18	72.091	73.096	74.108	75.126	76.152	77.185	78.224	79.270
19	80.324	81.384	82.452	83.526	84.607	85.695	86.790	87.892
20	89.002	90.117	91.240	92.370	93.507	94.651	95.802	96.959
21	98.124	99.296	100.474	101.660	102.852	104.052	105.258	106.47[illegible]
22	107.692	108.919	110.153	111.394	112.643	113.897	115.160	116.429
23	117.705	118.987	120.277	121.574	122.878	124.189	125.506	126.831
24	128.162	129.501	130.846	132.199	133.558	134.924	136.298	137.678
25	139.065	140.459	141.860	143.268	144.683	146.105	147.534	148.970
26	150.412	151.862	153.319	154.783	156.253	157.731	159.215	160.707
27	162.205	163.711	165.223	166.742	168.269	169.802	171.342	172.889
28	174.443	176.004	177.572	179.147	180.729	182.317	183.913	185.516
29	187.126	188.742	190.366	199.996	193.634	195.278	196.930	198.588
30	200.253	201.925	203.605	205.291	206.984	208.684	210.391	212.105
31	213.826	215.554	217.289	219.031	220.779	222.535	224.298	226.067
32	227.844	229.627	231.418	233.215	235.020	236.831	238.649	240.474
33	242.307	244.146	245.992	247.845	249.705	251.572	253.446	255.327
34	257.214	259.109	261.011	262.920	264.835	266.758	268.687	270.624
35	272.567	274.518	276.475	278.439	280.410	282.389	284.374	286.366
36	288.365	290.371	292.384	294.404	296.431	298.464	300.505	302.553



Factor	1.000	0.637	0.735	0.551	1.273	0.923	1.102	1.055	b/D	0.068

Factors for other materials..	Material	Aluminum	Brass	Bronze	Cast-Iron	Copper	Lead	Tin	Zinc
	Sp. gravity. .	2.681	8.45	8.735	7.2	8.815	11.368	7.418	6.872
	Lb. per cu.ft..	167	525	544	450	549	708	462	428
	Factor.....	0.342	1.076	1.113	0.917	1.123	1.448	0.945	0.875

dimensions may be almost instantly obtained by a single setting of the slide rule or manipulation of a calculating machine. Likewise the weight of pieces of the same length of other sections may be easily obtained by the "section factors," the table being computed for round sections because they are most common.

In computing the weights of machine parts, this table has saved in some cases as much as 80 per cent of the time required by geometric methods and about 50 per cent of that required by the "area by length by weight per cubic inch method" and over 30 per cent of the time required by the "weight per lineal foot" tables, by the same estimator at different times or equally expert estimators working independently.

Most machine parts are dimensioned in *inches*, so the weights are given for a length of *one inch*, and a few examples will probably better illustrate the use of the table than many rules.

Example A: A small piece to be made on a screw machine is of such a shape that the stock cut from a round bar per piece, including the wastage of cutting off and squaring up the end, will be 6.500 in. long x 1⅛ in. in diameter. Weight of stock taken = 0.282 lb. × 6.500 = 1.832 lb. each.

Example B: Square-headed bolts are to be made of 1⅛-in. cold-rolled bar steel on a screw machine, each 6⅜ in. long and requiring 6.500 in. of stock. Using the "section factor" for square stock, we have: Weight per piece = 0.282 lb. × 6.500 × 1.273 = 2.32 lb. each.

Example C: Same as *Example B* except that the material is to be bronze, so we shall have to use the "shape factor" and the "material factor": Weight per piece = 0.282 lb. × 6.500 × 1.273 × 1.113 = 25.8 lb. each.

Example D: What is the weight per foot of solid lead pattern makers' fillet of ½-in. radius. For ½-in. radius we read the table for 1-in. diameter of circle and apply the "shape factor" and the "material factor," therefore, 0.223 lb. × 12 in. × 0.068 × 1.448 = 0.269 lb. per foot.

Example E: This is the same as *Example D* except leather fillet. A cubic foot of leather, such as belting and fillet leather, will weigh about 60 lb. (about 0.035 lb. per cubic inch). We can deduce our own "material factor" compared with steel as 1.00, thus: 60 ÷ 489.6 = 0.12,245. So one foot of solid leather fillet of ½-in. radius will weigh about 0.223 lb. × 12 in. × 0.068 × 0.122 = 0.034 lb.

Railroad Shop Safety Devices

Common Sources of Accidents on Erecting Floor—The Use of Safety Screens—Saw Bench and Boring Bit Guards

By FRANK A. STANLEY

THE halftones in this article illustrate a few of the many special machine guards and other safety appliances which have gone far toward the elimination of accidents to workmen in railroad shops.

One of the common sources of accidents around the erecting floor is the instability of the various horses, trestles and steps for the men who have to work around engines at some distance from the floor and who usually have the handling of a number of tools any of which may fall from some inadequate platform and injure workmen below. Broad steps on trestles and general rigidity will help greatly in safeguarding the men at work over the engine and incidentally prevent certain classes of accidents to others on the floor.

One set of steps used with security is illustrated in Fig. 1. The broad, rigid treads give the workmen ample foothold and the liberal amount of space obviates crowding of men and tools. The security due to such construction also makes for the better handling of work in general, as it eliminates one important source of distraction from the immediate job in hand—the possibility of slipping with likelihood of accompanying injuries.

Another prolific cause of accidents is the flying rivet head when driven free from the side of a boiler or

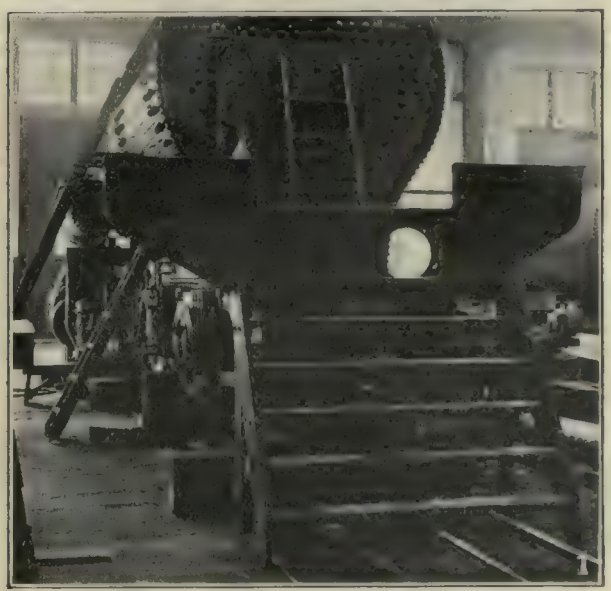


FIG. 1. PLATFORM AND RIGID STEPS USED FOR WORK AROUND THE BOILER

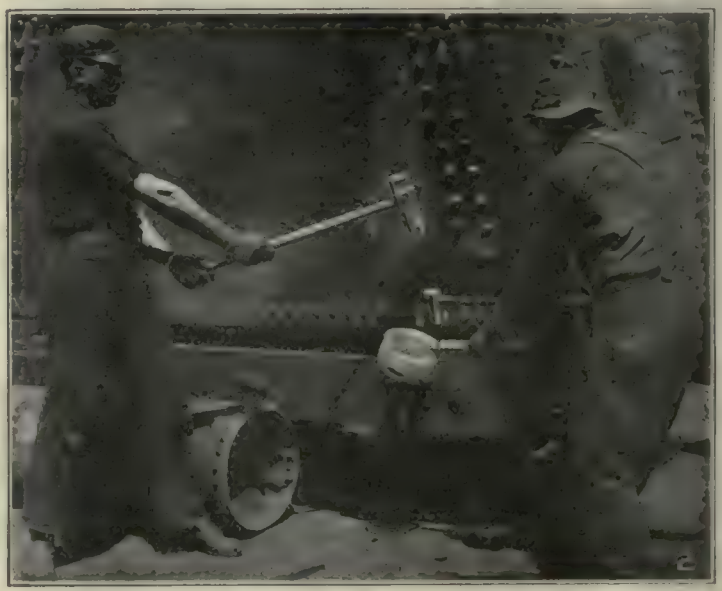


FIG. 2. CATCHING THE RIVET HEAD IN A WIRE BASKET

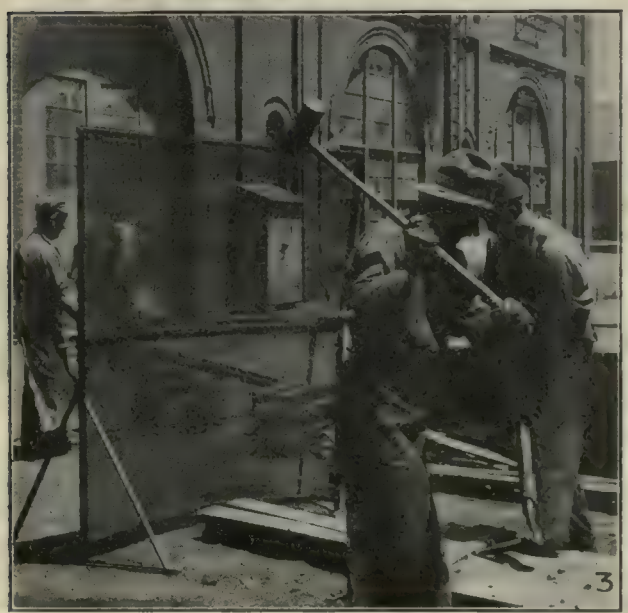


FIG. 3. SCREEN TO AFFORD PROTECTION FROM FLYING RIVET HEADS

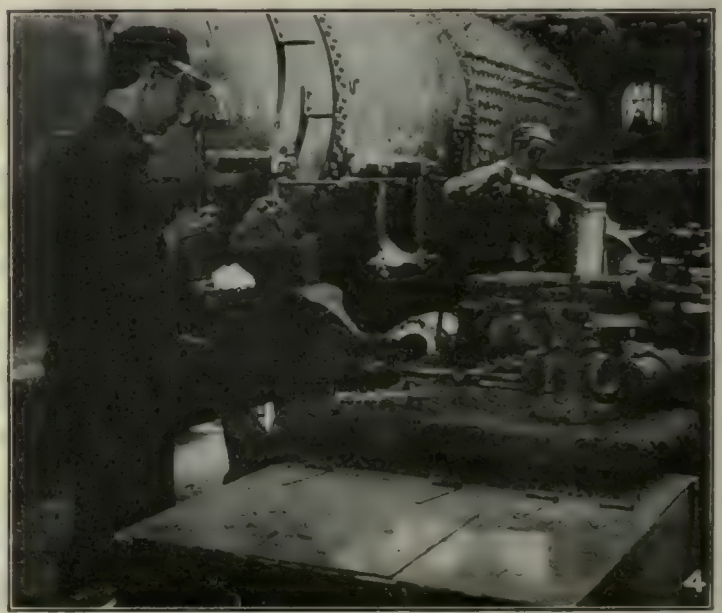


FIG. 4. USE OF SAFETY GOGGLES AT THE BENCH

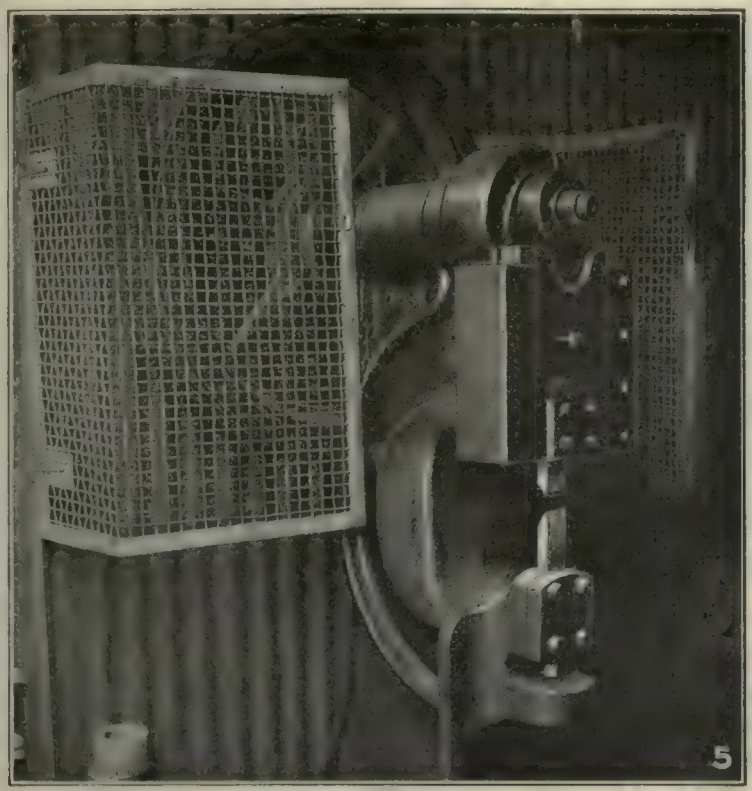


FIG. 5. HINGED FLYWHEEL GUARD ON A SPRUE CUTTER



FIG. 6. A BANDSAW GUARD

firebox by a heavy sledge and chisel. In Fig. 2 a method is shown for preventing rivet heads from flying. The man holding the chisel also holds, in his left hand, a strong wire basket which receives the rivet head as it is struck loose.

The handle on the basket is of a length corresponding to that on the chisel, and as the basket can be held close to the work there is no danger of the rivet head striking either of the men or flying across the shop to injure other workmen.

The Safety Screen

Along the line of preventing accidents from flying parts of this character, a safety screen, such as the one shown in Fig. 3, is of value and it is readily applicable to both shop and yard operations. The frame of this screen is made up of light but stiff steel strips and the end members are carried on feet made of steel straps which are side-braced as indicated.

The use of safety goggles needs no explanation but bench workers do not as a rule make any too liberal use of goggles if it is possible to avoid it. Yet, there is no more dangerous spot in the shop, so far as eye hazards are concerned, than along the lines of chipping benches where metal fragments, chisel corners and chips of all kinds are likely to be flying at any moment during the day.

The two men at the vises in Fig. 4 are both protected by goggles from danger to the eyes from flying chips of ordinary proportions.

Sprue-Cutter Guard

The guards for the sprue cutter in Fig. 5 consist of swinging wire frames which guard the pulley and belt to a height above that at which a workman could come in contact with belt or wheel. The hinged arrangement gives access to the belt when repairs or changes are required.



FIG. 7. A RIP SAW GUARD

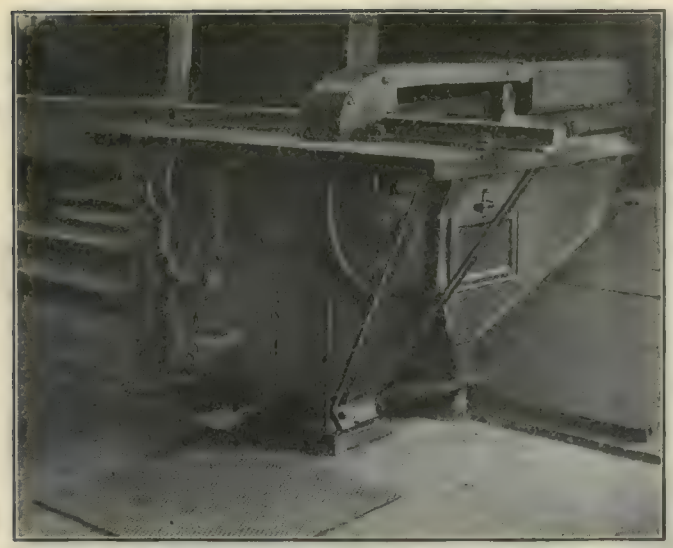


FIG. 8. A GUARD ON A SAW BENCH AND A RUBBER MAT TO PREVENT OPERATOR FROM SLIPPING

Naturally car shop guards are mainly for woodworking apparatus and several devices for equipment of this character are illustrated. Thus in Fig. 6 is shown a bandsaw guard which covers the entire face of the saw wheel and guards the saw blade at the rear of the table.

In Fig. 7 is illustrated a guard for the saw bench that admits of adjustment to correspond to the thickness of the lumber being ripped. The arm of the guard which extends forward over the circular saw is pivoted at the rear on a stud which is adjustable in the curved slot in the carrying bracket so that a satisfactory range of adjustment can be obtained for the front end of the guard arm. The arm is slotted directly over the saw so that inspection of the work in operation is not interfered with. The guard in Fig. 8 is applied to a draw cut saw bench in the cabinet shop. The rubber mat shown on the floor in front of the machine is another safety measure in this department. The mat is to prevent the workman from slipping while engaged in the operation of sawing. The final illustration, Fig. 9, represents the application of a guard tube to a machine bit in the mill. The bit is completely enclosed in a tube perforated with a number of holes of sufficient diameter to permit the wood chips to pass out during the boring operation. The tube forming this guard is located over the spindle in which the boring bit is carried. The tube is attached by a stud to a vertical bracket at the side of the spindle and prevents it from revolving with the spindle. The photographs illustrating this article were taken in various departments of the Southern Pacific Co.'s shops at Sacramento, Cal.



FIG. 9. GUARD TUBE FOR BORING BIT

"A dollar here and a dollar there" saved by a little forethought and carefully invested in the new $1 Treasury savings stamp will help you to save money that will enable you to make more money.

Liquidation of Labor

By E. W. Bergin

It would seem an opportune time to say a few words regarding the conditions governing labor today, their cause, and what we may reasonably expect in the immediate future.

Although some liquidation of labor has taken place in many businesses, leaving the labor market more or less unstable, additional liquidation must inevitably come before conditions reach normal. That the logic of this is not yet appreciated by labor is evidenced daily by men leaving permanent employment for one reason or another without any other position in sight.

A careful analysis shows that the cost of retail goods to the consumer has at present dropped approximately 10 per cent lower than the prevailing price during the early part of the year 1920. Wholesale prices on the average have dropped from 25 to 30 per cent. The average inventory of retail stocks, however, is at present about 25 per cent higher than in December, 1919. This stock must be reduced before manufacturers can expect to receive new orders, but this reduction will be slow unless retail prices are further reduced, and the retail merchants will naturally hold out as long as possible against taking heavy losses on goods they have on hand. On the other hand, it would probably pay them to make a quick turnover so as to enable them to buy new goods at lower prices.

The cost of goods varies principally in accordance with the prices of raw materials, labor, and the general overhead expenses of the business. Substantial reductions have taken place in most all classes of raw materials. Labor costs have also shown some tendency to drop, but further deflation must take place before conditions will become normal. Additional liquidation of labor seems inevitable before the labor element comes to its senses. Overhead expenses as they are related to the cost of fuel, transportation, maintenance, etc., also have an important bearing on this subject. They form one of the chief reasons why manufacturing costs have not yet reached bottom.

These facts would not seem to indicate the placing of large quantities of new orders in the immediate future, and the consequent employment of the necessary labor to manufacture the goods. Rather it indicates that whatever new orders are placed will be on a hand-to-mouth basis, and that labor will experience a further dropping off of its services, which will in all probability be followed by reductions in wage rates, in proportion to the reduction in selling prices.

Marking Tools by Etching

By F. P. Morrison

Referring to an article under the above title on page 1047, Vol. 53, of the *American Machinist*, I am sending a formula for an etching fluid that will not fume like nitric acid.

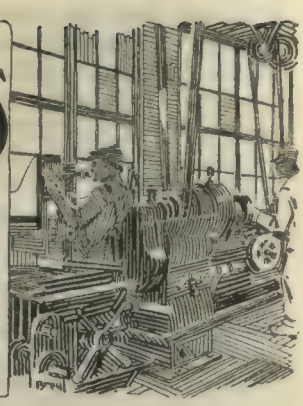
Reduce to powder: 1 oz. sulphate copper, ¼ oz. alum, ½ teaspoon salt and dissolve in 1 gill vinegar to which has been added 20 drops nitric acid. This solution can be kept in a bottle with an ordinary cork.

To use, coat the tool to be marked with melted beeswax, spread thinly, and when the wax has set write or mark the letters through it with a hard lead pencil. Apply the etching fluid with a small stick. When etched deep enough, wash off with gasoline.



MODERN PRODUCTION METHODS

By
W R. Basset
of
Miller, Franklin, Basset & Co



XIV. Analyzing the Labor Costs

Analysis of Labor Cost of Production Given—The Relation Between the Payroll and the Final Cost of the Manufactured Article Brought Out

THE man who watches his payments to labor only to the extent of noting the week to week fluctuations of the total payroll knows mighty little about an important part of his business. Even getting figures by departments does not help much. And, although many people say that it is the overhead expense that makes or breaks a business, I believe that the efficiency of labor is the biggest single thing a manufacturer can watch. The proper analysis of payroll figures is most often the guide to making betterments in production. The payroll can, with ease, be made to talk.

But the routine by which the labor cost is analyzed and controlled must be carefully chosen, otherwise a tremendous clerical expense may be set up which may or may not give reports that are informative. When I come across useless reports in the routine of a business I generally find that they are poorly conceived labor reports.

The labor performed in any shop can be broadly classified as productive or non-productive. Productive labor is charged directly to the product. Non-productive labor is not done directly on a product but is in the nature of a service which expedites the work of the productive employees. It goes first into the departmental overhead and later is applied with the other items of overhead to the product.

We saw, in article XI, a payroll check for $15,922.59 entered on the charge register, Fig. 56, in the payroll column. It later became a credit to accounts payable and a debit to the payroll account on Fig. 57. This is,

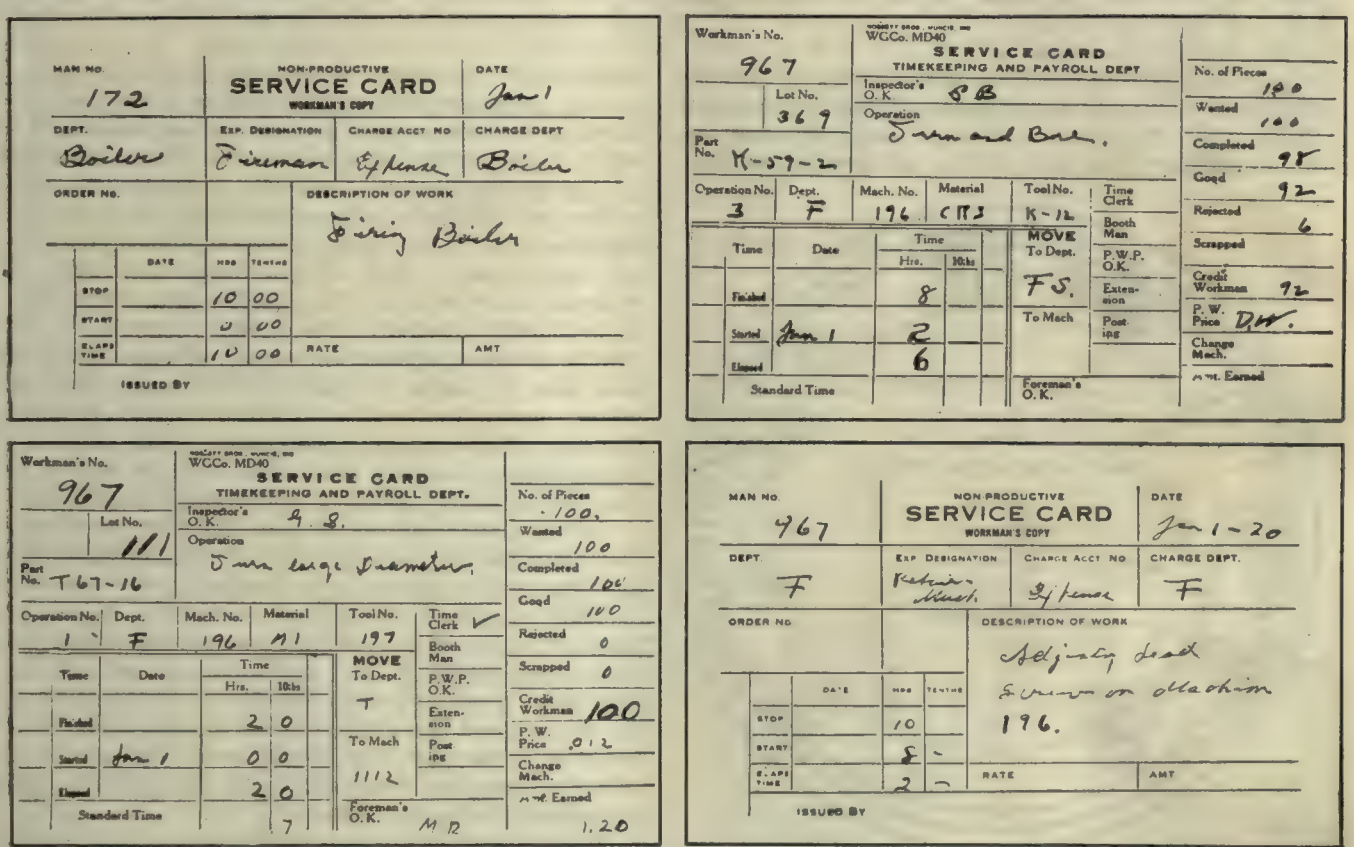


FIG. 62. SPECIMEN SERVICE CARDS

of course, only the check for one pay. Needless to say, there would be entries for three or four other payroll checks during the month, but each of them would be handled in the same way. The total of the payroll column is posted to the ledger as a debit to the payroll account.

The amount shown in the ledger account must of course be distributed to the various accounts that have been affected. Thus, the money paid for labor may have been spent for work upon the product that is productive or chargeable labor; or it may have been spent in wages for foremen, truckers, sweepers, millwrights, shipping room men and other so-called non-productive or non-chargeable labor. Again, some of this money may have been disbursed for the maintenance of the plant, for labor on new tools, new machinery, or new buildings. That is, it may have been paid to labor which has increased the value of the investment and can be capitalized; which might be known as asset labor. That is why, if costs are to be correct, we must see to it that the labor cost gets into the various accounts which have been affected. The starting point for all labor costs is the service card whose function in planning was mentioned in Article VII. Two kinds of service cards are used: one for productive labor and one for non-productive labor.

PAY ROLL COLLECTION NOTE

MONTH January NAME John Frye NO. 172

OCCUPATION Fireman DEPARTMENT Boiler RATE .50

DISTRIBUTION

Day	Clock Hours	Total Hours	O T Hours	PRODUCTIVE P W Hrs	PRODUCTIVE P W Hrs	PRODUCTIVE P W Amt	P W Guar	P W Deduct	N P Hrs	Tinig
1	10	10							10	10
2										
3										
4										
5										
6										
7										
Tot										
Amt										
Ded										
Net										

PAY ROLL COLLECTION NOTE

MONTH Jan - WEEK 1-7 NAME John Olsen NO. 967

OCCUPATION Lathe Hand DEPARTMENT Lathe F RATE 50¢

DISTRIBUTION

Day	Clock Hours	Total Hours	O T Hours	PRODUCTIVE P W Hrs	PRODUCTIVE P W Hrs	PRODUCTIVE P W Amt	P W Guar	P W Deduct	N P Hrs	P L Dept F	P L Hrs	P W Amt	Mach Repr Dept	P W Dept A Hrs	P W Dept A Amt	Over Time
1	10	10		6	2	1.20			2	6	2	1.20	2			
2	12	13	1		12	7.10								12	7.10	1
3	10	10		8	2	1.20	.11			8	2	1.31				
4	9	9		6	3	1.40				6	3	1.40				
5	10	10		5	5	2.10		.06		5	5	2.04				
6	5	5		5						5						
7																
Tot	56	57	1	30	22	$13.00	.11	.06	2	30	12	$5.98	2	12	$7.10	1
Amt			$.50	$15.00		$13.00	$.11	$.06	$1.00	$15.00		$5.98	$.00		$7.10	$.50
Ded						.05										
Net	$24.55		$.50	$15.00		$13.05			$1.00							$.50

FIG. 64. PAYROLL COLLECTION NOTES



FIG. 63. HOME-MADE TIME-CLOCK DIAL

Both kinds are shown in the group in Fig. 62. All service cards are made out in triplicate, one copy to be used by the timekeeper, one for the workman and the other going to the cost department. The time is shown on the service card in one-tenth of an hour intervals, either automatically with an electrical or mechanically operated clock, or by the time-keeper himself who reads the time from a clock with a blueprinted dial. The mechanical or electrical clock is of course preferable, as it practically eliminates the chance of error. In small plants, however, where the expense of such an installation does not seem advisable, an ordinary alarm clock with a special face such as is shown in Fig. 63 is satisfactory. This can be home-made. Note that in the figure shown, the shop is on a ten-hour day with a half-hour lunch period, which is automatically eliminated.

In the earlier articles of this series on planning, we described how the service cards are originally made out. If a man works all day on a single job, but one service card is turned in by him for the day. If his work changes, a separate card is made out for each job so that the charge for his time may be put where it belongs. When all tickets for all men in the plant, both productive and non-productive, have been made out and checked to see that none are missing, they are sent to the time-keeping department and are arranged chronologically by departments.

While a complete set of service cards for a man presumably shows his total time it would be easy for him

Form 119

PIECE PRICE ALLOWANCE

Man's Number	967	Man's Name	John Olsen		
Date	Jan 2	Dept. Letter	F	Part No.	T59-18	Order No.		Lot No.	110
Oper. No.		Name	Turn large diameter		
Low Efficiency ACC. 109-A		Hard Stock Bad Castings ACC. 109-B		Tool or Machine Trouble ACC. 109-C	
Unit Piece Price		Unit Piece Price	.012	Unit Piece Price	
No. Pieces		No. Pieces	10	No. Pieces	
Allow		Allow	.11	Allow	

Remarks: These should be corrected

Approved: L. Smith Signed: Jones

FIG. 65. PIECE PRICE ALLOWANCE FORM

PIECE PRICE DEDUCTION

Man's Number	967	Man's Name	John Olsen		
Date	Jan 3-20	Dept. Letter	F	Part No.	T37-18	Order No.		Lot No.	109
Oper. No.	1	Name	Turn large diameter		
Defective Work Returned for Repairs by Insp.	✓	Errors in Piece Price found by Checking		Errors in Amount Pieces found by Checking	
Unit Piece Price	.012	Unit Piece Price		Unit Piece Price	
No. Pieces	5	No. Pieces		No. Pieces	
Deduct	.06	Deduct		Deduct	

Remarks: Inspect

Approved: L. Smith Signed: Jones

FIG. 66. PIECE PRICE DEDUCTION FORM

to "beat" the company if service cards gave the only record of his activities. We, therefore, believe in safeguarding the payroll by furnishing a check in the form of "in-and-out" clocks at the shop entrance, on which the workman registers his time of arrival and departure at the plant. It is also well to have the men ring in and out at noon, as it prevents stretching the noon hour at the company's expense.

Where Two Sets of Cards Are Advisable

In a large shop where the clerical effort of checking the in-and-out time from the previous day is so great that the cards cannot be in the rack again when next they are needed, we have found it advisable to use two sets of cards—a set for Monday, Wednesday and Friday and another set for Tuesday, Thursday and Saturday.

In any event, the first step is to enter on the payroll the elapsed time as shown by the clock card—and here, naturally, we come to the discussion of the type of payroll which can be used to the best advantage. Fig. 64 shows a group of payroll collection notes, designed to cover a week. If the men are paid twice a month, the payroll collection note is easily made to fit. One of these forms is made out for each workman.

To show how we analyze the payroll, we shall consider the activities of two men: one who works in the boiler department and one in the lathe department. This gives us instances of a man who does all non-productive work, and one whose time is divided between productive and non-productive effort.

Thus, for man No. 172, a fireman, we find, Fig. 62a, but one service card for a day's work. It is a non-productive service card and calls for ten hours. In the column headed "non-productive hours" on this man's payroll collection note, Fig. 64a, we enter ten hours and under "distribution" in the non-productive column we put "10." In the column at the left of the payroll collection note, headed "total hours," we enter 10 hours. We do not extend this service card at the 50c. rate per hour for each day. When, at the end of the payroll period, the record for the period in terms of hours is accumulated on the payroll collection note, we will make a single extension to get the money value, thus saving many small calculations.

Time-Keeping on Productive Work

For the man who does productive work, and who, because he is a good mechanic, may be shifted from job to job, the time-keeping appears more complex, although the payroll collection note makes the accounting actually quite simple. To exemplify the method, let us examine the payroll collection note of John Olson, man No. 967,

LABOR DISTRIBUTION

DEPARTMENT / ITEM	Boiler	Power	Office	Tool Room	Gen'l Factory	Automatic	Milling	Lathe	Planner	Polishing	Hardening	Assembling	Shipping	Selling	Total
PRODUCTIVE LABOR															
DAY WORK				481 10		412 57	201 45	512 10	383 50	250 00	509 22	1040 44	450 00		4246 02
PIECE WORK						655 80	2287 69	1221 39	1371 90	460 50		361 36			6359 64
TOTAL PRODUCTIVE LABOR				481 10		1068 37	2488 14	1734 09	1755 40	710 50	509 22	1401 80	450 00		10615 06
FACTORY MANAGER SUPT & FOR'N			525 00	43 00	225 00	50 00	42 50	40 00	40 00	35 00	60 00	45 00	50 00		1157 50
REPAIRS TO TOOLS TOOL ROOM LABOR				130 00	71 00	38 40	10 60	5 12	8 80			31 00			295 92
REPAIRS TO MACHINERY						115 00	15 00	18 80	10 21			2 75			162 76
FACTORY TRUCKERS						18 13	16 82	12 10	14 15	17 80	16 32	50 41			125 53
WATCHMEN					37 50										37 50
TIMEKEEPERS				21 50	46 75	11 50	11 50	10 00	10 75	12 00	8 00	29 75			161
MISCEL NON PROD LABOR				109 07	566	102	175 00	229 69	300 00	50	67 80	212 50	135 00		1356 76
CLERKS			235 00	21 00	110 00	10 00	10 00	15 00	17 50			30 50	125 00		574 00
INSPECTORS						18 00	50 00	15 00	18 00			75 00			156 00
FIREMAN	67 50														67 50
ENGINEERS		60 00													60 00
OVERTIME						210 00	76 82	81 41	71 22		83 10	28 30	36 40		595 65
TOTAL PAY ROLL	67 50	60 00	760 00	526 57	1031 25	573 92	587 86	419 12	481 63	115 63	241 82	485 81	326 40		5507 55
												Journal Entry		Dr	Cr
												Goods Finished and in Process		10615 06	
												Mfg Expense		5507 55	
												Pay Roll			15822 60

FIG. 67. LABOR DISTRIBUTION RECORD

which is shown in Fig. 64*b*, and his service card for Jan. 1, shown in Figs. 62*b*, *c*, and *d*. Just as for the non-productive workman, we fill in the column headed "clock hours" from the in-and-out clock card. This is the control figure with which the sum of the various tickets turned in by the man for the day should agree. On Jan. 1 there are three service cards for man 967; two of them productive and one non-productive, shown as Figs. 62*b*, *c*, and *d* respectively. Fig. 62*b* shows a productive service card for 6 hours on day work which is entered on the payroll collection note in the fourth column. Fig. 62*c* is a productive card reporting two hours on piece work during which the man's piece work earning was $1.20. This data is entered in columns 5 and 6 of the payroll collection note. The non-productive service card, Fig. 60*d* shows two hours, which is entered in column 9.

Now we have a total of ten hours, which checks with the total taken from the clock card. But we want to get this labor correctly into the costs, so we detail it in the columns on the right of the payroll collection note under "distribution."

The information given comes, of course, from the service card.

Thus we head a column "P. L. Dept. F." which means productive labor performed in Department F, the lathe department, on day work. Six hours are entered there. The next two columns headed "P. L. P. W. Dept. F." are for recording the time and earnings at productive labor on piece work in Dept. F. A fourth column headed "Machine Repair Dept. F." is made to accommodate the two hours reported on non-productive service card 62*d* which shows man No. 967 busy "Adjusting lead screw on machine No 196." This closes out his day.

Jan. 2 shows how overtime and a transfer of the man from his regular department to another productive department are handled. The clock card for Jan. 2 showed that the man had been in the shop 12 elapsed hours. As this shop pays time-and-a-half for overtime, the man is entitled to one bonus hour which is entered in the column headed "O. T. Hours" which gives the man, then, a total of 13 hours.

The 12 productive piece work hours are entered as the two similar hours were on Jan. 1. However, these 12 hours were not spent in Dept. F, so we make note of that fact on the distribution side of the payroll collection note by heading two columns "Piece Work Dept. A." and in the column marked "Hours" entering 12 and in the column marked "amount," $7.10. The one hour overtime is entered in the column marked "Overtime A" so that the department which should be charged with the overtime can be easily determined.

The entries for Jan. 3, except for the entry in the piece-work guarantee column, present no features different from the other two days. The piece-work guarantee column is provided to handle the situation when, for some reason beyond the control of the workman, he fails to make his piece-work rate. For instance, he might, through lack of production planning, be kept at his machine waiting for parts to come to him. In the specific instance shown on this payroll collection note, we see by a glance at the piece price allowance card, Fig. 65, that the parts had not been annealed before the turning operation, and, because the metal was too hard, he could not make his standard time.

On the 5th of the month, you will notice that there is a piece work deduction of 6 cents. There are many ways in which a man might be credited with pieces which he was found afterward not to be entitled to. The price deduction form, Fig. 66, shows that in this case he had turned in five defective pieces, which the inspectors sent back for repairs. The way this deduction of 6 cents is handled is shown on the payroll collection note.

When the payroll collection note is complete for the period, it is totalled to determine the amount of money due the man. Just as is shown on the example, the various columns are footed and the overtime hours, the productive hours and the non-productive hours are extended by the man's hourly rate. The piece-work

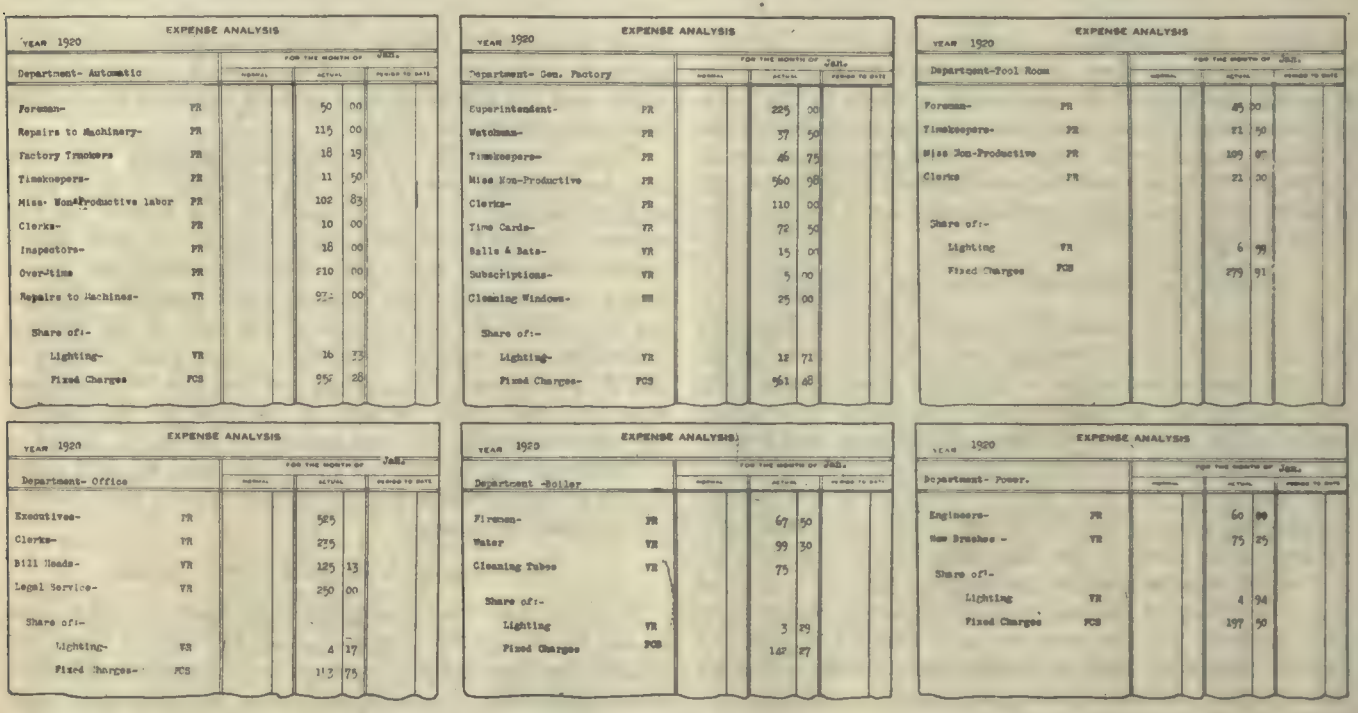


FIG. 68. EXPENSE ANALYSES

earnings are corrected with the piece-work guarantees and deductions and the net total made by the man on piece work determined. The total pay is, of course, the sum of all his earnings. We can prove the figure, in this case, $29.55, by checking it with the total of the distribution.

How the actual paying of the men is done is purely a payroll matter, not a factor in cost accounting. Therefore we shall not discuss it in detail. The individual however will have to decide for himself whether to pay by cash or check; whether to fill the envelopes by hand or by machine; and whether to require a receipt from the man. Usually I believe that a formal payroll form is not needed, as the payroll collection note gives all the record needed for actual paying, for cost purposes, and for reporting the men's earnings to the Government for tax purposes.

I do however, suggest that the payroll collection note be furnished with a slip sheet which can be folded under and take a carbon record of the totals on the left-hand side of the sheet. This is to be given to the man a day or two before he is paid to let him know what his earnings have been. Men appreciate this and the extra effort is small.

To go back to the strictly cost accounting phase of the labor charges: We must next gather from the payroll collection note the charges against each department under each class of labor which we have set up. This we do by adding up the total amount of the pay for each department shown on all of the collection notes. The distribution side of the payroll is then analyzed to the different divisions which we have made, adding these divisions and seeing that they check with the total. When each department has been handled in this manner, the totals of the distributions are added and the totals of the departments are added and the two are reconciled until a balance is found between them.

We then prepare a labor distribution sheet, Fig. 67, similar to the analysis of the expense from the charge register which we made prior to posting it to the expense analysis.

This final report from which we post to the expense analysis is prepared but once a month and should agree with the total amount of the payroll account on the ledger.

There are of course two main divisions of this distribution, one for productive labor and the other non-productive. For the present, all that we are dealing with is the non-productive or in other words, expense labor. In the lower right-hand corner are the journal entries needed to get these charges into the general books.

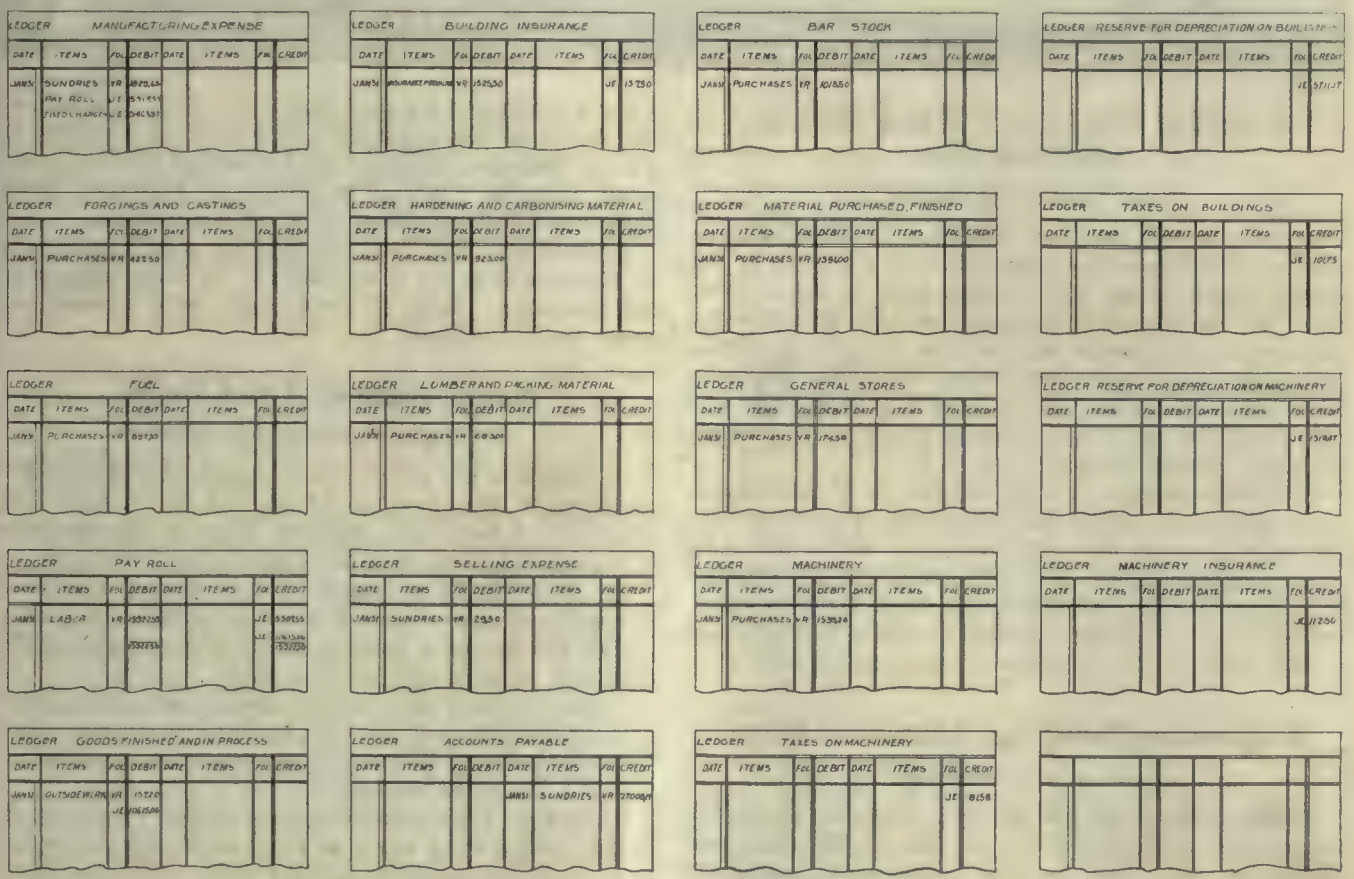


FIG. 69. THE DEVELOPED LEDGER ACCOUNTS

In Fig. 68 are shown the expense analyses for the typical departments we are considering with the expense labor posted to them. The productive labor we are leaving for a moment until we come to the time when we are ready to pick it up and get into the final costs.

Fig. 69 shows the standing of the ledger accounts after the proper entries have been made to take care of the fixed charges and labor. As we develop in future articles, other charges, the proper entries will be made both to the expense analyses and the ledger accounts. Thus simultaneously, we will develop the three essentials of a good cost system: (1) the cost of the product; (2) an analysis of expense which enables the executive to control his business; and (3) a tie-in to the general books which proves that the costs developed are correct.



A Spring Block for Use in a Milling Machine Vise

By Francis W. Shaw

A device much like that described by H. M. Fay in the *American Machinist*, page 697, Vol. 53, made by the writer, failed to act after it had been in use a short time for the reason that with continual pressure the block took a permanent set and then refused to release the work. Similar trouble arose on another occasion with spring vise jaws; again, with chucking rings and collets split in one or more places, in one place through, in others partly through.

The only real cure for this trouble is to use a hardening steel and harden and temper the piece, for even high-carbon steels left soft are apt to act in the same way in course of time. If complications are not objected to, springs can be introduced, but these must be fairly strong to be of service. Blocks or other devices made of cast iron are not so subject to permanent set.

Expanding Punch for Aluminum Ware

By J. R. Sheppard

Referring to an article by John Lindgren under the above title on page 1068e, Vol. 53, of the *American Machinist*, the writer has had considerable experience on all kinds of drawing and expanding by hydraulic pressure and has encountered none of the objectionable features you mention.

The rubber filler sometimes used has many disadvantages among which are crystallization and failure to flow sufficiently to fill all crevices of dies. We have used pressures up to as high as 6,000 lb. per square inch for drawing and expanding work.

As to difficulty in supplying a suitable locking mechanism, the hydraulic pressure is first applied to main ram of press, closing the dies, the pressure then is admitted to the inside of the shell, each operation requiring simply a single motion of the operating valve lever.

The mention of a spinning operation being necessary recalls to the writer's mind the fact that if high pressures are used the work will show even the faintest scratches in the dies. Further, as to metal breaking at its weakest point, this tendency is diminished by the use of a fluid as a medium, rather than increased, as the fluid applies the pressure uniformly to the entire interior surface of the shell, whereas in this particular case the corners of the expanding plug hit the wall first.

As to expanding the shell from 4½ in. to 6 in. in diameter, the writer has expanded a shell 1½ in. in diameter to 3 in. in diameter, making a bend of almost 90 deg. in the small diameter end—all by hydraulic pressure. This piece was the horn elbow on a talking machine.

Another case was that of expanding a shell from ⅝ in. in diameter to 1½ in. in diameter in the same manner in one operation. Both of these shells were tapered between their diameters.

Helix Angle of Twist Drills

By Frank Marsh Johnson

In regard to the article "Helix Angle of Twist Drills" by Bruce W. Benedict, page 1175, Vol. 53, of *American Machinist*, I have very different ideas of the qualities of high-speed steels than Mr. Benedict evidently has.

On page 1176 he says, "the superior hardness, strength and edge-retaining qualities of high-speed steel permit the use of a more acute cutting angle in drills than was possible with carbon steel."

I have always been taught that good carbon steel properly heat-treated was both harder and stronger than high-speed steel. Will some one please set me right on this if I am in the wrong?

I think it quite possible to get better results from a drill with a helix angle as great as 35 deg., provided it is used for cast-iron drilling only. However, drill manufacturers usually make drills to meet the requirements of both steel and cast-iron drilling.

It seems peculiar to me that so many mechanics have an idea that because high-speed steel will stand a higher cutting speed, that it is necessarily harder than carbon steel. I hope to hear more on this subject through your columns in the near future.

A Putting-On Tool

By O. S. Hopkins

Having some 3-in. shafts that were turned undersize by a workman whose micrometer was out of adjustment, I decided to avoid scrapping them if possible.

I took a common knurling tool and replaced the knurls with one plain roller and one made just as would be used to roll a 60-deg. thread. Setting the lathe to cut a 12-pitch thread, I fed the V-shaped roller into the stock and the plain one rolled the metal smooth, in fact, after increasing the diameter 0.003 in. (as that was all that was necessary) to my surprise the finish was almost equal to grinding, except the small groove made by the V-shaped roller which made no difference.

Meeting the Present Emergency

By the Treasurer of a Large Eastern Machine-Tool Company

DURING late months we have suffered the cancellation of orders for an exceedingly large amount of machine tools as made for stock, some of which have been cancelled arbitrarily with no regard to the wishes of those who have engaged to deliver them; while others have been cancelled by customers who have developed a credit character of an inferior sort. However great the cancellation evil has been in the case of our own customers, we believe a great many customers have not cancelled their orders because they have wished to stand back of their agreement to accept delivery.

There is a growing tendency to stand by orders once given, with a willingness to recognize the rights of the party who has engaged to deliver the goods. When criticisms are made as to the cancellation evil itself, it is well to recognize that progress is being made, notwithstanding considerable in the way of discouragement.

Reduction of Working Force

Our working force has been greatly reduced during late months and is now being engaged only three and four days each week. As deliveries are being accomplished, doubtless our working force will have to be reduced still more.

The more a business is developed on a manufacturing basis, as has been the case in the machine-tool industry during the last twenty years or more, the more is organization itself of vital importance. Hence, during slack times such as are upon us, it is important that the skeleton of the employing force be kept together and utilized to its best until larger manufacturing operations can be performed. Doubtless all manufacturers of machine tools have before them the importance of keeping their organizations. It is certainly a good time to make repairs to equipment, to re-organize systems where change is needed, for there is no better time than a rainy day to prepare for the busy times of sunshine.

Dull Times Ahead

In our opinion, the machine-tool industry is in for a period of dull times, the extent of which no man can predict.

Some relief may be effected in a relatively short period and then again there may be a prolonged period of dullness, reaching as far as 1922, or even beyond.

As for the automobile trade, which has been such a factor in the prosperity of the machine-tool business in years past, it has achieved a temporary recession, but the necessity for improved equipment must be resumed to some extent before a long period elapses. The automobile trade will be more of a normal one in future time, and insofar as it is, the machine-tool business will be more healthy.

As for the matter of wages in the industry, if the cost of living continues to recede throughout the country as is freely predicted, this lowering of prices must of necessity mean a cheapening in cost of production, which of itself means a lower wage scale. Without any doubt, the employees in the machine-tool industry will have a lower remuneration in common with that of other industries throughout the land. The extent to which this will affect the particular classes in machine-tool labor is unknown, but the general impression is that common labor, as such, has been paid much more than will be the case as business tends to resume.

Relations Between Employers and Employees

We have every confidence that the relations between the employers and employees in the machine-tool industry will be on the same high plane which they have enjoyed in time past. There is no industry where there has been employed, to a greater extent, those systems of payment which reward the individual worker according to his accomplishments, and these systems of payment will endure wherever the scale of payment may settle.

By the President of a Large Machine-Tool Building Concern

WE HAVE read the article "Meeting the Present Emergency," on page 104 of the *American Machinist*. After having carefully read it myself I handed it to my next in command. After he read it he came back to me and said: "Did you write that article? It covers our case exactly."

It covers the ground as we see it, perfectly. We have been running our plant 36 hours per week. Next week we will run it 27 hours with the hope that we can run it 36 or 45 hours. We have no unfilled orders on our books.

We are getting a few repair part orders, but very few. We have not discussed lower wages and have no idea when we will, if at all. We are going to run our plant as long as our money holds out. Then we are liable to give our bankers a slow note and run the plant some more. We think that we have the best crew of men in captivity and we are going to make every effort to keep them intact.

Business Depressions and Bad Weather

I have often told a little story which illustrates the present situation very well, we think: "It was a cold, dark, raw and rainy day. A man in a buggy was driving along a country road. The road was a foot deep in mud and there was absolutely nothing in the surroundings to encourage one. A farmer was plodding along the road, collar turned up, hat pulled down, hands in pockets and thoroughly drenched. The man in the buggy, wishing to be friendly, stopped his horse and called to the farmer:

" 'I say, friend, do you think it's going to clear up?'

"The farmer, without so much as raising his eyes, replied, 'It always has,' and went his way."

Now, you can bet your shirt that this "business weather" is "going to clear up" because—"it always has."

We believe it and are going to back our opinion to the limit. Just at present our profits would probably rattle in a hollow bird shot, but we have weathered a lot of "storms" since we started in our little business in 1832 and we are strong for this—"it always has" stuff.

IN THIS ISSUE

EACH of us occasionally ponders with somewhat of wonder on the developments of the past twenty-five years. The more spectacular objects, such as the automobile, airplane and submarine are given our greatest attention. We may well afford, however, to consider some of the less obvious developments, which, if not primary, are largely contributory to the successful accomplishment of those things which excite our wonder. The process of grinding is one of these contributory developments. "Twenty-five years ago," says Sheldon, in the article which opens this issue, "the use of emery or abrasive material upon surfaces that were to form a bearing was considered very bad practice indeed, and many superintendents, master-mechanics and others having responsible charge of the construction of machinery would not allow a workman to use a grinding wheel or piece of emery cloth upon such surfaces." After a brief introduction embodying this and several other pertinent generalities the article gets right down to business treatment of a number of special fixtures used in grinding operations.

The lathe tool has always borne the brunt of experimentation, it seems. Perhaps more has been written on the design and use of lathe tools than on any other type. The truth of this statement being admitted, you will agree that a splendid basis is furnished for comparison of the statements of the many who write on the subject. The third of DeLeeuw's series on metal-cutting tools page 166, deals with standard lathe tools and we believe that you will find in it several important conclusions that differ from those usually accepted, yet are so logically drawn that you will perforce agree with them.

One way of making a sheet-steel universal joint cover is described by W. A. Flumerfelt on page 171. He tells of the method of drawing and forming the cover of comparatively thick sheet metal and of flanging and closing in by means of sectional dies. He admits that this method is not the only one and says that his only intention is to pass along for consideration the information on how the job was done.

A good short article is that on page 177 on machining Ford transmission drums. It tells what the operations are and on what machines they are performed.

Fred Colvin in the current article on the foreman and his job says several things that may well be taken to heart by both foremen and higher-ups. Among the things that a foreman must not be are driver, routing clerk, time clerk, watchdog, glorified errand boy. Some of the things he should be—well, it's interesting reading, so we'll let you see for yourselves. Page 175.

Last week we ran the first half of the first part of the series on magnetic chucks. There was too much to the first part to get it all in one issue, so we saved the second half for this week. You will find the continuation on page 177. It deals chiefly with classification.

On page 180 we have a short article by Hunter on pneumatically operated clamps for drilling machines. Air chucks and clamps have been found to possess great holding power and desirable pressure control which make them particularly adaptable to certain lines of work. The several examples of their use that are given by Hunter are indeed instructive.

Two short articles follow that on pneumatic clamps. M. W. Davidson explains the action of the epicyclic gear train and F. W. Salmon gives a table for estimating the weights of aluminum, brass, cast iron, copper, lead and other metals of various sections.

Frank A. Stanley has been giving some attention to safety devices and he has found some very good ones in railroad shops. As not all of us can get around over the country enough to satisfy our hankering for information on such subjects we must rely upon just such informants as Stanley and such articles as the one he has written, for our store of knowledge. The devices he describes are not without ingenuity of design and many of them are applicable to machines in shops employed upon other and different lines of work. Page 184.

With the present treatise on analyzing the labor costs, page 187, we reach the fourteenth of W. R. Basset's extremely valuable and timely group on modern production methods. We think that there is little necessity to say anything by way of boosting these production articles, so we are using just enough space to let you know that there is taken up this week the relation between the final cost of the manufactured article and the pay roll, an important subject, indeed.

Coming Features

Next week will see a continuation of Colvin's "Building Motors on the Pacific Coast." In the fifth article he takes up final inspection and assembly, and construction and arrangement of the shop.

The second of Sheldon's magnetic chuck series, dealing with history and development, is scheduled for next week. Of historical interest is his statement that the first magnetic chuck was patented forty-eight years ago.

Last week we promised that some mathematical articles would be included in our pages from time to time. One of them is to appear on the tenth, if we may be permitted to classify as mathematics something which deals entirely with trigonometry. W. G. Holmes supplies formulas for the solution of right and oblique spherical triangles.

E. A. Dixie will furnish some first-hand information in regard to European recognition of the possibilities of the airplane for commercial use. They're getting ahead over there and we may as well admit it. At the same time we would do well to try to keep step and extend our own use of airplanes.

The railroad article for next week is by Stanley. It deals with tools for locomotive steam pipe joints.

EDITORIALS

Patent Office Salaries Still Unsettled

IT IS unusual to have a conference committee of the House of Representatives and the Senate holding hearings regarding a bill which has passed both houses of Congress, before undertaking to reconcile the differences in the legislation as thus passed by the two legislative branches. However, unfortunately it is not unusual to find that the riders and special conditions attached to a bill threaten to delay or perhaps even defeat the passage of the principal legislation which all agree is meritorious. This is the situation of the bill revising the scale of salaries of the United States Patent Office as now under consideration by Congress.

Almost without exception those appearing before the conference committee urge the revised salary scale for the Patent Office which will permit this institution to continue a useful service upon a proper plane. The whole opposition to the measure is upon grounds entirely foreign to the question of what should be the salary for the patent examiners.

There are three groups of complainants. One group addresses itself to the new authority which it is proposed to grant the Commissioner of Patents to supervise the professional practices and advertising of those who practice before the Patent Office. The second group is opposed to establishing a new basis upon which courts shall award damages for alleged or proven violation of patent rights. The third group attacks the section which provides for assignment of patents secured by Goverment employees to the Federal Trade Commission, which body it is proposed should administer these patents granting licenses and collecting license fees under rules to be laid down by the President.

The first of these three controversies is purely an administrative matter. The second one is a matter of great legal concern and the third one of public policy. All of them are of tremendous importance in their respective fields. But none of them, important as it may be, even approaches in importance a prompt attention to increased salary needs for the Patent Office staff. We trust that the conferees may quickly settle upon some policy with respect to these disputed points and report a measure to both houses of Congress. In such measures it is certainly to be hoped that the higher salary scale proposed by the House of Representatives will be adopted in preference to that which has been proposed by the Senate. Even this higher scale passed by the House is not really adequate to the needs of the service. Industry and business have already suffered too much for want of proper patent examination and are doomed to suffer still more if the exodus from the Patent Office of expert examiners cannot some how be stopped. There seems little ground for belief that the small economy proposed by the lower salary scale of the Senate will begin to compensate the country for the losses due to inadequate and delayed handling of patents which is sure to follow and become more serious if the technical staff of the Patent Office does not have this well deserved relief.

Let Us Have Action!

THE Federal Power Commission has pending before it applications for water-power development amounting to 13,000,000 horsepower. However, it is unable to give any sort of prompt and adequate attention to these applications under present conditions. All users of power—and what branch of industry is not a power user these days—can reasonably demand an explanation of this situation. The cause of this difficulty is quite obvious, and the remedy so simple that it seems absurd that it has not been applied.

The Power Commission under present legislation has no authority to employ personnel, directly. It must work only with employees borrowed from other executive departments concerned. This results in an inadequate staff and great possibilities of interruption.

There is pending in the House of Representatives a bill introduced by Representative Esch (H.R. 15,126), which provides a remedy for these conditions. This, with a slight increase in the appropriation amounting perhaps to two or three hundred thousand dollars, would put the commission on its feet ready for business. It would permit some of the tremendous power developments to go forward instead of being held up simply for lack of action by the Power Commission, and this through no fault of the commission itself.

When all industry is so anxious to have business of all types go forward promptly, it is especially unfortunate that Congress is dilatory in attention to this legislation. We cannot with any degree of satisfaction sit by and wait for the Power Commission, at its present snail's pace, to act on applications for the benefit of our great-grandchildren. We think at least our children should begin to see some benefits from developments that everyone feels are desirable. It is to be hoped that the game of politics and the urgency of certain "class legislation" will not be successful in preventing the passage of so worthy a measure of such broad interest.

Another Evidence That the Railroad Shops Are Inadequately Equipped

OVER in the news pages is a statement by the chairman of the Association of Railway Executives refuting the charges of the Machinists' Union that locomotive repairs are beng sent to the builders to break the union organization in the railroad shops. There seems to be little question as to the merits of the case and we refer to it here only to comment on the clear evidence presented of the hopelessly inadequate tool equipment of the average railroad shop.

Not only are there many more locomotives to be repaired than the shops were built to handle, but the new ones are in many cases so large that the shops have not the machine tools to handle the parts. If the union propagandists would use some of the energy they expend in endeavoring to subvert the railroad management in working constructively to obtain the much-needed new machinery for the railroad shops they would be doing a service for their own men and for industry in general.

SHOP EQUIPMENT NEWS

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and equipment

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

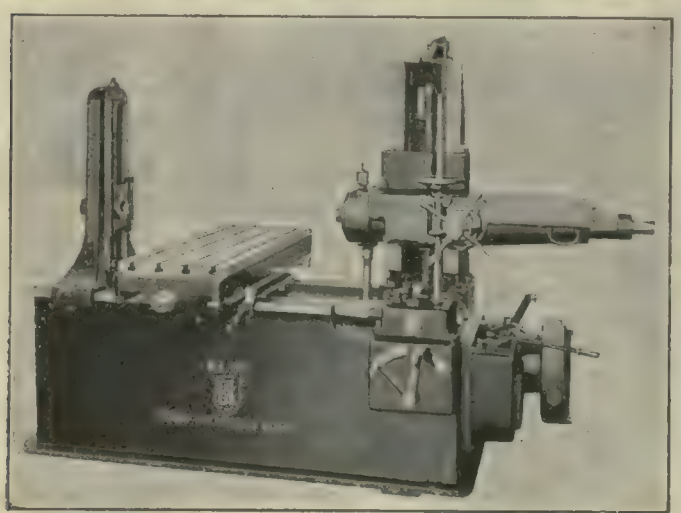
• CONDENSED • CLIPPING INDEX
A continuous record of modern designs and equipment

Giddings & Lewis No. 25 Horizontal Boring Machine

A recent addition to the line of horizontal boring, drilling and milling machines made by the Giddings & Lewis Machine Tool Co., Fond Du Lac., Wis., is designated as the No. 25 size. The machine, shown in the illustration, is intended to be used either for production work or for toolroom work on jigs and fixtures.

The bed is of box form with a full trussed bottom and three points of floor contact. The column is tongued to the bed, and it is so placed and arranged as to make the machine particularly adapted to a right-handed operator. The cast parts are of semi-steel, containing 20 to 30 per cent of steel. The guiding ways and T-slots are chilled. The moving units have long narrow guiding ways and are provided with taper gibs.

All control levers are so arranged as to be easily accessible to the operator. There is a quick-return mechanism at the end of the headstock. The spindle pilot is controlled by a quick-operating clutch, and the spindle is driven by long opposed driving keys. The spindle sleeve is provided with bronze take-up bearings, and with collet take-ups at both ends. The drive to both the spindle and the table is by means of helical gears. A change gear quadrant is provided for use in thread cutting. All feed screws are of high-carbon steel and run in bronze nuts. They have ball thrust bearings and are provided with micrometer dials for adjustment. The vertical screws for the head and the outer bar support are suspended from the top, so that they are always in tension.



GIDDINGS & LEWIS NO. 25 HORIZONTAL BORING, MILLING AND DRILLING MACHINE

Specifications: Spindle: diameter of bar, 2½ in.; taper hole, No. 4 Morse; longitudinal travel, 13½ in. Vertical adjustment of head on column, 20 in. Maximum distance table to center of spindle, 20 in. Distance from face of spindle to boring-bar support, 48 in. Size of table, 18 x 48 in. Table travel: transverse, 33 in.; longitudinal, 30 in. Spindle speeds: number, 8; range, 12½ to 337½ r.p.m. Feeds in each direction: number, 9; range, 0.0034 to 0.25 in. Driving pulley: size, 16 x 2½ in.; speed, 450 r.p.m. Motor recommended, 3 hp., 1,200 r.p.m., constant-speed. Net weight, 6,300 lb.

The machine is driven from a single constant-speed pulley. It is provided with a reversible friction clutch that runs in a bath of oil, and it has independent reverse mechanisms for the speeds and feeds. There are eight spindle speeds in each direction. There are nine power feeds in all directions, but extra change gears can be supplied for any desired feed. The feeds are driven from the spindle, being in inches per revolution of the spindle. The feed mechanism is protected by a safety device, so as to prevent overloading. The table motion can be governed by an automatic adjustable trip with stops at the extremes of the travel. All high-speed shafts are of heat-treated steel and run in ball-bearings. The heavy-duty clutches and gears are of heat-treated alloy steel, and all gears are fully enclosed in oil-tight cases.

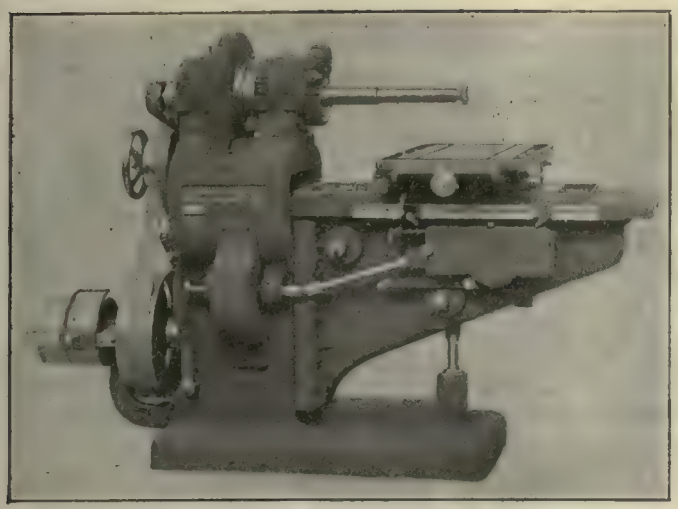
Special equipment that can be furnished for the machine includes an auxiliary table of the same height as the platen. For angular work, a plain hand-feed or power-feed revolving table, 24 in. in diameter and graduated to one-half degrees, can be provided. A star-feed facing attachment that will face from 0 to 18 in. in diameter can be furnished. It is regularly bolted and keyed to the spindle sleeve, but can be made to fasten to the spindle or boring bar.

Heald No. 55 Cylinder-Grinding Machine

The Heald Machine Co., Worcester, Mass., has recently placed upon the market the cylinder-grinding machine shown in the illustration. It is known as the No. 55 machine, being of the knee type, and is intended for general repair work, especially the re-grinding of automotive-engine cylinders. It is modeled on the lines of the No. 60 machine made by the same concern; although it has been simplified, thus making it cheaper, while still suitable for jobbing work.

No speed boxes are used, the drive being from a single shaft at the rear. The machine is self-contained and can be driven from the lineshaft, no countershaft being required with it. It is stated that the table is large enough to hold cylinder blocks of six cylinders without large overhang when grinding the end holes.

The grinding spindle is carried on top of the column in a cylindrical, rotating head made up of two eccentric sleeves, thus giving an adjustment to provide for grinding different sizes of holes. The spindle has two speeds,



HEALD NO. 55 CYLINDER-GRINDING MACHINE

Specifications: Capacity with standard spindle, to grind holes 2⅜ in. in diameter and larger, by 11 in. long; and 3 in. and larger, by 18 in. long. Standard wheels, 2¾, 3 and 3½ in. in diameter. Surface speed of wheels, 4,950 to 5,650 ft. per minute. Vertical adjustment of knee, 2½ in. Traverse adjustment of cross-slide table, 24 in. Cross-slide table: 36 x 18 in.; finished surface, 28 x 14 in. Main table: 55⅝ x 16 in.; finished surface, 24 x 13 in. Distance cross-slide table to center of grinding circle, 7 to 9½ in. Speed of driving pulley, 700 r.p.m. Motor recommended: 5 hp.; 1,000 to 1,200 r.p.m. Floor space, 72 x 110 in. Weight: net, 2,900 lb.; boxed, 3,700 lb.

obtained by means of the two-step cone on the main drive shaft.

The large, adjustable knee carries the main table, which slides back and forth in a line parallel to the spindle. The ways are protected from grit and dirt, and oil pockets with rolls are provided for continuous lubrication. The travel of the main table automatically reverses, adjustable dogs being provided to allow of controlling the limits of travel. Two speeds can be obtained by means of a knob placed at the front of the machine. The cross-slide, mounted on the main table, is provided with a hand feed screw fitted with a graduated dial.

The wheel spindle is hardened and ground, and runs in a solid, tapered bronze bearing at the wheel end, with a self-aligning ball bearing at the pulley end. It is fitted with interchangeable pulleys, to give different speeds to the grinding wheels, so that the proper speed for the size of wheel used can be obtained. The depth of cut is controlled by the feed mechanism on the right-hand end of the rotating head. It can be operated either by the knob for small adjustments, or by a small crank on the shaft below the knob when large adjustments are to be made, as when going from one size of hole to another.

Wheel spindles can be furnished to suit work of different types, the kind depending upon the diameter and length of the hole to be ground. Such equipment as a pump, tank, fan and diamond mounting can be furnished.

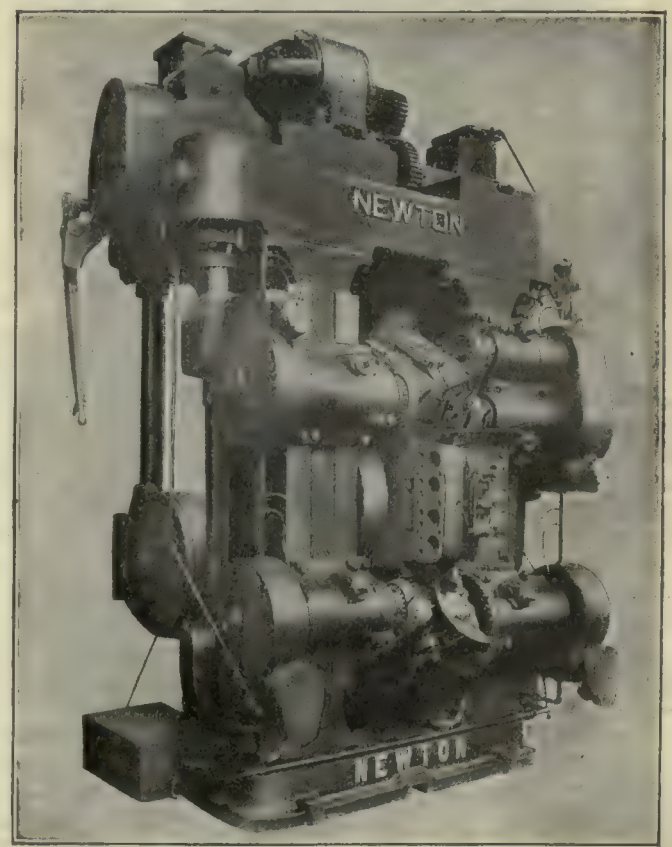
Newton Model O-4 Drum-Type Continuous Milling Machine

The illustration shows the Model O-4 continuous milling machine, placed on the market by the Newton Machine Tool Works, Inc., 23rd and Vine Sts., Philadelphia, Pa. The machine is intended for finishing two surfaces simultaneously, either on the same or on different castings, being especially adapted to the milling of opposite surfaces of cylinder blocks, parallelism of the surfaces being thus obtained. As can be seen, the bottom of the block is roughed by means of two small face mills and finished by one large one, the top of the casting requiring only one mill for roughing and one for finishing. The roughing cutters are placed at the top, the finishing cutters at the bottom, and the work is removed from and replaced on the rotating drum by an attendant at the rear of the machine, the cutting operation being continuous. Each piece is held by only one clamp, which has a double bearing, thus permitting of speedy operation. The roughing and finishing cutters do not cut upon the same casting at the same time, a point which is claimed to permit of a smooth finish.

The cutter spindles have individual adjustment and are driven by worms and wormwheels, the cutting speed of the finishing cutters being 80 per cent of that of the roughing cutters. The speed of the cutters can be changed by means of removable change gears. The work-holding drum is driven by means of herringbone gears and a worm and wormwheel, the speed being variable by means of removable change gears. The spindle of the drum is provided with taper bearings and adjustment for taking up wear.

All gearing, splined shafts and revolving parts are fully inclosed and run in oil, which is pumped from reservoirs on each side of the machine to the tanks at the top, from which it feeds by gravity through tubes to the bearings and back to the reservoirs. The bearings thus do not become flooded, and yet are automatically lubricated.

It is stated that the average rate of production on the cylinder block shown is 25 pieces per hour. Different heads can be supplied to suit different sorts of work. Machines of this type are also made for surfacing the ends of cylinder blocks, or of gear cases. It is stated that owing to the small amount of handling and high

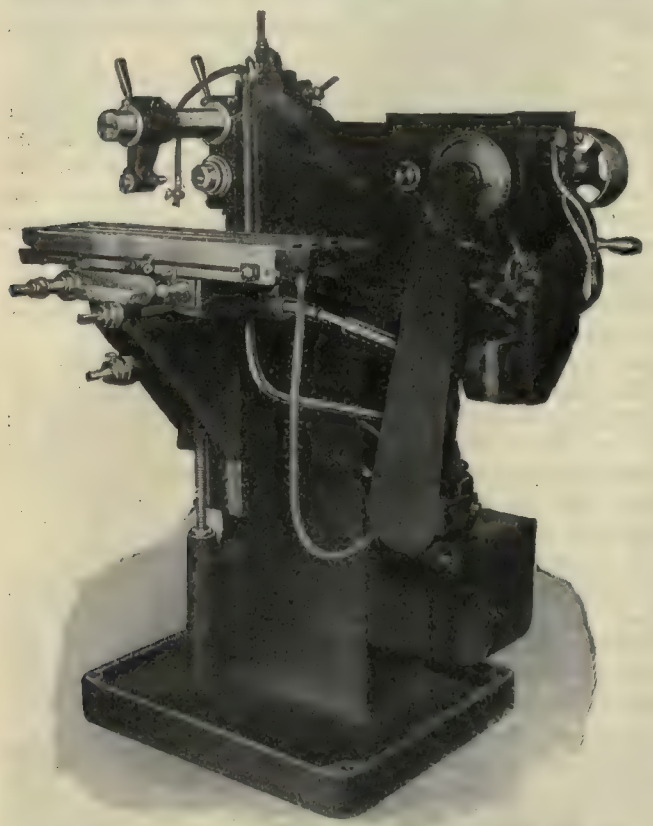


NEWTON MODEL O-4 DRUM-TYPE CONTINUOUS MILLING MACHINE

rate of production, the labor and machining cost is small; also, that the floor space required is very small in comparison with the productive capacity. The motor is mounted on the top of the machine and geared to the driving mechanism.

"Standard" No. 2 Milling Machine

The Standard Engineering Works, Pawtucket, R. I., has recently placed upon the market a milling machine designated as the No. 2 and shown in the illustration.



"STANDARD" NO. 2 MILLING MACHINI WITH POWER FEED AND OIL PUMP

The machine is of the plain, knee type, is fitted with positive drive throughout, and is said to be adaptable to all sorts of milling.

The column and knees are of the box type. The table is provided with three T-slots and has oil pockets at each end. The headstock is gibbed to the top of the column, so as to provide for vertical movement, but it can be clamped in any desired position. The spindle is high-carbon steel, and runs in phosphor-bronze bearings provided with an adjustment to compensate for wear. It is lubricated by means of felt wicks from oil chambers in the headstock; and it is driven by a Link-Belt silent chain, inclosed in a cast-iron guard, from the speed-change gear box, which forms a part of the column at the back of the machine. On the rear shaft of the box is mounted a single pulley, which is driven from the overhead shaft. The gears are of heat-treated steel, the shafts high-carbon steel and the bearings bronze.

Twelve spindle speeds are provided, ranging from 80 to 1,950 r.p.m. They are divided into two ranges, made possible by interchanging the sprockets used with the silent chain, the low range being used for heavy work and the high range for light work that can be done at high speed.

A power feed attachment can be mounted, thus providing a longitudinal feed for the table of 0.004 to 0.062 in. per revolution of the spindle. Four feed changes, controlled by a single lever, are provided, the gear box being located underneath the speed-change box. The feed motion is positive, being geared from the spindle drive, and driving through a telescoping shaft a worm and worm gear connecting with a pinion meshing with a rack on the under side of the table. A hand-driven quick-return is provided. The rotating parts are bronze bushed, and the gears are incased and run in oil.

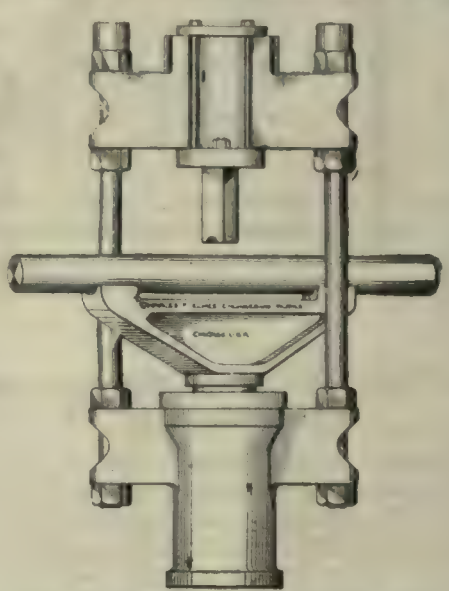
The machine is equipped with a Trahern reversible geared pump, having an automatic relief valve. The pump is mounted on the tank containing the cutter lubricant and is driven by a roller chain protected by a cast-iron guard.

The machine can be equipped for individual motor drive, the motor being mounted on top of the gear box and connected to it by means of a silent chain inclosed in a cast-iron guard. A 1-hp. motor of 1,200 r.p.m. is recommended. Attachments, such as plain vertical, universal or vertical spline milling heads, can be furnished.

Elmes "Five-in-One" Hydraulic Press

The Charles F. Elmes Engineering Works, Morgan and Fulton Sts., Chicago, Ill., has recently placed on the market the hydraulic press shown in the illustration. The machine is known as the "five-in-one" combination hydraulic shop press, and is intended as an all-around press for use in small shops or for repair work. This press will handle a large variety of forcing, bending, straightening and broaching work, having a capacity up to 50 tons.

In the illustration it is shown being used as a straightening press, as it is provided with a straightening attachment. With this attachment removed, the press may be used for vertical forcing, or as an arbor press. By adding platens, the press may be used for forming or compressing. By removing the side bars and top head, the press cylinder makes a 50-ton jack. On account of its light weight, the machine can be readily handled as a portable press, and used either vertically or horizontally. It can be provided with an extension



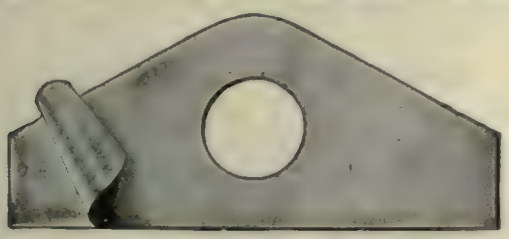
ELMES "FIVE-IN-ONE" HYDRAULIC PRESS

bar, for use when forcing long shafts into or out of gears and pulleys. The press weighs about 500 lb. and has a capacity of 50 tons. The distance between the columns is 18 in., but the side columns are adjustable and may be moved so as to increase or decrease the distance between them. The distance from the top-head to the ram lowered is about 20 in.

"Fit-All" Laminated Shim

The Laminated Shim Co., 47 West 34th St., New York, N. Y., has recently placed on the market a laminated shim of the shape and size shown in the illustration. The shim is made up of thin metal layers, so that by "peeling off" some of them the proper thickness can be obtained.

It is called the "Fit-All," because it is adapted to fit nearly all shapes of automotive bearings, it being stated



"FIT-ALL" LAMINATED SHIM

that the shape was decided upon after a study of the shapes of over 1,000 different shims. In some cases it may be necessary to trim the sheet, this being done with a tinner's shears. It is said that this shim combines the advantages of the laminated shim with the universality of the sheet-brass shim. It is made in different thicknesses, and can be furnished punched with holes of two different diameters.

Velco Staggered-Tooth Keyway Broach

The Velco Manufacturing Co., Inc., Greenfield, Mass., has placed upon the market a keyway broach having a tooth-form that provides for a large chip space. As can be seen in the illustration, the teeth of the broach are staggered. The arrangement can be described by comparing it to two keyway broaches of the usual form secured together side by side, so that the teeth of one are advanced beyond those of the other, one-half of the pitch. The teeth are milled from solid stock, and are deeply cut to provide chip room, although a strong cross-section is claimed. The depth of the recess makes possible a large radius at the base of the tooth.

The tooth faces slant in opposite directions on each side of the bar, thus obtaining a shearing cut, but neutralizing the side thrust on the bar. Because of the shape of the tooth, a large amount of metal can be removed by grinding on the top of it when sharpening, before the rake angle is changed. The broach has a pull

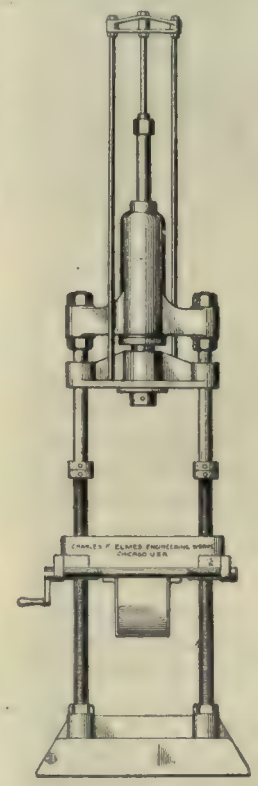


VELCO STAGGERED-TOOTH KEYWAY BROACH

shank, which is said to so attach to the broaching machine that it does not pull off-center. The capacity is such that any standard keyway may be cut at a single pass of the broach, which is made in the standard sizes.

Elmes "Rapid" Hydraulic Broaching Press

The illustration shows an hydraulic broaching press recently placed on the market by the Charles F. Elmes Engineering Works, Morgan and Fulton Sts., Chicago, Ill. The machine is known as the "rapid" broaching press, and it is stated that fifteen to twenty-five strokes per minute can be made. It will take work requiring up to 20 tons pressure.



ELMES "RAPID" HYDRAULIC BROACHING PRESS

The distance between the columns is 20 in. The platen or table may be raised and lowered quickly by means of the crank at the left of the press, the minimum opening from the ram to the table being 14 in. and the maximum 36 in. A plate set in the platen has an opening through it for the broaches; and it may be removed and replaced by another having any desired size of opening. Below the table is a hopper for receiving the broaches as they pass through the work.

The ram is hydraulically operated and is returned to its uppermost position by means of an hydraulic pullback cylinder. The operation of the press is controlled by a single, lever-operated valve, the speed also being regulated by means of a valve. No gears are, of course, used for speed control. If desired, the ram may be stopped at any part of the stroke. The operating arrangement is said to give accurate control at all times.

Rockford Automatic Lathe

The accompanying illustrations show the automatic lathe which has recently been added to the line of the Rockford Machine Tool Co., Rockford, Ill. The machine is intended for the rapid production of duplicate parts, especially for the turning of pistons, pulleys, cone pulleys and gear blanks where multiple tools can be used and the turning and facing operations done at the same time. It is said to be built on the lines of a 22-in. heavy-duty lathe, so as to insure absorption of vibration and to withstand the severest service demanded of such a machine.

The machine is provided with three changes of speed, operated by means of a gear-shift lever. The driving gears are of wide face and large pitch, the main drive being through helical gears, to give smooth running. The machine is driven by a single pulley of large diameter and wide face, the operating lever for controlling the starting and stopping of the machine by means of the clutch within the pulley being in easy reach of the operator. The machine has geared feed driven direct

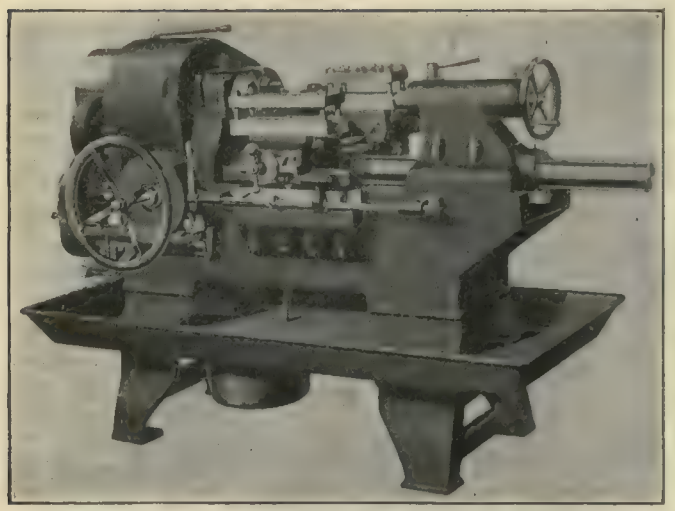


FIG. 1. ROCKFORD AUTOMATIC LATHE

from the spindle through a train of spur gears, the lower two being slip gears, so that variation of the rate of feed may be obtained.

The headstock is cast in one piece with the bed, so that there is no chance for slippage of the head. The front or turning carriage, Fig. 1, is mounted on a 3-in. bar, which has long bearings in both the headstock and the tailstock, the outer end of the carriage being supported on a hardened steel way that can be shaped so as to give to the work taper, convex or concave form. Rack teeth are cut in the bar and mesh with the cross-spindle of the machine for obtaining the feed. A worm and worm gear driven direct from the feed gears furnish power to the cross-spindle, the worm being mounted in a drop frame, so that the feed may be released at any predetermined position.

The back or facing head is mounted on a bracket on the back of the machine in alignment with the spindle and held in place by a tongue and groove and four bolts. This facing head is adjustable longitudinally according to the position of the work. Both turning and facing carriages are provided with suitable tool blocks, so that any desired number of tools may be used at the same time. The power feed for the rear

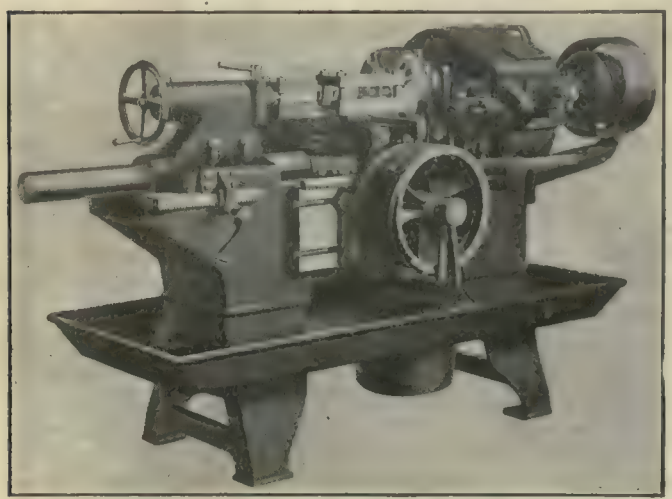


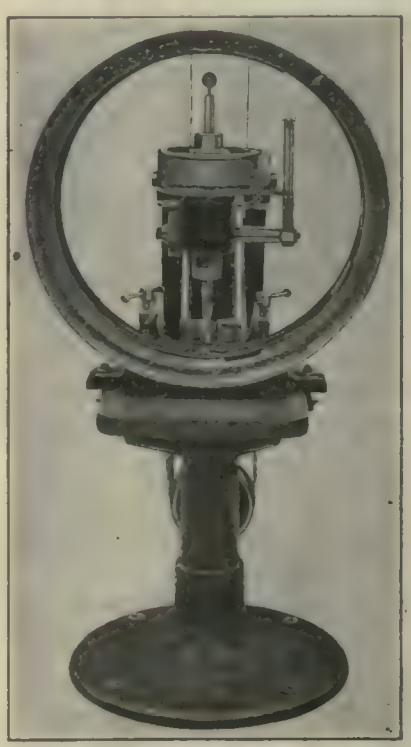
FIG. 2. REAR VIEW, SHOWING CAM DRUM ON ROCKFORD AUTOMATIC LATHE

Specifications—Swing: over side carriage bar, 14 in.; over cross carriage, 10¾ in. Distance between centers, maximum, 18 in. Travel of side carriage, 12 in. Spindle bearing: front, 4⅝ x 6 in.; rear, 3½ x 4⅞ in. Hole through spindle, 1½ in. Taper hole in spindle, No. 5. Spindle nose: diameter, 3⅝ in.; length, 2⅝ in. threads per in., 5 U. S. S. Tailstock spindle, 2⅞ in. in diameter. Drive pulley: diameter, 14 in.; face, 6 in. Weight, 3,500 lb.

or facing head is obtained through a cam drum, seen best in Fig. 2, driven from the cross-spindle by rack and pinion, enabling both the turning and the facing heads to be controlled by the same stop, the time taken to finish any operation being the time of the longest cut. Any shaped cam may be mounted on the drum, making it possible to secure different feeds on the rear head than provided by the feed gears for the turning head. The tailstock is of the four-bolt type, and has a quick-acting spindle for releasing the center. The tailstock is provided with a rack and pinion for changing its position. The bed has an oil pan, with reservoir for supplying cooling lubricant to the work, the pump being driven from the pulley shaft of the machine. The machine can be furnished arranged for direct motor drive. The motor is then mounted on a bracket and connected to the pulley shaft of the machine through spur gears, a large clutch gear being used in place of the clutch pulley used for belt drive.

Reed Rim-Drilling Machine

The Francis Reed Co., 43 Hammond St., Worcester. Mass., has developed a single-purpose machine for drilling rims of automobile wheels from the inside. The machine will accommodate any rim of 20-in. inside diameter or over. Though designed especially for this class of work, it is, of course, adaptable to any regular drilling within its capacity.



REED RIM-DRILLING MACHINE

The machine, shown in the illustration, is rigidly constructed and will drive drills up to ¾ in. in diameter. The drive to the spindle is through a 2-in. belt running over idlers on the back of the head. A three-step cone pulley provides for changes of spindle speed, the belt running on this pulley from another on a separate overhead countershaft. The spindle runs in plain bearings and the thrust is taken upon a ball thrust bearing. The lower end of the spindle has a No. 2 Morse taper hole, the hole being continued with the smaller diameter through the spindle, so that drills may be removed by means of a knockout rod instead of a taper drift. The spindle has a vertical movement of 5 in., and the feed is by rack and pinion operated by a hand lever. The machine will drill to the center of a 24-in. circle.

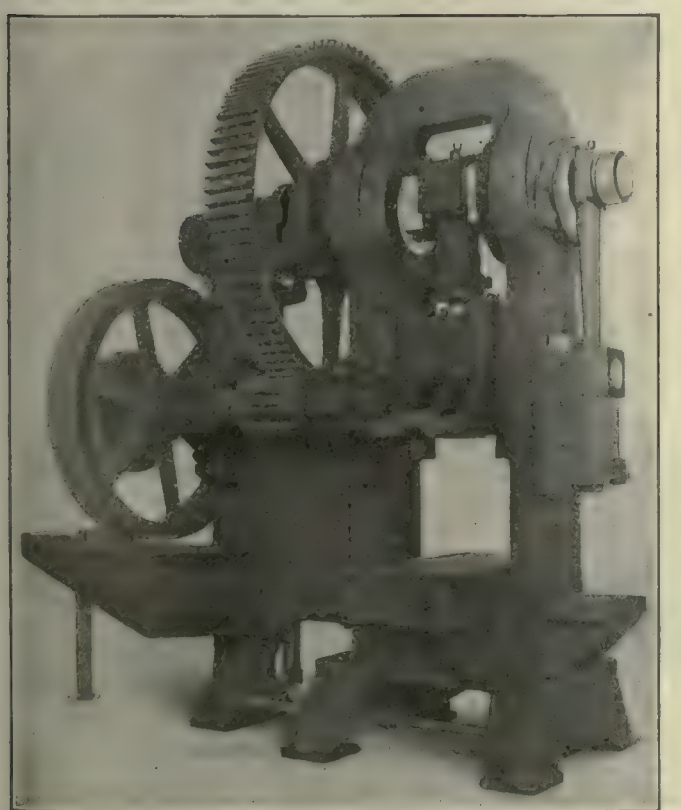
The work table is rectangular, 15 x 17 in., and has a vertical adjustment of 3 in. Two oil holes in the upper part of the head distribute oil to all running bearings. The machine stands 50 in. high and occupies a floor space of approximately 24 x 80 in. Its weight is 400 lb.

Williams-White No. 6 Straight-Side Trimming Press

The line of straight-side trimming presses manufactured by Williams, White & Co., Moline, Ill., has recently been re-designed, in part. A larger press, the No. 6, shown in the illustration, has been added to the existing series of four smaller machines. While these machines, as the name indicates, are primarily intended for trimming flashings from drop-hammer forgings, they are, however, due to the large area of the table and ram face adapted to other uses also—such as perforating, blanking, embossing, stamping and redrawing operations.

The frame is made of semi-steel. The outside slide, at the right, is of value when auxiliary operations are to be performed. The gears are large, and are made of steel, with cut teeth. The automatic-stop jaw clutch is said to be of ample dimensions and is positive and quiet in its operation. It has six jaws and is 21 in. in diameter. By means of a screw adjusting mechanism in the pitman, the ram can be moved up or down to adjust the die space, as required for the work at hand. The bushed pin connection between the ram and pitman should be of convenience when adjustments or repairs are necessary. The thrust end of the pitman works in a bronze-lined steel thrust block. A leather-lined brake is provided on the main shaft.

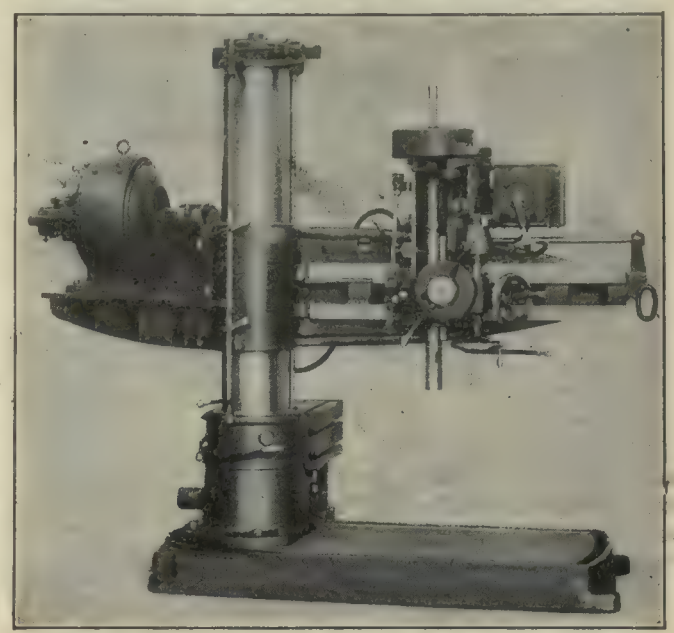
When desired, the machine can be driven by a motor mounted on the stand at the left. If belt drive is desired, the flywheel carries the belt as the tight pulley, thus making for compactness by shortening the pinion shaft. The illustration shows solid frame construction, but the tie-rod construction can be furnished, if required or preferred. Variations from the standard dimensions of ram face, table areas, die space, stroke, speed, etc., can be made to suit special requirements.



WILLIAMS, WHITE & CO. NO. 6 STRAIGHT-SIDE TRIMMING PRESS, REAR VIEW

Change in Drive of Fosdick Radial Drilling Machine

The Fosdick Machine Tool Co., Cincinnati, Ohio, has recently brought out the type of individual motor drive shown in the illustration upon a 4-ft. heavy-duty radial drilling machine. A 5-hp. Robbins & Myers, 3-to-1 variable-speed motor is mounted on an extension of the radial arm on the opposite side of the column from the head. A Cutler-Hammer controller is placed directly on the spindle-head.



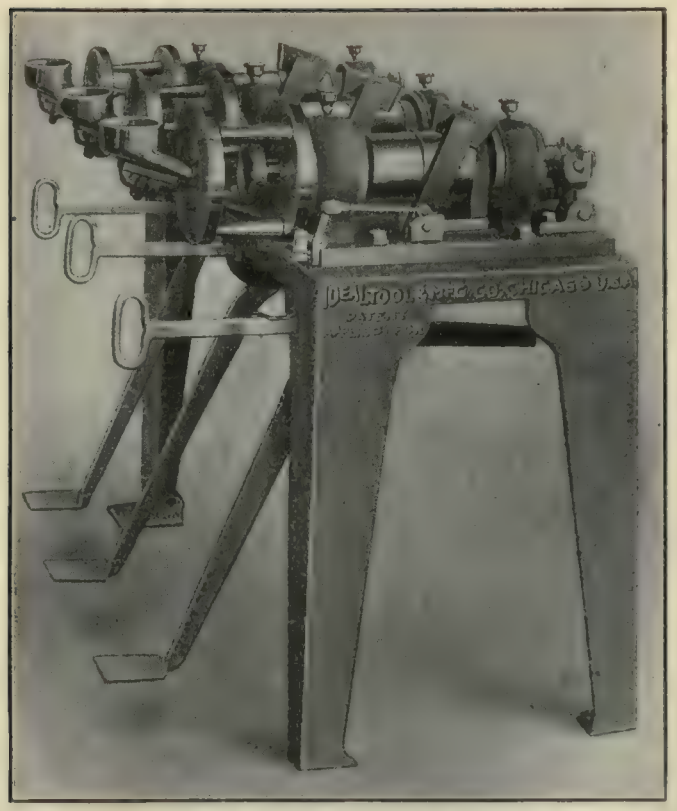
FOSDICK RADIAL DRILLING MACHINE WITH DRIVING MOTOR MOUNTED ON THE ARM

The drive is adaptable to the 4-, 5- and 6-ft. heavy-duty radial drilling machines made by the concern. A motor of any standard make or speed, but having a 3-to-1 speed ratio, may be used without any change in the mounting. The standard gearing of the machine is used, except in the case of the Bakelite pinion on the motor shaft, the size of which pinion is varied according to the speed of the motor adopted. Also, it is said that the use of two sets of bevel gears is eliminated, thus saving power. But one motor is used on the machine, the elevating mechanism being driven through the regular gear arrangement, which is provided with safety devices. The motor serves to partially balance the arm. By removing it from the floor, it is kept away from the dirt which ordinarily accumulates there, and additional floor space is made available about the base.

The controller is operated through bevel gears by the handwheel below it, thus putting the control lever within easy reach of the operator when large work is being handled and the arm is raised. The controller can be located on the girdle of the arm, being manipulated by the left hand of the operator. In this way, the flexible conduit running to the controller at the rear of the arm is eliminated.

"Ideal" Babbitt-Lining Machine

The Ideal Tool and Manufacturing Co., 5825-29 So. Western Ave., Chicago, Ill., has recently placed upon the market a machine, shown in the illustration, for lining bronze bushings with babbitt. The machine is intended especially for use upon automotive-crankshaft and elec-



"IDEAL" BABBITT-LINING MACHINE

tric-motor bearings, and is said to have an output of about 700 bearings per day. It is essentially a die-casting machine, but the bushing under treatment is rotated at a speed of 1,800 r.p.m. while the babbitt is cooling. In this way the babbitt is forced against the bronze, the centrifugal force tending to overcome the contracting force due to shrinkage of the babbitt; and it is said that a very close union of the two metals is obtained, the bearing resembling a solid one. The machine is provided with three spindles, so that each bearing can be allowed sufficient time to cool before it is removed, the operator constantly loading and unloading the spindles and refilling the funnels with molten babbitt.

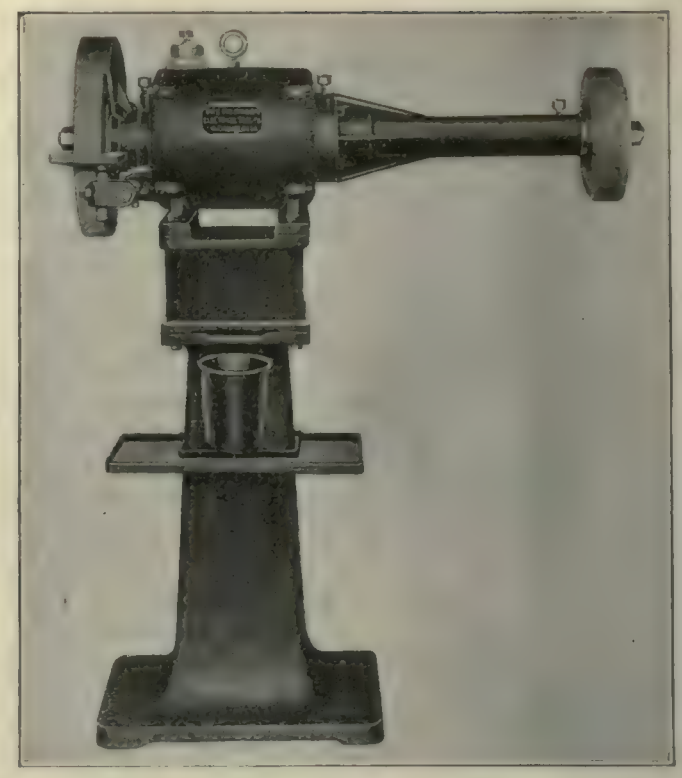
The machine is equipped with S.K.F. ball bearings. Chucks can be provided to suit the size of bushing being babbitted.

A belt-shifting mechanism, operated by a pedal, is provided for each spindle, and a brake working with the mechanism stops the spindle when the belt is shifted to the idle pulley.

The countershaft runs at 600 r.p.m. The over-all floor space required by the machine is 24 x 28 in. and the height 48 in. The weight is 1,200 lb.; the export box has a volume of 108 cu.ft.

Cincinnati Electrical Combination Grinding and Buffing Machine

A combination, electric-driven, floor grinding and buffing machine, which permits of alternate buffing and grinding without the necessity of changing wheels, has recently been brought out by the Cincinnati Electrical Tool Co., 1501 Freeman Ave., Cincinnati, Ohio. The machine, as can be seen in the illustration, is provided with both grinding and buffing wheels, the grinding wheel being adapted to both tool-grinding and general grinding of all kinds.

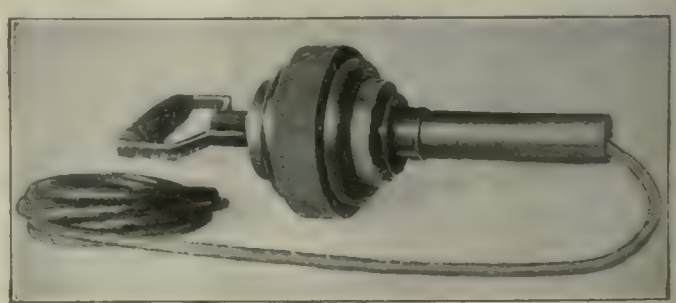


CINCINNATI ELECTRICAL COMBINATION GRINDING AND BUFFING MACHINE

The motors are made for direct or alternate current in ½, 1, 2 and 3 hp. capacity, to carry wheels from 8 to 14 in. in diameter. The motor windings and bearings are fully inclosed. Annular ball bearings are fitted on both ends of the armature spindle, as well as on the outer end of the extension spindle. Dust caps, fitted to the spindle, protect the bearings and windings from abrasive dust and dirt. The machine is fully equipped, including toolboard and water pot, and can be furnished without floor pedestal, if desired.

Forbes & Myers Portable Electric Grinder

Forbes & Myers, 172 Union St., Worcester, Mass., has recently brought out a hand-portable, electric-driven grinder that is intended for snagging castings or for similar work in which the grinding device can be held in the hand. As shown, the grinder is compactly made. The motor is contained entirely within the spool upon which the wheel is mounted. It is of the three-phase, induction type, the field being rigidly attached to the shaft which, of course, does not rotate. The motor is wound for 110-volt, three-phase current; for higher voltage a simple transformer, to be mounted on the wall at the point of attachment, is provided.



FORBES & MYERS PORTABLE ELECTRIC GRINDER

The tool is said to be very light in weight in proportion to its capacity. In order to utilize all the weight to the best advantage, the wheel flanges and end shields carry magnetic flux, while the end shields are coated with copper and carry electric current also. The wheel is 7 x 2 in., with safety flanges which are said to have withstood severe breakage tests without serious damage.

The bearings are of a copper-graphite composition encased in an aluminum sleeve, and do not require lubrication. When worn, they can be readily replaced. The motor gives a maximum output of ¾ hp., the total weight of the grinder being 20 lb.

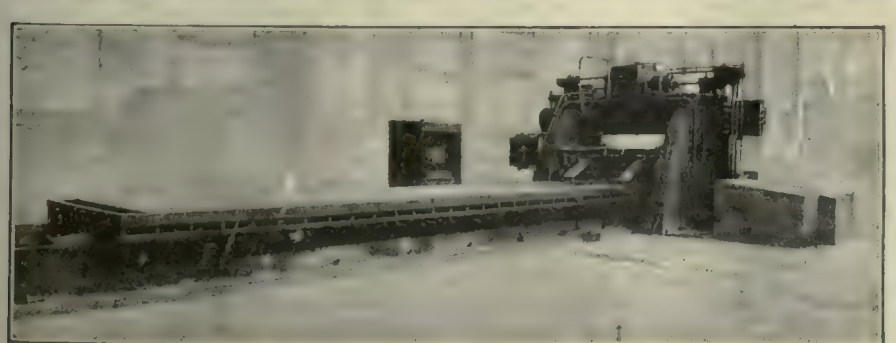
Southwark 7 x 3 x 42-Ft. Planer

The planer illustrated is one of three that the Southwark Foundry and Machine Co., Philadelphia, Pa., has recently built for the Baldwin Locomotive Works for heavy-duty service on locomotive frames. It is provided with two heads on the cross-rail, as well as two side heads fitted to the uprights.

The cross-rail is of the extended-back type having a bearing 26 x 40½ in. on the face of each upright, as well as 6 in. on the inside of the uprights. It is clamped to the box section uprights in the usual manner.

The table is made in two sections, joined with four 3-in. bolts and dowels. It has a box section, 12 in. deep at the center and 9⅜ in. deep at the sides, and all ribs run in the transverse direction. The top flange of the table is provided with three longitudinal T-slots, as well as 900 stop holes of 1⅝ in. diameter. The table is guided upon one flat and one V-bearing. It is also guided sidewise by two vertical surfaces, in order to resist any force that may have a tendency to push the table up the incline of the V-bearing. Both the flat and the V-bearings are lubricated by means of a pump, which circulates oil especially for this purpose.

The bed is composed of three sections of heavy box construction. Cross-ribs spaced 18 in. from center to center are provided throughout the entire length of the two end sections. The middle section is also of heavy box type, with an opening between the ways at the middle for the driving gears. The principal feature in connection with the drive gearing is that all gears run idle on their shafts, and are bushed with phosphor-bronze bushings. The shafts are fitted in dead bearings and locked with setscrews. It is stated that the arrangement makes the removal of the gears very easy.



SOUTHWARK 7 x 3 x 42-FT. PLANER

Specifications: Capacity; will plane 84 in. in width, 36 in. in height and 42 in. in length. Table: width, 6 ft.; length, 44 ft. Uprights: width of face, 22 in. depth front to back, 6 ft. 6 in. Cross-rail: face, 26 in.; depth at center, 23 in.; at uprights, 8 in. Table rack: circular pitch, 1½ in.; face, 14 in. Overall length, 80 ft. Weight, 250,000 lb.

The planer is driven by a regular reversing type of planer motor of 75 hp., having a speed range from 250 to 1,000 r.p.m. and giving cutting speeds of from 20 to 40 ft. per minute. The return speeds are selective between 40 and 80 ft. per minute. Safety devices are provided in the control panel to take care of low-voltage, no-voltage, overload and emergency stop. The master switch is operated by the usual type of table stops and dogs, and it is also provided with a portable pendent switch for the use of the operator.

Van Keuren Micro-Gage Set

The Van Keuren Co., 361 Cambridge St., Allston, Boston, Mass., has placed on the market a set of micro-gages, giving by combination every thousandth of an



SET OF VAN KEUREN COMBINATION GAGE BLOCKS TO GIVE THOUSANDTHS

inch from 0.4 to over 5 in. The set, as shown in the illustration, is intended especially for production departments, small shops, or for individual workmen, being adapted to such purposes as setting sine bars, checking instruments, snap gages and tools, and for measuring dimensions on pieces being machined.

Only 16 separate gages are used, thus reducing the cost per set. The sizes provided are: In the thousandth series, 0.101, 0.102, 0.103, 0.106 in.; in the hundredth series, 0.110, 0.120, 0.130, 0.160 in.; in the tenth series, 0.100, 0.200, 0.300, 0.500 in.; and four 1-in. blocks. When making combinations, it is necessary in some cases to use two gages to secure the desired thousandth. Thus, 0.789 in. is obtained by using the blocks 0.106 and 0.103 in., with the blocks 0.160, 0.120 and 0.300 in. The gages are cylindrical and made of tool steel, heat-treated and seasoned. The flat gaging surfaces are ground and lapped to a mirror finish. The blocks are standardized by light-wave measurements, against standards certified by the National Bureau of Standards, Washington, D. C. It is stated that each gage is held within a few millionths of an inch for flatness and parallelism of faces, and that the length is held within 0.000025 in. of the marked size at 68 F., the standard temperature of measurement. The set is arranged in a plush-lined, leatherette-covered case.



NEWS SECTION

War Department Still Selling Surplus Machine Tools

That there still is a brisk demand for standard machine tools is indicated by the prompt way in which the Director of Sales of the War Department is able to dispose of such tools when they are declared surplus. The market for the single-purpose machines, however, has been found so limited that much of the surplus of that type is being sold for junk.

The Director of Sales has completed the Belgian contract for machine tools and the last shipment on the French order now is being made.

In the settlement of contracts, the Ordnance Department is being compelled to take back some machine tools, although every effort is made to sell the tools to the contractor with whom the settlement is being made. In cases where manufacturers were supplied with War Department tools, it has been found profitable to make important price concessions, rather than to undergo transportation and selling expense in the effort to sell such tools in the open market.

A new practice which allows the lists of Government surplus property to remain open for three weeks so that Government agencies may select such of this property as they may be able to use to advantage, has cut down very materially the amount of surplus property being placed upon the market. An auction of surplus tools and other property was planned recently at one of the arsenals. Under the new procedure 90 per cent of the material offered for sale was absorbed by Government agencies.

At most of the arsenals a considerable number of machine tools are being held in stand-by condition. In this way a considerable number of the best tools are held off of the market and the shops are thus equipped so as to permit immediate expansion of capacity in case of an emergency. A considerable proportion of the machine tools being declared surplus by the Ordnance Department are old machines which have been replaced from the stocks acquired by the Department during the war.

If you're afraid to train an understudy you're not big enough for your job.—*Forbes Magazine* (N. Y.).

A New Foreign Trade Outlook

The people of this country have always gloried in their economic independence of the rest of the world; perhaps more than in their political isolation. They have taken pride in the vast extent and variety of the country's natural resources, and have felt that so far as dependence upon our own products is concerned, we were sufficient unto ourselves. This boast has never been wholly justified except, perhaps, in the early part of the Colonial period of the country's history. It certainly has not been true for more than a century unless one is prepared to say that the United States could get along without coffee, tea, cocoa, silk, jute, hemp, rubber, spices, indigo, nickel and a number of other important foodstuffs and raw materials which have become to a considerable extent indispensable for sustenance as well as for raw materials for manufacturing industries. . . .

There has been a marked development of interest in foreign trade during the past ten years. The American manufacturer who was for many years content with the rich and developing domestic market, and who wanted to be left in almost undisputed control of this market, soon found that his production was outrunning domestic requirements and began to look for outlets abroad. For a time his efforts to secure foreign trade were spasmodic. He was anxious for or indifferent to exports according to the state of the domestic demand. If the domestic market could consume his production the foreign market might be neglected. In a number of lines the nation's foreign trade suffered because of this varying degree of interest.

We thought we were in a favorable position in the years prior to the war, when the trade balance was half a billion dollars in our favor. We were considerably elated when the favorable balance rose in 1915 to more than a billion and in 1916 to more than two billions of dollars, but when the balance rose to more than three billions in 1917 and in 1918, and to more than four billions in 1919, many of our people began to be alarmed. The so-called favorable balance had become all too favorable, and as a result exchange began to be disarranged.

Expansion of Birmingham, Ala., District Expected

Considerable development and expansion in the Birmingham district, so far as the iron and steel industry is concerned, is expected to follow the purchase of the rich manganese ore fields in Brazil by the United States Steel Corporation, through the $4,000,000 deal announced recently by Judge E. H. Gary, chairman of the executive board of the corporation.

For some time large quantities of manganese ore from Brazil have been coming to the Birmingham district, consigned to the Tennessee Coal, Iron and Railroad Co., subsidiary of the steel corporation.

With this ore now available and easily handled from Brazil to the actual point of consumption the future is expected to result in a considerable expansion and development in the Birmingham district that will ultimately make it one of the greatest iron and steel centers.

It is evident that Europe has very little more gold to send us if its inflated currencies are to have any support at all, and that the volume of American securities still held abroad is not considerable. It is evident, too, that Europe cannot expect the same credit facilities that it received during the war. Therefore there must come before long a decline in the value of this country's exports and, at the same time, an increase in the value of its imports.

We must take, therefore, a new outlook on foreign trade. These changes, which must soon set in, require important readjustments which will determine the economic policy of the Government and of manufacturers and producers during the coming decade.

American business men must be alive to the fact that fundamental conditions have radically changed, and must be prepared to act quickly and farsightedly. Our economic welfare is now so closely connected with the economic status and economic development of other nations that we cannot conceivably draw back again into a state of economic isolation. No longer can we live unto ourselves.—Grosvenor M. Jones in *The World's Markets*, published by R. G. Dun & Co.

Business Conditions as the Big Banks of the Country See Them

First National Bank of Boston Comments on Steel, Wool and Leather Industries

Iron and steel works operations by the close of 1920 fell to a rate not paralleled since December, 1914, when the industry was feeling the first shock of the war. One concern, however, has been standing out from the rest. The United States Steel Corporation has maintained an unchanged schedule of prices from March, 1919, to the present time, whereas independent steel makers advanced their prices sharply during the bull market in steel. The slowing-up of business has found the steel corporation with heavy order books, in consequence making it possible to maintain a high operating rate. Independent sheet mills, for instance, have been down to a 20 to 30 per cent operating rate in some districts, whereas the steel corporation's sheet making subsidiary has been operating to 96 per cent. Similar comparisons obtain in other branches. Due to improved operating conditions and to slow new demand, unfilled tonnage in December again declined sharply. Independent steel makers have reduced their quotations for practically all products to a level with those of the leading interest. In fact, independents are shading those quotations in some lines, such as plates. Among the latest price reductions were those made on pipes and rails. Following announcement of a $47 price for open-hearth rails, some heavy awards were made by the railroads for 1921 delivery, including 400,000 tons placed in the East alone. The Gary, Ind., rail mill has its normal capacity of about 1,000,000 tons booked. Structural lettings improved somewhat in December. Exports of iron and steel have been fairly well maintained, about 15 per cent of last year's output being shipped abroad. Many independent steel mills and merchant blast furnaces have reduced wages from 10 to 25 per cent, and others, not including United States Steel, are expected to follow. Pig iron output in December reached the lowest figure for 1920, amounting to 2.703,872 tons, a decline of 231,209 tons from November. Forty-two additional blast furnaces were blown out.

Prospects for 1921 in the wool and wool textile industries are very much brighter than they have been for many months. Liquidation seems to have been fairly well accomplished throughout the entire fabric, with the exception of the retailer, who, however, has been making some real reductions in prices recently. This, in conjunction with the reduction of wages of 22½ per cent now made general in the American mills by the action of the American Woolen Co.; with prices of raw materials well down to the 1913-14 levels on most grades, some low wools being even below that level; and with the strong probability that a protective tariff will be enacted within the next six months; makes for much greater confidence in the wool trade.

The new year is bringing more real confidence to the shoe and leather industries than has been felt for many months. Liquidation through even the retail lines is becoming an accomplished fact, although the consuming public appears reluctant to concede that the retail dealer has met fully the lower level of prices which the present situation, in their judgment, demands. Efforts to analyze public opinion seem to indicate a price range of $5 to $8 as a level at which retail business could be done on the better grades of footwear, and some manufacturers are understood to be pricing their new lines more or less on this basis. With inventories taken, however, and losses charged off, there is a strong inclination to do business, and the shoe factories are beginning to cut more shoes in some instances, while in other cases there is evidence of special endeavors to keep organizations intact or to get in touch with operatives who have been scattered through the unemployment of the past few months. Resumption may be slow, but the prospects of early tariff revision in favor of the domestic industry promise well for the more remote future.

Improvement in Financial and Business Conditions Noted by the Guaranty Trust Co. of New York

From many competent sources in widely separated sections comes the opinion that the United States has now definitely entered upon its return to normal conditions. The average business man has come to see that a continuance of war-time prosperity, with its attendant circumstances of credit inflation, high wages, high prices, reckless spending, and public and private waste, is impossible. He has come to see also that the black pessimism of a few months ago is unjustified by any intelligent estimate of the economic situation. Worry and fear have given way to clear judgment and courage. The disposition now is to face the facts calmly and to make such use of them as accords with the peculiar initiative and enterprise of our people. Judge Gary refers to the phenomenon as the better "temper of business men." Governor Harding of the Federal Reserve Board calls it "a more normal state of mind." All agree that the prevailing feature of the business outlook is just now the change that has come over the mental processes of business men.

Nothing has happened to bring about this change, except possibly the failure of some of the dire predictions that have been agitating the country, particularly in recent months. Those who have from the beginning held that fundamental and not ephemeral factors would determine the course of economic events in this country have never thought that there was imminent danger of any such collapse as was forecast in quarters less well informed or less capable of interpreting conditions. Their attitude seems now to be justified by the country's change of spirit rather than by any turn of events. It may be added that there could not possibly be a better foundation for an actual revival of business.

The consolidated statement of the Federal Reserve Banks for last week shows that an unprecedented reduction in Federal Reserve note circulation has taken place since the last week in December. Total cancellations since then have been more than $250,000,000. This cancellation followed a reduction of nearly $200,000,000 in rediscounts, which leaves the item of "bills held" in the statement about $325,000,000 below what it was during the last week in December. While circulation still remains some $300,000,000 above what it was in the corresponding week last year, increases in cash and stocks of gold have given the banks excess reserves of about $504,000,000, the highest figure reached since October 3, 1919, and the reserve ratio of the system at the end of last week stood at 48.1, the highest ratio reached since October 24, 1919. The condition of "excess reserves," representing the base upon which loans and circulation could be expanded by $5,000,000,000 without impairing the legal reserve ratio, and the margin now existing between the legal reserve ratio and the actual reserve ratio, are eloquent of the soundness of the system and its ability to meet any conceivable contingency.

The improved sentiment of business men, generally observable throughout the country synchronizes with an acceleration of readjustment measures. These latter are of two varieties. There is first a continuance of the processes by which manufacturers and distributors are reducing their production costs, either by laying off a part of their working forces, or by reducing wages, or by insisting upon greater efficiency. In most cases this has resulted in a curtailment of output, in some the level of output has been maintained, and there are occasional reports of an in-

creased output even with shorter hours and fewer employees. As a rule employers have stated their situation to employees plainly; it is either a case of reducing the cost of production or of not being able to produce at all, the second alternative being predicated of course upon a continuance of the prevailing decline in the prices which consumers will pay. Such statements have been variously received, but in general workmen have accepted the first alternative.

A second phase of the readjustment movement is the meetings which are now taking place between jobbers and buyers. Here the views of producer and consumer are being brought into contact and conflict by the men whose bargainings establish market prices. Buyers are apparently going to the big distribution centers prepared to restock the shelves and storehouses of their principals. In other words, there are the makings of a good buying movement in the interest which they disclose in a great variety of lines. The probability is that wholesale purchasing will be in substantial volume, with the chances considerably in favor of big sales in those lines where the consumers' strike has been broken by a readjustment of retail prices to a fair level.

Money on call has been loaning on the floor of the Stock Exchange at a uniform rate of 6 per cent for several days, with outside offers being made down to 4 per cent. Similar easement has taken place in the time money market, where last week's rates were from 6 to 7½ per cent for all periods. Commercial paper in New York is being bought at 7¾ and 8 per cent and the general comment on this market is that no easing of rates may be expected while rediscount rates at the Federal Reserve Bank are held at present levels. In general the money market may be said to reflect the conservative disposition of business men and the public at this moment. Despite cheaper money there is apparently little interest in the stock markets, while bonds have swung upward under the demand for investment securities.

United States Trade with the European War Area in 1920 Exceeds That of 1913

Trade of the United States with the war sequestered areas of Europe in 1920 actually exceeded in stated value that of the year preceding the war. The aggregate value, says a statement by the National City Bank of New York, of our trade with Germany, Russia, Finland, Belgium, Austria, Bulgaria, Hungary, Rumania, Greece, Turkey, Poland, Czecho-Slovakia, and Jugo-Slavia in the calendar year 1920 was over $1,000,000,000 against only three-quarters of a billion dollars in the year preceding the war; or, to be more closely accurate, $1,035,000,000 in the calendar year 1920 against $775,000,000 in the calendar year 1913, though this figure of 1920 necessarily includes an estimate for the closing month of the year, for which official figures are not yet available.

The imports from the dozen countries in question were in 1920 $233,000,000 against $296,000,000 in 1913 and the exports thereto $803,000,000 in 1920 against $477,000,000 in 1913. The imports from the countries in question are less in 1920 than in 1913 as a result of the fact that in most cases they have little which they can spare for exportation, while the exports to them were last year nearly twice as much as in 1913 as a result of the fact that they are at this time greatly in need of foodstuffs and manufacturing materials, of which the United Stated is still a large exporter, especially in raw cotton, breadstuffs, and limited quantities of meats.

Conditions Improve in the German Machine-Tool Industry—American Tools Popular in Austria and Hungary

By H. O. Herzog, Berlin Correspondent

The improvement of the market situation which first became noticeable in September has lately become more marked. While part of the machine-building shops still reported a decline of business in October, the picking-up became more general in November. According to the official labor statistics the number of unemployed workmen has decreased. About one-half of the shops are satisfactorily employed and working at full, some even at double shifts; in the other half, reduced shifts down to 16 hours a week are general. Those best employed are the railroad material and shipbuilding establishments; the manufacturers of electrical material, chiefly those manufacturing telegraph and telephone material; and the manufacturers of agricultural machinery. The volume of new business coming in is not large. Up to now the improvement finds expression chiefly in the steadily increasing number of inquiries and the brisker tone in which they appear.

Machine-Tool Market Improving

The improvement in the machine-tool market is getting stronger from month to month. The leading firms are exceedingly busy. Reineker's has just declared a dividend of 20 per cent for the past business year, which involves only a part of its actual earnings. This company's annual report states that the outlook for the current year is very favorable, which is a strong word for such occasions and one which indicates excellent business. Schiess in Düsseldorf is paying for its business year, 1919-20, a dividend of 8 per cent, the first in a series of years. The Deutsche Maschinen-Fabrik A.-G. in Duisburg, already a combine of three large works, has acquired control of the Schiess stock. Richard Hartmann in Chemnitz, the largest Saxon machine-building shop—consisting of a railroad machinery building, a textile machinery and machine tool building departments—has turned over 128 million M. in 1920 compared with 47 million M. the preceding year. The works is stated to have large orders in hand both for domestic and foreign destinations and will be busy on these orders for a long time. Its net profit was nearly 12 million M., a very good return considering that the capital is only 15 million marks. Such results are not exceptions, but rather the rule among large firms. It has become quite common for industrial establishments to bring forward complaints during the year about bad business, handicapped on all sides, and then to issue a brilliant balance-sheet at the end of the year. The Machinenfabrik Kappel A.-G. in Chemnitz, for instance, a firm making machine tools for wood and metal working, has declared a dividend of 30 per cent for its last business year, July, 1919 to June, 1920, and is doubling its capital stock, making the increase a present to its stockholders.

Smaller firms are, however, not so fortunate. The demand for machinery has a strong tendency to go for the best makes and does not penetrate to the lower strata until the foremost manufacturers have had their fill of orders. This fact is strongly noticeable in the machine-tool market, where the leaders are almost full up with orders, while the rank and file are happy to notice a slight increase of the incoming business.

The revival of business is mostly due to foreign orders, and can be ascribed largely to the low state of the German exchange. It is, however, far from being the rush which the sinking of the exchange caused at the end of 1919. However, the present revival gives more satisfaction as it comes mostly from actual consumers and not from speculative dealers and is therefore judged to be of a more lasting and more substantial character.

Conditions of Neighboring Countries

It is easy to recognize that the demand appearing now is of a different character. The dealers of the neighboring countries are still very reticent with orders, according to the depressed conditions prevailing almost anywhere. Sweden, one of the best buyers of a year ago, is now suffering a complete reverse. Denmark, Norway, Holland and Switzerland are complaining of strong business depressions, which is not surprising, seeing that their use as a goods exchange, upon which their prosperity of recent years was chiefly based, is gradually diminishing. Dealers in these countries are still overstocked and find it difficult to reduce their stocks. This applies especially to dealers of machine tools.

The German second-hand dealers still

hold very large quantities of such tools; this stock does not seem to diminish but rather to increase. The German State Works have lately made arrangements to dispose of their suplus equipment to second-hand dealers. The huge quantities of these machines will certainly be a drug on the market. The second-hand trade has become very wealthy during the war and is able to stick out critical times, which is very fortunate for the manufacturing interests.

The dealer, as a whole very badly treated during the War but the master of the situation during the last few years, is gradually getting back into his customary place in the same degree as resumption of pre-war business connections is progressing. Strong efforts are made in this direction everywhere, and the German approaches seem to be received now in a better spirit. It is noteworthy that large concerns with foreign offsprings, of which they have been deprived of during the war, are gathering up the severed threads and seem to find willing reciprocity.

Reunion of Foreign Offsprings of Large Companies

The Mannesmann Works, for instance, has recently made public that a reunion with its British filial establishment, the British Mannesmann Tube Co., is in the course of progress. The aim of this rapprochement is stated to be the exchange of technical experiences rather than for business purposes; and it seems that the world is waking up to the necessity of such exchange and of the extending of business organizations in general.

Plans for international co-operation seem to exist everywhere. Vienna has lately received the visit of representatives of the Morgan concern, who have been in close consultation with the leading men of industry and finance. The chief object seems to be the exploitation of the Austrian waterpower resources, of which the country possesses a sufficient supply to satisfy her own and her neighbors' requirements. The Austrian industry is suffering chiefly from lack of raw material and fuel. To develop hydro-electric power, the electrical manufacturers of Austria have to be put into a position to resume normal work. It is contemplated to establish in Vienna stores of American raw material, chiefly metal, pig iron, sheets and American crude oil. It is hoped in Austria that American capitalists will take the exploitation of the Austrian water power in hand. This would go a long way toward helping Austria which has not yet and probably never will, without help from outside, be able to get over its dismemberment.

Czecho-Slovakian Conditions

Only one state formed out of the former members of the Austrian empire is evidently capable of making headway. This state is Czecho-Slovakia, which has been the most fortunate one when the former possessions of the Austrian Empire were dealt out. Its population is full of surprising energy and optimism. It wants to spread out and be in touch with the whole world, and this may cause exalted ideas of the country's importance in foreign countries. It is a fact, however, that, provided the country can keep out of political disturbances and is subject to clever ruling, Czecho-Slovakia is on a fair road to prosperity in the near future.

The business in the machine-building factories in Bohemia and Moravia continues to be brisk according to the majority of reports. The various shops have work on hand which will keep them employed beyond 1920 and well into the spring of 1921. A large part of this work is for export, principally for the devastated provinces of northern France. Export orders have been further received from Jugoslavia, Poland, Rumania and, in a smaller degree, from Austria. The Bohemian agricultural-implement industry is experiencing strong foreign competition. The industry building railroad stock is well employed with state and export orders, without being able to comply with the demand. The government has been compelled to order 800 freight cars from an American firm.

The machine-building industry is complaining of the shortage of iron supply, which has lately been somewhat relieved by better coal supply to the Slovakian mills, resulting in improved delivery of raw material to the Bohemian and Moravian Works.

The business relations formerly existing between the Czecho-Slovakian and the Austrian machine-building factories will soon be a thing of the past. The Austrian factories are trying to obtain castings from Czecho-Slovakia, where most of the foundries of the former Austrian empire are situated, but the Prague government does not allow export of castings unless a corresponding amount of scrap is offered in exchange. As scrap is very scarce in Austria the Austrian machine builders are forced to obtain their castings from Germany.

Conditions in Hungary

The Hungarian machine-building industry is in a less favorable position. Hungary, in itself a country of very rich soil and one of the best granaries of Europe, has suffered considerably during the war and still more during the short, but ruinous reign of the Soviet government. It has lost 15 per cent of its machine-building establishments by the Peace Treaty. The annual production of Hungarian machine-building works amounted to 500 million kronen before the war. The present employment is 60 per cent of this; lack of fuel and raw material is chiefly responsible for the decline. The country possesses unopened coal deposits which are sufficient for her own requirements.

The Hungarian machine-building establishments, which have all been started during the past 20 to 25 years, are exceedingly well equipped with up-to-date machinery, mainly of American origin, as a strong preference to American machine tools prevailed in Hungary as well as in Austria.

The country has completely lost its iron deposits which now belong to Czecho-Slovakia. Considering all these difficulties the present degree of employment can be said to be satisfactory. The chief products of the Hungarian machine-building industry are machinery for agriculture and for the oil and chemical industry.

Cincinnati Milling Machine Company To Manufacture Grinder Company Products

Announcement is made to the effect that the Cincinnati Milling Machine Co. has become financially interested in the Cincinnati Grinder Company.

It is the purpose of the milling company to manufacture the latter company's line of universal and plain cylindrical grinding machines and internal grinding machines in its own plant. Extensive additions have recently been made in this plant; it has one of the most modern equipped foundries in the Middle West, and its splendid facilities for manufacturing high-grade machine tools will now be available for the product of the Cincinnati Grinder Company.

The marketing of the grinding machines will be carried on as heretofore through the Cincinnati Grinder Company.

Pennsylvania Railroad System Inaugurates New Method of Handling Labor Disputes

The management of the Pennsylvania Railroad system has just concluded, with the representatives of its engine and train-service employees, a mutual working agreement, regarding the settlement of future labor differences, which, if lived up to in spirit by both sides, should, in the belief of the management, eliminate any question of strike on this railroad, as far as train operation is concerned.

As a medium to carry out the purposes of peaceful settlement, upon which the railroad is now in such complete accord with these classes of employees, there has been established the "Joint Reviewing Committee of the Pennsylvania Railroad System" for the settlement of all controversial questions affecting the engine and train men.

The joint reviewing committee will be composed, on behalf of the management, of two representatives from each of the four regions of the system, and, on behalf of the employees, of the general chairmen of the men in the engine and train services. The votes of all members, whether representatives of the management or of the employees, will be of equal power and not less than a two-thirds vote will be necessary to reach a decision upon any question presented.

Discipline cases will be handled somewhat differently, as they involve a personal element which must be accorded

recognition. It has therefore been decided that when such a case comes before the joint reviewing committee, the two representatives of the management in the region in which the case arises, together with the representatives of the employee involved, shall not sit as members of the committee, during consideration of that particular case, but shall act as counsel for the presentation of their respective claims. The remaining members will hear the case and determine the matter at issue. This will insure expeditious handling and fair judgment upon all discipline cases.

The work of the Joint Reviewing Committee will be supplemented by an extension of and improvement upon the methods of handling differences and grievances which were in effect prior to the war. Each division superintendent will have a meeting once a month with the local chairman of the engine and train service employees under his jurisdiction, at which either side may present matters for consideration. Each general superintendent will have a monthly meeting with the general chairmen, and the general manager of each region will also hold monthly meetings with the general chairmen.

Appeals may be taken in the order named, and appeals from the decision of a general manager will be taken to the Joint Reviewing Committee of the system. Thus, in the final determination of any matter, the employees, through their representation upon the Joint Reviewing Committee, will have equal power with the officers in determining the issue.

The Joint Reviewing Committee will meet monthly in order that all pending matters may be promptly determined.

For the purpose of definitely establishing decisions and interpretations upon the Pennsylvania System, a very important provision has been adopted. Under its terms, whenever an agreement is reached, regarding any particular controversy, between the representatives of the management and men —whether at a superintendent's meeting, a general superintendent's meeting, or a general manager's meeting—the settlement agreed upon will at once be placed in effect, but an immediate report of the same will be made to the Joint Reviewing Committee. The Joint Reviewing Committee, in its turn, will at its earliest convenience, either ratify the ruling, as adopted, or modify it as may be thought best, and the principles so established will then become binding upon the management and employees in all regions, and will govern all existing and future cases of a similar nature.

The management feels justified in expressing the conclusion that the understanding reached should not only make future strikes wholly unnecessary, but should obviate even the necessity for ever taking a strike vote among the engine and train service employees of this railroad, if both sides live up to the friendly spirit in which the understanding has been established.

U. S. Navy to Have Largest Crane Ship

Upon completion of alterations which will convert the old battleship "Kearsarge" into "Crane Ship No. 1" the U. S. Navy will have the largest-capacity floating crane in the United States. It is believed that it will be the largest-capacity self-propelled crane in the world, taking into consideration its reach as well as hoisting capacity.

The crane with which the ship is to be equipped will be capable of handling weights up to 250 tons. Under test load it will be required to lift 312 tons.

The duty of the vessel in its new service will be to proceed under its own power from one building yard to another in the open sea, and to handle at the various yards guns, turrets, armor plates, boilers and other heavy material to and from piers, cars, lighters and ships. Its primary purpose is to lift turrets, partly assembled, from their building cribs into battleships. Sections of a modern triple 16-in. gun turret, which must be assembled and riveted complete before putting aboard a battleship, will weigh 200 tons or more. As this weight is beyond the crane capacity of some of the navy yards and private yards building battleships it is essential for the Navy Department to have a large crane that can be moved from yard to yard to supply this deficiency.

All work in connection with refitting the vessel for the reception of the crane, including the foundations, is being done at the Philadelphia Navy Yard.

The crane itself is being built under contract by Wellman-Seaver-Morgan Co., Cleveland, Ohio, and will be shipped to the Philadelphia Navy Yard in parts, where it will be assembled. It will be of the revolving, hinged, jib type, electrically operated, and capable of rotating 360 deg. It will be capable of hoisting a load from 40 ft. below the base of the crane to 103 ft. above, and by luffing the jib without rotating the crane the load can be moved through a horizontal athwartship range extending from 72 to 101 ft. from the center of rotation of the crane. It will also be provided with an auxiliary trolleying hoist of 40-ton capacity, having an outreach of 114 ft. and a vertical lift of 40 ft. below the base of the crane to 135 ft. above. With the above characteristics the crane will be capable of reaching any part of any U. S. naval vessel.

The main hoist consists of two hooks, each 125 tons, which are fitted to take an equalizer when lifting 250 tons. The plant for supplying the power for the



crane will be located in the hold of the vessel, from which leads will be taken to the collector rings at the center pivot. All motors are of the same type and capacity so as to make them interchangeable.

The vessel as refitted will also be capable of transporting at one time two triple 16-in. gun turrets with their guns from one yard to another, foundations being provided forward and aft under the main deck.

The "Kearsarge" was built by the Newport News Shipbuilding and Dry Dock Co., being launched on March 24, 1898, and commissioned Feb. 20, 1900. Her length between perpendiculars is 368 ft.; her draft after conversion will be about 20 ft. and her breadth over the bulges, 92 ft.

Now Time to Buy

Have you begun to ask yourself whether the time has not come to start buying? Are not many things cheap? Is not the next movement in quite a number of products almost certain to be upward? For example, many good securities are unquestionably selling at bargain prices; if you have money, buy them now, for they are certain to increase very substantially in value before very long. Manufacturers who have funds or can arrange the necessary credit would probably make no mistake in contracting for future supplies of such raw materials as cotton, wool, silk, rubber, sugar, coffee, flax, cottonseed oil, hides, leather, copper, lead.

Powerful interests are quietly making substantial purchases of basic commodities now selling below cost of production and, therefore, at quotations which cannot last very long. I have a feeling that quite a few surprises are in store for business concerns which are confidently counting upon being able to enter the market at any moment they choose and obtain anything and everything they want at bargain prices.

There have not been wanting occasional indications that the bottom has been reached in many directions. Experienced stock market operators never try to wait for the last eighth of a point before buying or selling—as it has been proved that the person who does try to wait for the last eighth often "gets left."—*Forbes Magazine* (N. Y.).

Cole Motor Co.'s Industrial Movie

"The Porcelain Lamp" is a feature film of the automobile industry fostered by J. J. Cole of the Cole Motor Co., Indianapolis, Ind., and shown by the educational department of the National Automobile Chamber of Commerce, New York, for its initial appearance Jan. 12, 1921.

It shows the various carrying devices of the world progressively up to the automobile. From here it shows the improvements in the Cole automobile up to the present time.

The picture is well gotten up and is interesting both historically and mechanically.

Evolution of an "American Machinist" Article—II

And now we have reached the managing editor with the incoming contributions. Unfortunately many of these reverse from his desk and prove to be of the "outgoing" variety; however, all contributions are carefully gone over and judged on their merits, as to what value they contain to the readers of the *American Machinist.* The M. E. gives all articles his attention and distributes each to the associate



editor whom he judges best capable of editing it. The managing editor has a cinch. All he has to do is to schedule the date of publication of articles; pass on the associate editors' work; be responsible for all intercourse between the editorial and other departments; decide on anything in general that may need careful decision; write editorials; write the "In This Issue" and "Coming Features" page; answer inquiries, etc., etc.

Correspondent Draws Gloomy Picture of Swiss Business

Business in general is very bad in Switzerland and the people there are despondent. Some of the biggest dry goods houses are closing. On the other hand French houses like the Printemps are opening branches in Switzerland, the low rate of the French franc enabling them to undersell Swiss merchants.

The automobile industry is paralyzed. Everyone is buying American, German, French and Italian cars such as Cadillacs, Marmons, Buicks, Lancias, Benz, Mercedes, Renaults, etc. They can be imported and sold at a price below that of the Swiss made chasses so that it looks dark for the Swiss automobile builders.

The situation of the watch industry is equally bad. Its life has depended on export and now the customers, Germany, Austria, Italy and France cannot buy with their depreciated currency.

One of the finest machine-tool plants in Switzerland is running almost entirely on stock. It is obvious that this practice cannot be kept up for very long.

A job and joy go together these days. —*Forbes Magazine* (N. Y.).

Appropriation Limits Aëronautic Research

Aëronautical research will be restricted this year because of reduced appropriations passed by the House for the maintainance and operation of the National Advisory Committee for Aëronautics. A total of $405,266 was asked specifically for development of aëronautic power plant materials and aëro dynamical research. The House appropriations committee and subsequently the whole House allowed only $260,000 for scientific inquiry and administrative expenses.

It is understood here that engineers and manufacturers interested in the promotion of the science of aëronautics intend to bring pressure to bear on the Senate in order to restore the original estimate for the advisory committee.

The estimate of $131,600 for power plant research prepared by the advisory committee was to be devoted to current problems with a view of reducing costs of engines, fuel and other maintenance charges which hinder the development of commercial aviation. The program also contained a provision for continuing the performance tests of new and improved aircraft engines and accessories.

The Railroads Answer the Charges of the Machinists' Union

New York, Jan. 23, 1921.

Thomas DeWitt Cuyler, Chairman of the Association of Railway Executives, authorizes the following statement:

In the unexampled traffic congestion of 1920 the railroads took steps which it would have been almost criminal neglect not to have taken, for the country's business was suffering great losses.

The Interstate Commerce Commission is making a complete inquiry into the reasons why the railroads sent cars and locomotives to outside shops for repairs, an inquiry which the railroads welcome and will assist in every way they can.

That the public may have a basis of facts upon which to judge the emergency methods taken by the railroads, I quote briefly a few excerpts from reports on the situation telling the steps which railroad managements took and the reasons therefor.

Conditions Which Faced the Roads

These quotations follow:

1. Mr. H. E. Byram, President, Chicago, Milwaukee & St. Paul Railway Company:

Work done on twenty locomotives at Baldwin Works was not ordinary repair work, but complete rebuilding of locomotives and converting them from compound to simple type. This involved almost as much work as building a new locomotive. The converting of these engines from one type to another involved a class of work which could not be done as economically in our own shops as at shops of Baldwin Works, where these locomotives originally were built and where the necessary facilities were available for rebuilding them in most economical manner. These locomotives were obsolete type, several of which had not been used for several years, and when turned out of shops were practically new engines and cost less than one-half the price of new locomotives.

2. Mr. Hale Holden, President, Chicago, Burlington & Quincy Railroad Company:

The only arrangements of this character made by this company were with Baldwin Locomotive for seven and with Davenport Locomotive Works for seventeen. It was after careful survey of our power. Situation indicated that during previous two years the condition of engines was below normal and so many required overhauling we would be unable with our own facilities, and considering limitations as to employing machinists provided by schedules with labor organizations made during Federal control, to have sufficient power to satisfactorily handle the heavy traffic through winter months.

3. Mr. W. H. Finley, President, Chicago Northwestern Railway Company:

At the beginning of Federal control we had 175 engines out of service for repair. At the end of Federal control there were 386 engines out of service, and the number of engines that were good for but sixty to eighty days' more service was as much greater at the end of Federal control than at the beginning as the number actually out of service.

Have had repairs made by American Locomotive Co. The first locomotives so repaired were sent to outsiders during Federal control by Railroad Administration. The company has continued sending locomotives at same cost. Railroad Administration sent thirty-five. Company has sent thirty.

4. Mr. Henry Walters, Chairman, Atlantic Coast Line Railroad Company:

This action on the part of the Atlantic Coast Line Railroad Co. was rendered necessary by the condition of undermaintenance in which its locomotives were returned by the Director General. To illustrate: On December 31, 1917, the Atlantic Coast Line Railroad Co. had in service 297 locomotives which had made less than 40,000 miles. When the road was returned there were only 246 which had made less than 40,000 miles.

On December 31, 1917, the Atlantic Coast Line had only 93 locomotives that had made over 100,000 miles, and on February 28, 1920, there were 118 which had made over 100,000 miles, a difference of 25, and this in spite of the fact that during the period of Federal control there had been added 85 new locomotives, all of which were of the heaviest class used by the Atlantic Coast Line Railroad Co.

This created a condition which made it impossible for us to keep up at our shops with the requirement of repairs to meet the power demand, and we were forced very regretfully to place 30 of our locomotives needing the heaviest repairs with the Baldwin Locomotive Works upon the best terms that we could make with them. Superheaters were to be placed upon all 30 of these engines, together with some other improvements.

How the Traffic Congestion Was Met

In the inquiry before the Interstate Commerce Commission the railroads are prepared to show:

1. That on the return of the railroads on March 1, 1920, there was an abnormal number of locomotives and cars in bad order requiring repair and an abnormal number of locomotives then in operation which would nevertheless require "shopping" at an early date.

2. That it was impossible to take care of all of these repairs, immediate and prospective, within any reasonable length of time in railway companies' shops.

3. That at the time most of this equipment was sent to outside shops for repairs there was one of the worst traffic congestions in the history of the country, and that the railway companies were properly under the pressure of the Interstate Commerce Commission, the Car Service Division of the American Railway Association, and of their shippers, to use any and every available means to restore this equipment to service at the earliest possible date.

4. That generally when equipment was sent outside it was to the company which had originally constructed it, for the obvious reason that the original manufacturer had the patterns, extra parts and machinery which would enable him to effect these repairs more promptly than could be done elsewhere; that if for any reason the original manufacturer could not accept such cars, then the nearest available shop having adequate plant and available capacity was chosen; and that these were the considerations which controlled the choice of outside shops, and not any alleged dual interest between equipment and railroad companies.

Non-Comparable Figures Compared

5. That with regard to cost, the comparative figures given are entirely misleading, as so-called cost figures in railway shops cover substantially only cost of material and labor, most of the expense—overhead, supervision and maintenance—being carried in other railway accounts, and being further misleading because cost in outside shops necessarily includes a reasonable profit.

6. Furthermore, that the comparisons of cost given are erroneous and misleading because in many cases the equipment sent outside required the heaviest kind of repairs, sometimes amounting to substantial rebuilding, frequently including additional improvements, and in general not being comparable to the normal classified repairs in a railway company's shop.

7. That, as additional proof that the companies had no ulterior purpose in sending this equipment to outside shops for repair, the companies were merely carrying on the practice of following the precedent established by the United States Railroad Administration during similar but lesser emergencies.

8. That certain organizations of railroad employees, through the Shopcraft Agreement signed by them with the United States Railroad Administration, are themselves in part responsible for the inability of the railway managements to expand the capacity of railways shops. Reference will be made particularly to Rule 153 of the National Agreement with the Shopcrafts, by which the railroads are precluded from employing upon the repair of cars any men who have either not served an apprenticeship or have not had four years' previous employment in car repair work. Under this provision the railway companies at the time of their greatest need were prevented from adding to their forces competent and available painters, carpenters, machinists, blacksmiths and others necessary to increase the capacity of their car repair plants.

9. That the equipment sent to outside shops constituted only a small part of the equipment in need of repairs.

10. That nevertheless the value of the equipment imperatively demanding repair and beyond the capacity of railway companies' shops in the spring of 1920, represented an investment of many millions of dollars, and that the contention that this equipment should have been held out of service for months or even a year until it could be repaired in railway shops, is a proposition in violation of all respect for the public's right to service and of good business and sound management.

The truth is that the effect of the rules and working conditions still controlling the repair of equipment in railway shops has been disastrous to efficiency and output, and is in itself one of the causes of the abnormal number of cars and locomotives out of repair.

Insofar as the organizations of railway repair employees have helped to produce a situation in which all of the railway repair work could not be taken care of in railway plants, or where outside plants can now do the work more economically and speedily than railway shops, they have only themselves to blame.

The Public's Own Stake in the Case

The real point of public concern at the present time is not the measures taken by the railway companies for the repair of cars and locomotives in 1920, but is the question now before the United States Railroad Labor Board at Chicago, as to rules and working conditions in railway companies' shops.

This involves millions upon millions of dollars, which, in the last analysis, are a charge to be paid by the public for its railroad service. These costs, often for work not even performed, result from unjust and burdensome regulations, which, in the interest of the public, the railroads are seeking to have changed.

Fifteen Research Graduate Assistantship Openings

To assist in the conduct of engineering research and to extend and strengthen the field of its graduate work in engineering, the University of Illinois, Urbana-Champaign, maintains fourteen Research Graduate Assistantships in the Engineering Experiment Station. Two other such assistantships have been established under the patronage of the Illinois Gas Association. These assistantships, for each of which there is an annual stipend of $600 and freedom from all fees except the matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics, or applied chemistry. There are at present fifteen vacancies.

An appointment to the position of research graduate assistant is made and must be accepted for two consecutive collegiate years, at the expiration of which period, if all requirements have been met, the degree of Master of

Science will be conferred. Not more than half of the time of a research graduate assistant is required in connection with the work of the department to which he is assigned, the remainder being available for graduate study. Nominations to these positions, accompanied by assignments to special departments of the Engineering Experiment Station, are made from applications received by the Director of the Station each year not later than the first day of March. The nominations are made by the executive staff of the station, subject to the approval of the president of the university. Nominations are based upon the character, scholastic attainments and promise of success in the principal line of study or research to which the candidate proposes to devote himself. Preference is given those applicants who have had some practical engineering experience following the completion of their undergraduate work. Appointments are made in the spring, and they become effective the first day of the following September. Vacancies may be filled by similar nominations and appointments.

The Engineering Experiment Station, an organization within the College of Engineering, was established in 1903 for the purpose of conducting investigations in the various branches of engineering, and for the study of problems of importance to engineers and to the manufacturing and industrial interests of the State of Illinois. Research work and graduate study may be undertaken in architecture, architectural engineering, ceramic engineering, chemistry, civil engineering, electrical engineering, mechanical engineering, mining engineering, municipal and sanitary engineering, physics, railway engineering and theoretical and applied mechanics.

The work of the Engineering Experiment Station is closely related to that of the College of Engineering, and the heads of departments in the college constitute the executive staff of the station. Investigations are carried on by members of the station staff and also by members of the instructional staff of the College of Engineering.

$1,000 Prize for Safety Horseshoe

A prize of over $1,000 is offered through the American Humane Association for the most satisfactory horseshoe or device which will prevent horses from slipping on roadways and wherever in service. All inquiries regarding this competition should be addressed to Dr. William O. Stillman, president, the American Humane Association, 287 State St., Albany, N. Y.

Obituary

J. Wendell Cole, general representative of the Detroit Grinding Wheel Co., and Wm. Sellers & Co., Philadelphia, died at his home in Columbus, Ohio, on Jan. 8. He was seventy-eight years old.

Foreign Trade Supply Corporation Organized

The organization of the Foreign Trade Supply Corporation, with its main offices at 17 Battery Place, New York, has been announced. E. C. Morse, former Director of Sales, War Department, is the president. With Mr. Morse are A. La Mar, former assistant Director of Sales, War Department, vice-president; Paul Klopstock, of New York, chairman of the board of directors, and Arthur Mayer, of New York, counsel.

The corporation will engage in a general merchandise brokerage exporting and importing business, and in the buying and selling of foreign securities.

Mr. Morse resigned as War Department Director of Sales on Dec. 31. For two years he was in the director of sales office and for more than sixteen months he was at the head of that big sales organization of the War Department which has supervised the sale and transfer of material costing the Government about $1,700,000,000. Mr. La Mar, who was assistant director of sales for eighteen months, was in charge of the sales to foreign governments.

Business Items

The Charleston Machine and Welding Co., Charleston, W. Va., has been incorporated with a capital stock of $25,000. The incorporators of the company are: H. E. Marquis, F. W. Fletcher, J. B. Price, South Charleston, W. Va.; C. L. Smith and J. E. Flesher, Charleston.

The Poldi Steel Corporation of America has been established to handle the products of the Poldi Steel Corporation, which has two plants in Czechoslovakia. The American company has been organized by J. B. Smiley, president of the Smiley Steel Co., 115 Broadway, New York. The company has opened a warehouse at 173 Spring St., New York, to carry stocks of high-speed and tool steels, alloy and other special steels, drill rods, spring steel and machinery steel.

The Black & Decker Manufacturing Co., Towson Heights, Baltimore, Md., announces the opening of a new branch and service station at 75 Fremont St., San Francisco, Cal.

The J. B. Wise, Inc., Brass Works, Watertown, N. Y., has recently completed the installation of a 2,300-volt Bailey electric melting furnace of the resistance type. This furnace is said to be the first of its kind in the north country.

At a recent meeting of the stockholders of the Crankless Engine Co., which is now constructing its plant and machine shops at Jacksonville, Fla., to manufacture crankless engines that can be operated by both gasoline and steam power, W. H. Tucker was elected president; J. E. Emley, first vice-president; Lee W. Wicker, second vice-president; W. S. Emley, treasurer, and F. S. Tausey, secretary and assistant treasurer. Dr. E. H. Armstrong was elected chairman of the board of directors.

The Lumen Bearing Co., Buffalo, N. Y., announces that its stockholders have decided to increase its capital stock approximately to double its present capitalization.

The Rentz Spark Plug Co. has been incorporated in Atlanta, Ga., with a capital stock of $500,000. The company will establish a plant for the manufacture of spark plugs.

With a paid-in capital of $6,000 the Savannah Machine and Boiler Works has been incorporated at Savannah, Ga., to operate a general foundry and machine shop.

The Northey Manufacturing Co., Waterloo, Iowa, has increased its capital stock to $200,000. The company manufactures cold-storage systems and refrigerators.

The General Grinding Wheel Co. has purchased the factory plant at Thompson and Clementine Sts., Philadelphia. The factory was bought from W. D. Gherky at a cost of $100,000.

At the annual meeting of the Marion Foundry Co., Marion, Ohio, William Ring was elected president and general manager; C. M. Hecker, vice-president and assistant manager; C. A. Bolen, secretary and treasurer.

The E. W. Carpenter Manufacturing Co., of Bridgeport, Conn., manufacturer of tools and gages, special cutters and special machinery, has increased its capital stock from $50,000 to $150,000.

The new building of the Vonnegut Machinery Co. at 19 West South St., Indianapolis, has been completed and is now occupied by it. During the week of Jan. 17 the company displayed an unusually complete line of machine tools and accessories as a sort of inauguration for its new showroom.

Young & Franklin Co. Inc., Syracuse, N. Y., has been incorporated with a capital of $100,000, of which amount $60,000 has been paid in. The concern will make tools, dies, screw-machine products, machine specialities, and special machinery.

The Worcester Nut Co., Worcester, Mass., a newly incorporated company, has established a shop at 85 Foster St. It will manufacture small nuts of any regular or special shapes up to ½ in. in diameter. The shop is now being equipped to handle larger sizes. A. W. Larson is president and general manager, and Harry W. Goddard, treasurer.

Catalogs Wanted

The McVicker Engineering Co., 716-718 Metropolitan Building, Minneapolis, Minn., would be pleased to receive catalogs in connection with metal and woodworking machinery.

Trade Catalogs

Graphic Production Control. McVicker Engineering Co., 716-718 Metropolitan Life Building, Minneapolis, Minn. Booklet, pp. 22, 5¼ x 8¼ in. This booklet attempts to give a broader knowledge of graphic methods of controlling production and tends to widen the field of graphic application to control of production and material. A nominal fee is charged.

Transveyor Picture Book. Cowan Truck Co., Holyoke, Mass. Catalog, pp. 31 8½ x 11 in. This catalog contains seventy views of installations showing how the Cowan transveyor is used in all sorts of industries.

Riveters. Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill. Catalog No. 4, pp. 63, 6 x 9 in. This catalog contains illustrations and an explanation of the Hanna motion, a feature incorporated in the Hanna type pneumatic riveters.

"Bristo" Safety Setscrews. The Bristol Co., Waterbury, Conn. Bulletin No. 810. This is a small bulletin describing and illustrating the "Bristo" safety setscrews in use; it also gives its list prices.

Steel. Brown-Wales Co., Boston, Mass. Catalog, pp. 192, 4 x 6¾ in. This is an illustrated catalog of its various products manufactured from steel. Tables of weights and measures, revised list prices, extras, differentials, etc., are given in condensed form.

"Spurgin" Belt-Shifting Device. R. G. Haskins Co., Chicago, Ill. Catalog, pp. 7. This catalog describes the company's belt-shifting device used on a cone pulley.

Tubular Steel Poles. National Tube Co., Pittsburgh, Pa. Bulletin No. 140, pp. 47, 8½ x 11 in. This bulletin illustrates and decribes the many uses to which the company's tubular steel poles can be advantageously applied.

Milling Cutters. Goddard & Goddard Co., Detroit, Mich. Catalog B, pp. 79, 5 x 7½ in. This catalog of milling cutters, both regular and special, includes some form cutters and cutters in gangs; also shelled drills, shell reamers, hand reamers and chucking reamers.

Time Studies. Smalley-General Co., Inc., Bay City, Mich. This seven-page circular gives time studies of the Smalley-General machines manufacturing typical products.

Milling Machines. Smalley-General Co., Inc., Bay City, Mich. This is a four-page circular describing and illustrating the Smalley-General No. 23 hollow-spindle thread and form milling machine.

Excavating Crane. Pawling & Harnischfeger Co., Milwaukee, Wis. Bulletin No. 205, pp. 11, 8½ x 11 in. This bulletin describes various uses of the crane, the illustrations showing the excavator at work equipped with digging bucket, back-filling scraper bucket, lifting magnet, sling chains, etc. Details of construction, specifications and operation are also included.

Starrett Tools. Catalog No. 22. The L. S. Starrett Co., Athol, Mass. A 350-page catalog, 5 x 7½ in., containing complete information on all Starrett products. Steel tapes, combination squares, micrometers, calipers, gages, clamps, hacksaw blades, dividers, wrenches, punches, and sets of apprentice tools, specifications and price lists are included.

1921 Bank and Public Holidays Throughout the World. Issued by the Guaranty Trust Co., New York. 8 x 5 in., 165 pages. This booklet gives the dates of legal holidays of all countries.

High-Power Vertical Surface Grinder. The Blanchard Machine Co., 64 State St., Cambridge, Mass. Catalog No. 16, 8½ x 11½ in. This catalog illustrates and describes this machine in the several types of drive in which it is built. It also describes and illustrates some typical examples of the work the machine handles.

Portable Conveying Machinery. Brown Portable Conveying Machinery Co., 10 South La Salle St., Chicago, Ill. Catalog pp. 48, 8½ x 11 in. This catalog describes and illustrates the design and manufacture of portable and sectional elevating, conveying, loading and unloading machinery.

Grinnell Bulletin. Grinnell Co., 1 Liberty St., New York. Bulletin, pp. 15, 7⅜ x 10½ in. This bulletin gives a brief summary of the dangers of fire, also how to prevent them.

Diamond Surface Grinding. Diamond Machine Co., Box 1188, Providence, R. I. Catalog, pp. 30, 8½ x 11 in. This catalog gives examples of work adapted to the Diamond surface grinding machine, together with materials, grinding times, limits of accuracy, etc.

Ladles. Whiting Corporation, Harvey, Ill. Catalog No. 156, pp. 31, 6 x 9 in. This catalog describes and illustrates its complete line of foundry ladles, including its new-style helical worm geared crane ladle and teapot-spout ladle.

Pipe Thread. (American Engineering Standards.) American Engineering Standards Committee, 29 West 39th St., New York, N. Y. A summary of standardized pipe threads as approved by the above committee and sponsored by the A. G. A. and the A. S. M. E. Some of the subjects covered are taper thread, gages and methods of gaging, working tolerances, straight thread, and locknut threads. Tables and drawings are also included.

Personals

RICHARD ROBERTS, who has been employed in an engineering and executive capacity by Guggenheim Bros. and their allied interests for the past five years, has recently resigned to accept a position as sales engineer with the Wayne Oil Tank and Pump Co. at its New York office.

JAMES R. LOWE has been appointed general sales manager of the Harrisburg Foundry and Machine Works, with headquarters at Harrisburg. Prior to this connection he was located at Anderson, Ind., as sales engineer for the Midwest Engine Co.

H. M. DINE was elected president of the Lucius Manufacturing Co., Canton, Ohio, at the annual meeting of directors held recently. H. B. RAMEY was named vice-president and general manager and J. E. MILNER, secretary and treasurer.

C. R. WEBBER was elected treasurer of the Sherritt & Stoer Co., of 2006 Market St., Philadelphia. Mr. Webber was formerly in charge of the accounting department.

G. R. JAMESON has recently been appointed production engineer of the Graton & Knight Manufacturing Co. of Worcester, Mass.

New Publications

Standard Practice in Personnel Work. By Eugene J. Benge, 286 pages, 5 x 7-in. Published by the H. W. Wilson Co., 960 University Ave., New York.

The author takes up the various phases of the problem under the headings of: The Personnel Audit, Job Analysis, Study of Community, Labor Turnover and Labor Loss, Organizing the Personnel Department, The Employment Process, Selection by Mental and Skill Tests, Methods of Rating Ability, Education and Training, Health Supervision, Maintenance of the Working Force, Incentive and Wages, Employee Representation, Record Keeping in the Personnel Department and Personnel Research. Under these headings the various problems of personnel work are discussed from different angles.

The importance of personnel work is even greater now than when the shops were overwhelmed with work, and this volume is filled with valuable suggestions as to building up of a personnel organization. Now is a good time to consider this subject and to become familiar with its many phases and its possibilities.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A firm of commission agents in India desires to get in touch with American firms for the importation of hardware of all kinds, wire goods, tool and spring steel, vises, anvils; mill, cotton-gin, and railway stores; machinery, electrical goods, glassware, enameled ware, mild steel bars, plates, angles, etc.; corrugated iron sheets, plain galvanized sheets, brass and copper sheets and rods; boiler fittings, motor cars and motorcycles, and parts. Agencies in these lines are desired for sale in British India, Burma and Ceylon. Reference. No. 34,350.

A commercial agent in Spain desires to secure the representation of firms for the advertising and organizing of sales offices for the sale of agricultural machines and tools, automobiles and accessories, machines for preparing and grinding corn, electric motors, sewing-machines, player pianos, hardware and cutlery, saws, hair clippers, steam-laundry machines and washing machines for home use, printing presses, gas and electric cooking ranges, and labor-saving devices of all kinds. References. No. 34,351.

A firm of commercial agents in Greece desires to be placed in communication with manufacturers and exporters with a view to securing the representation for the sale in Asia Minor of machinery, raw materials, and industrial supplies. Catalogs in triplicate are requested. References. No. 34,316.

A manufacturer in India desires to purchase machinery for setting up a cotton mill of 15,000 spindles and 250 looms, which should be supplied in 10 or 12 months; and also an agency for oil and gas engines, cotton-ginning plants, lathes, drills and similar machinery. Payments to be made through banks in India. References. No. 34,318.

A commercial representative in Ireland desires to secure an agency for the sale of labor-saving devices, machines and tools. No. 34,307.

A manufacturer in Brazil desires to be placed in communication with firms handling machinery for the manufacture and boxing of toothpicks. No reference offered. No. 34,308.

A manufacturing company in England desires to purchase or secure an agency for the sale of machinery used in the tanning industry. Quotations should be given c.i.f. Indian port. Terms: Payment against documents at destination of goods. References. No. 34,312.

Forthcoming Meetings

The National Civic Federation will hold its twenty-first annual meeting at the Hotel Astor, New York City on Feb. 14, 15 and 16, to discuss International, European and American labor problems.

The National Foreign Trade Council will hold its eighth annual convention in Cleveland, Ohio, on May 4, 5, 6 and 7. J. G. Hammond, care of the Council, 409 Park Bldg., Cleveland, is secretary.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The Spring Convention of the National Machine-Tool Builders' Association will be held on Thursday and Friday, May 19 and 20, at Hotel Traymore, Atlantic City, N. J. The general manager is Ernest F. DuBrul, 817-818 Provident Bank Building, Cincinnati.

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Conn., New Haven—The Snow & Petrelli Mfg. Co., 152 Bway., hardware manufacturers—one Natco multiple drill to drill nine ⅝ in. holes.

Mass., Fall River—Congdon & Carpenter Co., 58 4th St.—machine for bending inside and outside round corners on angles and tees.

Md., Baltimore—The Brosvik Manufacturing Co., 316 St. Paul St.—$15,000 worth of machinery for the manufacture of automobile specialties and household novelties. B. B. Brosvik, Genl. Mgr.

N. Y., Buffalo—A. Alexander, 26 Lyth St. woodworking machinery and machine shop equipment for modern size shop, (used).

N. Y., New York (Borough of Manhattan)—K. Mandel & Co., 90 West St.—one double rule feed perforating press and one sheet metal perforating press.

N. Y., New York (Borough of Manhattan)—A. Stroud, 327 Bway.—one 4½ in. model A Cleveland automatic screw machine.

N. Y., Rochester—The Delco Garage, 95 East Ave., C. Dell, Purch. Agt.—small drill press.

N. Y., Summitville—J. Pollock, Stop 26, machinist—small machine tools.

N. Y., Wilson—The Niagara Preserving Co.—drill press, power hacksaw and circular saw with frame, (new or used).

Pa. Erie—The W. N. T. Co., 1015 Parade Ave.—one No. 60 Heald cylinder grinder, (new or used).

Pa., Williamsport — The Bd. of Educ., 229 West 3d St., H. A. Sterner, Secy.—one 14 in. shaper, one No. 2 electrical driven universal milling machine and two light engine lathes.

Ky., Louisville—The Measurite Co., 522 Marion E. Taylor Bldg., manufacturers of gasoline dispenser—
One 3 ft. radial drill.
20 in. x 6 ft. lathes.
16 in. x 6 ft. lathes.
Bench lathes and general shop equipment.

Va., Ashland — G. C. Skillman—small lathe for auto repair shop.

Ill., Chicago—The Amer. Steel & Wire Co., 208 South La Salle St., I. E. Bowen, Dist. Purch. Agt.—one milling machine for milling samples from wire, capacity 1 in. width x 3/32 in. depth.

Ill., Chicago—The Central Iron & Metal Co., 3650 South Rockwell St.—power punch to punch hole 1 x 1¼ in.

Ill., Chicago — The Harder Mfg. Co., c/o W. G. Carnegie, Archt., 189 West Madison St.—equipment for the manufacture of electrical appliances.

Mich., Detroit—A .F. Cullen & Co., 3001 Baker St. — miscellaneous machine tool equipment.

Mich., Grand Rapids—The Adzit Printers Supply Co., 232-240 Lyon St., N. W.—one sliding head automatic feed drill press with No. 4 taper spindle, also one 10 in. Universal dividing head.

Mich., Royal Oak—C. W. Latham, 245 Catalpa Drive — small lathe and watchmakers lathe.

O., Cleveland — The Cleveland Duplex Mchy. Co., 1224 West 6th St.—five No. 60 Heald cylinder grinding machines.

O., Cleveland — The Hotstream Heater Co., 1289 Marquette Rd.—four spindle drill press.

Wis., Ft. Atkinson — The Bull Milking machine Co., North Main St., J. W. Meyer, Purch. Agt.—
Sheet metal machinery to work 20 gage material.
One turret lathe.
One 18 in. engine lathe.
One 16 in. engine lathe.
One 24 in. shaper.

Wis., Marinette—The Bd. of Educ., P. F. Neverman, Secy.—manual training and machine shop equipment.

Wis., Milwaukee—The Milwaukee Die & Tool Co., 136 Reed St., A. C. Reediger, Purch. Agt.—stamping presses.

Wis., Milwaukee—The Natl. Blow Pipe & Ventilating Co., 489 12th St., F. Goethel, Purch. Agt.—one 37 in. pipe former and one 36 in. square shears.

Kan., Manhattan—W. W. Carlson, 1729 Laramie St.—one No. 1 Gavin tapping machine.

Minn., St. Paul—Siems-Stembel Co., 2600 Como Ave., W. H. Erskine, Purch. Agt.—one tinners brake; one tinners open-gap shears, and one 8 ft. folding machine for car repairing.

Cal., Berkeley—Schuyler Co., 2725 Shattuck Ave.—one machine for cutting spur and spiral gears up to 10 in. diameter, 10 pitch; and mitre gears up to 4 in. diameter, 10 pitch.

Que., Montreal—W. R. Cuthbert & Co., 41 Duke St.—$50,000 worth of machinery for the manufacture of brass finishings.

Que., Montreal — McGuire, Patterson & Palmer, Ltd., 343 Dorchester St., W. — $200,000 worth of machine shop equipment, including pulleys, belting, lathes, drills and all kinds of machine tools, for plant at Pembroke, Ont. E. B. Reed, local Mgr.

Machinery Wanted

N. Y., Ogdensburg — The St. Lawrence Marine Ry. Co.—20 ton capacity electric dry dock crane.

N. Y., Rochester—L. W. Kneeland Co., Lincoln Park, manufacturers of paper machinery—paper mill and general machinery.

N. Y., Seneca Falls — The Wagner Rug Wks., R. Wagner, Purch. Agt. — power looms.

N. Y., Troy—The Mill Supply Co., 226 Hill St.—woodworking machinery.

Md., Baltimore — The Eastern Rubber Products Co., 361 North Calvert St., C. M. Wyatt, Pres.—rubber cutting machines, rubber mixing machines and can fillers.

Va., Richmond — The Virginia Carolina Rubber Co., 10 North 19th St., R. J. Bell, Purch. Agt.—fabric pulling machinery, moulds, presses and cutting machines.

Mich., Detroit — The Detroit House of Correction, 1441 Alfred St., J. O. Stutsman, Supt.—one planer for woodworking factory.

Mich., Iron Mountain—The West Chopin Mines Co., J. A. Cusick, Purch. Agt.—equipment for blast furnaces and equipment to recover chemical by-products.

O., Cleveland—C. W. Stran & Son, 2281 East 89th St., manufacturers of sheet metal—portable unit.

O., Columbus—W. Ritter Lumber Co., 115 East Rich St.—hydraulic wheel press of about 200 ton capacity (used).

Wis., Independence—L. D. Dubbs—woodworking machinery for woodworking plant.

Wis., Jefferson — The Jefferson Rubber Co., C. R. Girton, Purch. Agt.—rubber mill, vulcanizers and small crane.

Wis., Merrill — The Lincoln Box Co. — machinery for the manufacture of wooden cheese boxes and wire butter dishes.

Wis., Park Falls—L. A. Fosse & Co., L. A. Fosse, Purch. Agt.—woodturning and other machinery for the manufacture of spools.

Wis., Sturgeon Bay — T. Ellenbecker & Sons, toy manufacturers — woodworking machinery.

Kan., Pittsburg — The Atlas Powder Co.—mixers.

Mo., Neosho — F. A. Simpson—laundry machinery.

Ont., Beamsville—The Beamsville Basket Co. — machinery for making baskets and berry boxes.

Ont., Listowel—City, Purch. Dept.—equipment for making tile.

Metal Working

NEW ENGLAND STATES

Conn., Hartford—T. F. O'Loughlin, 44 Elm St., Rockville, has awarded the contract for the construction of a 1 story, 50 x 50 ft. addition to his garage on Wethersfield Ave. Estimated cost, $10,000.

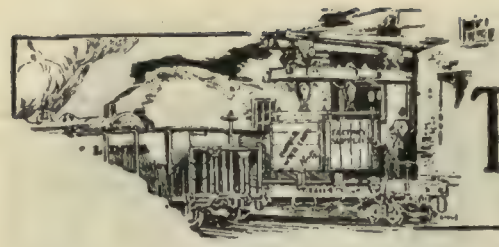
Mass., Boston—The Suburban Real Estate Co., 59 Jerome St., West Medford, is having plans prepared for the construction of a 9 story garage on Boylston St., here. J. C. Spofford, 36 Bloomfield St., Archt.

Mass., New Bedford—O. Cropo, 514 Bowditch St., has awarded the contract for the construction of a 1 story, 50 x 100 ft. garage on Clark St. Estimated cost, $15,000.

Mass., Roxbury (Boston P. O.)—T. H. Connolley, 110 Bower St., is having plans prepared for the construction of a 1 story, 120 x 145 ft. garage on Washington St. Estimated cost, between $75,000 and $80,000. Tuck & Gilman, 34 School St., Boston, Archts.

Mass., Springfield — Chaplin & Chaplin, 374 Main St., are having plans prepared for the construction of a 1 story, 50 x 215 ft. garage and service station, on Pecousic St. Estimated cost, $60,000. A. W. Cobb, 374 Main St., Archt.

Mass., Worcester—H. Edinberg, 22 Brown St., will soon award the contract for the construction of a 1 story, 40 x 80 ft. garage on Pond, Grace and Harding Sts. Estimated cost, $15,000. J. P. Kingston & Son, 518 Main St., Archts. Noted Dec. 2.



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Year Ago
CINCINNATI		
No. 2 Southern	$38.50	$36.60
Northern Basic	34.50	34.00
Southern Ohio No. 2	34.00	36.55
NEW YORK—Tidewater Delivery		
2X Virginia (Silicon 2.25 to 2.75)	40.41	39.40
Southern No. 2 (Silicon 2.25 to 2.75)	44.26	41.40
BIRMINGHAM		
No. 2 Foundry	34.00	33.00
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25–2.75 sil.	36.00	38.10
Virginia No. 2	40.00	39.10
Basic	34.00	34.60
Grey Forge	34.00	34.60
CHICAGO		
No. 2 Foundry local	35.00	35.25
No. 2 Foundry, Southern	40.60	38.00
PITTSBURGH, including freight charge from Valley		
No. 2 Foundry	36.96	28.15
Basic	31.96	34.40
Bessemer	33.96	35.40

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	*Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.58	$3.80	$3.47	$3.58	$3.32	$3.58	$3.47
Soft steel bars	3.45	3.70	3.52	3.34	3.52	3.48	3.52
Soft steel bar shapes	3.45	3.70	3.52	3.48	3.82	3.48	3.52
Soft steel bands	4.18	4.65	4.22	6.25			
Plates, ¼ to 1 in. thick	3.78	4.00	3.67	3.78	3.62	3.78	3.67

*Add .10 for trucking charge to Jersey City and .15 to New York and Brooklyn from warehouse.

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$2.60	$3.50
Warehouse, New York	4.75	3.52
Warehouse, Cleveland	3.52	3.42
Warehouse, Chicago	4.12	3.52

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York *Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55	4.68	5.50–6.00	4.50	4.68
No. 12	3.60	4.73	5.56	4.60	4.83
No. 14	3.65	4.78	5.92	4.65	5.03
No. 16	3.75	4.88	6.02	4.75	5.13
Black					
Nos. 18 and 20	4.20	5.58	6.80–7.80	5.30	5.80
Nos. 22 and 24	4.25	5.63	6.85–7.85	5.45	5.85
No. 26	4.30	5.68	6.90–7.90	5.50	5.90
No. 28	4.35	5.78	7.00–8.00	5.60	6.00
Galvanized					
No. 10	4.70	6.13	6.50	5.95	5.30
No. 12	4.80	6.23	6.60	6.05	5.40
No. 14	4.80	6.23	6.60	6.05	5.40
Nos. 18 and 20	5.10	6.53	6.90	6.35	5.70
Nos. 22 and 24	5.25	6.68	7.05	6.50	5.85
No. 26	5.40	6.83	7.20	6.65	5.90
No. 28	5.70	7.13	7.50–9.00	7.95	6.00

AUTOMOBILE SHEETS—Patent level stock for automobile bodies and fenders. Prices in cents per pound for 100 lb. lots at warehouse, New York and Chicago—No. 16, 7.48; No. 18 20, 7.53; No. 22-24, 7.58.

*To these prices .10 must be added for delivery in Jersey City and .15 for New York and Brooklyn.

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.50	$5.80	$4.84
Flats, square and hexagons, per 100 lb. base	6.00	6.30	5.34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, grades "A" and "C" (base)	72
Copper nickel ingots	42
Hot rolled copper nickel rods (base)	52
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb lots sells as follows, f.o.b. New York: ⅛, 8½c. per lb.; ¼, 8c.; ⅜ to ½, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	9.00
Spring steel (light)	10.00	7.00	12.00
Coppered bessemer rods	9.00	8.00	7.00
Hoop steel	4.65	4.04	4.18
Cold-rolled strip steel	9.50	8.25	9.25
Floor plates	5.75	4.00	6.03

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
⅛ to 3	54–57½%	41½–44%	⅛	15½–25½%	+1½–11½%
			¼	19½–29½%	1½–11½%
			⅜ to 1¼	24½–34½%	8–18½%

LAP WELD

2	47–50½%	34½–38%	1¼		
2½ to 6	50–53½%	37½–41%	1½		
7 to 12	47–50½%	33½–37%	2	20½–28½%	6½–14½%
13 to 14	37½–41%		4½ to 6	22½–30½%	9½–17½%
15	35–38½%		2½ to 4	22½–30½%	9½–17½%
			7 to 12	19½–27½%	6½–14½%

BUTT WELD, EXTRA STRONG PLAIN ENDS

⅛ to 1½	52–55½%	39½–43%	⅛ to 1½	24½–34½%	9½–19½%
2 to 3	53–56½%	40½–44%			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	45–48½%	33½–37%	1¼		
2½ to 4	48–51½%	36½–40%	1½		
4½ to 6	47–50½%	35½–39%	2	21½–29½%	8½–16½%
7 to 8	43–46½%	29½–33%	2½ to 4	23½–31½%	11½–19½%
9 to 12	38–41½%	24½–28%	4½ to 6	22½–30½%	10½–18½%
			7 to 8	14½–22½%	2½–10½%
			9 to 12	9½–17½%	5½–+2½%

Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅛ to 3 in. steel butt welded	44%	28%	42½%	33½%	57½%	44%
2½ to 6 in. steel lap welded	39%	24%	44½%	29½%	53½%	41%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 45%. Cast iron, standard sizes, plus 5%.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	15.00	15.00	19.50
Tin in 5-ton lots	34.25	34.25	62.75
Lead	5.75	5.75	8.75
Zinc	7.00	7.00	9.55
ST. LOUIS (In carload lots)			
Lead	5.25	6.25	8.575
Zinc	6.00	6.75	9.225

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

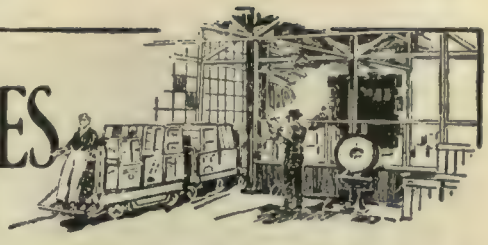
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	21.00	22.50	29.00	23.00	31.00	26.50	36.00
Copper wire (carload lots)	16.00	17.00	28.25	19.00	29.50	24.00	27.00
Brass sheets	18.75	20.25	25.50	24.00	29.00	30.00	27.00
Brass pipe	23.50	25.00	32.00	25.00	34.00	23.25	35.00
Solder (half and half) (case lots)	26.50	27.25	35.00	26.00	40.50	21.00	38.00

Copper sheets quoted above hot rolled 24 oz., cold rolled 14 oz. and heavier; add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill, 1,000 lb and over, warehouse; net extra:

	Current	One Year Ago
Mill	18.25	23.75
New York	16.75	23.75
Cleveland	20.00	29.00
Chicago	21.25	26.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f.o.b. mill + less 8% for carload lots..... 11.50

	Warehouse			
	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	13.70	14.50	14.30	15.00
New York	13.50	13.00	14.50	14.00
Chicago	14.50	15.00	14.95	15.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	5.375	10.25
Chicago	6.50	10.50
Cleveland	7.50	11.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	*New York			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	11.50	18.50	10.00	10.50
Copper, heavy, and wire	11.00	16.50	9.50	9.50
Copper, light, and bottoms	9.00	14.50	9.00	8.50
Lead, heavy	4.00	7.25	4.00	4.00
Lead, tea	3.00	5.25	3.00	3.00
Brass, heavy	7.00	9.50	7.00	10.00
Brass, light	5.50	8.00	5.00	5.50
No. 1 yellow brass turnings	6.00	9.50	5.50	6.00
Zinc	4.00	5.00	3.00	4.00

* These prices nominal because of dull market.

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb.	28.10	24.50	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	28.00	34.00
Chicago	24.50	29.00
Cleveland	22.00	32.00

BABBITT METAL—Warehouse price per pound:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	70.00	90.00	46.50	68.50	35.00	70.00
Commercial	30.00	50.00	15.50	17.25	9.00	15.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at from 16.00 to 20.00.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+ $3.00	List	List net	$1.00	+ 1.15	1.45
Hot pressed hexagon	+ 3.00	List	List net	1.00	+ 1.15	1.45
Cold punched hexagon	+ 5.00	List	List net	1.00	+ 1.15	1.05
Cold punched square	+ 5.00	List	List net	1.00	+ 1.15	1.05

Semi-finished nuts, $\frac{7}{8}$ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	70-5%
Chicago	40%	50%
Cleveland	50%	60-10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
$\frac{3}{4}$ by 4 in. and smaller	25%	50%	40%
Larger and longer up to 1$\frac{1}{4}$ in. by 30 in.	25%	40%	30%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York.....$2.00 Cleveland.....$3.00 Chicago.....$2.50

For cast-iron washers, $\frac{1}{4}$ and larger, the base price per 100 lb. is as follows:

New York.....$7.00 Cleveland.....$4.50 Chicago.....$5.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
$\frac{3}{4}$ by 6 in. and smaller	+15%	40%	25%
Larger and longer up to 1 in. by 30 in.	+15%	35%	25%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	25%	30%	10%	30%
Chicago	net	10%	net	10%
New York	40%-5%	10%	net	10%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel $\frac{7}{8}$ and smaller	40%	50%	30%
Tinned	40%	50%	30%

Structural, $\frac{3}{8}$, $\frac{1}{2}$, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York.....$5.13 Chicago.....$5.73 Pittsburgh.....$4.50

Boiler, same sizes:

New York.....$6.00 Chicago.....$5.83 Pittsburgh.....$4.60

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	25.00	27.00	29.00
Brass	24.00	24.00	28.00

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼-2 in. inclusive in rounds, and ½-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.50 per 100 lb.

In Cleveland—$8.50 per 100 lb.

COTTON WASTE—The following prices are in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
White	7.50@13.00	13.00	14.00	14.25
Colored mixed	7.00@11.00	9.00-12.00	10.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.00	$2.00	$2.25
Philadelphia	2.75	2.75	2.00
Cleveland	4.00	3.00	2.50
Chicago	2.25	2.75	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.50	$3.50	$3.40
Philadelphia	3.65	3.65	4.625
Chicago	4.00	3.85	4.125

COKE—The following are prices per net ton at ovens, Connellsville:

	Current	One Month Ago	One Year Ago
Prompt furnace	$5.00@$5.50	$6.00@$7.00	$6.00@$7.00
Prompt foundry	6.25@ 7.00	7.00@ 8.00	6.00@ 7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels, (5 bbl. lots)	$0.83	$1.80	$0.90	$2.00	$0.91	$1.98
5-gal. cans	0.90	2.00	1.15	2.25	1.16	2.23
1-gal. cans (6 to case)	1.05	....	....	....	....	....

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	14.50	15.50	13.00	14.50
25 and 50-lb. kegs	13.25	14.75	14.75	15.75	13.25	14.75
12½-lb. keg	13.50	15.00	15.00	16.00	13.50	15.00
5-lb. cans	16.00	17.50	15.00	17.50	16.00	16.50
1-lb. cans	18.00	19.50	16.00	18.50	18.00	17.50

500 lb. lots less 10% discount. 2,000 lb. lots less 10-4% discount. 10,000 lb. lots less 10-7½% discount.

Mass., Worcester—M. Fine, 147 Olean St., will soon award the contract for altering and constructing a 2 story, 40 x 40 ft. addition to his garage on Central St. Estimated cost, $25,000. Noted Jan. 6.

Mass., Worcester — J. H. Fontaine, 530 Grafton St., has had plans prepared for the construction of a 2 story, 30 x 80 ft. garage. Estimated cost, $30,000. J. A. Jollette, 58 Front St., Archt.

Mass., Worcester—J. W. Maguire Co., 806 Main St., is having plans prepared for the construction of a 3 story, garage, sales and service station, on Park Ave. Appleton & Stearns, Exchange Bldg., Boston, Archts.

Mass., Worcester—R. P. Rob Power Co., Albany St., plans to rebuild its foundry which was recently destroyed by fire. Estimated cost, $50,000.

N. H., Berlin—The Dept. of Pub. Wks. will soon award the contract for the construction of 1 story, 20 x 60 ft. garage. Estimated cost, $15,000. F. J. Brennan, Berlin, Engr. Noted Dec. 30.

N. H., Hanover—H. H. Downing, c/o Larson & Wells, Archts., Hanover, plans to build a 2 story, 60 x 100 ft. garage on Cottage St.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Brosvik Manufacturing Co., 316 St. Paul St., is remodeling a 2 story, 74 x 80 ft. building in the rear of 3510-3522 Philadelphia Rd., which will he used for the manufacture of automobile specialties and household novelties. B. B. Brosvik, Genl. Mgr.

Md., Baltimore—The Waldorf Development Co., Reisterstown Rd and Virginia Ave, is having plans prepared for the construction of a 1 story, 100 x 200 ft. garage. Estimated cost, $40,000. S. Russell, 11 East Lexington St., Archt.

Md., Woodberry (Baltimore P.O.)—W. E. Hooper & Sons, 3502 Parkdale Ave., have awarded the contract for the construction of a 2 story, 28 x 34 ft. addition to their machine shop.

N. J., East Orange—R. Bloom & Co., c/o Kruger & Siegler, Archts., 207 Market St., Newark, is having plans prepared for the construction of a 1 story, 57 x 223 ft. garage at 102 Market St. Estimated cost, $50,000.

N. J., East Orange—The D. & H. Constr. Co., 128 Market St., will build a 1 story 55½ x 164 ft. garage at 100 Main St. Estimated cost, $30,000.

N. Y., Rochester—The Eastman Kodak Co. plans to build a 1 story, 362 ft. x 110 to 150 ft. machine shop, at Kodak Park.

Pa., Philadelphia—B. Barron and M. White, Commonwealth Trust Bldg., have had plans prepared for the construction of a 2 story, 27 x 190 ft. sales and service building at 1310 North Broad St. L. B. Rothchild, 1225 Sansom St., Archt.

Pa., Philadelphia—N. Litman, 1597 North 52nd St., will soon award the contract for the construction of a 1 story, 36 x 75 ft. garage at 421 Gaskill St. Estimated cost, $10,000. I. W. Levin, Mutual Life Bldg., Archt.

SOUTHERN STATES

Ky., Louisville—The Measurite Co., 522 Marion E. Taylor Bldg., is having plans prepared for the construction of a new factory for the manufacture of gasoline dispensers.

MIDDLE WEST STATES

Ill., Chicago—The Harder Mfg. Co., care of W. G. Carnegie, Archt., 189 West Madison St., has awarded the contract for the construction of a 1 story, 100 x 125 ft. factory on Lincoln and Fulton Sts., for manufacture of electrical appliances. Estimated cost, $65,000.

Mich., Hamtramck (Detroit, P.O.) —The Palmer Bee Co., Cameron Ave. and East Grand Blvd., plans to build a 4 story factory for the manufacture of conveying equipment. Estimated cost, $500,000. Private plans.

O., Cleveland—The Bryan Automobile Co., 3191 West 25th St., has had plans prepared for the construction of a 3 story, 80 x 180 ft. garage. Estimated cost, $75,000. P. Matzinger, Caxton Bldg., Archt.

O., Cleveland—The Craig Motor Co., 1914 Euclid Ave., will soon award the contract for the construction of a 2 story, 75 x 220 ft. garage and commercial building at 3800 Euclid Ave. Estimated cost, $100,000. W. S. Ferguson Co., 1900 Euclid Ave., Archts.

O., Cleveland—Detello Bros, 3502 Orange Ave., have awarded the contract for the construction of a 2 story, 40 x 80 ft. garage. Estimated cost, $40,000.

O., Cleveland—C. Mondello, 16.532 Burnsick Ave., will soon award the contract for the construction of a 1 story, 50 x 100 ft. garage at 16,109 St Clair Ave Estimated cost, $25,000 W. W. Sabin, 1900 Euclid Ave., Archt.

O., Dayton—Lapedes & Yassenoff, 13 Jones St., plan to build a 2 story, 46 x 140 ft. garage on Jefferson and Jones Sts. Estimated cost, $75,000. Architect not selected.

Wis., Milwaukee—The Amer. Metal Products Co., 671 Kinnickinnic Ave., will soon award the contract for the construction of a 1 story, 80 x 200 ft. machine shop and foundry, on Burnham St. Private plans. Noted July 8.

WEST OF THE MISSISSIPPI

Minn., Minneapolis—H. W. White, Agt. of the H. W. White Investment Co., 105 Phoenix Bldg., plans to build a 2 story garage. Estimated cost, $50,000. Architect not selected.

Minn., Montevideo—P. F. Bonde is having plans prepared for the construction of a 2 story, 100 x 100 ft. garage. Estimated cost, $50,000. S. J. Bowler, 617 Phoenix Bldg., Minneapolis, Archt.

Wyo., Casper—The city plans to build a 2 story, 40 x 80 ft. fire hall and a 1 story, 35 x 130 ft. garage on South David St. Estimated cost, $75,000. Garbutt, Weidner & Sweeney, Oil Exchange Bldg., Archts.

WESTERN STATES

Cal., Los Angeles—Shepard-Campbell Co., 1900 South Main St., is having plans prepared for the construction of three auto service stations. 18 x 50 ft., 16 x 25 ft. and 26 x 85 ft. Estimated cost, $8,000. J. M. Cooper, Marsh-Strong Bldg., Engr.

Ore., Portland—Henninger & Ayes, 80 North 5th St., plan to build a factory for the manufacture of canning machinery and equipment.

Wash., Seattle — The Rothert Process Steel Co., 622 Othello St., manufacturers of ingots, bar steel and high grade steel products, plans to erect new buildings. Plans include installation of one or probably two, 15 ton electric steel furnaces, etc. E. H. Rothert, Pres.

CANADA

Ont., Toronto—A. G. Peuchen, 181 King St., W., plans to build a 2 story, 40 x 80 ft. addition to his garage. Estimated cost, $20,000. Architect not selected.

Ont., Toronto—The Standard Meter Co., 10 Morrow Ave., will soon award the contract for the construction of a 2 story, 40 x 60 ft. addition to its gas and water meter factory. Estimated cost $15,000. J. M. Cowan, 67 Bond St., Archt.

Ont., Wallaceburg—W. McLean plans to build a factory for the manufacture of tool steel. Estimated cost, $25,000.

Que., Montreal—W. R. Cuthbert & Co., 41 Duke St., plans to build a 3 story factory for the manufacture of brass finishings. Estimated cost, $35,000.

General Manufacturing

NEW ENGLAND STATES

Conn., New Britain—The New Haven Dairy Co., 201 Hazel St., New Haven, is having plans prepared for the construction of a 1 story, 50 x 50 ft. addition to its dairy, here, and will convert same into an ice cream manufacturing plant. Estimated cost, between $15,000 and $18,000.

Mass., Pittsfield—The Pittsfield Milk Dairy, 125 Dawes St., plans to build a 1 story, 62 x 90 ft. dairy. Estimated cost, between $35,000 and $40,000. Harding & Seaver, 7 North St., Archts.

Mass. Springfield—Hinsdale Smith & Co., 23 Hampden St., tobacco manufacturers, plan to rebuild plant and warehouse which was recently destroyed by fire. Loss between $75,000 and $100,000. Architect not selected.

Mass., Worcester—M. K. Smith Co., North Foster and Union Sts., woodworkers, plans to construct a factory to replace the one which was recently destroyed by fire. Estimated cost, $100,000.

MIDDLE ATLANTIC STATES

N. J., Glen Moore—The Delaware River Quarry & Construction Co., Lambertville, plans to construct a boiler house and quarry buildings, here. Estimated cost, $100,000. R. A. Montgomery, 21 Bridge St., Lambertville, Pres. Architect not selected.

N. J., Trenton—The Puritan Rubber Co., plans to build a 2 story, 60 x 80 ft. rubber plant on Perrine Ave., to replace the one which was recently destroyed by fire. C. L. Seifert, Pres.

N. Y., Baldwinsville — J. Frazee Milling Corp., East Genesee St., has purchased a site on East Genesee and Elizabeth Sts., and plans to build a flour and feed mill. Estimated cost between $150,000 and $175,000. R. H. Quackenbush, Pres.

Pa., Harrisburg—The Amer. Cold Storage Co. is having plans prepared for the construction of a 7 story cold storage plant on South 2nd St., below the bridge of the Philadelphia & Reading Ry. J. F. Feeser, Pres. C. E. Schaup & Co., 222 Market St., Engr.

SOUTHERN STATES

Va., Richmond—Virginia Carolina Rubber Co., 10 North 19th St., is alterating its factory.

MIDDLE WEST STATES

Ind., Indianapolis—The Natl. Lamp Co., Nela Park, East Cleveland, O., has awarded the contract for the construction of a 2 story, 80 x 200 ft. factory, here. Estimated cost, $200,000.

Ind., Lafayette—The Chamberlain Ice Cream Co., 5th and Alabama Sts., will soon award the contract for the construction of a 2 story, 65 x 90 ft. ice cream plant. Estimated cost, $50,000. Riedel & Zink, Lafayette, Archts.

O., Alliance—City plans election March 29 to vote on $375,000 bonds to build artificial gas plant.

O., Cleveland—The Frank Dry Cleaning Co., 1361 East 55th St., has awarded the contract for the construction of a 2 story, 44 x 76 ft. factory, on East 60th St. and Bonna Ave. Estimated cost, $50,000. M. H. Merver, Mgr. Noted Nov. 25.

O., Cleveland—The Premier Refining Co., 1187 West 11th St., has awarded the contract for alterations to its 2 story factory on East 65th St. and Harvard Ave. Estimated cost, $35,000. Private plans. Noted Dec. 16.

Wis., Marinette—The Bd. of Educ. is having plans prepared for the construction of a 2 story, 65 x 225 ft. Junior High School and a 1 story, 79 x 100 ft. manual training shop. Estimated cost, $200,000. P. F. Neverman, Secy. Parkinson & Dockendorff, Linker Bldg., La Crosse, Archts.

WEST OF THE MISSISSIPPI

Col., Denver—The Oregon Lumber Co., 17th and Platte Sts., plans to build a lumber mill. Estimated cost, $25,000. Architect not selected.

Kan., Pittsburg—The Atlas Powder Co. will build five 1 story, 35 x 55 ft. powder houses, near here. Estimated cost, $18,000.

Mo., Neosho—F. A. Simpson plans to build a 1 story laundry on the Public Square. Estimated cost, $15,000. Architect not selected.

WESTERN STATES

Ore., Portland—The Portland Vegetable Oil Mills Co. plans to build a plant for the manufacture of vegetable oil to have a daily capacity of 100 tons. Estimated cost, $450,000. C. A. Painton, Pres.

Utah., Brigham — D. L. Reeder, 48 South Main St., and associates, plan to build first unit of packing plant. Estimated cost, $25,000. Total cost, $75,000. Architect not selected.

Wash., Chehalis—The Chehalis Box, Basket & Veneer Co., recently incorporated with $100,000 capital stock, plans to alter and equip a factory for its own use. L. J. Sticklin, Pres.

CANADA

Ont., Niagara Falls—The Dominion Canners Co., St. Davids St., has awarded the contract for the construction of a 2 story, 50 x 80 ft. addition to its factory. Estimated cost, $20,000.

February 10, 1921 American Machinist Vol. 54, No. 6

Littell Automatic Punch-Press Feeding Devices

Automatic Feed to Increase Output and Safeguard Workmen—Construction of Attachments for Feeding From Roll—Dial, Slide and Hopper Feeding Mechanisms

By J. V. HUNTER
Western Editor, *American Machinist*

THE F. J. Littell Machine Co., Chicago, Ill., has lately developed a number of units for providing continuous feed for punch presses. The automatic feeding of punch presses is a development that is rapidly coming to the attention of production managers. It permits almost continuous operation of the press, and has shown the possibility of both safeguarding the workman and, at the same time, developing an increased output from the machine. A large share of continuously operated presses work on coil stock. Material in this form, when of light gage, has advantages over strip stock in that it requires much less attention and frequently can be purchased at a lower cost than that of similar stock cut to strips.

One of the devices to be used for handling coil stock is the easy-running reel, shown in Fig. 1. It is known as the No. 1 reel stand, style "D." This reel is designed for use in connection with a power winding reel, the latter rewinding the scrap coil stock as it comes from the press. While a reel stand must not offer too much resistance to the feeding roll, it is necessary, however, to provide an adjustable brake to prevent overrunning. The spring for regulating the brake can be seen where the reel shaft passes through its adjustable supporting bracket.



FIG. 1. NO. 1 STYLE D REEL STAND FOR USE WITH POWER WINDER

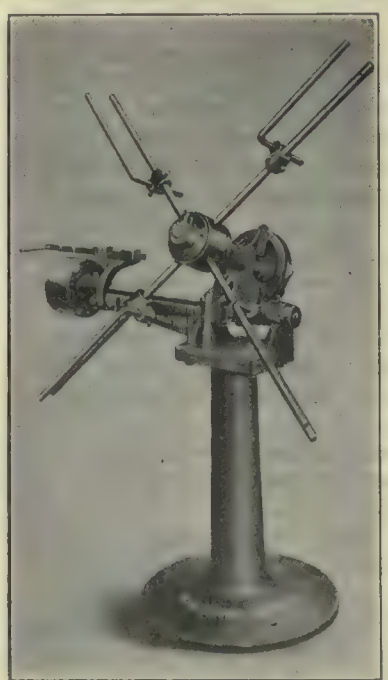


FIG. 2. POWER WINDING DEVICE FOR REELING COIL SCRAP

The No. 1 power scrap-winding reel, shown in Fig. 2, is used when the punched stock must be re-wound to use for some further service, such as punching out another row of pieces. The scrap winder is driven by a belt, from an overhead countershaft, to a tight and loose pulley on its main shaft. A worm on this shaft drives a worm gear keyed to the jack-shaft that carries the reel, and rotates it at a predetermined speed. The speed is sufficiently fast to take care of the scrap when the reel is winding at its shortest radius. When the radius increases, a friction device in the reel head relieves any undue tension that may develop. The bracket that carries the reel shaft can pivot on the main shaft, and may be adjusted so as to set the reel at different angles from the vertical within a limit of about 45 deg.

The reel spiders on both styles of standards are interchangeable. After the spider on the power-winding reel has been filled by the first passage of the coil stock through the dies, it can be removed, turned with the other side toward the press, and placed on the style "D" standard ready for the second passage of the stock through the dies. The reel spider is held on its shaft by a small spring-operated pin that makes removal for transfer very easy. The manufacturer has adopted the roller drive for the feeding mechanism instead of the ratchet drive that has frequently been employed for this purpose. Five small steel rollers running inside of a hardened steel ring are employed. The rollers are held by an inside cam with five notches, and the drive works on the coaster-brake principle. When the cam turns in one direction, the rollers roll against shoulders in their respective notches and turn freely. When the cam reverses, the rollers slip into the wedge sides of the notches, which forces them against the outside ring, upon which they bind firmly, so that the latter rotates with the cam. A type of drive known as the Acme drive is also employed. This is claimed to be even more powerful than the roller drive and to have none of the disadvantages of the ratchet feed.

The example of the roll type of feeding mechanism shown in Fig. 3, is known as the No. 2 single-roll feeding device. It can be made to operate either by pushing the stock from left to right into the die or by pulling the stock from right to left, if so desired for feeding light stock. This device and similar roll feeds of this make are driven by a connecting rod from an adjustable crank on the opposite end of the crankshaft from the flywheel. They are designed to handle any width of stock up to the maximum by adjusting the

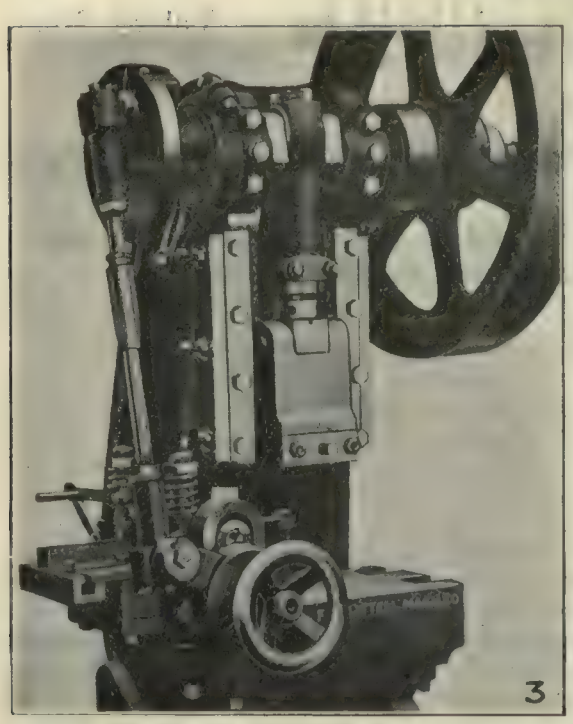


FIG. 3. NO. 2 SINGLE-ROLL FEED FOR COIL STOCK

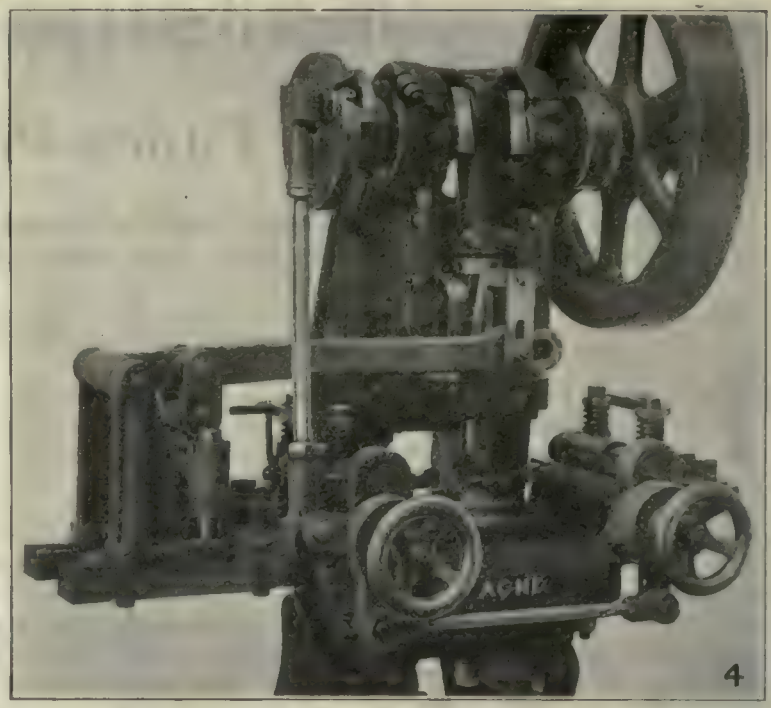


FIG. 4. NO. 2 DOUBLE-ROLL FEED WITH SCRAP CUTTER

stock guides. Any feed from nothing up to the maximum can be obtained by loosening a nut and adjusting the location of the bearing pin on the crank.

The feed rolls are made relatively large in size in order to increase their pulling power. They are made of hardened steel to lengthen their life and ground to finish.

The pressure on the rolls is governed by adjustable springs located on each bearing. Brakes are provided on the rolls to prevent them from overfeeding. To facilitate the insertion of fresh pieces of stock between the rolls, they are provided with hand lifters. The illustration shows the lever for the hand lifter at the rear on the extreme left side.

Automatic lifters are provided on all roll-feeds and are of service when feeding stock to progressive dies. They lift the feed rolls just before the end of each punch stroke, so that the pilot pins can accurately locate the stock in the dies. Other automatic attachments can be furnished for roll feeds when the nature of the work so demands. Among them is a strong spring pusher that is used to hold heavy stock against the back gage. This pusher is released automatically when the slide starts on its up-stroke.

Double Roll Feeds

Double roll feeds can be provided to handle the stock on both sides of the dies. The set of rolls at the right operates to push the stock to the dies. The rolls on the left side pull the stock from the dies. A Size 2 roll-feeding device of this character is shown in Fig. 4. The general construction of both sets of rolls is almost identical. Each has the standard features, such as hand and automatic roll-lifters that have already been mentioned. A connecting rod across the front of the bed of the press joins the feed mechanisms of the rolls.

The device shown also has a scrap cutter, the mechanism being located at the far left of the bolster plate. Its function is to take the skeleton stock after it leaves the second pair of feed rolls and cut it into short pieces, the length of which is equal to the amount required for each punching. This reduces the scrap to a condition where it is far easier to handle than in a strip or roll, as it can drop from the scrap cutter into any convenient receptacle.

The scrap cutter is simply a light shear, operated by an arm attached to a pin on the slide of the press. It is mounted on an extension of the bed-plate or bolster that carries all of the feed mechanism. It is bolted in slotted holes in the extension that permit it to be moved in or out from the press, and should be adjusted so as to cut the scrap through its weakest section, thus saving undue strain on the cutter.

The heavier type of automatic roll feeds is represented by a No. 3 double-roll feed with scrap cut-off shear, shown in Fig. 5. The general features of this

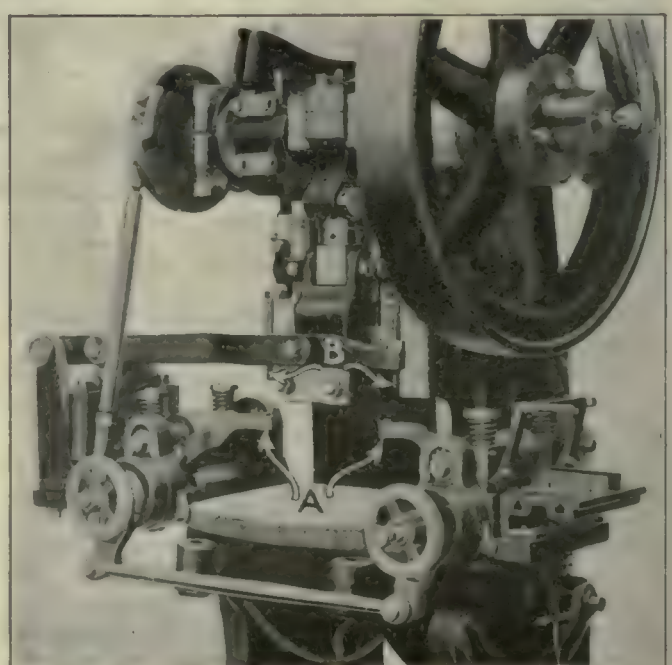


FIG. 5. LARGE DOUBLE-ROLL FEED WITH SCRAP CUTTER

feed are very similar to those described in connection with the smaller feed shown in the previous figure. The automatic lifters that raise the feed rolls while the pilot pins on progressive dies are centering the stock are shown at *A*. They are short levers with a fulcrum on the roll housing and a lifting point under each roll bearing. When the slide descends, the setscrews *B* (fastened in lugs on the slide) come into contact with hardened steel studs in the ends of the arms *A*, forcing the latter down and thus lifting the rolls. The setscrews *B* can be adjusted to time the point where the roll lifting begins, in order to regulate this action for various thicknesses of stock or lengths of pilot pins.

A Large Roll Feed Device

One of the larger sizes of roll-feed devices is shown in Fig. 6. It is a No. 5 size and is equipped with a scrap-cutter and with straightening rolls. The straightening rolls at the right-hand end consist of five rolls, three stationary ones below and two adjustable above. A bracket at the extreme right carries a set of adjustable angle irons for guiding the stock into the attachment. The device will handle stock of any width up to 8 in. The bolster is a steel casting. The weight of the complete device is about 3,000 lb.

Ratchet Dial Feeds

Another development in automatic punch-press feeds is the ratchet dial feed, of which the No. 0 dial feed shown in Fig. 7 is an example. This class of attachment can be used for various purposes. It can serve simply as a carrier, in which case it is especially useful in many redrawing or forming operations. When used in this manner for different jobs, bushings can be placed in the dial recesses to fit the size of the work. For other classes of work the dial can be made extra thick so that the dies can be mounted on it. This necessitates making a number of dies corresponding with the stations on the dial.

The indexing mechanism is mounted on a dove-tailed slide on the left-hand side of the bolster. It is fitted with an adjustable gib so that all wear can be taken up, as it is very necessary that all play be reduced to a minimum for accurate registering of the dial. The slide is operated by a rocker arm *A*, pivoted on a bracket from the bolster, and given its stroke by a connecting rod from a crankpin on the end of the crankshaft. The locking mechanism that holds the dial in position while the punch is working is located at the rear of the bolster on the left side. It is released by a pin on the slide as the indexing mechanism draws back to start a new stroke. As the driving pawl *B* finishes its feeding stroke, the latch *C* falls into a notch, preventing the dial from rotating further. At the same time a latch *D* at the right drops into a notch and holds the dial so that it cannot swing back in the reverse direction of rotation. Thus the dial is held between two positive-acting latches, which prevent it from being out of true indexing position in either direction. The latch *D* is provided with an arrangement for taking up wear, so that the dial will always register accurately.

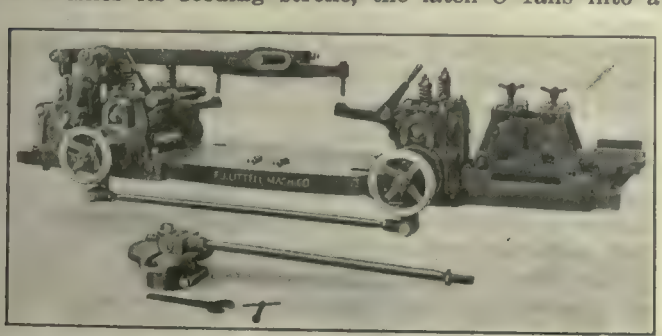


FIG. 6. NO. 5 ROLL FEED WITH SCRAP CUTTER AND STRAIGHTENING ROLLS

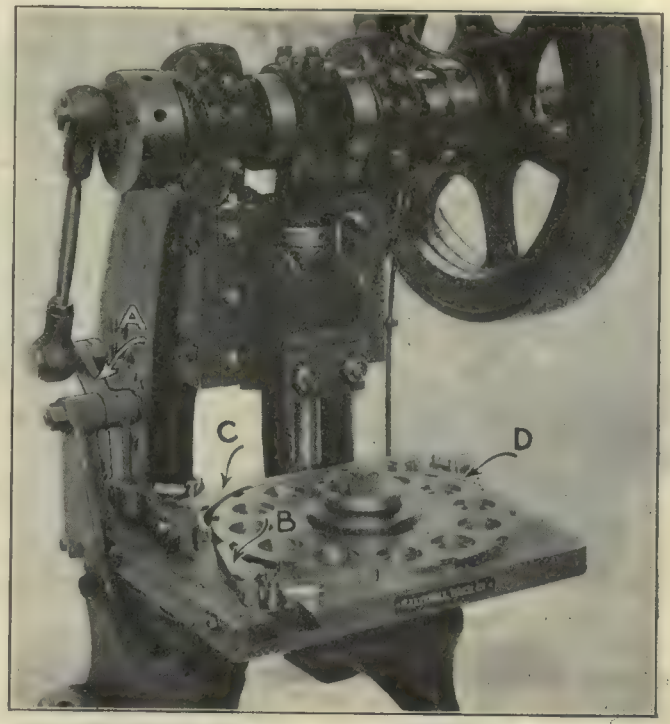


FIG. 7. NO. 0 DIAL FEEDING DEVICE

Chute and Slide Feeding Mechanism

It is stated that dangerous jobs can be handled rapidly and safely by the use of the chute and slide mechanism, shown in Fig. 8, that has been designed for operations that ordinarily involve some danger to the operator. The tray standing above the press table carries the work. It is in a convenient position, so that the operator can rapidly feed the pieces into the chute *A* that extends down to the die-feeding mechanism. The automatic feeding mechanism is contained in the block *B* and consists of a spring-actuated slide that moves toward the die as the punch rises and pushes a fresh piece in place above the die. These devices can be built so that they will either put the piece of work over the end of the punch or slip it into any used in this manner for different jobs, bushings can form of opening in the die, which will serve for registering or guiding the pieces.

Standard work knockout features should be incorporated in the punch by the toolmaker so that the pressed piece is automatically thrown from the punch after each stroke of the press. The feeding slide is pushed away from the punch as the press slide descends by means of a bracket with roller *C*. This roller presses against a bevel cam *D* standing up from the top of the feeding slide. A mechanism of this character is rarely adjustable and is designed to be a permanent part of each piece of die equipment. While operating, the attendant sits on a high stool before the tray with his foot on the press trip-treadle, which can be

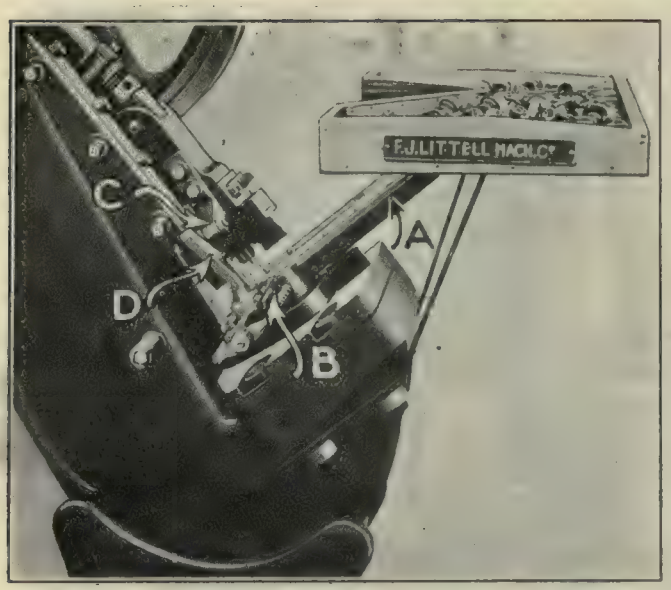


FIG. 8. COMBINED CHUTE AND SLIDE FEED

released immediately should any piece of work jam in the dies.

Automatic Hopper Feeds

The dial and chute feeding attachments that have been described require hand feeding, but this service from an attendant can sometimes be avoided by the use of the automatic hopper-feeding device shown in Fig. 9. The hopper feed here shown is intended for use in connection with a chute and slide feed of the type just described. It stands before the press with the chute on its left side extending into the slide-feed chute. The work is dumped into the large circular hopper on top. The hopper revolves constantly and is driven by a light belt drive to the pulleys at its right. The pieces of work roll over and over until they are in the correct position to fall through the openings *A* in the lower portion of the circular rim of the hopper. The holes are designed in accordance with the shape of the work, to insure that the piece is right side up. The pieces fall through the openings into an alleyway *B* surrounding the hopper, and they travel along this passage with the rotation of the hopper. The rotation is clockwise and the pieces are carried over to the chute, down which they can slide until it is filled. As soon as the chute is filled, the pieces pass its opening and continue to move around the hopper into which they return without jamming, with the exception of occasional pieces that pass to an overflow box. This arrangement prevents any damage to the mechanism when the delivery of the work is too rapid to be handled by the press. Therefore the delivery of the hopper is planned to be of greater capacity, to insure that the work chute to the press is always kept full.



FIG. 9. NO. 1 HOPPER FEED FOR CHUTE OR DIAL MECHANISMS

Disintegrating a Lathe for Mule-Back Transportation

In most countries improvements in manufacturing equipment and transportation facilities have kept fairly well abreast. As machinery grew in size and weight, the carrying capacity of freight cars and the power of locomotives likewise increased and about the only difficulty encountered was the lack of sufficient tunnel headroom for large machines.

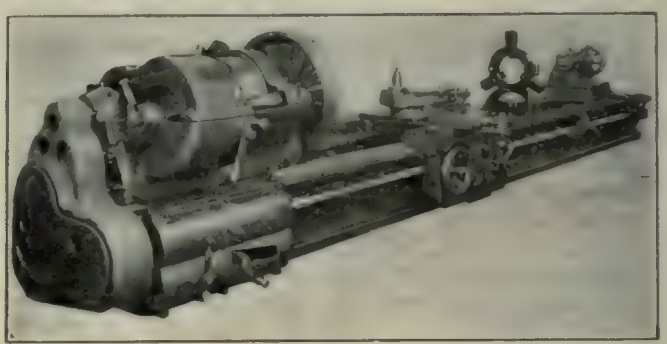


FIG. 1. ASSEMBLED LATHE

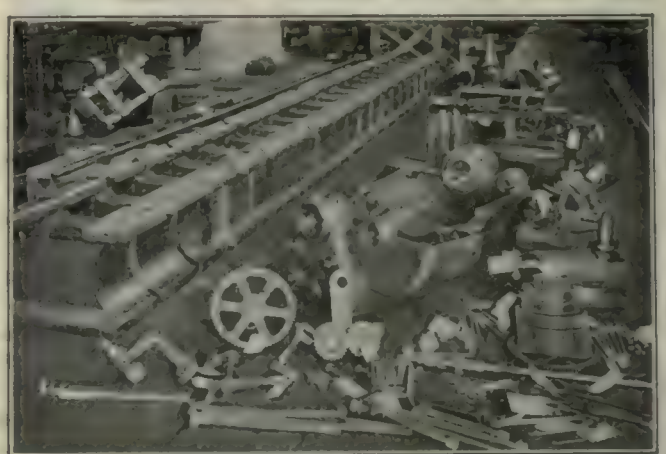


FIG. 2. LATHE KNOCKED DOWN AND SECTIONED FOR MULE-BACK SHIPMENT

In western South America industry has outstripped the railroad and the only means of transportation in some localities is the mule or the llama. The capacity of a mule is rather limited and so far no one seems to have had much success in enlarging his size and lifting power. Hence it is necessary to limit the size of the burden to the means at hand and the difficulties of each particular problem are unique.

How the Pittsburgh Machine Tool Co. fixed up one of its lathes for South American travel in shown in the illustrations. Fig. 1 shows the complete machine and Fig. 2 the parts disassembled and the bed cut into "one-mule" sections.

Magnetic Chucks



Ellsworth Sheldon
ASSOCIATE EDITOR AMERICAN MACHINIST

II. History and Development

First Magnetic Chuck Patent Issued Forty-Eight Years Ago—Early Chucks and Their Construction—Progress from 1873 to 1914

THE magnetic chuck, so familiar to the present-day toolmaker, by means of which flat work is so quickly and conveniently located and held for surface grinding as well as to a lesser degree for operation on other machines, is not a thing of yesterday, but is rather contemporaneous with our fathers' or possibly our grandfathers' experience.

Instead of being developed consequent to the introduction of a cheap, satisfactory and dependable supply of electric energy the chuck made its first appearance so far in advance of its time as to antedate any but the most crude machinery for generating electric current, and its early sponsors, though speaking in their patent application of a "dynamo-electric machine," relied rather upon the primary battery as a source of energy for their device.

The First Magnetic-Chuck Patent

The first magnetic chuck patent issued by the United States Patent Office was granted on April 15, 1873, to three residents of England; one of whom, John Thomas Oakley, of Bermondsey, was an engineer. Allowing a not unreasonable period of two years for working out the idea, making and testing models, etc,. this would accord to the device the somewhat venerable age of 50 years. As the caption of this early patent is "Improvement in Magnetic Chucks for Lathes and Planers," it is to be presumed that the subject of the patent was not the first of its kind.

The claims, in part, of the patentees covered the "construction of chucks for lathes in an improved manner so as to render them more generally useful, and in adapting a magnetic holder (constructed on the same principles as the chucks for lathes) to planing, drilling and surfacing machines for the purpose of holding the metal article steady while under operation."

To quote further from the patent specifications: "In constructing a magnetic chuck for a lathe we form the chuck of two circular disks one of which is divided across its center into two parts which are separately connected with the bottom disk by pillars or studs round which is coiled insulated copper wire so that by means of a galvanic battery or a magneto-electric machine the chuck will be converted into a powerful electromagnet which, when an article made of iron or steel is placed thereon, will hold it firmly."

The construction of the chuck for planers, etc.—what we now call the rectangular chuck—was practically the same except that there were more divisions. For the purpose of strengthening the divided upper plate of the chuck the slots, or openings between the poles were to be "filled in with brass, copper, or other non-magnetic substances."

The claims cover various modifications of mechanical construction, all involving the same magnetic principle, which indeed to the lay mind would seem to be amply covered by the first claim. Any departure from the original chuck would necessarily lie in the direction of changes in the mechanical structure and in methods of application of the magnetic principles.

A reproduction of the patent drawing of this grandfather of magnetic chucks is shown in Fig. 16. Little description is necessary as the eye of the practical mechanic will cover all its details at a glance.

Independent Magnet Construction

As will be seen, this chuck incontestably belongs in the independent magnet class already considered in Part I of this aticle. The rotary chuck carries but one single U-shaped magnet, both poles of which are brought to the working surface. The rectangular chuck is a series of such magnets, or units, and may be made to any size by adding more units.

Nothing is said in the specifications as to the material of which the "circular casing," enclosing the magnets, is made, but the back plate which screws to the spindle is one of the two "steel disks" referred to. It obviously is no essential part of the magnetic circuit, and it, as well as the casing, might better be made of non-magnetic material, as the heavy iron back-bar of the magnet is capable of carrying all the magnetic currents that the coils could induce.

The contact rings of brass are mounted upon the periphery of the chuck, being insulated therefrom by a ring of vulcanite, and current is carried to them by spring contacts "to be mounted upon any convenient part of the lathe."

Little Difficulty from Electrotechnics

"Volts," "ohms," "amperes," "lines of force," etc., caused little uneasiness of mind to these pioneers of magnetic-chuck manufacture for no current that they

would be likely to get from any "magneto-electric" machine of that period would be likely to burn out their coils. Nor were they troubled with overheating of coils or of the breaking down of insulation by reason of alkaline grinding solutions. All of these troubles belonged to a later day of high-voltage currents and high-powered grinding machinery.

They did however, evidently discover that the electro-

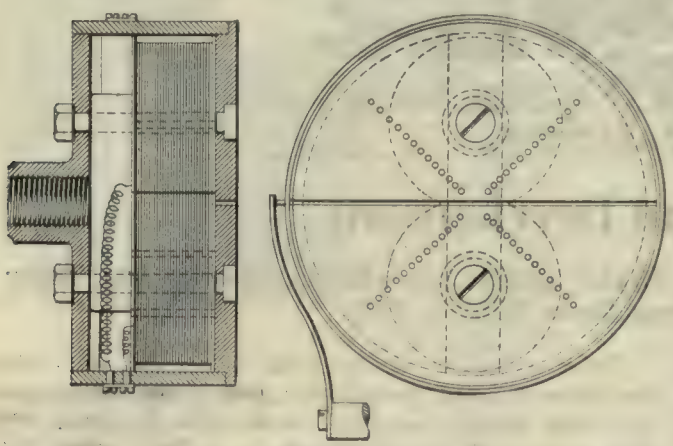


FIG. 16. THE GRANDFATHER OF MAGNETIC CHUCKS PATENTED 1873

magnet exercised little restraint upon the movement sidewise of a piece being operated upon, hence the two rows of small holes at right angles "into which pins or studs may be driven or screwed, to assist in centering and holding the article on the face of the chuck."

Oakley S. Walker, Pioneer in Magnetic Chuck Development in America

To Oakley S. Walker, of Worcester, Mass., belongs a large share of the credit that goes to the pioneer in this undertaking. Recognizing the possibilities of a device that had hitherto been looked upon as little more than an impracticable toy, though in all probability even he did not fully visualize the extent to which it would become a factor in production, he early began the experiments that have resulted in making the magnetic chuck one of the most indispensable auxiliary devices in modern machine industry.

Mr. Walker's first patent on magnetic chucks was granted on July 21, 1896, twenty-three years after the issue of the original patent. For a number of years he had privately conducted experiments with the device and had promptly recognized its then fatal defect, which

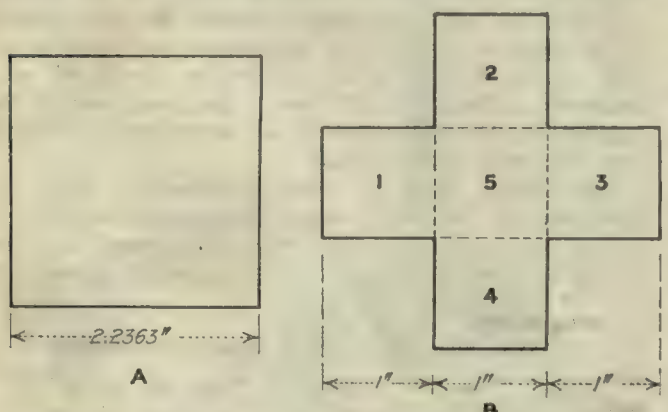


FIG. 17. INCREASING THE "MAGNETIC EDGE" BY BREAKING UP THE SURFACE

was its inability to oppose any resistance other than friction to the lateral movement of a piece of work held upon its surface, so long as that movement did not tend to decrease the number of lines of force passing into the work.

Probably for this reason the first Walker chuck was a marked departure from the chuck of 1873, in that the independent magnet feature of the original had been discarded and the principle we have classed as "single-magnet" had been substituted. This was perhaps the natural result of his endeavor to break up the holding surface into as many areas of opposed polarity as was practical without reducing the size and consequent power of the magnets.

"Magnetic Edge"

This breaking up of the magnetic surface was accomplished by making one of the polepieces of irregular outline and enclosing it within the other so that the air-gap, from being a straight line across the surface, became a narrow, though still continuous, line weaving in and out in such a way as to cover the larger part of the chuck face; thus making it impossible for even quite a small piece of work to lie upon the magnets

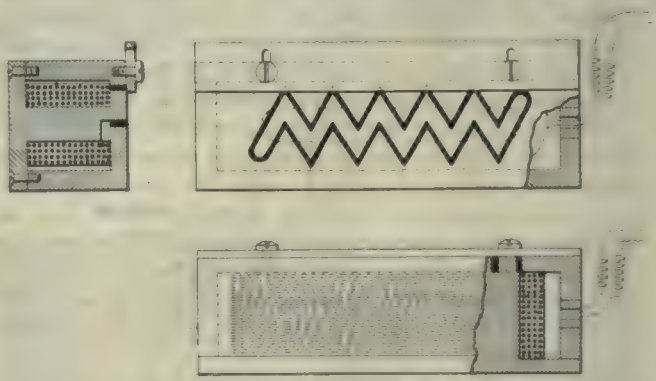


FIG. 18. THE FIRST WALKER CHUCK, PATENTED 1896

without crossing the gap two or more times. Mr. Walker had discovered the value and bearing of "magnetic edge."

If we inspect the diagram, Fig. 17, we will note that both outlines enclose the same superficial area. This (in the original drawing) is 5 sq.in. The length of contours, however, is quite different, being less than 9 in. in *A* and 12 in. in *B*. Considering them as poles of a magnet, with the same degree of magnetic saturation or lines of force per square inch, the "pull" of one should exactly equal that of the other.

If, on the other hand, we consider two magnetic surfaces one made up of square poles as at *A* and the other of poles similar in shape to *B*, we will see that a sliding movement of a piece in contact with the surfaces of the magnets *B* would alter the magnetic flux to a much greater degree than a similar movement on magnets *A*. The resistance of the former to such a movement would therefore be greater.

It may be safely assumed that the original patentees knew little, if anything, about lines of force and very likely did not know the reason why their chuck, while holding the work strongly to itself, would permit it easily to slip sideways.

The first chuck patented by Mr. Walker, shown in Fig. 18, displays evidence of much thought and experiment. It is the beginning of the long line of "single magnet" chucks that has been developed by this prolific

inventor. It differs from the chuck in 1873 in that there is but a single coil of wire to carry the energizing current and that the body of the chuck is included in the path of the magnetic currents. The core of this magnet is "cast metal" though whether of iron or steel

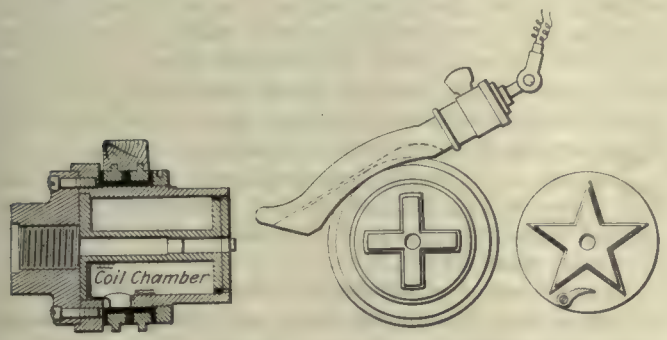


FIG. 19. WALKER ROTARY CHUCKS

the specifications do not say. It is cast in one piece with the flange at one end and the zig-zag polepiece at the other (length in this case being the shortest dimension), thus forming a spool upon which the wire is wound.

The shell, also cast, is a rectangular box with one of its larger sides open, the other side, corresponding to the bottom of a box, having an opening to fit loosely over the polepiece, leaving at all points a narrow space between itself and the polepiece to be filled with non-magnetic material. After dressing the surfaces the core is placed in the box and fastened by means of countersunk head screws. The sinuous opening between the polepiece and shell is then filled by pouring in lead or babbitt, and the outer surface dressed off smooth.

To increase the holding power of the chuck against a lateral movement of the work the holding surface was later designed so that a part of the magnetic gap lay in a straight line parallel to the longer dimension of the chuck and near to the rear edge. A strip of soft iron about ⅛ in. thick was screwed and dowelled to the magnetic surface in such position that it paralleled the straight line of the air gap, and, as it was in contact only with the outer magnetic pole, it thus became a part of the latter and exerted a strong attraction upon any piece of work lying in proximity to it.

This strip thus served two purposes: as a straight edge, parallel to the direction of travel of the machine table upon which the chuck was used, it served to bring the work into alignment; by its magnetic attraction exerted in a horizontal direction, it had a tendency to prevent the work from becoming displaced by "slewing" or sidewise movement.

Changed Conditions Affect Type of Chuck

Curiously enough, the original patentees seemed to be chiefly concerned with lathe chucks, their flat chuck for planers being apparently a secondary consideration; while Mr. Walker's first serious attempts are in the direction of developing the flat chuck. This would be accounted for by the development in the intervening years of the process of surface grinding as a machining operation, to which the magnetic chuck is peculiarly adapted. Grinding wheels of the earlier period were mostly made of wood with a leather cover to which emery grains were fastened with glue, and were used for polishing; actual grinding for the removal of materials as we know the process today was accomplished, if at all, by means of grindstones, the work being held in the operator's hand.

Mr. Walker's experiments had not been confined exclusively to the flat chuck, however, for at the time the latter was first described in the *American Machinist* (July 16, 1896) mention was also made of a rotary chuck for use in a lathe, the work for which it was adapted being the facing of some thin special washers. A description of the chuck shown in Fig. 18 was given in the article and also there was displayed a half-tone engraving showing the actual chuck mounted upon a milling machine. In the Aug. 13, 1896 issue of the same journal were shown not only drawings of a modification of the surface of the flat chuck, but also two forms of rotary chuck, the latter being reproduced in Fig. 19.

Between 1896 and 1898, Mr. Walker made further experiments with the rotary chuck, and on Nov. 15 of the latter year obtained a patent on such a chuck to be used on a lathe, but as is distinctly shown in Fig. 20 the device, though mounted in a lathe, is intended for use as a grinding fixture. In this device as in his previously patented first chuck the inventor departed from the independent magnet construction of the early chuck and made a single central core with the energizing coil surrounding it; the magnetic circuit being completed through the casing of the device.

Contact of the work *A* with both poles is provided by the screwed bushing *B* which becomes a part of the casing and consequently of the same polarity, and the sliding, self-adjusting center plug *C*, which, slightly tapered on its outer ends, will be drawn into the holes in the work when the energizing current is thrown on. The tapered end of this movable plug centers the work and at the same time acts as the central pole of the magnet. Bushing *B* and plug *C* had to be made to suit the work to be ground so that the tool was hardly one for the casual job.

No Provision to Exclude Water

Up to this time little attention had been accorded to making the face of the chuck water-tight, but the increasing use of grinding compounds to absorb the heat generated by the wheel as grinding pressures and amount of material to be removed increased, especially the use of strongly alkaline solutions, made trouble for the magnetic chuck by breaking down the insulation, causing short circuits and burning out of coils.

On June 19, 1900, a patent was granted to Mr. Walker

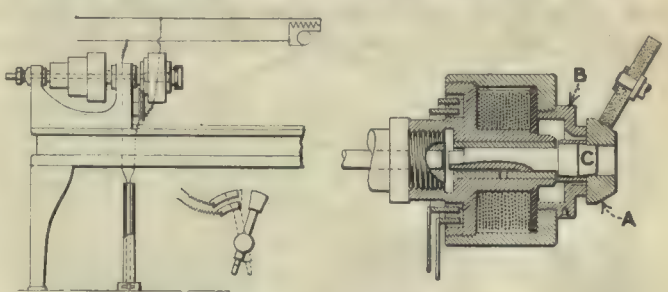


FIG. 20. SECOND STAGE IN THE EVOLUTION OF THE ROTARY CHUCK

covering a departure in mechanical construction of magnetic chucks. Heretofore it had been considered sufficient to close the air-gap by simply pouring in molten babbit, but in the new type the bottom and side of the box were cast integral with the core and a separate

polepiece made which became part of the cover or upper surface, notwithstanding the fact that the upper surface had to do duty as two separate magnetic poles of opposed polarity.

This seeming difficulty was adjusted by making the

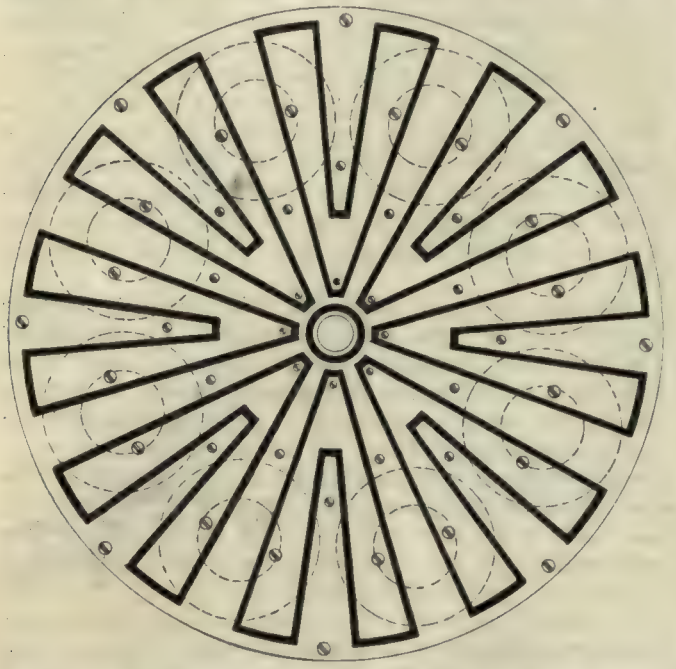


FIG. 21. WORKING SURFACE OF PERFECTED WALKER ROTARY CHUCK, PATENTED 1912

cover in the form of a grid with long narrow openings extending nearly across it and making a polepiece with projections fitting into but not filling the openings in the grid, leaving at all points at least ⅛ in. of space between the two pieces. Fixing these two parts firmly in their relative positions, molten babbitt was poured into the joint and after it had become cold the babbitt was staked or swaged in with a caulking tool. Just how all this was done will be amply explained in a later article dealing with the manufacture of the Walker chuck, for though the shape has been somewhat changed, the top plate here described is still standard construction.

In January, 1902, Mr. Walker was granted a patent covering the tilting feature, by which the chuck could be inclined to plane or grind taper pieces, for by this time the magnetic chuck had become a recognized adjunct of the planer as well as the surface grinding machine. This patent also covered modifications of the top plate: the well-known double-comb form of polepiece being adopted and the plate made wider than the chuck with the edges turned down to act as a sort of umbrella in protecting the interior from water.

Leakage from the top was practically eliminated but the front of the box where the contact switch was located remained open and the splash could still get in its deadly work on the coils.

Various means of combating this trouble were tried, including the attachment of an air hose to the chuck body and keeping a continuous current of air sweeping

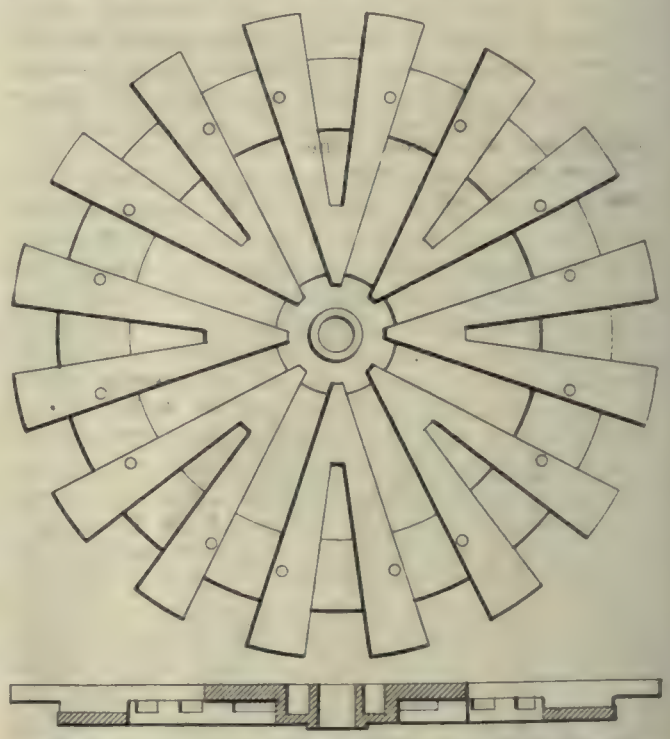


FIG. 23. POLEPIECE OF WALKER ROTARY CHUCK

through the interior in order to keep the coils dry, but this involved extra operating expense and caused additional trouble, besides presupposing the existence in the shop where the chuck was to be used of a pressure blower. Later improvements closed up the box entirely, placed the contact switch on the wall or some other part of the machine and made the chuck body as tight as a German submarine before the coming of a depth bomb.

From 1902 to 1912 there was not much activity in the way of patents upon the magnetic chuck. In 1904 a patent was granted to C. W. Sponsel, of Hartford, Conn., upon a magnetic chuck, but his "chuck" appears to be a device for picking up, turning over, and depositing certain articles for the purpose of inspecting, and is not in any sense a work holder for machining operations.

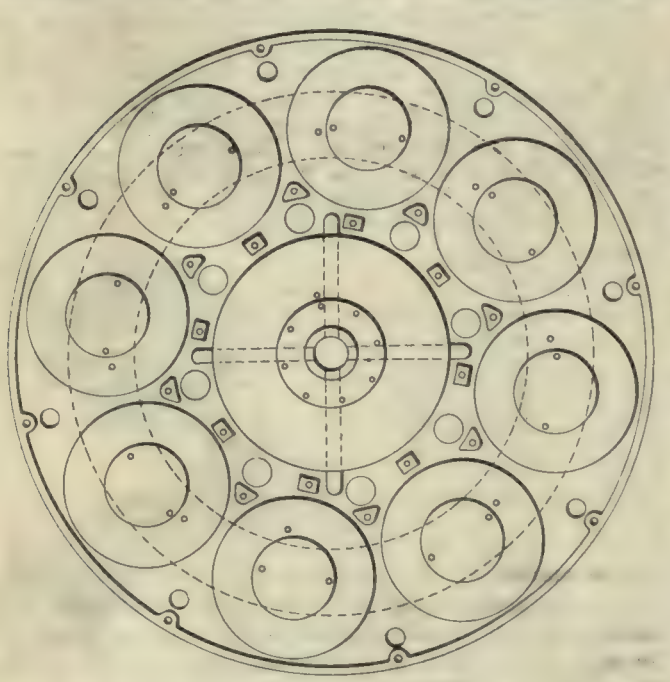


FIG. 22. ROTARY CHUCK BODY; WALKER 1912 PATENT

A Two-Part Chuck

In 1911 B. M. W. Hansen, also of Hartford, took out a patent upon a two-part chuck, the top plate of which was provided with handles and was not permanently

attached to the magnetic body. The idea seems to have been to provide one chuck with two or more top plates so that when the operation, whatever it was, upon one plateful of work was completed the plate could be lifted off and replaced with another that had previously been loaded, thus allowing the operator to clear off the finished pieces, clean his top plate, and arrange new work upon it while the machine was at work.

In 1912 Mr. Walker again comes forward, this time with the rotary chuck which is now so well known in connection with his name. It should be borne in mind that with the increasing applicability of the magnetic chuck and the enormous expansion of the range of manufactured products, the work which it was called upon to do and the conditions affecting it were rapidly changing. Up to 1900 the device was strictly a toolroom proposition and the work which came to it was in the nature of comparatively large pieces, rarely more than one or two of a kind, of hardened steel that had already been machined, requiring only light grinding operations to finish them.

Becomes a Real Factor in Production

From now on, however, the chuck becomes a more and more important factor in production. It was expected to hold large numbers of small pieces at a time, often rough castings or forgings, against the enormously increased grinding pressures necessary to remove stock fast enough to keep pace with modern manufacturing requirements.

The advent of the vertical spindle grinding machine had created an entirely new job for the magnetic chuck and to meet its exacting requirements in the manufacture of small parts the surface of the chuck must be split up into many more sections of opposed polarity than had hitherto been considered necessary, for by this time the fact was recognized that if you wanted to hang on to a piece of iron or steel the piece must span at least one air-gap on the chuck's surface.

Chucks were regularly made as large as 26 in. in diameter and were expected to hold small pieces of work clear to the edge. To obtain this distribution of holding power the top plate was made in the shape shown in Fig. 21, the parts enclosed within the heavy black lines being inserted polepieces.

Fig. 22 shows the body or shell of the chuck and the circular magnet cores, while Fig. 23 shows the shape of the polepieces which, as will be noted, are all in one casting; the ring base of which rests on the top of the cores. As in all single magnet chucks the casing carries the magnetic current to the grid which forms the opposite pole.

The central part of a rotary chuck also presented a difficulty in the shape of a rather large area which was all of one polarity. This condition did not cause trouble so long as large pieces were to be held, but when working upon a large number of small pieces there must necessarily be a large space left vacant at the center. This did not please the advocates of rapid production and various methods of obviating this difficulty were put forward. One of these methods which will be discussed in a later article was the use of an auxiliary top plate, having polepieces extending much nearer the center than the construction of the chuck itself would allow. Such an auxiliary plate was included in this patent.

(Part II to be continued next week.)

Transformation of Krupp Works

Special Correspondence

The German Krupp Works has just published the first after-war annual report. It will be appreciated that it certainly was not an easy task to transform the largest plant for the manufacture of war material the world has ever seen, into a plant, or better into a hundred different departments, for the output of instruments, machines and other appliances of peace. This has now been accomplished, not without great exertions and a considerable loss of capital to the stockholders.

It would fill too many columns to give a full account of all the changes which have been made and we therefore confine our remarks to the following data: Iron and other mines, coal mines and most of the metallurgical works have undergone no changes. The Buckau-Magdeburg establishments, the so-called "Gruson Works," have resumed their old activity and considerably enlarged their plants. The shipbuilding yards at Kiel, the "Germaniawerft," are building and repairing merchant vessels. The Bavarian Gun Factories at Munich, which had been erected during the war, have been sold to the firm of F. Neumeyer, Ltd., at Nurnberg, at a considerable loss. Especially at Essen and at some other places, large machinery plants and other works have undergone great changes and a number of very large buildings had to be torn down and rebuilt. The report points out that these works in particular necessitated the expenditure of large funds.

The Essen works, besides making rails, railway material of every class, locomotives, etc., has added new plants for the manufacture of paper-mill machinery, spinning and weaving machinery, etc. In connection with the Gruson Works at Magdeburg the manufacture of excavating machinery also has been started. In order to develop the sale of all these new enterprises, special arrangements have been made and new sales organizations have been established, the most prominent among them being the Krupp Harvest Machinery Co., of Berlin; the Krupp-Ernemann Kino Apparatus Co., of Dresden; the Krupp Motor Co., of Berlin; the van Eupen Automobile Co., of Essen; and the Krupp Sales Bureau for Small Machinery, of Berlin. Furthermore, the Krupp Works has taken a large financial interest in the "Devon Company" of Rotterdam, in order to facilitate the importation of foreign iron ore. The Krupp Co. has also made arrangements with the Prussian State authorities and the wealthy Duke of Croy for the development of new mineral deposits within the border of the Prussian State.

The large Graphite Works of Passau, in Bavaria, and the Kropfmuhl Graphite Works, Ltd., in both of which the Krupps are largely interested, have been united into one company under the control of the Essen works.

At the end of the year the number of men employed amounted to 92,260 of whom 49,837 were in the Essen works alone. Though the net earnings were 79.5 million marks, no dividend could be paid out. The net earnings during the previous year showed only 11.7 million marks.

The above-mentioned net earnings were divided as follows: 35 millions special reserve funds, 20 millions for new homes, 20 millions for beneficent purposes and the remainder for new account.

Tools for Locomotive Steam Pipe Joints

Making Reamers for Steam-Pipe Work—Saving High-Speed Steel—An Expanding Chuck and a Double Toolpost—Turning a Ball Joint

By FRANK A. STANLEY

THE halftone Fig. 1 illustrates a type of ball joint reamer for steam pipe work on locomotives, while the line drawing Fig. 2 gives details of its construction.

The reamer is made up with a soft steel body and high-speed steel blades which are inserted in milled slots in the body and calked in place. The body is bored out and threaded and a Morse taper shank is threaded at the body end to screw tightly into place. The taper shank is formed with a liberal shoulder which sets up squarely against a faced seat in the body.

The slots are ½ in. wide and are cut at an angle of 55 deg. with the vertical so that the included angle would be 110 deg. The method of cutting the blades from the bars of stock is shown by the detail at the bottom of the drawing. The ends, front and rear, are cut off at 55 deg. angle so that practically no metal is wasted except for the saw kerf and the small corner at the rear end which is milled away in squaring off the heel of the blade.

A 45-deg. reamer with inserted blades of high-speed steel is represented by the line drawing Fig. 3. This

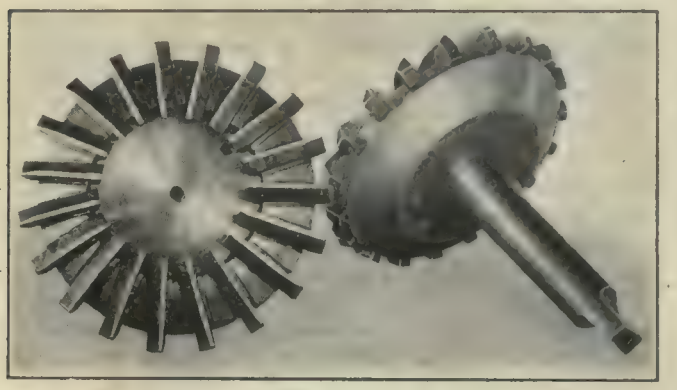


FIG. 1. BALL-JOINT REAMERS

tool is for steam pipe joints and general work. Its blades are of the same section as those used in the radius reamer described above, and shank and body are assembled in a similar manner.

A fixture for grinding radius or spherical reamers of the type illustrated by Figs. 1 and 2 is shown in Fig. 4. This device is made to be used on the table of the grinding machine and consists of a swivelling head carrying a spindle which receives the reamer to be sharpened. The upper swivel plate carries a tooth rest against which the reamer teeth are brought in succession for grinding to radius. The swivelling action of the fixture under the hand of the operator carries the edge of the blade past the wheel in an arc of the required radius and brings all teeth to uniform shape.

One of these reamers is seen in operation on a dry pipe in Fig. 5. The work is done under a radial drilling machine with the pipe supported under tool by means of its flange and the outer end carried upon suitable leveling blocks.

An interesting operation is represented by Fig. 6 which shows the turning of a Mallet universal-joint pipe with the aid of a radius attachment for the lathe.

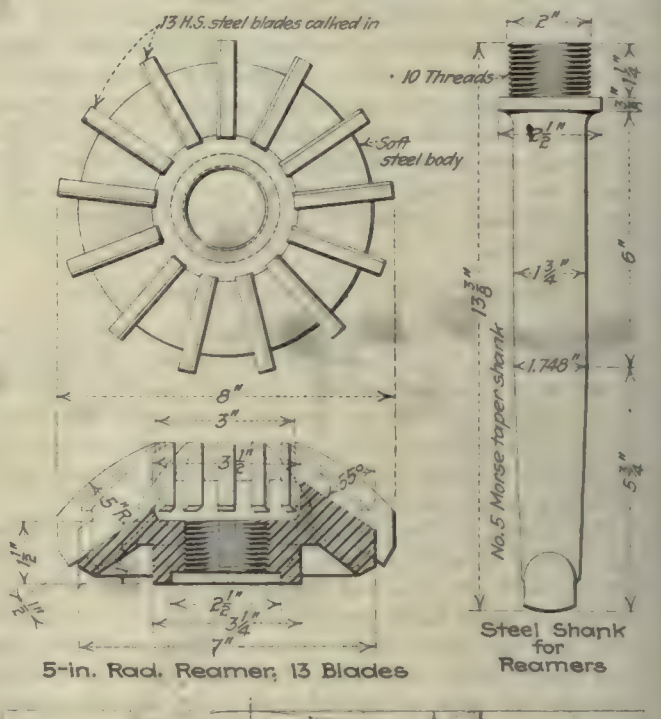


FIG. 2. DETAILS OF BALL-JOINT REAMER

Other special features of interest in connection with the equipment include an expanding form of chuck for carrying the end of the pipe, and a double toolholder, both of which appliances are shown in Fig. 7 representing the rear of the lathe. The chuck and toolholder may be briefly described before further reference is made to the details of the radius attachment.

The chuck is attached to the faceplate of a 42-in. lathe and consists of a flanged cylindrical body in which are three jaws adapted to be expanded radially by means

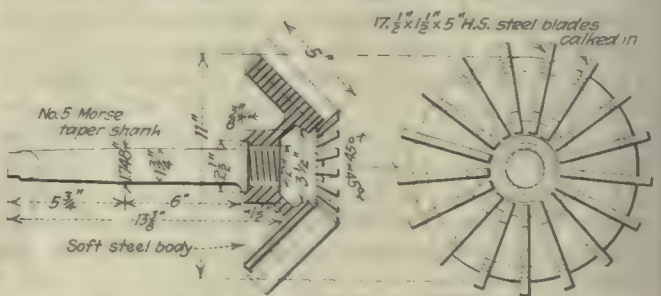


FIG. 3. 45-DEG. REAMER FOR STEAM PIPE JOINTS

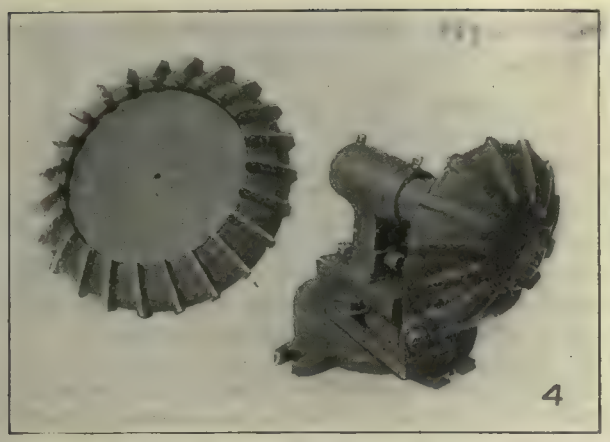


FIG. 4. FIXTURE FOR GRINDING BALL-JOINT REAMER



FIG. 5. REAMING A PIPE FOR A BALL JOINT

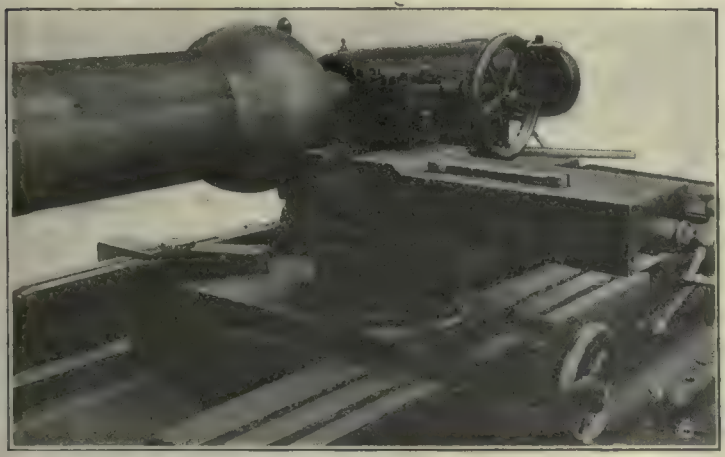


FIG. 6. TURNING A BALL JOINT

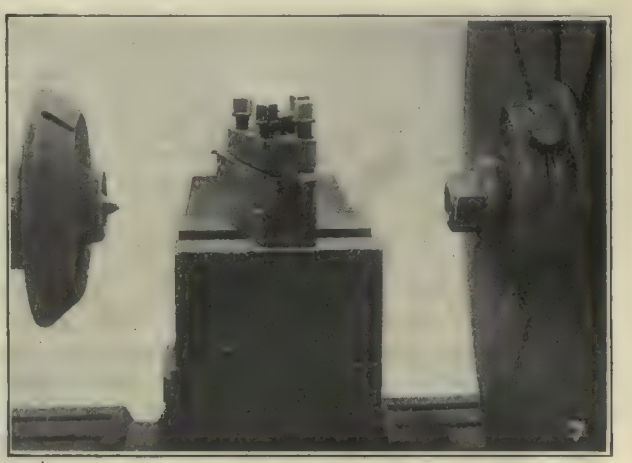


FIG. 7. CHUCK, CENTER AND TOOLHOLDER

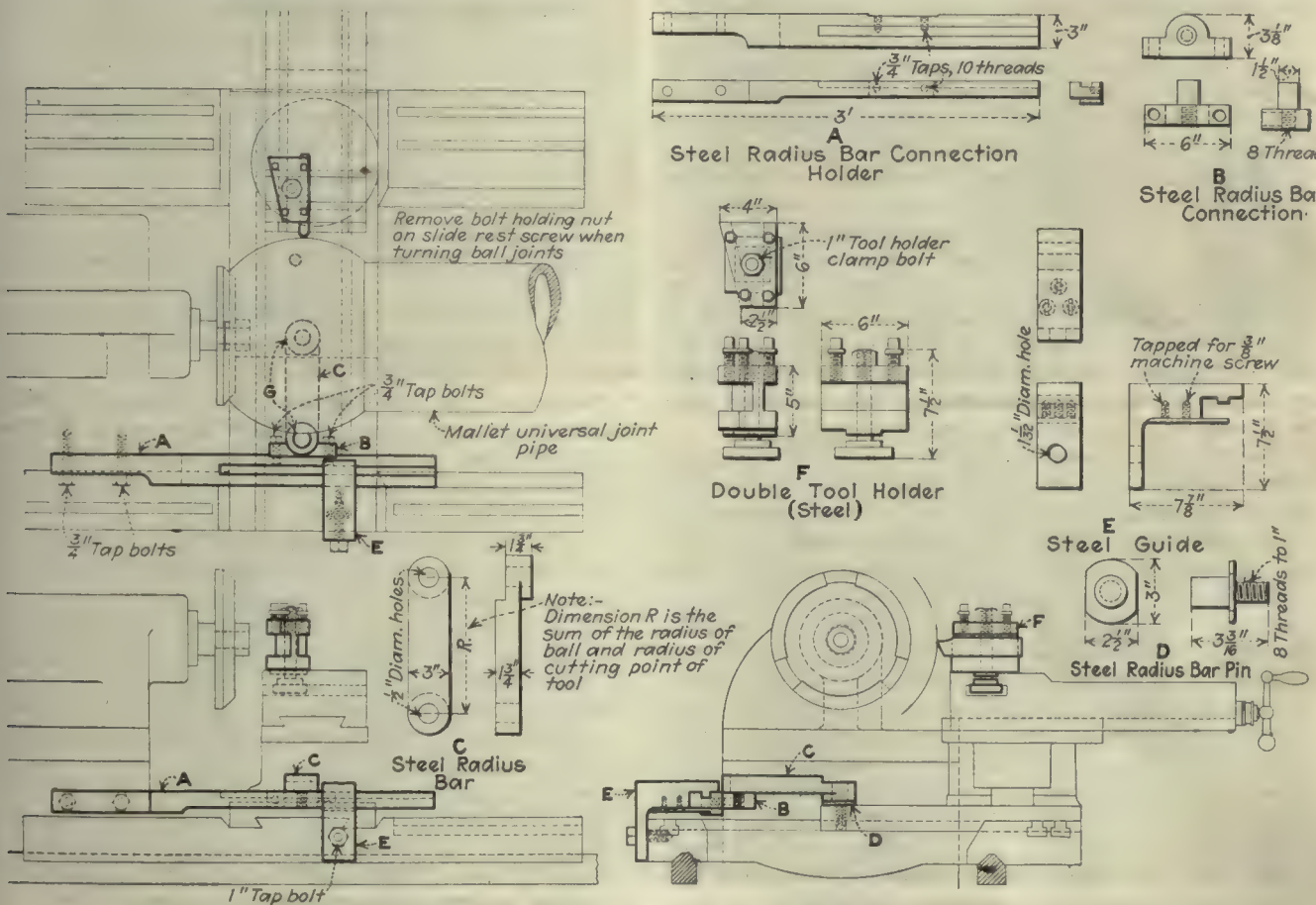


FIG. 8. RADIUS ATTACHMENT FOR TURNING BALL JOINTS

of a cone-shaped center-plug which is operated by a draw-in bolt. The jaws are held in their radial seats in the chuck by a spring-wire ring which passes through holes drilled crosswise in the outer ends of the jaws. This spring also holds the jaws in contact with the expanding plug and when the latter is released the jaws move toward the center and release the work. In operation they expand uniformly and so locate the work centrally by the interior surface.

The end of the pipe to be machined is carried on a large cone mounted upon the tailstock center. This cone is cleared on three different portions of its surface, thus leaving a three-point bearing for the pipe end.

The double toolholder is arranged as seen in Fig. 7. The tool for finishing the ball end of the pipe is shown in the straight slot at the right side of the holder or the side nearest the faceplate. The other side of the holder is machined at an angle so that the tool carried therein may be adjusted laterally by simply moving it in or out in its slot. The toolholder is shown in detail with all parts of the radius attachment in Fig. 8.

The principal parts of this attachment are the radius-bar connection holder *A*, the radius-bar connection *B*, the radius bar *C*, the radius-bar pin *D*, and the guide *E*. The double toolholder will be seen in three views at *F*. All parts are of steel as marked on the drawing.

The radius-bar connection holder *A* is attached to the rear of the tailstock base by two ¾-in. bolts and projects out over the rear of the carriage where it is engaged by the guide *E* which is bolted to the carriage by a 1-in. tap bolt. The connection holder is 3 in. wide by 1½ in. thick and it is provided with a ¾ x ½-in. groove which fits a tongue on the upper arm of the guide. Thus as the carriage is moved along either to right or left, the connection holder is firmly supported and cannot be sprung out of line by the action of the radius bar in operating the toolslide upon the carriage. The supporting gib under the opening in the guide *E* is shown by the drawing and the method of attaching the radius bar will be seen in the assembly views.

The radius bar connection *B* is secured to the holder *A* by two ¾-in. tap bolts and carries a shoulder stud which is screwed into a 1-in. tapped hole. The 1½-in. body of the stud enters the rear hole in the radius bar, while the front end of the radius bar is bored to fit over the similar sized body of the bar pin *D* which is tapped into the cross-slide on the carriage. The nut for the regular slide-rest screw is, of course, released by removing its holding screw so that the slide may be free to move under the action of the radius bar.

The plan view shows the work set up with the round ended turning tool exactly along the center line of the radius bar when the latter is at right angles to the lathe center or in its fully extended position. When the carriage is fed along the work the rear end of the radius bar pivots about pin *G* in connection *B* and the front of the radius bar must then draw the toolslide and tool toward the work. The feeding motion of the carriage must therefore produce a movement of the cutting edge of the turning tool in the path of a circle and bring the end of the pipe to a spherical form. The radius bar, it should be noted, is made with a distance between centers *R* equal to the sum of the radius of the ball end to be turned and the radius of the cutting point of the tool.

The tools described were made and are used by the Sacramento shops of the Southern Pacific Co.

Don't Be Too Busy—Systems That Clog Business Are Worse than None at All

By John R. Godfrey

There are different brands of efficiency bugs—just as with other things. Some few are as near 100 per cent as mortal man can hope for. But most of them just play around as naggers and fault-finders.

I ran across a new brand the other day however—the queerest combination of them all—an efficiency expert who is so busy he never gets anything done.

He's developed a new device which has merit—and he's got an ample supply of real brains into the bargain. But he's got them sidetracked by an obsession that he's the busiest man in the world. The one-armed paperhanger with the hives has nothing on him.

He pointed with pride to two fat folders, full to running over with unanswered letters. Some of them ran back for six months and he just hadn't been able to take time to answer any of them. If I couldn't have answered half of them in the time he wasted on me, I'd eat my shirt—and I'm shy on shirts, too, this winter. And you see efficiency mottoes all over the place. "Make every minute count"—"Put not off till tomorrow"—"Plan your work"—etc., etc. He kept two salesmen parked outside the rail while he spoiled a perfectly good afternoon for me.

And then I ran into one of his systems as she is in action. I wanted some special lamp sockets for a hurry job. So I 'phoned the factory, got the price and was told I'd get a delivery date the next day. And here the alleged system began to get in its fine work.

Days passed, so I called up the factory—long distance toll each time. Was greeted with a sadly surprised voice—"Haven't you got that information yet We told the city office to let you know at once. We'll 'phone them immediately."

Two days more passed and not a peep out of the city office, so I called them up myself. For a wonder the chap at the other end knew something about the inquiry.

"When can I get delivery on those lamps?"

"Can't tell you over the 'phone. I'll send a salesman to see you.'

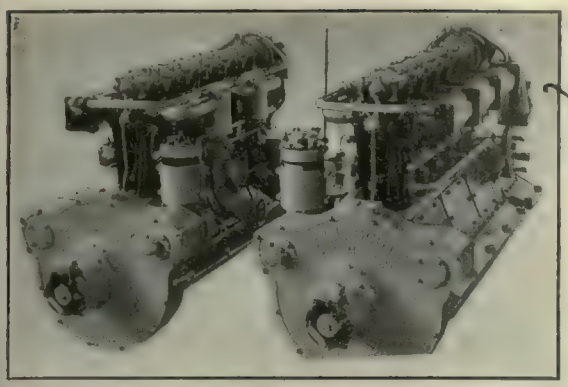
"Send your salesman where he can do some good. I don't need him. I know exactly what I want. I know the price. All I want is a delivery date. You know that as well as the salesman. Why not tell me now and save time? I've waited two weeks now."

"Sorry sir, but our system says a salesman must handle all such matters. We can't bust up the system, you know, sir. It cost a bunch of money, you know, and, by heck, we've got to use it! I'll send the salesman right away, sir."

That was a week ago, and he hasn't shown up yet. In the meantime I've placed the order where there was less system and more pep—and the sockets came today.

We've got to have systems—but we don't want the wrong kind. Many of them are simply ways and means of telling you what you ought to have done last week. They are sort of postmortems on our mistakes without the redeeming features of preventing the same mistake occurring again.

Don't get the bug of being too busy to get anything done. And don't tie up to a system that clogs the getting of orders and the delivery of goods. For orders are not overly plentiful just now and customers need nursing if we want to keep the wheels turning.



BUILDING MOTORS ON THE PACIFIC COAST

By Fred H. Colvin
EDITOR-AMERICAN MACHINIST

V. Construction and Arrangement of the Shop — Inspection of Crankshafts, Camshafts and Cylinders—Assembly and Tests of the Motors

THE unusual amount of daylight illumination in the Hall-Scott shop has been previously referred to and is still further shown in Figs. 85 and 86. These views also show something of the toolroom equipment as well as of the arrangement of the toolmaker's benches in Fig. 85. Instead of being parallel with the windows, the benches are at right angles to them which has some advantages, both as to light and in making it easily possible to give each toolmaker who requires bench space, an individual work bench where he can keep his tool kit and also have the privacy which is necessary on some work. The use of wire screens for separating departments is clearly shown.

The inspection bench for crankshafts is shown in Fig. 87 and can be studied in considerable detail, beginning with the substantial faceplate *A* in box form which acts as a surface plate. The crankshaft is placed on the blocks *B* and *C* so that it can be easily turned in order that main bearings can be readily tested by means of the Ames indicator *D*. Turning the crankshaft into different positions will indicate if the shaft is sprung and how much.

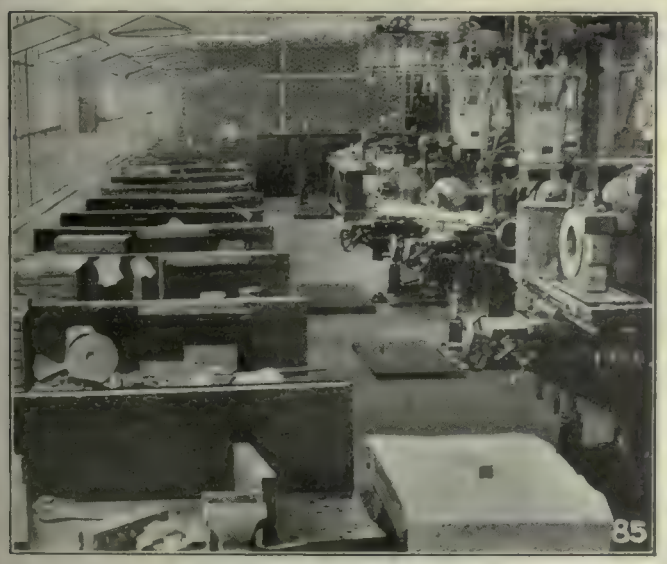


FIG. 85. TOOLROOM BENCHES AND LIGHTING

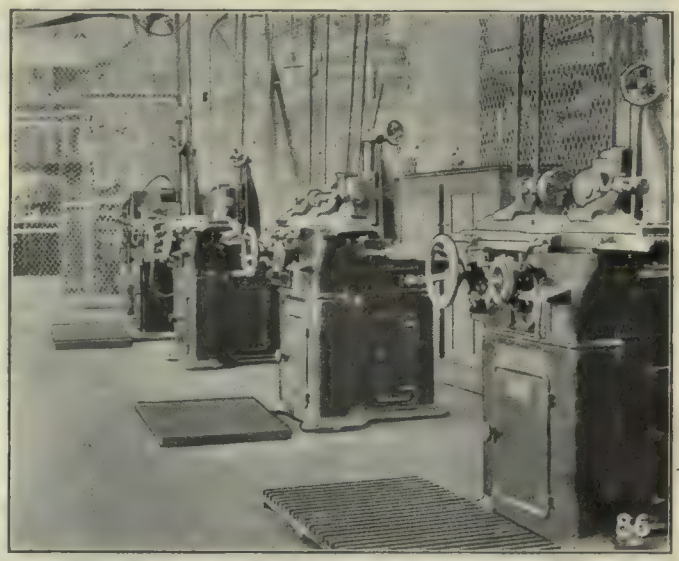


FIG. 86. A GROUP OF GRINDING MACHINES

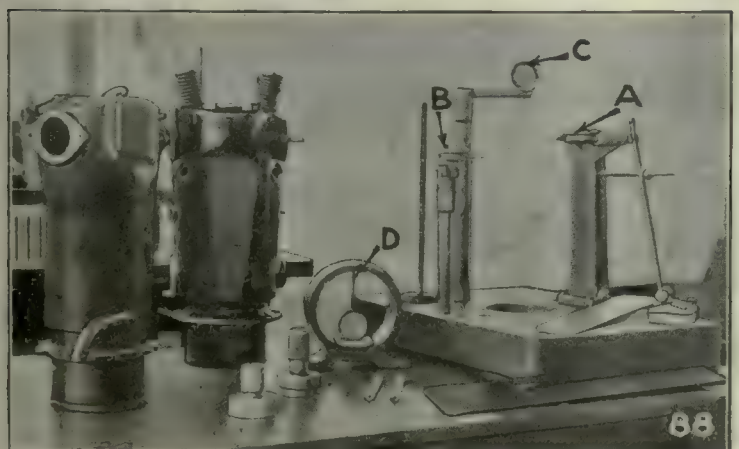


FIG. 88. GAGING FIXTURE FOR CYLINDERS

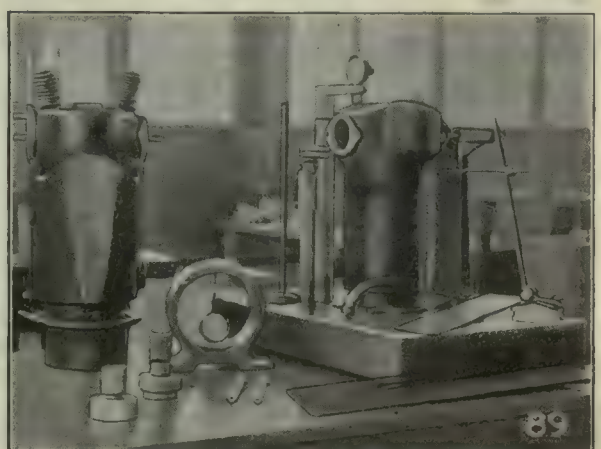


FIG. 89. INSPECTING MARINE AND AVIATION CYLINDERS



FIG. 87. TESTING A CRANKSHAFT

Various length gages are shown at *E*, *F* and *G*, each being used in checking different dimensions. These gages test the location of the various cranks with relation to each other and to the end of the shaft. The outside diameter of the shaft, the main bearings and the various crankpins are tested by the snap gage *H* and the micrometers shown at *I*.

The gaging fixtures for the cylinders are shown in Figs. 88 and 89. The first shows the inspection block empty and the second with an aviation cylinder in

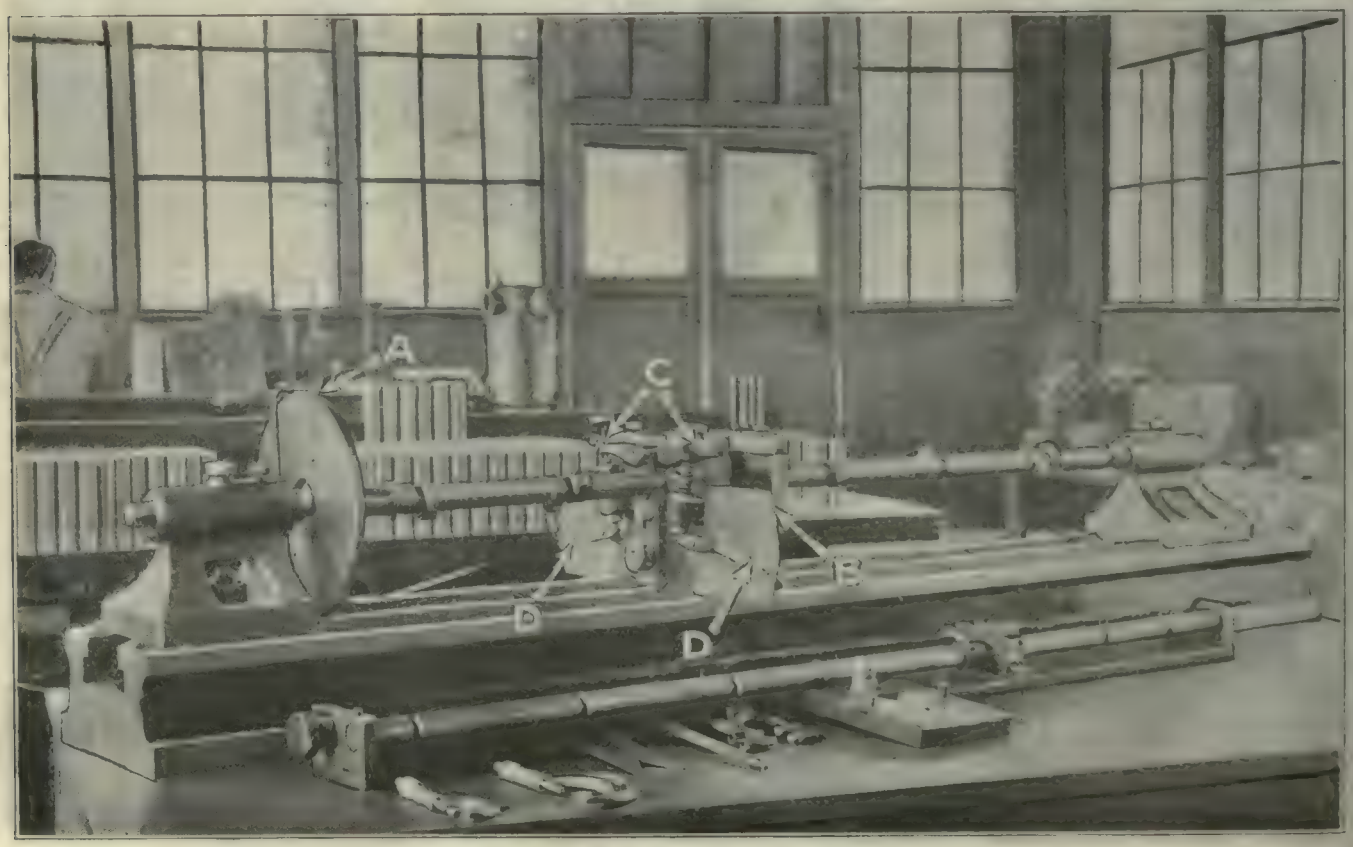


FIG. 90. INSPECTING THE CAMSHAFT

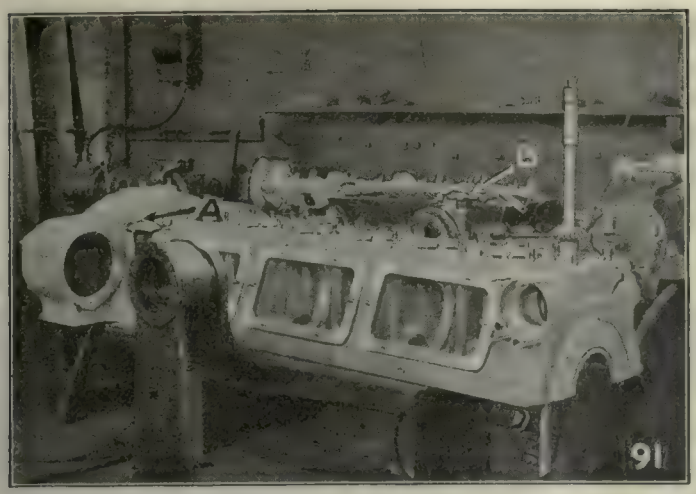


FIG. 91. THE ASSEMBLING STAND

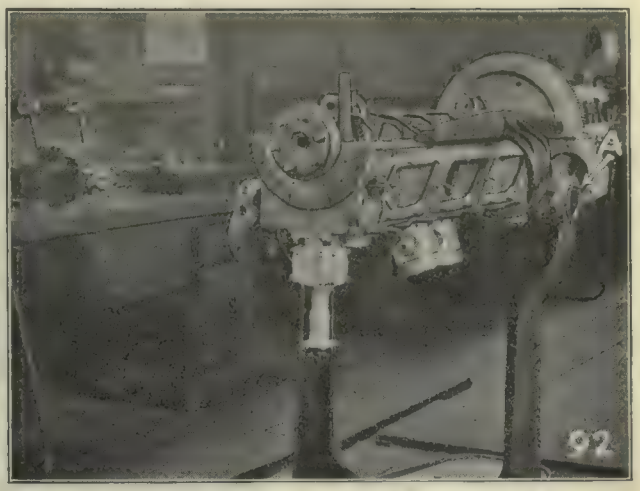


FIG. 92. THE ASSEMBLY UNDER WAY

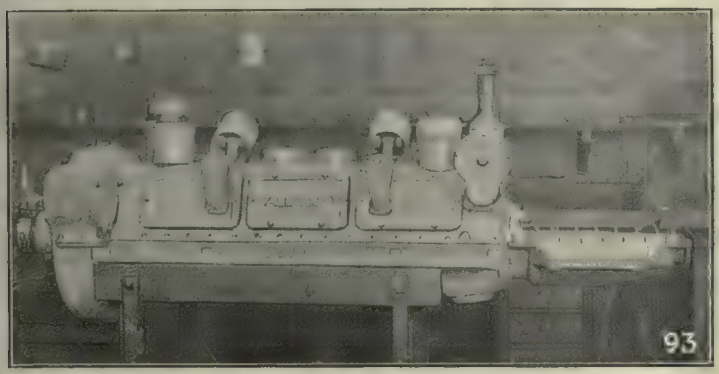


FIG. 93. READY FOR THE CYLINDERS



FIG. 94. A LOT OF MARINE MOTOR-BASES

place. It will be noted that the block or base has a hole for the projection of the cylinder which centers it and also allows it to rest on the bolt flange. The two pins in the uprights *A*, Fig 88, locate the holes in the flange while the dial indicator *B* measures the space of the opposite flange. The height of the pad for the camshaft housing is shown by the indicator *C*, the gage for testing the cylinder bore is shown at *D*, together with the standard ring by which it is set. Gages of other kinds are also shown in both illustrations.

The machine for testing the camshaft is shown in Fig. 90. As with the crankshaft the camshaft is mounted on a substantial cast-iron base which acts as a surface plate and on this is mounted the bed and the two centers on which the camshaft is revolved for testing. The disk *A* is suitably graduated so that by carefully noting its position, it is an easy matter to watch the valve openings at all points and to thoroughly test the accuracy of the cams themselves. The indicating fixture *B*, in the center is moved along the bed so as to test each pair of cams.

Rocker arms which duplicate the rocker in the motor itself, form part of this indicator, the ends which actuate the valve stems being shown at *C*. The valve

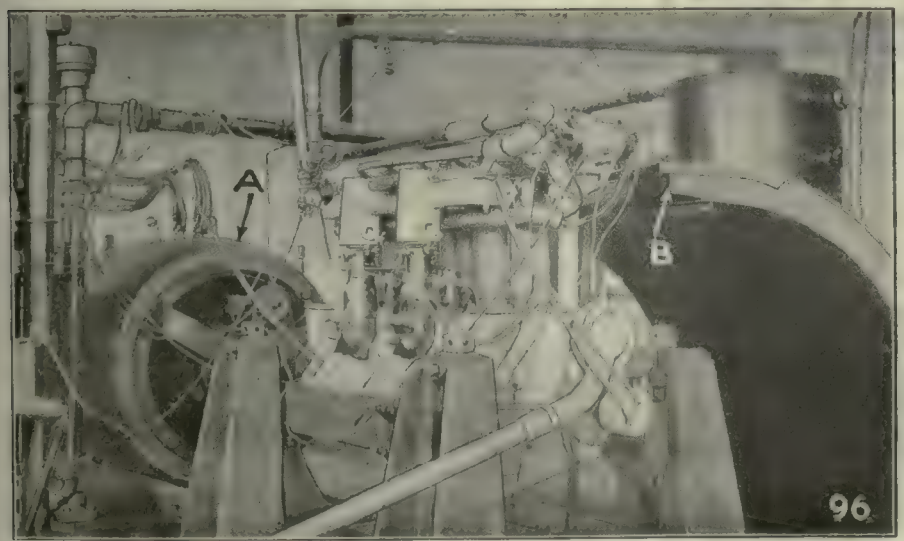


FIG. 96. A DYNAMOMETER TEST

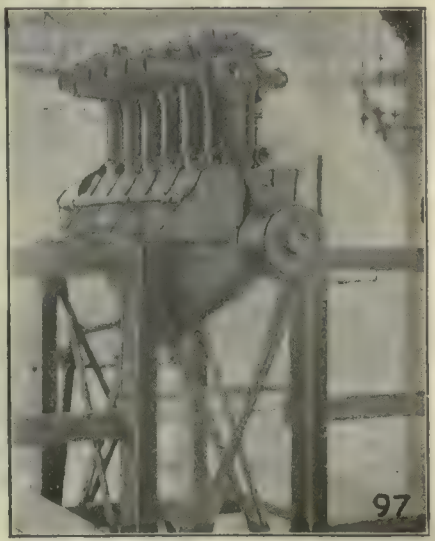


FIG. 97. TESTING WITH THE PROPELLER

stems bear on the inner end of the multiplying levers *D* which show the opening of the valve on a large scale.

After the inspection of parts comes the assembling, Fig. 91 showing a marine motor-base mounted in a trunnion assembling fixture which allows it to be swung into any desired position in order to get at various parts of the case or the parts which go in, or on, it. The trunnions are of substantial size and the bearings are split on one side so as to be easily clamped by means of the hand screws *A* and *B*.

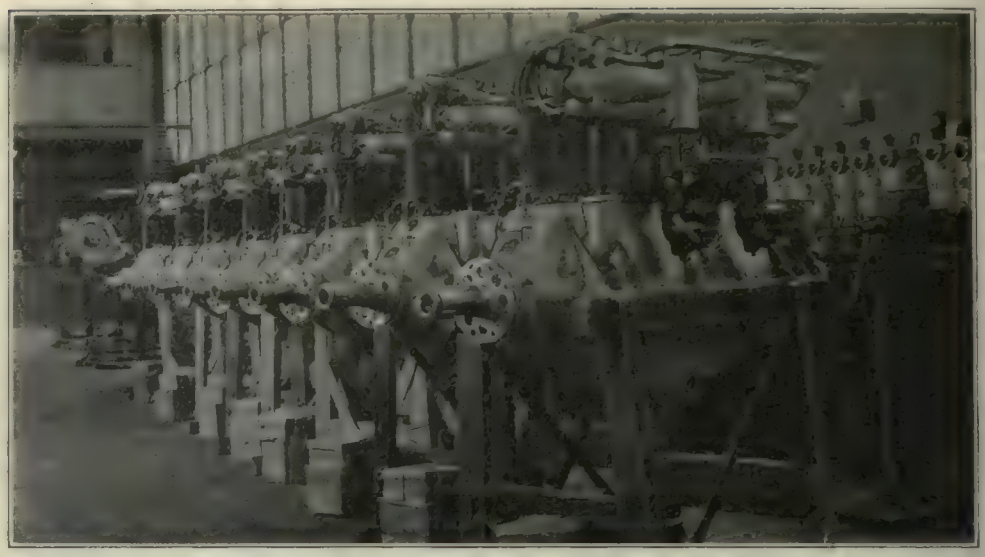


FIG. 95. AVIATION ENGINES AWAITING TEST

In Fig. 92 the assembly has progressed considerably and it will also be noted that this stand has a different clamping arrangement as at *A*. Fig. 93 shows the assembly ready for the cylinders and the reversing-gear which goes in the case at the right.

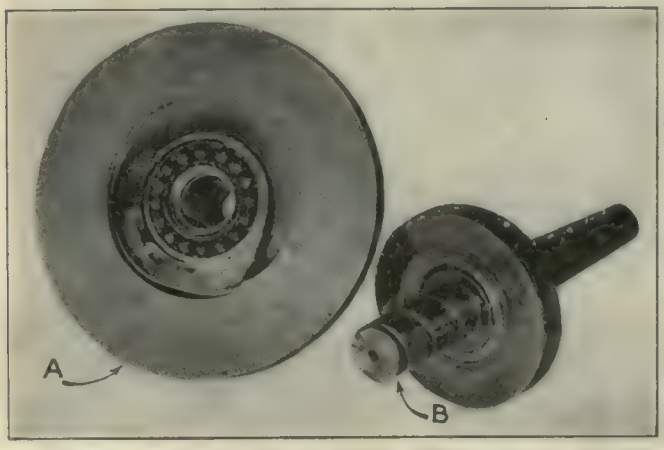
The row of engine bases shown in Fig. 94 gives an idea of the way in which the bases go through the assembling department. Another indication of the way in which the motors are built, can be seen in Fig. 95 where a lot of aviation motors are waiting test. One of the test stands is shown in Fig. 96, the motor load being supplied by the large dynamometer at *A*. It will be further noted that the exhaust hood *B* is shaped especially to receive the exhaust from the motor so as to keep the air of the testing room as pure as possible. An exhaust fan in connection with this hood keeps practically all of the products of combustion out of the testing room.

Fig. 97 shows one of the motors on the test stand with a propeller. The lack of vibration in the motor is shown by the sharp outlines of the motor which is in motion, while nothing can be seen of the propeller except the hub.

A Ball Bearing Pipe Center

SPECIAL CORRESPONDENCE

In the locomotive shops of the Chicago & Alton Railroad Co., at Bloomington, the pipe center shown in the illustration has been made. This is somewhat different from those usually found in that it possesses a ball-thrust bearing to take up the end thrust from the pipe. It should be understood that the opposite side of the head from that appearing at *A* is conical in form so that it slips inside and centers one end of the pipe.



DISASSEMBLED VIEW OF BALL BEARING PIPE CENTER

The part *B* was turned from a single forging and its ball race and bearing spindle were carefully case-hardened. Spiral oil-grooves are provided on the spindle. The head was turned from a gray-iron casting and the ball cup race pressed in place. The maximum size of pipe that this center will take is 6 inches.

Some Standards of the Last Century

BY L. L. THWING

Now that the matters of low costs and extreme accuracy are holding the attention of production managers, let us consider how our predecessors looked at these problems, and how well they were satisfied with their efforts. In the proceedings of the Society of Arts 1825 (England), Mr. Clements in reporting on the efficiency of planers says: "Results which satisfy all ordinary requirements cost 1 penny per square foot with a variation of less than 0.01 in. in 10 in." This is reported with evident satisfaction. The cost would be highly so, even today.

James Watts in 1879, in building his first engine, was forced to be contented with a cylinder 18 in. in diameter with a variation of $\frac{1}{8}$ in., and he packed the piston with paper, putty, pasteboard, and even an old hat. After developing his processes somewhat he writes to his partner, Mr. Bolton, saying: "The completion of the cylinder with the new boring bar is most satisfactory, the piston fitting so well that there was scarcely room for inserting a half-crown piece at the worst part."

Henry Maudsley who is generally credited with the invention of the slide-rest was hired by the English mechanic Joseph Bramah at the age of nineteen. After working for several years his pay was increased to 7½ pence a week (which probably included his board), but upon Maudsley's demand for a further increase he was refused so curtly that he left Bramah's employ.

The *American Machinist* for June 28, 1879, gives a list of about seventy machine-tool builders, with the current wage for machinists in their employ. This averaged 15 to 20c. an hour for skilled workmen, and was mentioned as 10 per cent higher than in 1863.

Taxes and Business Depression

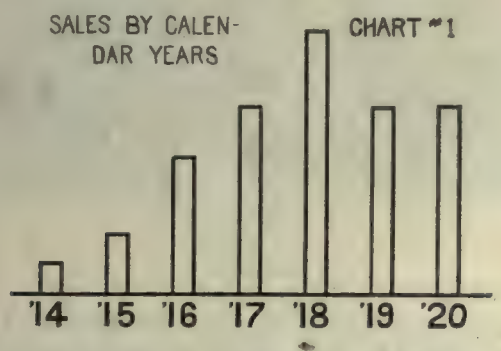
Increased Sales Do Not Yield Correspondingly Increased Profit—Excess Profits Tax Keeps the Cost of Living High—Revised Method of Taxation Is Necessary

By A. W. MARKLEY

AT THE present time we hear much discussion and complaint concerning the Federal income, excess profits and war profits taxes. A noteworthy example of this rather widespread dissatisfaction was the recent petition of a large group of business men, representives of all lines of industry, to the Federal government requesting that the December payment of taxes be deferred to a later date. It was thought by this group that such a procedure would ease somewhat the already strained financial resources of the country. That this movement did not succeed because of the pressure of government debts in no way lessens the necessity for a revised method of taxation.

Some interesting sidelights on this situation may be obtained from the following charts and figures reproduced from the actual records of a company engaged in producing a staple line for machinery manufacturers. Their case is perhaps typical and this discussion may help to clarify the issue and portray the need for an improved method of industrial taxation.

Let us begin with chart No. 1.



This chart shows a comparison of sales in dollars over the seven years from 1914 to 1920 inclusive. There is a steady rise from 1914 through 1918. Sales in 1919 and 1920 are practically equal to 1917 sales. This fact should be borne in mind.

Having portrayed the sales conditions the next step is to show the results in the way of earnings. Chart No. 2 shows the gross earnings of this typical company over the period of years from 1914 to 1920 inclusive. Charts 1 and 2 are *not* drawn to the same scale, but chart 2 may be compared to chart 1 to very good purpose. The difference between the two charts that may be noted is that the large increase in sales in 1918 over 1917 and 1919 did not yield correspondingly great profits. The sales column for 1918 is nearly half again as tall as that for 1917 or 1919 but earnings were not in proportion. The explanation undoubtedly lies in the facts that many inexperienced men were taken on at that time and that these men were unable to produce as effectively as the experienced men. The dotted lines depict the difference between the actual earnings and what would have been a proportionate increase in earnings, the volume of business being taken into account. This shows how important labor efficiency is in a factory.

Another point that strikes the eye upon comparing these charts is the marked decline in earnings of 1920 as compared with 1919. As was mentioned before the volume of sales for the two years was approximately equal. This decline in earnings is due to two things: (1) the increased cost of materials and supplies such as fuel, oil power, etc.; (2) to the increased cost of labor. The latter item is the great factor and this cost alone rose 25 per cent.

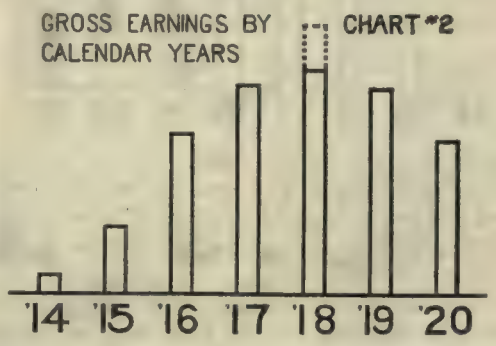
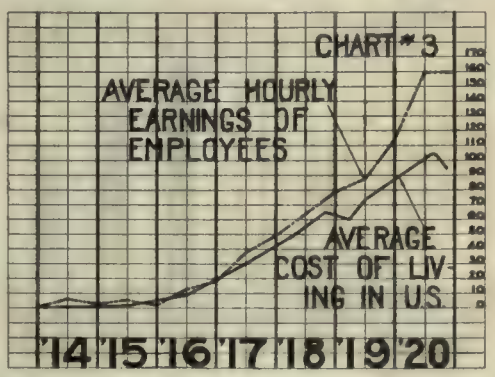


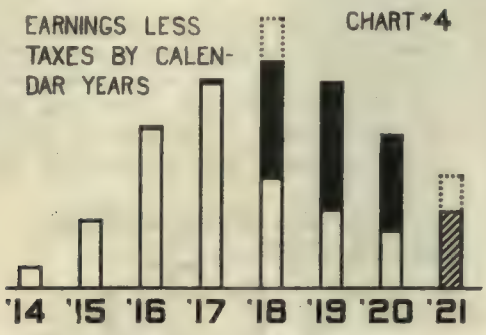
Chart No. 3 shows the steady and typical rise of wages and the way wages kept ahead of the average cost of living.

Chart No. 4 brings us to our subject matter, namely, the effect on earnings of Federal income, excess profit and war profit taxes. In this chart the total heights of the columns represent the gross earnings in each year from 1914 to 1920 while the blackened area represents the proportion that was paid to the government in taxes. The white part shows the net earnings of this company in each year.

The taxes from 1914 to 1917 inclusive were so small that the blackened area is scarcely visible. In October, 1917, the first war tax bill passed Congress; the first payment fell due in June, 1918, and a heavier one in December. As may be seen, half the earnings of this typical company went to the government and in 1919 two-thirds of this company's gross earnings were paid out as taxes. For in February, 1919, the second war tax bill was passed, increasing the taxes for 1919 but reducing them slightly for 1920. As may be seen, however, two-thirds of the earnings again went to the government in 1920.



Taxes are paid each year on the gross earnings of the *previous* year. The last or right-hand column of chart 4 shows the taxes which have already accrued against the 1920 income of this company and which must be paid in 1921. The dotted portion at the top represents additional taxes which are in dispute. It may be easily seen that the tax accrued for payment

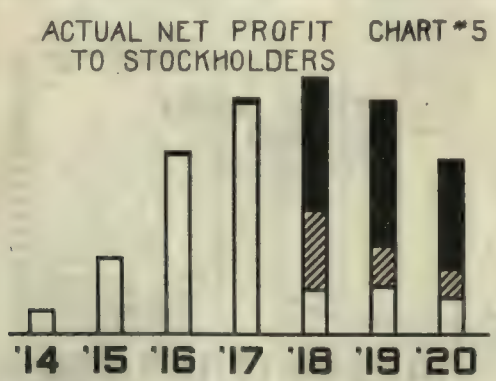


in 1921 is actually larger than the net income for 1920. The same thing was true in the two preceding years—the taxes to be paid in each of these years were actually larger than the entire net income of the preceding year.

It is for this reason that the excess profits tax tends so powerfully to keep up the high cost of living—for every business man knows that he must keep up his profits or the following year will show a heavy loss.

Even if the excess profits tax should be repealed by the present Congress the effects would not be felt until 1922, for with the present business depression taxes for 1921 will more than wipe out the profits of this year in this typical case. The war taxes have not only taken two-thirds of this company's earnings, but they have also borne very heavily on individual stockholders as well. Chart 5 depicts this condition. In this chart the columns represent the gross earnings of the company each year from 1914 to 1920 inclusive. The black portions of the columns represent the amounts paid out *by the company* in war taxes. The shaded portions represent the amounts paid out *by the larger stockholders* as personal taxes.

In other words, the small white portion of the columns show the slight return received by the larger stockholders on their investment. To put this in figures, only one-sixth of the gross earnings of this company in the years 1918, 1919 and 1920 can be listed



as net for the stockholders. In the case of this company, and we believe that this is not an unusual example, very close to five-sixths of the entire earnings have gone to the government either as taxes on the company itself or as taxes paid by individual stockholders. That this condition cannot and should not continue is self-evident. Capital must be assured of an adequate return or business cannot progress.

As was pointed out before, even if the present Congress should see fit to reduce the burden of taxation the results would not be felt until 1922. But it is far better to look forward to relief in the ensuing year than to continue the present policy indefinitely. As both political parties pledged themselves in the last election to a prompt repeal of the excess profits tax, and as President Wilson and Secretary of the Treasury join in recommending it, we feel that the end is in sight. And this end will be gained the more quickly provided labor and capital join in the fight on excessive taxes, one of the great contributing causes not only to the high cost of living but also to our present business depression.

An Unusual Welding Job

The first and last stages of an interesting and unusual application of welding are illustrated herewith; the work being performed by the welding shop of the Oxweld Acetylene Co. at its Newark plant for the Watson-Stillman Co., which has a contract to furnish steam-heated brass platens for the curing of phonograph records.

After trying a number of ways of making the neces-



THE FIRST AND LAST STAGES OF AN UNUSUAL WELDING JOB

sary steam passages in castings by the use of cores, it became evident that satisfactory castings could not be produced by this method, and accordingly, a new line of procedure was undertaken.

In a solid rolled-brass plate (1½ in. thick by 14 in. square) concentric grooves were turned to a depth sufficient to give the necessary steam capacity. The whole working face of the plate (12-in. diameter) was also cut away to a depth of ⅜ in. except for a central boss, to accommodate a cover plate which was to be welded to the central boss and to the outer circumference of the undercut. This central boss and the outer circumference of the undercut were chamfered in the manner usual for preparing an edge to edge weld. The edges of the cover plate were bevelled in the same manner, leaving the usual trough for welding.

A specially prepared clamping jig was affixed to the work to prevent warping; the entire job was preheated and the welding done in the usual way. The job was allowed to cool slowly in the fire, and as a result of this annealing all contraction strains were satisfactorily eliminated.

The final operation was performed by facing off the plate in a lathe, and the work was so well done that it was barely possible to discover the joints. The plates were easily made and have given complete satisfaction in service.

Formulas for the Solution of Right and Oblique Spherical Triangles

By W. G. HOLMES

THE following definitions and rules are fundamental in spherical trigonometry:

I. Spherical trigonometry treats of the relations of the six elements of a spherical triangle, namely the three sides and the three angles.

II. The relations between the sides and angles of a spherical triangle are independent of the length of the radius of the sphere.

III. The sides of a spherical triangle are arcs and are expressed in degrees.

IV. The length of a side of a spherical triangle, being an arc, is found by the equation: length of arc $=$ $\frac{\text{Circumference of great circle} \times \text{degrees in arc}}{360 \text{ deg.}}$.

V. The side of a spherical triangle may have any value from 0 to 360 deg. But in calculating values of parts of a triangle, the triangle whose sides are less than 180 deg. is the triangle used.

VI. To find the trignometric functions of angles between 90 and 180 deg.:

$\sin (180° - x) = \sin x$. $\operatorname{cosec} (180° - x) = \operatorname{cosec} x$

$\cos (180° - x) = -\cos x$. $\sec (180° - x) = -\sec x$

$\tan (180° - x) = -\tan x$ $\cot (180° - x) = -\cot x$

Examples: $\sin 130° = 180° - 130° = \sin 50°$

$\cos 130° = 180° - 130° = -\cos 50°$

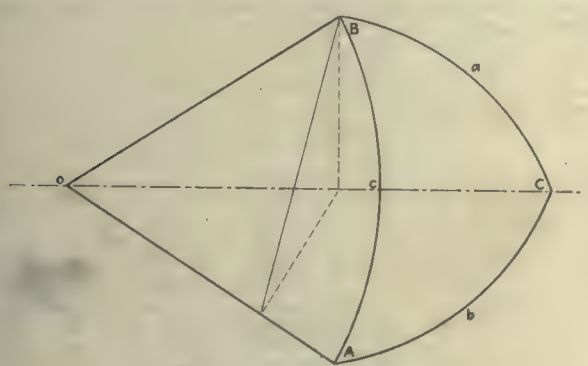


FIG. 1. RIGHT SPHERICAL TRIANGLE

The Solution of Right Angle Spherical Triangles

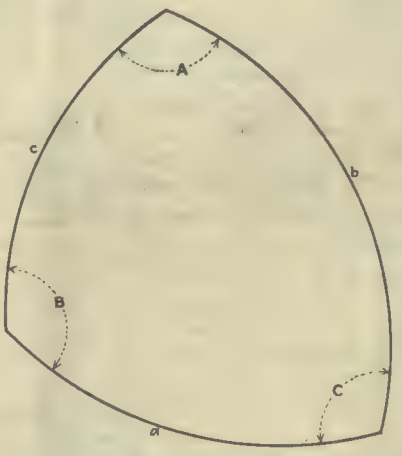


FIG. 2.
OBLIQUE SPHERICAL TRIANGLE

Referring to Fig. 1,

Let O = the center of circle; A, B, C = the angles of the spherical triangle; $C = 90$ deg.; a, b, c = the sides of the spherical triangle, side a opposite angle A, side b opposite angle B and side c opposite angle C. All angles and sides are expressed in degrees. Table I gives the formulas for finding the value of any one element in terms of any two other given elements.

TABLE I. FORMULAS FOR SOLVING RIGHT SPHERICAL TRIANGLES

Given	To Find				
	A	B	a	b	c
a A		$\sin B = \frac{\cos A}{\cos a}$		$\sin b = \tan a \cot A$	$\sin c = \frac{\sin a}{\sin A}$
a B	$\cos A = \cos a \sin B$			$\tan b = \sin a \tan B$	$\cot c = \cot a \cos B$
a b	$\cot A = \cot a \sin b$	$\cot B = \sin a \cot b$			$\cos c = \cos a \cos b$
a c	$\sin A = \frac{\sin a}{\sin c}$	$\cos B = \tan a \cot c$		$\cos b = \frac{\cos c}{\cos a}$	
b A		$\cos B = \cos b \sin A$	$\tan a = \sin b \tan A$		$\cot c = \cos A \cot b$
b B	$\sin A = \frac{\cos B}{\cos b}$		$\sin a = \tan b \cot B$		$\sin c = \frac{\sin b}{\sin B}$
b c	$\cos A = \tan b \cot c$	$\sin B = \frac{\sin b}{\sin c}$	$\cos a = \frac{\cos c}{\cos b}$		
c A		$\cot B = \cos c \tan A$	$\sin a = \sin c \sin A$	$\tan b = \tan c \cos A$	
c B	$\cot A = \cos c \tan B$		$\tan a = \cos B \tan c$	$\sin b = \sin c \sin B$	
A B			$\cos a = \frac{\cos A}{\sin B}$	$\cos b = \frac{\cos B}{\sin A}$	$\cos c = \cot A \cot B$

TABLE II. DIRECTIONS FOR SOLVING OBLIQUE SPHERICAL TRIANGLES

Given	To Find					
	A	B	C	a	b	c
a b A		$\sin B = \frac{\sin b \sin A}{\sin a}$	Find B, then $\tan \frac{1}{2} C$ = (13)			Find B, then $\tan \frac{1}{2} c$ = (16)
a b B	$\sin A = \frac{\sin a \sin B}{\sin b}$		Find A, then $\tan \frac{1}{2} C$ = (13)			Find A, then $\tan \frac{1}{2} c$ = (16)
a b C	Use both formulas and solve for A: (7); (10)	Use both formulas and solve for B: (7); (10)				Find A and B, then $\tan \frac{1}{2} c$ = (16)
a c A		Find C, then $\tan \frac{1}{2} B$ = (15)	$\sin C = \frac{\sin c \sin A}{\sin a}$		Find C, then $\tan \frac{1}{2} b$ = (18)	
a c B	Use both formulas and solve for A: (9); (12)		Use both formulas and solve for C: (9); (12)		Find A and C; then $\tan \frac{1}{2} b$ = (18)	
a c C	$\sin A = \frac{\sin a \sin C}{\sin C}$	Find A, then $\tan \frac{1}{2} B$ = (15)			Find A, then $\tan \frac{1}{2} b$ = (18)	
b c A		Use both formulas and solve for B: (8); (11)	Use both formulas and solve for C: (8); (11)	Find B and C; then $\tan \frac{1}{2} a$ = (17)		
b c B	Find C, then $\tan \frac{1}{2} A$ = (14)		$\sin C = \frac{\sin c \sin B}{\sin b}$	Find C, then $\tan \frac{1}{2} a$ = (17)		
b c C	Find B, then $\tan \frac{1}{2} A$ = (14)	$\sin B = \frac{\sin b \sin C}{\sin c}$		Find B, then $\tan \frac{1}{2} a$ = (17)		
a A B			Find b, then $\tan \frac{1}{2} C$ = (13)		$\sin b = \frac{\sin a \sin B}{\sin A}$	Find b, then $\tan \frac{1}{2} c$ = (16)
a B C	Find b and c; then $\tan \frac{1}{2} A$ = (14)				Use both formulas and solve for b: (2); (5)	Use both formulas and solve for c: (2); (5)
a A C		Find C, then $\tan \frac{1}{2} P$ = (15)			Find c, then $\tan \frac{1}{2} t$ = (18)	$\sin c = \frac{\sin a \sin C}{\sin A}$
b A B			Find a, then $\tan \frac{1}{2} C$ = (13)	$\sin a = \frac{\sin A \sin b}{\sin B}$		Find a, then $\tan \frac{1}{2} c$ = (16)
b A C		Find a and c; then $\tan \frac{1}{2} B$ = (15)		Use both formulas and solve for a: (3); (6)		Use both formulas and solve for c: (3); (6)
b B C	Find c, then $\tan \frac{1}{2} A$ = (14)			Find c, then $\tan \frac{1}{2} c$ = (17)		$\sin c = \frac{\sin b \sin C}{\sin B}$
c A B			Find a and b; then $\tan \frac{1}{2} C$ = (13)	Use both formulas and solve for a: (1); (4)	Use both formulas and solve for b: (1); (4)	
c A C		Find a, then $\tan \frac{1}{2} B$ = (15)		$\sin a = \frac{\sin c \sin A}{\sin C}$	Find a, then $\tan \frac{1}{2} b$ = (18)	
c B C	Find b, then $\tan \frac{1}{2} A$ = (14)			Find b, then $\tan \frac{1}{2} a$ = (17)	$\sin b = \frac{\sin c \sin B}{\sin C}$	
a b c	Use formulas in order given: (19); (20); (21)	Use formulas in order given: (19); (20); (22)	Use formulas in order given: (19); (20); (23)			
A B C				Use formulas in order given: (24); (25); (26)	Use formulas in order given: (24); (25); (27)	Use formulas in order given: (24); (25); (28)

The Solution of Oblique Spherical Triangles

Referring to Fig. 2: Let A, B and C be the angles of the oblique spherical triangle. Let a, b and c be the sides of the same triangle, a being opposite A, etc. All sides and angles are given in degrees.

The following formulas which are numbered, are to be used in solving oblique spherical triangles. The numbers of the formulas correspond to the numbers in Table II.

(1) $$\tan \tfrac{1}{2}(a-b) = \frac{\sin \tfrac{1}{2}(A-B)}{\sin \tfrac{1}{2}(A+B)} \tan \tfrac{1}{2} c$$

(2) $$\tan \tfrac{1}{2}(b-c) = \frac{\sin \tfrac{1}{2}(B-C)}{\sin \tfrac{1}{2}(B+C)} \tan \tfrac{1}{2} a$$

(3) $$\tan \tfrac{1}{2}(c-a) = \frac{\sin \tfrac{1}{2}(C-A)}{\sin \tfrac{1}{2}(C+A)} \tan \tfrac{1}{2} b$$

(4) $$\tan \tfrac{1}{2}(a+b) = \frac{\cos \tfrac{1}{2}(A-B)}{\cos \tfrac{1}{2}(A+B)} \tan \tfrac{1}{2} c$$

(5) $$\tan \tfrac{1}{2}(b+c) = \frac{\cos \tfrac{1}{2}(B-C)}{\cos \tfrac{1}{2}(B+C)} \tan \tfrac{1}{2} a$$

(6) $$\tan \tfrac{1}{2}(c+a) = \frac{\cos \tfrac{1}{2}(C-A)}{\cos \tfrac{1}{2}(C+A)} \tan \tfrac{1}{2} b$$

(7) $$\tan \tfrac{1}{2}(A-B) = \frac{\sin \tfrac{1}{2}(a-b)}{\sin \tfrac{1}{2}(a+b)} \cot \tfrac{1}{2} C$$

(8) $$\tan \tfrac{1}{2}(B-C) = \frac{\sin \tfrac{1}{2}(b-c)}{\sin \tfrac{1}{2}(b+c)} \cot \tfrac{1}{2} A$$

(9) $$\tan \tfrac{1}{2}(C-A) = \frac{\sin \tfrac{1}{2}(c-a)}{\sin \tfrac{1}{2}(c+a)} \cot \tfrac{1}{2} B$$

(10) $$\tan \tfrac{1}{2}(A+B) = \frac{\cos \tfrac{1}{2}(a-b)}{\cos \tfrac{1}{2}(a+b)} \cot \tfrac{1}{2} C$$

(11) $$\tan \tfrac{1}{2}(B+C) = \frac{\cos \tfrac{1}{2}(b-c)}{\cos \tfrac{1}{2}(b+c)} \cot \tfrac{1}{2} A$$

(12) $$\tan \tfrac{1}{2}(C+A) = \frac{\cos \tfrac{1}{2}(c-a)}{\cos \tfrac{1}{2}(c+a)} \cot \tfrac{1}{2} B$$

(13) $$\tan \tfrac{1}{2} C = \frac{\sin \tfrac{1}{2}(a-b)}{\sin \tfrac{1}{2}(a+b) \tan \tfrac{1}{2}(A-B)}$$

(14) $$\tan \tfrac{1}{2} A = \frac{\sin \tfrac{1}{2}(b-c)}{\sin \tfrac{1}{2}(b+c) \tan \tfrac{1}{2}(B-C)}$$

(15) $$\tan \tfrac{1}{2} B = \frac{\sin \tfrac{1}{2}(c-a)}{\sin \tfrac{1}{2}(c+a) \tan \tfrac{1}{2}(C-A)}$$

(16) $$\tan \tfrac{1}{2} c = \tan \tfrac{1}{2}(a-b) \frac{\sin \tfrac{1}{2}(A+B)}{\sin \tfrac{1}{2}(A-B)}$$

(17) $$\tan \tfrac{1}{2} a = \tan \tfrac{1}{2}(b-c) \frac{\sin \tfrac{1}{2}(B+C)}{\sin \tfrac{1}{2}(B-C)}$$

(18) $$\tan \tfrac{1}{2} b = \tan \tfrac{1}{2}(c-a) \frac{\sin \tfrac{1}{2}(C+A)}{\sin \tfrac{1}{2}(C-A)}$$

(19) $$S = \tfrac{1}{2}(a+b+c)$$

(20) $$K = \sqrt{\frac{\sin(S-a)\sin(S-b)\sin(S-c)}{\sin S}}$$

(21) $$\tan \tfrac{1}{2} A = \frac{K}{\sin(S-a)}$$

(22) $$\tan \tfrac{1}{2} B = \frac{K}{\sin(S-b)}$$

(23) $$\tan \tfrac{1}{2} C = \frac{K}{\sin(S-c)}$$

(24) $$S = \tfrac{1}{2}(A+B+C)$$

(25) $$M = \sqrt{\frac{\cos(S-A)\cos(S-B)\cos(S-C)}{-\cos S}}$$

(26) $$\cot \tfrac{1}{2} a = \frac{M}{\cos(S-A)}$$

(27) $$\cot \tfrac{1}{2} b = \frac{M}{\cos(S-B)}$$

(28) $$\cot \tfrac{1}{2} c = \frac{M}{\cos(S-C)}$$

A Problem in Oblique Spherical Trigonometry

To illustrate the use of Table II and the list of formulas, the following example is solved. Negative values are denoted by (n).

Given $a = 57° 56'$, $b = 137° 22'$, $C = 94° 48'$. To find A, B and c.

To find A, Table II directs the use of formulas (7) and (10).

To solve formula (7) which is

$$\tan \tfrac{1}{2}(A-B) = \frac{\sin \tfrac{1}{2}(a-b)}{\sin \tfrac{1}{2}(a+b)} \cot \tfrac{1}{2} C,$$

(n) $\tfrac{1}{2}(a-b) = 39° 43'$
$\tfrac{1}{2}(a+b) = 97° 39'$
$\tfrac{1}{2} C = 47° 24'$

Inserting values found, formula (7) becomes

$$\tan \tfrac{1}{2}(A-B) = \frac{\text{(n) } \sin 39° 43'}{\sin 97° 39'} \cot 47° 24'$$

The logarithmic solution of which is:

(n) log sin $39° 43' = 9.89559 - 10$
colog sin $97° 39' = 0.00388$
log cot $47° 24' = 9.96357 - 10$
(n) log tan $\tfrac{1}{2}(A-B) = 19.77295 - 20$
(n) $\tfrac{1}{2}(A-B) = 30° 40'$

Solving formula (10) in the same manner, $\tfrac{1}{2}(A+B) = 100° 40'$.

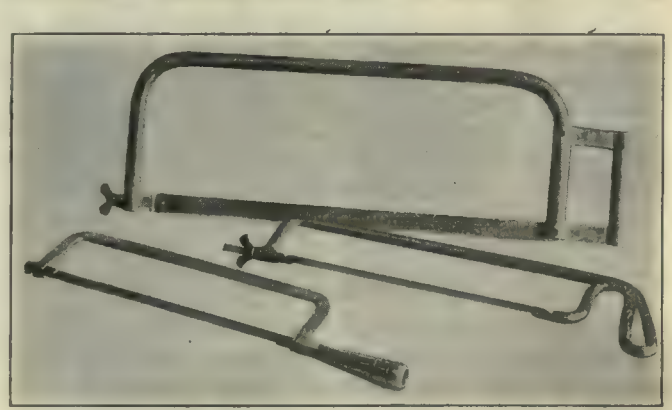
Adding, $A = 70°$. Subtracting, $B = 131° 20'$.

In the same problem to find c. As the table directs, find A and B, then use formula (16).

Hacksaw Frames Made by Hand

By J. H. Vincent

The largest frame holds an 18-in. blade. It is made from a piece of ¼-in. gas pipe, to which a simple handle with pin-hook, has been riveted at one end, and a thumbscrew and pin-hook attached at the other for tightening. Beneath this in the illustration lies another for a 12-in. blade. This is made almost entirely from a single piece of ⅛-in. pipe which has been bent around to form a conveniently shaped handle and welded to hold it firmly together. The last of the frames is made more elaborately. These frames were found in the toolroom of the Wabash Railway Co.'s shop at Decatur, Ill.



HACKSAW FRAMES MADE IN A RAILROAD SHOP

Programs of Apprenticeship and Special Training In Representative Corporations

By J. V. L. Morris



IX. Brown & Sharpe Manufacturing Co., Providence, R. I.

Apprentice Training Has Gone on for Seventy Years—Present School Holds Classes During Working Hours—Co-operative Students Also Are Employed

NO DISCUSSION of apprenticeship in the United States would be complete without consideration of the apprentice school provided by the Brown & Sharpe Manufacturing Co. This well-known firm manufacturing machine tools, in order to maintain the quality of its products, has been equally concerned in maintaining by apprenticeship the quality of its mechanics. The management is justly proud of the fact that for over seventy years apprentices have been trained in the plant.

At present among a working force of seven to eight thousand employees there are two hundred apprentices, a number which, it was stated, is at the present time being increased. The apprentices are distributed as follows:

Machinists	150
Draftsmen	23
Patternmakers, coremakers, molders and blacksmiths	27
Total	200

In addition to these there are twenty-five students employed in the drafting and machine shop departments on the half-time basis through co-operation with the local technical high school.

The supervisor of apprentices states that the records show that 95 per cent of those who sign the indenture agreement remain throughout the course, and that 75 per cent of those who start the trial period finish to graduation. This suggests that the conditions of apprenticeship here provided are satisfactory to the young men in training.

The Apprentice School

An apprentice school is provided, with classes during working hours, having one two-hour session a week during the first two years of apprenticeship, and two two-hour sessions weekly during the third and fourth years. In order to provide for sufficient individual instruction, the size of the classes is limited to eighteen students in each, Fig. 43 giving a view of the classroom.

A far more careful analysis has been made of all the operations involved in the trades being taught than was found in any other plant visited. Against this analysis the shopwork of the apprentice is checked, to insure not only that the apprentice is transferred from one department and one machine to another, but also that experience in all useful operations is obtained. This necessarily requires a considerable amount of recording and use of files, which the management believes is justified, in order that every element of the trade may be taught. Shop instructors are also provided, not to relieve the foreman of any responsibility to the boys, but to act as an additional help to both parties.

Figs. 44 and 45 show apprentices at work in the shop, giving an idea of the jobs that they perform.

The Lesson Sheets

The course at school is presented in the form of lesson sheets, on which the work is done by the apprentices, some of the sheets being shown in Fig. 46. These sheets become the property of the boys at the completion of their apprenticeship, so that they can make use of them in their later work. As far as possible, it was stated in a booklet describing the apprenticeship course, there is correlation between shop and school work during the course of apprenticeship. "Problems are approached from a standpoint somewhat different from that which is usual. Without the use of text-books, and without the learning of rules and formulas, problems are presented as they would arise in the shop, except that they are in regular sequence as to subject and difficulty. They are taken up with such reference books and tables at hand as should be in the possession of intelligent workmen, and the boys are taught to use such means to solve the problems. They are not taught algebra, geometry, trigonometry, etc., as such, but are instructed in the applications of the principles of these subjects to the practical problems of the shop."



FIG. 43. A VIEW OF THE CLASSROOM

One interesting record kept of the apprentice is that of his interviews with company officials. During his last two years of apprenticeship he has an interview every six months with a company official, who endeavors to discover his possibilities and interests. The impressions received from these interviews form a series of four letters, which are filed with the cumulative record of the apprentice. These interviews are intended to serve in enlisting the loyalty of the apprentice to the company through an assurance of the personal interest of the management in his welfare, and they aid in locating promising material for more rapid promotion.

Apprentices are rated as excellent, good, fair or poor, based on work in the shops, class record, deportment, attendance, etc. Those rated excellent or good are rewarded by an hourly bonus varying in amounts up to four cents an hour. Upon this basis rates of payment are at present in force as follows:

	1st Yr.	2d Yr.	3d Yr.	4th Yr.
Machinists and Patternmakers....	$0.20	$0.23	$0.28	$0.34
Good bonus....	.01	.02	.02	.02
Excellent bonus	.03	.04	.04	.04
Blacksmiths.....	.28	.32	.36 (3-year	
Good bonus....	.02	.03	.03 course)	
Molders.....	.28	.32	.38 (3-year	
Good bonus....	.02	.03	.03 course)	
	1st 6 mos.	2d 6 mos.	3d 6 mos.	
Coremakers.....	.26	.28	.32 (1½-yr.	
Good bonus....	.02	.02	.02 course)	
	1st 10 mos.	2d 10 mos.	3d 10 mos.	
Draftsmen.....	.24	.30	.36 (2½-yr.	
Good bonus....	.02	.02	.02 course)	
Excellent.....	.04	.04	.04	

The machinist and drafting students of the half-time course in which the company is cooperating with the technical high school receive the same pay for their time in the shops and drafting offices as the boys in the corresponding year of the machinist apprenticeship scheduled above.

The company carries out a policy which is not usual in apprenticeship, of permitting machinists, molders and coremakers to work at piece work or contract work after the first period of initial training. The supervisor states, however, that this system is not permitted to prevent the transfer of the apprentice even though such transfer would entail a financial loss to the boy. The customary piece-work rate is 75 per cent of the journeymen's rate for the same work.

The company carries out an invariable policy of requiring an indenture agreement which conforms to the

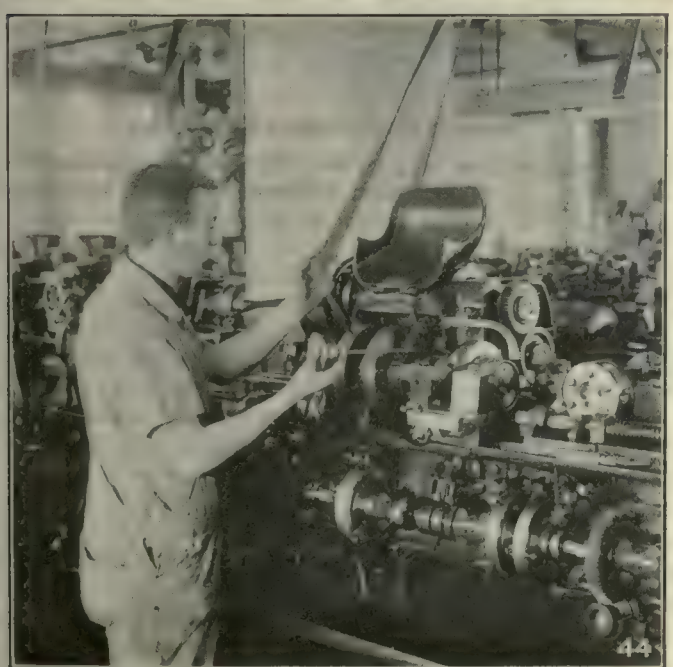


FIG. 44. APPRENTICE SETTING UP AND RUNNING A SCREW MACHINE JOB

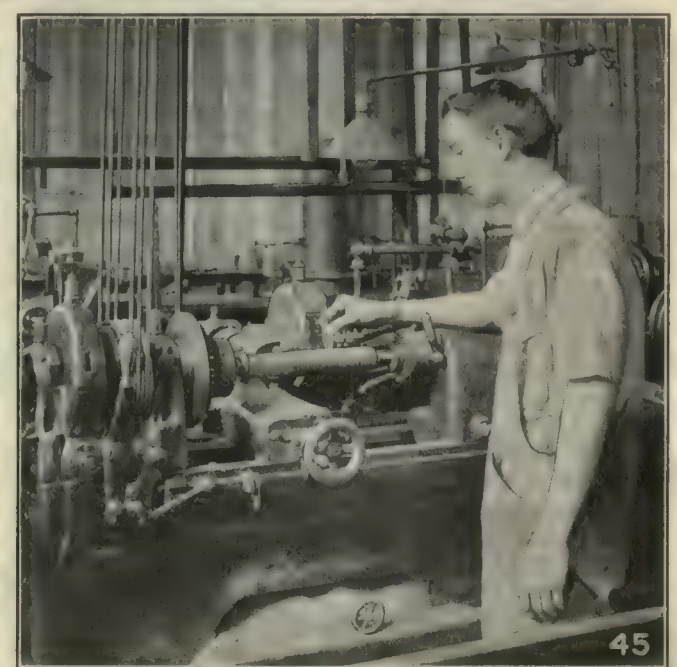


FIG. 45. APPRENTICE CUTTING A SCREW ON A THREAD-MILLING MACHINE

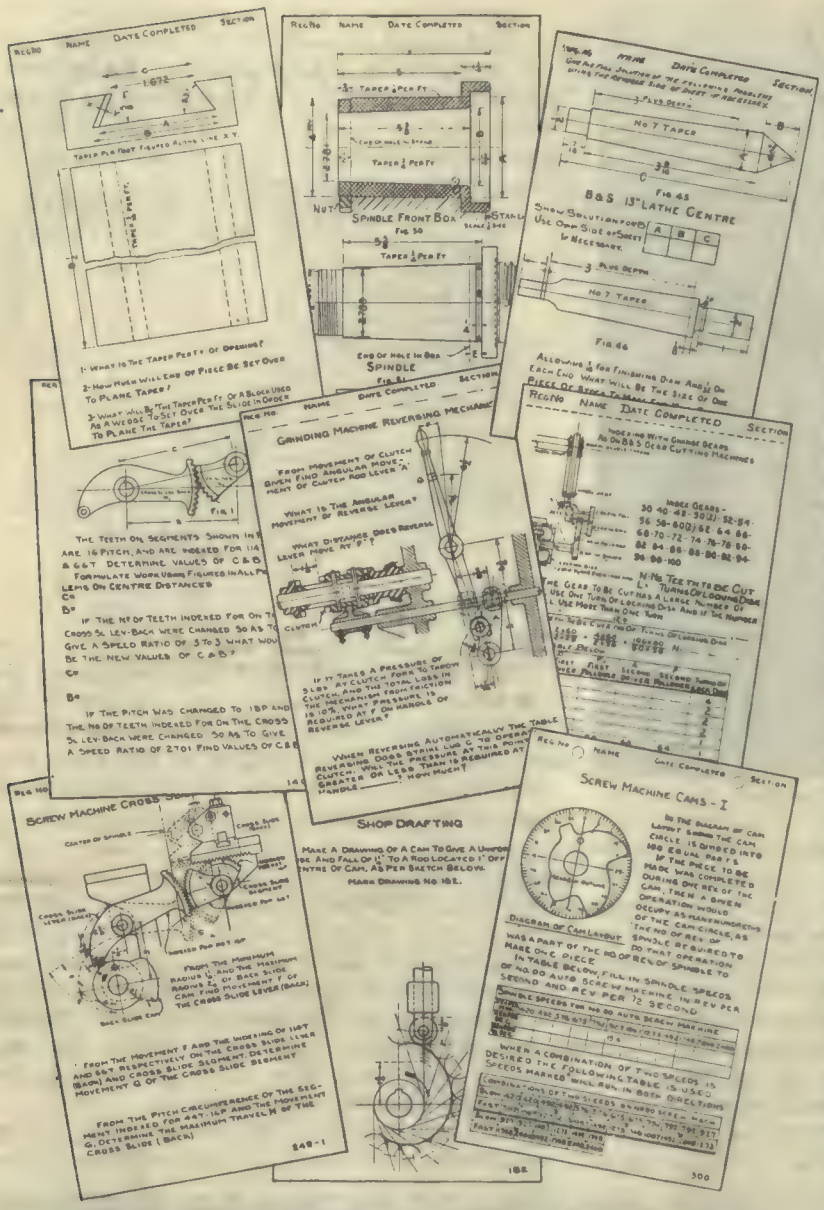


FIG. 46. PROBLEM SHEETS USED IN THE SCHOOL WORK

usual practice in most respects. The one noteworthy exception is that the apprentice, or rather his father or guardian, is required to pay $50 at the end of the three-month trial period as compensation for acceptance of the young man as an apprentice. The apprentice is also required to purchase a set of apprentice tools costing $11. Correspondingly, the bonus paid at the end of his apprenticeship to four-year apprentices is $150.

The fee required of drafting, foundry and blacksmith apprentices is $25 and the bonuses are correspondingly reduced to suit the length of the period of training. The reputation of the company for providing good apprenticeship permits them to make this charge and still secure the more capable young men as apprentices. On the other hand, it probably deters the less serious-minded fellows from starting apprenticeship and provides an incentive to those signing the contract to complete their course, in order to recover their investment by receiving the bonus. That the requirement of the fee may not work a hardship to a worthy boy, when he can not pay the fee outright he is permitted to make a part payment and to pay the balance in weekly installments.

A factor which may be noted is that the year for computation of period of service is considered to consist of 2,455 working hours, which, with the usual working week of fifty hours, is equal to 295 working days. This allows the apprentice a considerable period each year for recreation, which may be taken at such time or times as the company may direct.

Co-operative High School Students

The employment of technical high school students on a half-time basis offers an opportunity to compare the relative advantages of the co-operative system with regular apprenticeship. The co-operative plan is that of one week in school and one week in the shop, provided by pairing boys so that while one is in the plant his alternate is in school. It will be seen that there is no tendency to displace regular apprenticeship by this system, as there are only 25 part-time machinist and drafting students to 150 machinist and 23 drafting apprentices.

On the whole the co-operative plan seems to work better in the case of draftsmen, who can not well obtain too much technical and general education, and it does not in that case offer any serious difficulty if one member of a pair of alternates drops out. This is a more serious matter in the case of machinists, because with a well laid-out system of progress through the shops it is not desirable to pair one boy who has, let us say, advanced to the third or fourth year of the course with one just beginning. It was not the opinion of the apprentice supervisor that the co-operative students were likely to advance ultimately more rapidly than regular apprentices by reason of their more extended general education, though he appreciated the value of the good general education attained by the longer continuance in school.

Hints on Crane Operation

A word of warning is often the means of preventing trouble. In the *Travelers Standard*, page 11, Vol. 9, are given some excellent hints on crane operation and also a description of a safety device for the cranes of the earlier types. These were constructed with the wheels entirely outside of the bridge frame and no part of the bridge projecting over the rails. The device consists of strips of angle bar iron bolted to the ends of the main frame in such a way that they project over the rails and in case of a wheel, axle or shaft breaking, the frame would drop only until these angle bar irons rest on the rails.

When a hazardous load is being carried in a general passage way, it is a good precaution, in addition to the regular signaling device, to have a man walk just ahead of it, to keep people out of the way.

The cables of the hoist and all tackle, consisting of chains, ropes and hooks should be inspected regularly. A man may be a good crane operator and not have much conception of the requirements of the tackle used.

European Recognition of the Possibilities of the Airplane for Commercial Uses

English Daily Papers Publish Meteorological Reports—There Are Two Lines of Air-Buses Between London and Paris—Air Bus Habit Is Easily Acquired

BY E. A. DIXIE

IN SPITE of the enormous amount of intensive work done by the United States in connection with the manufacture and development of airplanes during the World War, we now, with the exception of the air post and occasional airplane races and tests, hear little on this side of the Atlantic of the development of the commercial possibilities of the flying machine.

I am given to understand that most of the machinery of our great wartime aircraft factories has been sold, but whether sold or not, it has been applied to the manufacture of things other than airplanes. To a far less degree is this true of the airplane industry in Europe.

In spite of their poverty the European nations are going ahead with the development of airplanes as a means of transportation. It may be that from her proximity to the war, Europe was better able than we to grasp the advantages of the airplane and estimate its value as a commercial vehicle. Whatever the reason the fact remains that Europe has already mapped out numerous air-bus routes. While practically all these "lines," if I may borrow the term from the steamship companies, are run by private concerns they have the hearty co-operation and assistance of the various governments, and the meteorological reports of the various governments have been amplified so that they now contain observations of particular use to aviators. Further, the government meteorological reports are very fully published in all of the leading daily papers of Europe. The "sailings" of the air-buses are published daily in the papers throughout Europe, and from time to time as new routes are incorporated new air maps are also published in these same papers. As an example of how thoroughly this work is done in England I would refer you to the weather column from the *London Times* of Sept. 18, 1920, reproduced herewith, and also to the European Air Routes Map published in the same issue of that newspaper. I may mention that similar meteorological information and a similar map were published in practically all the other British papers of that date.

THE WEATHER

A CHANGEABLE WEEK-END

GENERAL SITUATION, BASED ON THE METEOROLOGICAL OFFICE 7 P.M. (18H.) REPORTS OF FRIDAY, SEPT. 17, 1920.

A depression extending from the Atlantic over northern Ireland and Scotland maintained an unsettled and changeable type of weather during yesterday, rain or showers being experienced both by night and by day over the greater part of the country. The largest measurements reported were 20 mm. (0.8 in.) at Swansea, 16 mm. (0.6 in.) at Hastings and Folkestone, 15 mm. at Aberystwyth. The duration of sunshine varied greatly. Montrose having none and Nairn and Falmouth only 0.2 hr., although several stations in northern and eastern England returned more than 7½ hours, Skegness 9.1 hours. Temperature nowhere exceeded 66 deg. and failed to pass 51 deg. at Montrose, 52 deg at Nairn. By night the sheltered thermometer fell to 33 deg. at the last-named health resort and to 34 deg. at Banff. A new secondary disturbance was indicated over our southwestern districts by evening, rain being reported over a wide area.

GENERAL INFERENCE FROM OBSERVATIONS AT 7 P.M. (18H.)—The disturbance lying off Ireland is dispersing, but further primary and secondary depressions are likely to arrive from the Atlantic and to maintain unstable conditions, although bright intervals are probable. Unsettled weather is expected to continue for some days.



MAP OF EUROPEAN AIR ROUTES (HANDLEY PAGE)

FORECASTS FOR SATURDAY, SEPT. 18

(24 HOURS FROM MIDNIGHT, FRIDAY.)
(Issued last evening by the Meteorological Office.)

ENGLAND, WALES, SCOTLAND, S.W., ISLE OF MAN ..	Wind mainly from southwest, moderate or fresh, stronger locally; variable sky; much cloud at times; bright intervals; some rain or showers; *visibility mainly good;* moderate temperature.
SCOTLAND, E., N., N.W., HEBRIDES, ORKNEYS AND SHETLANDS ..	Light, rather variable winds; changeable; some rain; *visibility fair;* rather milder.
IRELAND	Winds between south and west, moderate or fresh, strong locally; much cloud; some rain; *visibility fair;* moderate temperature.

FURTHER OUTLOOK—Changeable; bright intervals; rain at times.

AMPLIFIED LONDON FORECAST

Surface-wind mainly from about south-west, 12 to 22 m.p.h., stronger in squalls; much low cloud generally, with rain or showers at times, but periods of considerable clearance; visibility mostly above five miles. Temperature ranging from about 50 deg. to near 65 deg.

LONDON OBSERVATIONS, KENSINGTON PALACE, 7 P.M. (18H.), SEPT. 17—Bar., 1,004.5 mb. (29.66 in.), Wind, S.W., light. Temp., 59 deg. Humidity, 80 per cent. Weather, dull.

Thursday, 7 p.m. (18h.), to Friday, 10 a.m. (9h.)—Min. temp., 48 deg. Rainfall, nil.

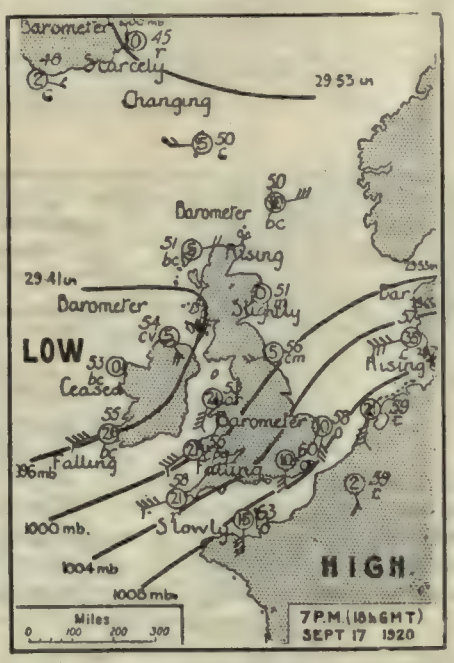
Friday, 10 a.m. (9h.) to 7 p.m. (18h.)—Max. temp., 65 deg. Rainfall, 0.1 mm. (0.004 in.).

Sunshine to 6 p.m. (17h.), at Kew Observatory (Richmond), 5.7 hours.

Mean temperature for 65 years at Greenwich for Sept. 17—Max., 68 deg., min., 50 deg.; extremes—max., 90 deg. in 1898; min., 36 deg. in 1889.

London Observations for Sept. 17, 1820—Max., 68 deg.; min., 50 deg.

There are at least two lines of air-buses between London and Paris. If my memory does not fail me, the trip costs ten pounds (about $35 at the present rate of exchange) and under normal conditions the trip is made in a little over two hours. Using this time and price as an approximate basis for calculation one can, with the aid of the map, figure about what it would cost and how long it would take to fly from, say, Koenigsberg in Poland to Vienna in Austria, by way of Danzig, Berlin, Leipzig, Nuremburg and Munich. Or from Nice or Bordeaux in France to Rabat in Northern Africa.



Referring to the reprint of the Weather Column, under the heading "Forecasts for Saturday, Sept. 18," one will note that the word "Visibility" seems to have been taken its place as a definite meteorological term to describe a weather condition, which before the war was esteemed of so little importance that it elicited no comment at all, much less a specific word to qualify and describe it with accuracy.

My recollection of the first use of the word was in connection with the description of the weather conditions encountered by the British gun pointers during the battle of the North Sea. I also distinctly remember the varied definitions offered for "low visibility." At that time its meaning was known to flying and firing men only, but every man now knows more or less accurately just what visibility means and its importance to those who fly and to those who aim big guns.

As a result of government and public support the commercial air-bus companies of Europe are making money. If this is possible in war- and poverty-stricken Europe how much more should it be possible for such concerns to make money in this big wealthy country.

The air-bus habit is just as easily and permanently acquired as were the bicycle and automobile habits. I have talked to a number of men who have used the European air routes. All of them speak highly of their speed, convenience and safety and when one takes the great saving of time into consideration, the cost is negligible.

Ingenious Method of Machining an Arc

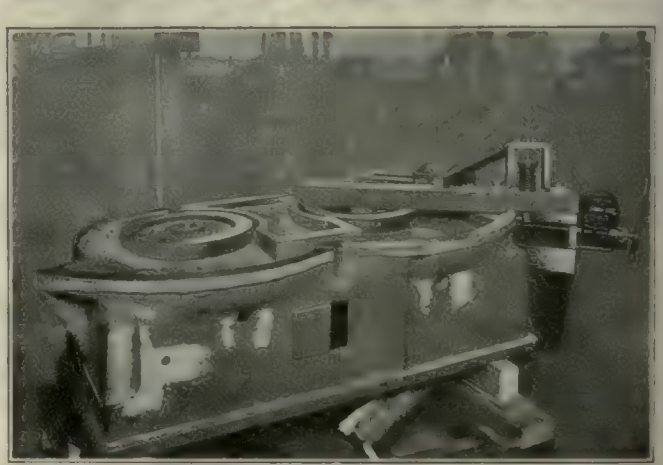
BY DOUGLAS T. HAMILTON

Some ingenious schemes have been used for machining arcs, where suitable equipment for the job was not available. The accompanying illustration shows how one such job was handled successfully in the toolroom of the Fellows Gear Shaper Co.

The work was a bed for a special machine of the double-head type, on which circular arcs had to be accurately machined equi-distant from the central holes. This casting was too large and heavy to be handled on any machine in the shop.

While the scheme looks rather crude, it did a very satisfactory job. The casting was placed in front of a 16-in. crank shaper and levelled up on blocks. A good rigid bar of machine steel of square section was fulcrumed on a pin located in the central hole of the casting, and a turning tool held in a suitable holder was located in the forward end of this bar; the holder being operated by a screw retained in a bracket fastened to the bar in the manner shown. A spring, located between the bar and a washer attached to the toolholder, served to return the tool to the top of the work when the screw was withdrawn.

A connecting link, located practically midway between the tool and the fulcrum of the large bar, was attached to the latter by a pin; the other end of the link being held in a swivel holder in the toolpost of the shaper. The table on the shaper was moved out of the way to permit free action of the connecting link, and the shaper set at full stroke, which was necessary to machine the arc, the angle of which was approximately 65 deg.



SET-UP FOR MACHINING AN ARC

Shop Politics

The Several Mental Attitudes of a Political Executive—Comparison of Political and Honest Executives—The Effect of a Policy of Secrecy

By L. J. VOORHEES
Industrial Engineer

AFFAIRS at the factory were not going well. In all departments there were grumblings and mutterings among the workmen. To the shop-wise there was a tense feeling of unrest and discontent in the air. Some of the executives thought this was due to the fact that a new manager was in charge and therefore it would soon wear off. Others said it was not and that the men were accustomed to new managers, as some had worked under a dozen or more during their term of employment and a change had never upset them.

This feeling of discontent increased and in a short time reached a point where even the foremen began to leave, some of whom had held their positions of responsibility so long that they were called "old timers." Every department was more or less disorganized by the lack of employees familiar with the work and from the attempt to "break in" new ones. Men were being continually discharged and in many instances the new men were paid more than the old employees on the same work. This tended to cause still more discontent as did the fact that most of the executive positions were refilled with friends of the manager.

Word came through the shop one morning that a very important and well-liked foreman had resigned and that his men were talking of "going out." I happened to be down in Bill Freeland's department when I heard it. Bill looks young but is really old enough to retire. He has been around factories most of his life and he is a keen observer, so I said to him, "Bill, what is the cause of all this discontent?" and in the language of the shop he expressed the situation in a nutshell when he replied:

"Too damn much Shop Politics."

He was right too. It was not the manager who was causing the discontent, but his methods. Consequently, here was a large, well equipped, modern factory, that in just a few months had been transformed from a state of peaceful production to one of suspicious discontent and all because the manager had been playing Shop Politics.

With some variations, I have observed the foregoing series of events several times. From what I hear I believe they are occuring in almost every factory community and certainly, when they do occur, they materially lessen the production of a factory as well as increase the cost of the product. These events are the result of Shop Politics, and at the present time when the whole country is in urgent need of economic production I believe we should carefully observe the men who are managing our factories to see if their methods are helping to cause discontent. These disturbing methods can usually be classed as some form of Shop Politics.

Most men. who have been around factories for any length of time, have heard the term Shop Politics. It is found in nearly all factories to some extent, and it is practiced by nearly all classes. Usually, the larger the factory the more prevalent it is, and the higher the rank of the user the more dangerous it is.

Shop Politics, as its name implies, is politics in the shop. But there are two kinds of politics, good and bad, and the term Shop Politics always means bad politics. One authority defines politics as *"The art of management, or control."* Therefore, bad politics would be, *The art of bad management, or control.* The International Dictionary defines politics, in a bad sense, as *"Artful or dishonest management to secure the success of political candidates or parties."* Therefore, Shop Politics might be defined as *artful or dishonest management to secure the success of the manager and his friends.* Sometimes, the term is used to imply *a form of deception practiced by factory executives whereby their personal interests are given precedence, or preference.* And again, it is used to express the *means used in securing and holding a position requiring more experience and ability than the aspirant possesses.*

It is often difficult for one who is not in a factory every day to recognize Shop Politics. It is liable to be confused with ignorance, incompetence, dishonesty, poor judgment, and the effects of a new position on the conduct of an executive. When an aspirant executive succeeds in securing a coveted position it seems to give him an inordinate sense of added power which causes him to pass through certain well defined stages from which he later emerges with valuable experience or political cunning according to his innate proclivity or natural tendency. Usually the first of these, and the most common, might be termed the Self-Laudatory. This is characterized by much bragging and overestimation of past accomplishments. The next stage is very derogatory or belittling. This is the captious or hypercritical stage and is characterized by unjust criticism of co-workers, their efforts and sometimes conditions in general. This stage is often followed by a period of Captation, or praise seeking, in which unnecessary, and often undue, praise and appreciation are solicited or sought. Following this is the last stage which might be called the Condescending and this one denotes the real character or tendency of the person under observation. It is characterized in the conscientious executive, by consideration for others, a willingness to take advice and the exercise of better judgment, and in the political executive by secrecy, injustice, deception and trickery.

The honest executive does not conceal the fact, when he goes into a new factory, that he is ignorant or uninformed about many of its processes. He freely admits it and asks to be shown as he knows he is contributing the executive ability that the factory needs to the trade knowledge it already possesses. Such is not the way of the political executive. Apparently, he does not know that a man may possess sufficient ability to manage a factory and at the same time know very little about its intricate processes. He seems to think that because he holds the position of highest authority he should know more about any subject than any man under him. In order to carry out this idea it is often necessary for him to keep silent and look wise when a subject is discussed or to inopportunely drop it when his

lack of information nears exposure. Sometimes he will carry a point by sheer domineering bluff when he thinks he can intimidate his hearers so they will not question his statement. These methods and the fact that a political executive is seldom a student, preclude him from rapidly gaining knowledge. As he is always in the same position it is easy for the factory men to "get his number." It is soon known throughout the organization that he is "chucking a bluff." Factory men hate a "four flusher" and one of the surest ways to get them discontented is to place one in charge. They are also quick to perceive this trait in a man and to take advantage of it and no matter how easy he is with them they always hold him in contempt. But not so with the man who is square. One case that I observed in a very large and very political organization will serve as an illustration.

How One Executive Made Good

The organization referred to secured an executive who knew practically nothing about the manufacture of their product. After he was installed in his office he called the department heads in, one at a time, and frankly said: "This business is all new to me. To help me get started suppose you tell me what you have charge of and what you are doing." Each man told him, without reservation, just what he had charge of, what he was doing and what he wanted to do and why. In the same manner they told him their troubles, aims and aspirations, suggested remedies, economies and production methods. In a short time he knew what every department was doing, why and how. Their efforts were harmonized and guided, good feeling prevailed and production increased. Contrast this situation with the one at the beginning of the article and notice the difference in the results these two men obtained.

Many of the undesirable human qualities that cause discontent and high prices are often found so closely intermingled in a political executive that it is difficult to tell in what proportion they exist. Probably ignorance and incompetence are as closely associated and as hard to segregate as any two qualities and the combination, sometimes mixed with dishonesty, is often displayed by the executive when attempting to show his omniscience or unusual quantity of superior knowledge. To illustrate this I will relate an occurrence I recently observed to which I have added my deductions regarding the process of reasoning.

Good To His Friends

When this executive was selected I presume he was told that his predecessors were incompetent and that the factory was not hard to manage and that what it needed was a man with strong will power to dominate the employees. He probably reasoned that if his predecessors were incompetent the associates were also; that as he possessed all the information and ability required to manage the factory the way to insure the factory's success was to insure his position; and that the best way to do this would be to get rid of the present executives, who might not agree with him and would therefore work against him, and to replace them with his friends upon whose support he could rely. Anyway, that is just what he did. Some of the foremen were discharged while others were treated in such a discourteous manner that they resigned. Each was replaced by one of the executive's supporters. An executive organization was got together that was principally an echo chorus for which each man was picked not on account of his fitness for the position he held but to help keep the manager in charge. To this end they worked harder than they did to save money for the company, because if the manager should lose his position they would probably lose theirs also. It was a typical political organization and like all organizations of its kind that I have observed, was short-lived. How little is known of Shop Politics and how difficult it is for even experienced administrators to detect it is shown by the fact that it took nearly a year to apprehend the glaringly destructive methods in this instance.

Self-laudation, or self-praise, denotes in the honest executive a natural pride in good work well done. In the political one it is often used to distract attention from some of his present activities, or as ammunition for his echo chorus. The honest executive usually thinks of the success of the factory first and all of his energies are expended in that direction. The political executive thinks of his personal success first.

When the honest executive is hypercritical it is usually an overzealous desire to have everything go exceptionally well, while with the political one it is often a self-laudatory way of domineering his co-workers into a state of timidity.

When the honest executive is tired out, and perhaps a little discouraged, he often seeks praise as a stimulant to greater efforts. The political executive usually seeks it in one place with a view of using it to his advantage in another.

In the condescending stage the broadened, honest executive realizes where he could have taken more advice; where he could have used more consideration for others; could have been more human; in fact could have done better in nearly every way. If the political executive ever reaches this stage his condescending remarks are only mock flattery to gain favor or time and opportunity to carry out some political scheme that will further his personal desires.

Secrecy

Secrecy is used very little by the honest executive. His methods are always open and aboveboard. With the political executive there is something secret about a large part of his affairs. He frequently wants each of his more important men to work secretly, without telling his associates what he is doing, or he wants his orders to one department kept secret from the others. He wants each man to feel that he is being paid a little more than his fellows—when he usually is not—and to keep it a secret. He uses secrecy as a barrier to keep his co-workers from getting mentally close to him and he also uses it to create a false air of importance by trying to make them think he is always doing something big and important, something he wouldn't dare tell them about. Little does he realize how soon the men see through these methods and secretly laugh about them and perhaps mentally scorn him at the time he is telling them.

Injustice, deception, and trickery are also found only in the political executive, as a rule. As he is inclined to believe that he possesses all the information that is ever needed to run a factory he is inclined to be unjust to his associates who possess knowledge and try to use it for the benefit of the concern. He often does this by being dictatorial about petty matters. For instance, a man will come to him with feasible plans for doing some simple job and ask his approval. Instead of

saying, that's all right, go ahead, he will imperiously dictate how several of the less important details must be done and then will dismiss him with a curt—"That's all now, I'm busy." This often leaves the man confused as in carrying out his authoritative orders he may spoil the whole job. Here is an illustration:

One of the inventors designed an acceptable addition to the product. Without consulting the inventor or taking his advice the manager sent a sample to the engineering department with orders to make drawings of it. The engineering department was not permitted to consult with the inventor and when the inventor offered his assistace the manager rudely dismissed him, saying, "You tend to your job, we'll make this all right." That was his way of keeping the work in each department concealed from the other departments. When the engineering department completed the drawings their advice was disregarded and tools were ordered without physically checking the drawings. As these tools were to be made outside and as the inventor felt that the wrong course was being followed, he offered to assist with the tool design but was again repulsed. When the tools were delivered and tried out they were found to be wrong. At considerable expense they were made over and finally they produced a fairly good article. Then the drawings were made to agree with the tools. As a result of these methods at least several thousand dollars were wasted, as well as several months' time.

Deception

Deception, as practiced by the political executive, is usually in the form of reports or information, cunningly constructed and warped into such shape that they give the wrong or incorrect impression to the men higher up who receive them.

I am aware that after reading this article a number of people are going to say, "It's impossible. I don't believe such conditions could exist except in some country shop." But, I will assure you that they do exist, as these illustrations were taken from modern factories located in large industrial centers. I will agree that they were all a particular kind of factory—I refer now to their policy, not their product—but it is only in a particular kind of factory where Shop Politics thrive. Usually this particular kind is a large factory, situated in an industrial center where labor is plentiful. It has been running for several years and all the departments have well trained help that needs little supervising. It is probably governed by a holding company of financiers who never see it except on visiting days. The scale of wages is set and cannot be exceeded. As the executives advance it is necessary for them to leave to get more money. The same condition applies to the workers. The price of labor has been increasing for a number of years, and well governed factories have frequently changed their rates to meet this condition. But not so in the particular kind of factory I am describing. As wages increase in other places the employees in these factories ask for more money and are told they are getting the limit. As a result they leave and those who are hired to take their places, at the same money they were getting, are much poorer workers with less experience. As they are poorer workers more must be employed to do the same amount of work. While this keeps the rate of pay down it does not keep the cost of the product there. The same condition also applies to the executives, when they leave poorer men at the same pay fill their places.

Nevertheless the men are not as much to blame as the policy of the concern. It is extremely difficult for the average executive, who has been connected with a well-directed organization where the work of every man was mapped out and supervised by a superior, to go into a strange organization where no work is mapped out and where he must find his work as best he can; where the departments are not co-ordinated, and often work in opposition to each other; and where it is the unwritten law that any man, no matter how incompetent, is all right so long as he in no way endangers the jobs of his co-workers. He sees faults everywhere and is powerless to correct them. If he tries to improve the conditions in his own department he is looked upon with disfavor, as a dangerous radical. Each man affected by any change he tries to make gets his friends to exert pressure to prevent their being carried out. He is continually in a state of agitated impotence. His efficient methods and training are useless as he can find no place to apply them. He says to himself, "Why did they bring me here if they didn't want me to do something? They need my knowledge everywhere. Why won't they let me use it?" The "they" he is thinking about is a line of governing authority which he is accustomed to being in and from which he received instructions and support. The factory he is now in has no such line. That is one of the reasons why it is a particular kind of factory. And often before the executive finds the real trouble he becomes discouraged.

It is to be hoped that in time directors will learn to judge factories by the unit cost of the product and not by the wages of the employees; that they will select their executives by their ability to produce economic results and not because they are good fellows and belong to some particular society or club; that they will learn to distinguish quickly between the political job holder and the honest, earnest, able executive.

The Cost of Unnecessary Service

By S. O. Livingston
Grand Rapids Grinding Machine Co.

In the writer's twenty years of experience in the selling end of the machinery business he has seen a constantly increasing tendency on the part of machine-tool users to demand service from the machine-tool builders which is having a tremendous influence in the price of machine tools.

In the lines with which I am most familiar the sales are small in dollars and cents and the machines have been more or less in the nature of specialties. Perhaps the point I wish to make can be best illustrated by two or three examples.

The XYZ Co. bought a twist drill grinding machine. On its receipt they complained that it wasn't satisfactory and requested a representative to come at once and straighten out the matter. We were therefore confronted with three problems. We could stand on our rights and incur the ill will of the customer; we could take the machine back and have a law suit to collect for it, or we could accede to their request. We did the latter.

On arriving at the plant our representative found that there were two criticisms: one was that the machine burned the drills; the other was that on "some drills" the machine didn't grind the cutting lips the same length.

The minute that our trouble man saw the machine started up he asked for a speed indicator, put it on the spindle, and demonstrated that it was running 2,400 r.p.m., whereas it should have run 1,400 r.p.m. Of course the extra speed of the wheel not only introduced an element of risk in running the wheel, but an absolute certainty of burning the drills. He asked the customer where the blueprint was that accompanied the machine. The reply was that they didn't think that there had been any blueprint sent with it, but upon being urged they finally hunted it up. He showed them the countershaft speed called for, and asked them how they came to put such a large pulley on the line shaft. They didn't know but upon calling in the millright he explained the condition by saying that they had moved another machine from the location where the twist drill grinding machine was set up and he "thought the pulley on the line shaft looked as though it was about the right size, so he didn't bother to change it."

The difficulty regarding the varying lengths of cutting lips on the drill they were unable to demonstrate in any way. Neither our representative nor any of their operators were able to grind a drill so as to justify that part of their criticism, and they finally admitted that they had only had that happen on one particular drill which they were unable to locate at the time of our demonstrator's call. The trouble, as we well knew from several previous cases, was accounted for by the fact that the drill manufacturers had let a defective drill get away from them, one on which the flutes were milled of unequal depth. They readily agreed when this condition was explained to them, that this was undoubtedly where the trouble arose.

Two Conditions Complained Of

The point I want to make is that here were two conditions that were complained of, one of which arose from their own careless setting up, and the other which arose entirely aside from any trouble with the machine, and which should have been discovered by them if they had given just a little care and thought to the problem. On account of their lack of thoughtfulness we had the expense of sending a man on a trip of several hundred miles with the railroad and hotel bills, and the cost of the man's time, which had to be charged to our overhead expense.

Another illustration: A concern bought a machine, but they were so skeptical that they insisted on the machine being subject to their approval at the expiration of a thirty-day trial. They not only approved of it and paid for it, but even expressed their pleasure in the way the machine operated. A little over a year afterward they wrote in to complain that it wasn't working satisfactorily any more, and requested that we send a representative to tell them what was the matter. The writer went out to this plant, which was in the New York district, and the minute he looked at it he wondered how they had even tried to use it in the condition in which it was found. A diamond truing device is supplied with the machine in question, in which the truing action of the diamond automatically locates a stop which positions the drill holder in the proper relationship to the grinding wheel. The diamond had been taken off as they explained, "for fear some one might steal it." The wheel had been dressed back with a common dresser, and the stop had been left in its original position, holding the drill holder much too far away from the wheel. They had then tried to overcome the difficulty they encountered by putting on a different shape liprest, etc. The result was that the machine was all out of adjustment.

In either one of these two typical cases, if any one of the many competent mechanics which these plants had available had given as much time to looking into catalogs and directions for operating the machine as they spent with our representatives at the time of their call, they would have discovered the trouble and rectified it. In this way they would have gotten the machine into satisfactory working condition much quicker and would have saved themselves time and money as well as saving the manufacturer the expense of special service trips.

I believe that users of machine tools must either refrain from asking these unnecessary demands for service or else they must expect that prices they pay for machinery will have to be loaded with an overhead expense for service. In a majority of cases it would be much cheaper for them to furnish this service themselves. Traveling expenses, salaries of competent men, and all the incidental expenses of doing business are higher today than they have ever been before. Are they not high enough without having to have the unnecessary burden for unnecessary service? Every high-grade manufacturer wants to have every legitimate criticism of his machines brought to his attention, but it does sometimes "get his goat" to be asked to give a hundred dollars worth of free service on a two hundred dollar machine, when the fault, so far as it can be thus designated, arises solely from the carelessness of the user.

Know What You Are Doing and Why You Are Doing It

By Lester Ferenci

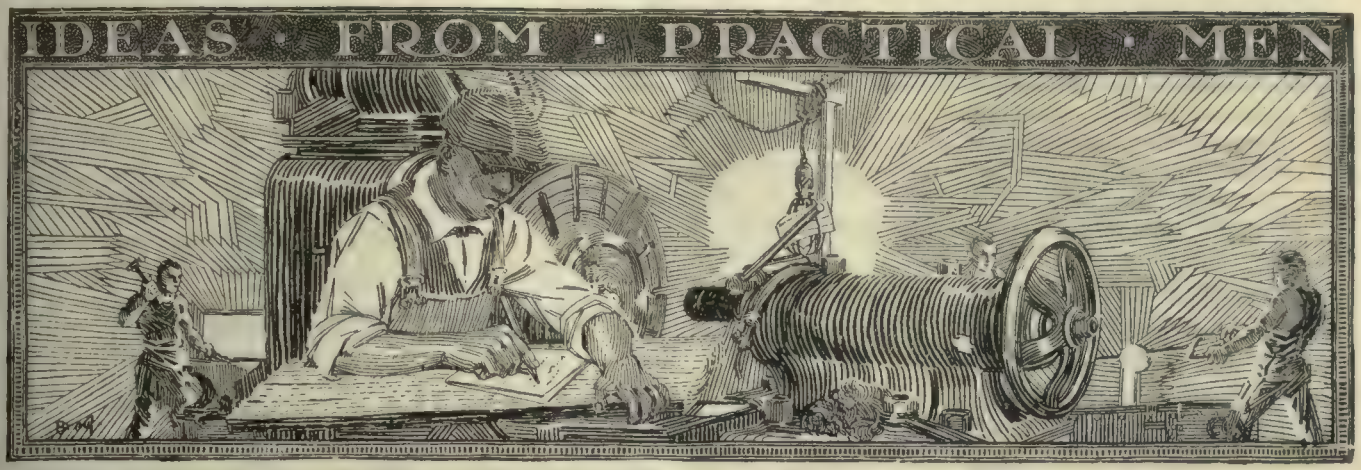
On page 612, Vol. 53, of the *American Machinist* A. W. Forbes writes, advocating setting a lathe tool below the center line on the facing operation, and again on page 1196 J. A. Grill suggests the reverse—that of setting the tool above the center line to do away with chatter and to produce a good finish, but he can not explain why.

An experience of mine was practically a duplicate of that of Mr. Forbes. I had a medium-sized casting with four lugs at one end which had to be faced off. After setting the tool various ways I tried setting it quite a bit below the center line and found that it worked excellently. I studied the cutting action in this position and can explain it in this way:

Wherever a finish is required the general practice is to set the cutting edge of the tool at an acute angle with the face of the work to utilize a wider cutting edge. Now, if the tool is set below the center line, the cutting really becomes a shearing action, inasmuch as the point of the tool is relatively lower than the back of the tool. The same condition can be produced by setting the tool on the center line and grinding it so that the point is lower than the back of the cutting edge.

Setting the tool above the center line amounts to practically the same thing, except that in the former case the shearing is toward the point and in the latter case it is away from the point.

[Turning the tool over and running the lathe backward tends to pull the headstock against the shears. We have seen the same method applied to boring bronze cylinders of comparatively large diameters to overcome chatter or vibration.—Editor.]



Improvised Rig for Milling Handwheel Rims

By Frank G. Senter

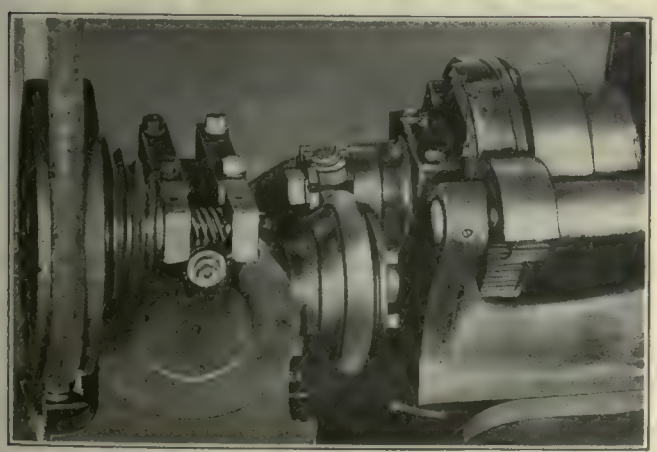
Having experienced considerable difficulty in securing true running handwheels, with uniform shape and finish of rim, by the old methods of turning them with a radius attachment on the engine lathe while they were held upon and driven by a mandrel, the writer devised the machine shown in the illustration for milling the rims; the hole in the hub being finished in a following operation instead of a preceding one. Both production and quality were materially increased over the old method by the use of the new machine.

The essential parts of the rig, besides a substantial base upon which to mount it, comprises the headstock of an old lathe, to hold and drive the formed cutter, and a plain dividing head from which the index plate and crank have been removed and an extra worm gear drive substituted.

On the end of the spindle of the dividing head, a faceplate that is specially formed to match the contour of the inner part of the rim of the handwheel serves to drive the work, which is held to it by a similarly formed circular plate on the outside attached to the driving plate by four capscrews passing between the spokes of the handwheel.

The entire dividing head is drawn toward the cutter by a hand operated cross-feed screw, and to start the work it is necessary only to draw in this head until the cutter is at the proper depth to give the required diameter of the work and then throw in the rotary feed. As no further attention from the operator is needed until the wheel has made a complete revolution, this feed is purposely made quite slow, thus leaving a very good finish upon the work, which requires little polishing.

The central hole in the wheel is finished upon the turret lathe, where the work is held in true-running chucks with jaws formed to fit the rim.

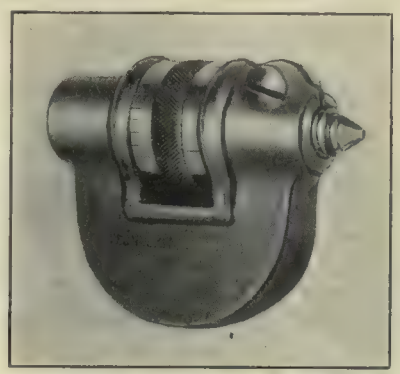


RIG FOR MILLING THE RIMS OF HANDWHEELS

An Old Inside Micrometer

By Amos Ferber

A micrometer caliper for making internal measurements is shown in the accompanying illustration. It measures nothing less than 1½ in. in diameter, but it may be excused for this slight deficiency in view of the fact that when it was made (1874) there were few, if any, tools with which minute internal measurements could be taken.



AN OLD MICROMETER

The frame is of bronze. One of the bosses is threaded to take the measuring screw and the other to take a steel adjusting bushing with a fine pitch thread on its external surface, to permit minute adjustments. This bushing is also threaded internally to hold distance pieces of various lengths when the tool is used to measure larger diameters.

The measuring screw is of 32 pitch, and the end of the boss from which it projects is finished off to the same helix as the thread so that, no matter at what angle it is viewed, there is always a full thread or number of threads projecting, obviating the uncertainty that would attend an attempt to read a measurement were there a fraction of a thread visible.

The thimble of the tool fits closely between the two bosses of the frame and is splined to the measuring spindle so that the latter turns with it but is free to advance.

The thimble is graduated to 31¼ divisions, so that a measurement can be read as so many thirty-seconds, indicated by counting the projecting threads, plus so many thousandths, read directly from the thimble; or the complete measurement can be quickly computed in the mind and expressed wholly in decimals. In a day when every apprentice boy knew the decimal

equivalent table as well as he knew the multiplication table, reading this tool was no hardship.

Distance pieces by half inches up to 4½ in., to permit measurements to 6 in., were once a part of the tool, as was also a knurled handle which screwed into the bow and enabled the artisan to hold it conveniently; but these have long since been lost.

This micrometer was made by Oakley S. Walker.

Using the Lathe as a Turret Machine

By E. F. Tuttle, Jr.

We recently had a large number of specially formed rollers to make and as no screw machine was available

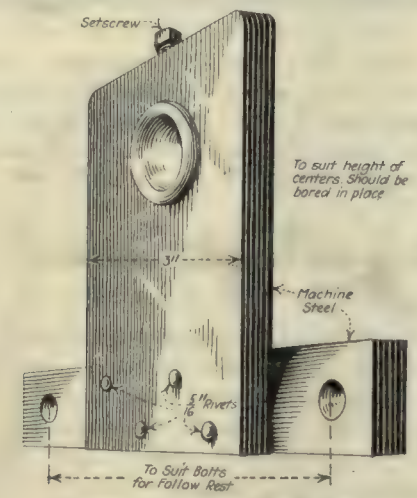


FIG. 1. STOCK SUPPORT

a 13-in. lathe was rigged up and the pieces were made in short order.

First we rigged up a stock support as shown in Fig. 1. The crosspiece is put across the bottom and the two holes are drilled so it may be fastened to the lathe carriage by bolts in the holes for the follow rest bolts. Different sized bushings may be made from machine or cold rolled steel, and casehardened. This stock support enables us to run the stock out 2 to 4 ft. (depending on the size) from the lathe chuck and to make a number of pieces without stopping the machine.

Fig. 2 is a multiple toolholder and is fastened to the compound rest by a T-shaped bolt which fits into the T-slot. The block *A* is made the correct thickness so that its top will be about 3/32 in. below the height of the lathe centers. The stud *B* is riveted and pinned in place. This stud turns in the lower part and permits the tool block to be swung around to an angle. The upper block *C* has a number of holes tapped ¼-20, so that setscrews may be used to hold the toolbits (⅜ in. square) and is held to the block *B* by the four shouldered rivets as shown. By putting a cutting-off tool in the regular toolpost a piece may be formed and cut off by merely running the cross-slide back and forth against stops.

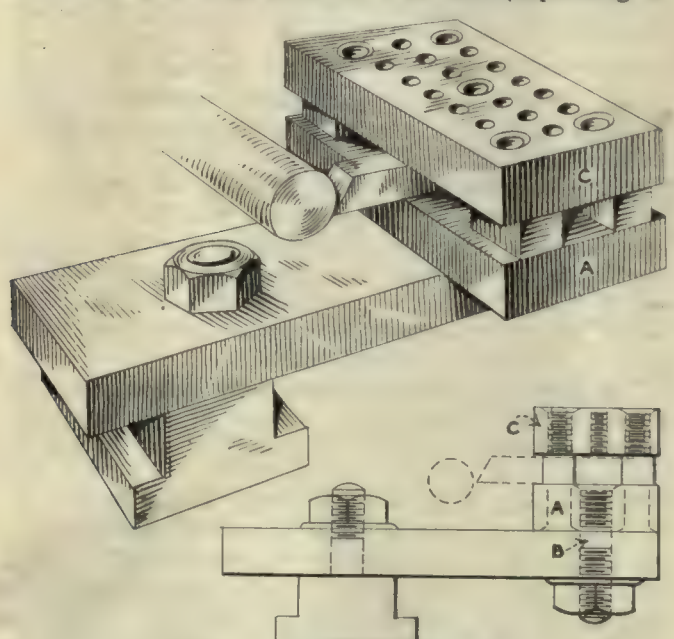


FIG. 2. THE TOOLHOLDER

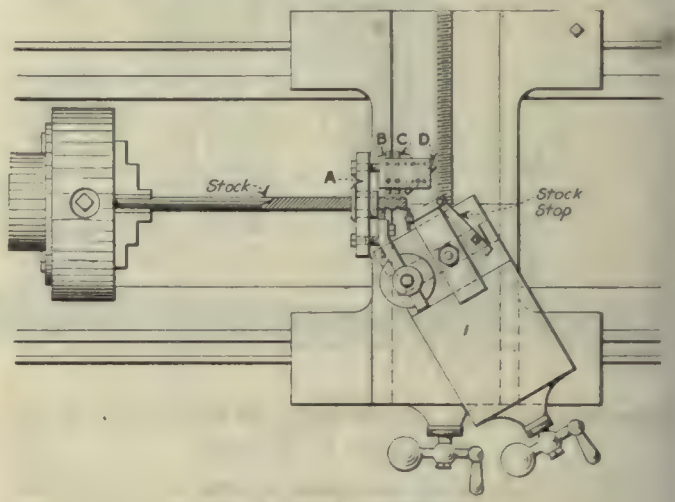


FIG. 3. THE ASSEMBLY

An assembly is shown in Fig. 3 with the stock support at *A*, and the multiple toolholder with rear ends of tools at *B*, *C* and *D*. The cutoff tool is held in the regular toolholder, and as the other tools are upside down the work does not need to be reversed. On ¾-in. cold-rolled stock with this outfit we have had the stock project as much as 3 ft. and were not obliged to stop the lathe until the tools were up to the chuck.

Piston Clearances for Internal Combustion Engines—Discussion

By G. Strom

When I wrote the article which is found on page 615, Vol. 53 of the *American Machinist*, I had in mind the repair mechanic or those with limited facilities in the customary repair shop. Proper piston and ring fitting seem to be regarded as a trade secret judging by the meager amount of reliable information published.

On page 1244, Vol. 53, Mr. Richards describes a better method for obtaining the same results when better facilities are available. Although I have never used this method, I have seen practically the same results obtained on small pistons by finishing them on a Pratt & Whitney toolroom lathe using a special cam for the relieving attachment. On page 546, Vol. 37, of the *American Machinist*, Fig. 8 is an illustration of a device that will accomplish the same results although no mention is made of the fact.

When fitting pistons by hand, care and judgment must be exercised to avoid misalignment of piston with wrist pin due to unequal filing on the sides.

Meeting the Present Emergency

BY A WESTERN MACHINE-TOOL BUILDER

There has been some criticism of the position taken by many bankers and business men, and being interested to a considerable extent, I have looked into the matter considerably. While in some parts of the country bankers may have ruled a little too severely, yet it was absolutely necessary to call a halt on some things that were going on.

There is no question as to this country being in the strongest position, in every way, of any country on the globe. It is also true, however, that we are none too strong, when we consider our indebtedness. This, I fear, may tend to prevent our coming back to normal conditions for a number of years. I have never been a pessimist but have always been enthusiastic about the machine and tool business. I must, however, confess that at the present time I see very little encouragement for the near future.

The question of taxation is a very serious one for all business men and one that requires the most careful thought and study at this time. Book profits, with perhaps nothing to pay the taxes with, is a serious proposition.

REDUCING HOURS AFTER BUILDING STOCK

We kept our organization together until the first week of the year although running at forty-eight hours a week. Last week we went to thirty-two hours and have reduced the force considerably. A further reduction of the force is planned for this week and at that time the shop will be down to about 50 per cent of its capacity on a thirty-two hour a week basis, four days of eight hours each. I dislike to think of a further reduction of hours or a still further letting off of the men, but unless there is a decided improvement quickly both steps must be taken.

The fact that we kept the entire force on so long has already given us a stock so that we can ship anything we list immediately. In fact, our stock is even now as large as it ever should be.

I believe that this is a time when much thought can be given to new development, designs, shop improvements and things of that nature and we are at work along these lines.

THE AUTOMOTIVE INDUSTRY

I am very glad to find that others share my views regarding the automobile industry. I believe that it has overshot its peak. And, having sold so much to the automobile field during the past few years, I feel that it will be a long time before there will be anything like a good demand for standard tools. It is quite probable that special machinery will have a better sale in the immediate future.

The motor truck field and the tractor field should both develop. But these two industries are so closely allied with the automobile field in the ordinarily accepted sense, that I look for comparatively little in that direction. The railroad field looks even less promising than it did a few months ago. We have all been hoping, believing and expecting much from this field but it has not materialized.

I have just made an analysis of the business we did in 1920 as compared with the business of 1919 and this includes wage payments plus premiums and bonuses, for both years. We shipped about the same amount but the labor cost was considerably higher. I believe that within a reasonable time there will be some reduction in wages but that it will never go back to the 1914 basis. I am very glad of that because the machinists have always been underpaid and I want to see a better wage rate in this industry.

In my opinion the actual business now being done by machine-tool builders of this country, is less than 1 per cent of normal. A recent canvass in the endeavor to show the amount of cancellation and held-up orders, seems to be in the neighborhood of $25,000,000. This I believe is too low if anything. The situation is extremely serious and critical, not to say discouraging. I will, however, be on the job each morning bright and early to take advantage of the first ray of sunshine that comes.

BY THE PRESIDENT OF A MIDDLE WESTERN MACHINE BUILDING COMPANY

The present quiet in the demand for machine tools affords a long-wished-for opportunity for a so-called thorough house cleaning. Owing to pressure for production during the war period, all sorts of things have crept into the organization, which greatly increased the overhead expenses. These seemed necessary at the time, but a careful review and more detailed study of the needs of the business show that many can be dispensed with. In other cases the various functions can be so coordinated or combined as not only to decrease the overhead, but in fact increase the efficiency. This applies particularly to personnel.

We are now thoroughly going over our entire equipment of machine tools, jigs and fixtures and small tools, for the purpose of finding the very best machine equipment and methods for doing a given piece of work. Such a searching inquiry sometimes develops the necessity for having the equipment in better condition, but in many cases it suggests entirely new and more efficient methods of doing the work.

We are making a thorough study and review of designs for the purpose of either improving them or simplifying them, in order that manufacturing processes can be simplified. This study has taken many kinks out of details, which will lead to improvement in quality and a reduction in cost.

A very careful study is being made at this time as to the efficiency of the individual workman, the foremen and others. Study is also being made of the arrangement of shop departments to see whether they are most efficiently laid out for the handling of work.

The efficiency of sales methods is also being carefully studied, including a review of all printed matter. We are also studying more carefully the efficiency of advertising mediums, and the future possibilities of business in certain lines of industry.

All of this of course is done in the belief that competition for the American machine-tool manufacturer will be quite severe for the immediate future, and that in order to meet this competition, each department of our business must be brought to its highest possible standard of efficiency.

While current business is still at a very low ebb, we cannot help but feel that the one hundred million people of the United States are going to continue to consume enormous quantities of goods, and that in time machine tools will come into their own again because it is the basic industry.

IN THIS ISSUE

LITTELL automatic punch-press feeding devices furnish the subject matter for the leading article this week. We'll let these interesting and useful devices tell their own story.

We didn't know there was so much that should properly be included as history and development of magnetic chucks. But Sheldon seems to have ferreted it all out with the result that while his articles may be classed as long, they are also full of interest and downright valuable information. The several pages of Part II, beginning on page 213, are only a part of the second article of the series. The remainder will appear in later issues. A very peculiar fact concerning magnetic chucks, a characteristic not common to many appliances is that "instead of being developed consequent to the introduction of a cheap, satisfactory and dependable supply of electric energy the chuck made its first appearance so far in advance of its time as to antedate any but the most crude machinery for generating electric current." The quotation is from Sheldon's article and serves to indicate that, as we have said, there is some valuable information at the reader's disposal.

A railroad article by Stanley, beginning on page 218, describes tools made and used by the Sacramento shops of the Southern Pacific Co. for making locomotive steam pipe joints.

Colvin, in his story about building motors on the Pacific Coast, tells about the inspection of crankshafts, camshafts and cylinders, and assembly and tests of the motors. He doesn't use many words—why should he when his pictures serve so well? Colvin's story begins on page 221.

On page 225 there is an article on taxes and business depression. It is pretty generally conceded that the next Congress will repeal the excess profits tax against which in particular the article is directed. Taxes we have with us always and for the next several years they are going to be heavy. They can't be any other way because we have incurred vast debts that must be paid off. Business will have to stand its share. The point about the excess profits tax is that it compels business to stand more than its just share and that it must therefore give way to some more equitable method of taxation, a method apparently still to be discovered or at any rate disclosed. The article we are writing about is meritorious in that it shows exactly what has happened to one firm and it should serve to dispel any lingering doubts that any one who reads it may have as to the retarding influence on business of the tax in question.

W. G. Holmes has done something that many of us have often thought of doing, but on which we couldn't quite make up our minds to get busy. It is only occasionally that we need to solve a problem in spherical trigonometry, but when we do, we like to be able to get right down to it and get it over with. Holmes is now giving us the opportunity of possessing in three pages all necessary formulas for the solution of right and oblique spherical triangles. Further than that he tells us just how to use them. For our part we don't intend to forget this article. Pages 227, 228 and 229.

Seventy years of training apprentices must have placed Brown & Sharpe in an enviable position as concerns their ability to judge of the merits of a given system. The other day we saw a list of names of the men they have graduated. It made quite a formidable pamphlet. Their present school is the subject of Morris' ninth article on programs of apprenticeship and special training in representative corporations. Page 230.

We, meaning the United States, started the airplane job, but somehow we seem willing to let the European nations develop it, a willingness that doesn't seem to be characteristic of the United States and should not exist. Dixie brought back with him, and is now passing along, some information going to show that Europe, though decidedly impoverished, recognizes the possibilities of the airplane for commercial uses and is going ahead with developments. Perhaps we'll catch up, maybe we'll pass them some day, but it does seem that for very obvious reasons now is the time for us to make an effort to lead the procession. Dixie's article is on page 233.

A somewhat unusual article is that on shop politics, page 235, by L. J. Vorhees. We shall not attempt to define shop politics, because the article does that, but we do say that the whole thing is very interesting and has its good points. Something on "Meeting the Present Emergency"—page 241.

Coming Features

The issue of the 17th will contain, in the way of series installments, the third of Colvin's articles on the foreman and his job and the fourth of De Leeuw's on metal cutting tools. Colvin's story contains more of his very good advice to foremen, those who hope to become foremen and the executives who handle them. De Leeuw's article is a general consideration of boring tools.

Among the one part articles there will be one on the "business" of a safety department, by Henry Landesman, in which he summarizes the fundamentals of this comparatively new, but important, department.

George A. Richardson will tell what to do when you have trouble with the tool steel you are using.

The repair of steel freight cars will be taken up by Hunter. Steel freight cars that have been in a wreck cannot be burned, as could the old wooden cars, and their cost makes salvage necessary. So some problems in heavy plate work are offered the car repair shop. It is of these problems and the methods used in solving them that Hunter writes.

EDITORIALS

Daylight Saving

DURING the past year or so there has been much discussion as to whether or not we should adopt Daylight Saving as a national practice governed by Federal law. There are two sides to every question, and each side deserves to be heard, but those in favor of such a law seem to be more powerful, both in argument and in number.

A bill introduced by Senator Walter E. Edge of New Jersey, providing for daylight saving in the Eastern time zone for five months, from the last Sunday in April to the last Sunday in September, is pending in Congress. It must be passed before March 4, when the present Congress ends, or we cannot hope to enjoy the benefits which it would bring during the coming summer months.

The strongest opposition to this bill comes from agricultural interests, particularly from dairymen, whose only objection lies in the inconvenience of having to get up an hour earlier in the morning in order to connect their products with the railroads—which run on Standard time. But should the Edge bill become a law the railroads would be compelled to run on daylight saving time—hence this objection is automatically eliminated.

The farmers, so statistics prove, constitute only fourteen per cent of the total number directly affected by daylight saving. And their only argument seems to be the fact that they must rise an hour earlier in the morning. Surely this is not an economic reason, nor is it worthy of consideration when weighed with the arguments in favor of the measure.

The sentiment in the Eastern time zone seems to be overwhelmingly in favor of retaining daylight saving time. Commercial, labor and medical associations, large employers of labor and numerous others all agree that the extra hour of daylight made available to the workers by this law has resulted in materially increased efficiency in industrial enterprise; improved the health and promoted the general welfare of millions of indoor employees; permitted and encouraged the cultivation of home gardens; and saved vast quantities of fuel through reduced consumption of gas and electricity for lighting purposes.

In only five states in the Eastern time zone is the rural population greater than the urban. In the State of New York, for example, the urban population is 8,589,844, while the rural districts number only 1,794,985 people. And the sentiment in the cities, and particularly in the great industrial centers, is unanimously in favor of daylight saving.

In view of the industrial chaos that is accompanying the reconstruction period through which we are now passing, it is apparent that the great economic benefits which would be derived from the passage of the daylight saving law are far more important than the inconvenience which it would bring to the small percentage of our population in the rural districts.

The manufacturers of the Eastern zone are particularly interested in the passage of the Edge bill, for with the coming of spring and the expected resumption of full-time operation of factories, the saving of overhead by daylight saving would be a welcome asset.

Our industries are the life and wealth of the nation. There should be no opposition to any law which aims to nourish and preserve these elements of our industrial growth.

The Cost of Unnecessary Service

ON ANOTHER page, Mr. Livingston discusses a problem that confronts every maker of machine tools or machinery of any kind.

The average factory management is generally ready to blame a manufacturer of a machine if it doesn't work right.

However, this condition exists and always will, so long as human nature remains as it is today.

As we see it, the remedy, or rather palliative, is for the machine maker to frankly recognize the condition and quote his prices accordingly.

If a machine maker refuses to accede to a user's request to put his machine in order, he loses the good will of his customer and probably the chances of future sales.

Some very successful seller's have adopted the slogan "The customer is always right" and they count on, and charge for, a certain percentage of demands which mean individual losses.

Aside from charging for such service in the overhead and in consequence adding to the price of each machine, the only remedy is for the machine makers to unanimously agree not to furnish such free service—but they won't.

Taxes, High Cost of Living and Business Depression

THE article "Taxes and Business Depression" published elsewhere in this issue, serves better than any other we have seen to drive home a realization of the dampening effects on business of our present tax methods. It tells of a manufacturing concern whose tax accrued for payment in 1921, against the 1920 income, is actually larger than its net income for 1920. The same relative condition pertained during the two preceding years. The author's conclusion is easily drawn and is beyond contention: "It is for this reason that the excess profits tax tends so powerfully to keep up the high cost of living—for every business man knows that he must keep up his profits or the following year will show a heavy loss."

Because the political party that will come into power in March is pledged to the repeal of the excess profits tax, we feel, with the author, that the end is in sight, though the effects of a repeal cannot be made manifest until 1922. But even though we feel reasonably certain of relief we must continue to keep fresh the topic of the repeal of the excess profits tax, lest in some way it fail to receive prompt and efficacious action.

Undermining Business

Foundation of Our Commercial System Is Individual Trustworthiness—Cancellations Causing Uncertainty—Restored Faith Now More Essential than Legislation

WHAT is considered a very good story is going the rounds in business circles, a story so apt and so amusing that it is always recited with gusto and received with chuckles of appreciation.

Two manufacturers of widely distributed products, it runs, met the other day at the club during the luncheon hour. "How is business in your line?" asked one. "We're working overtime," answered the other; then, in answer to the look of incredulity on his listener's face, he added, "We're at least a month behind on our cancellations."

The pungent flavor of the story lies, of course, in the plausibility of the exaggeration. Wholesale cancellation of orders entered months ago, in good faith, on the books of manufacturers, is the outstanding feature of the present business situation. The practice is so prevalent that it has become one of the principal factors in causing the closing of mills and the slowing down of industries. It has disrupted the production plans of thousands of manufacturers and brought some to the brink of ruin. Furthermore, it reveals a deplorable slackening of the moral fiber that is so essential an element in sound business relationships.

Business on Good Faith

Every country has its own ways of doing business, customs which reflect racial habits of thought and express the characteristics of the individuals making up the population. American methods are an inheritance from the pioneering days. Trade and commerce were then conducted upon a basis of confidence in the repute and good faith of the individual.

A man's word was as good as his bond—or else it was of no worth at all and he could not transact affairs in the market.

It was upon that foundation of individual trustworthiness and fidelity to engagements that this country built up a vast commercial system, the stability of which is vital to the production and distribution of commodities needed to sustain life and promote comfort.

Business deals aggregating billions of dollars are carried out every year in this country, based upon the assumed good faith of both parties in each transaction and with no exchange of formal contracts. The wholesale distributor or the retailer places his order with the manufacturer in the form of a memorandum; he is not required to deposit a bond or to give any guarantee beyond his implied word that he will take the goods. He, too, does business on faith; he buys from sample, and trusts the manufacturer to deliver products identical in quality.

It is upon the aggregate of the orders thus received that the manufacturer makes his production plans and finances his operations. It is in reliance upon them that he arranges for credit from his bankers, makes contracts for raw materials, invests in machinery and obligates himself to meet payrolls. It is upon the basis of these orders that he devotes his capital and his energies to the production and delivery of goods from which he cannot expect returns for many months. Incidentally, his profits are limited by the figures in the sales memoranda; except under special agreements, if prices rise before delivery is made the advantage goes to the buyer, while if prices fall the manufacturer gains nothing additional.

It is because of the breaking down of this far-reaching system of mutual confidence, and the prevalent habit of peremptory cancellation, that uncertainty and demoralization are spreading in many lines of industry. The canceling of orders for goods is not, of course, an absolute innovation; it has always been a recognized factor of risk—one which the producer had to take into account. But formerly it was seldom resorted to except for pressing cause, and usually there was an element of mutual consent. The disturbing fact is that what was once an exception has become almost the rule.

Brought on by the War?

This deplorable and dangerous manifestation is directly traceable to the abnormal conditions produced by the war. Sudden prosperity and alluring opportunities for great profits aroused the passion of self-interest, and the caveman instincts that are latent in the race found expression everywhere—among the forces of capital, in the ranks of labor, throughout the world.

Human nature never revealed a stranger paradox than in the complex mood of idealism and selfishness that the wartime pressure created. An ordeal which inspired millions of men and women to heroic sacrifices aroused at the same time in millions of others a spirit of avarice. There were those, indeed, who yielded wholeheartedly to both impulses. Psychology itself might be baffled to analyze the minds of men who gave their sons to the great cause of humanity and then turned their talents to ruthless profiteering—of some who even piled up gains from cheating in the quality of supplies sent to the front where their own boys were fighting.

More saddening still was it to see how many of those who had offered their lives in the highest service succumbed, upon their return, to the prevailing spirit, plunging into the scramble for unearned wages or excessive profits. In the universal mood of synical self-seeking moral standards were upset with commodity values, and in every activity the controlling influence was a reckless doctrine of self-interest. And it is of precisely this spirit that the present orgy of order-canceling is a manifestation.

Yet before condemning those who resort to this destructive practice it is only fair to consider their side of the case. It is urged in their behalf that they are merely exacting belated compensation, or satisfaction, for very similar treatment inflicted upon them; that almost from the beginning of the war the merchants were at the mercy of the manufacturer and wholesaler, who seldom scrupled to profit at the expense of their customers. This was done, it is said, not only by arbitrary price increases, but more frequently by refusing or failing to fill orders regularly booked. In innumerable cases purchases upon which retailers had based their merchandising plans were never delivered; because abnormal scarcity of goods had inflated prices shipments were diverted to late buyers willing to pay a premium.

It is contended that the device of repudiation or

evasion of orders really originated with those controlling raw materials, such as coal and cement and iron and cotton and building materials, and that then it was adopted by the manufacturers. The general charge is made that it was profiteering by the producers, both of raw materials and finished goods, after the war, that raised prices to such a level that the consumer was driven out of the market. And the canceling of orders now, it is represented, is the only defense left to the merchant against a condition for which he is not really responsible.

These arguments go far to explain the practice, and in some measure they present extenuating reasons. But they do not justify it as a matter of business ethics or vindicate it as a matter of business judgment. The buying public had convincing experience that the retailers, as a general rule, were as alert in exploiting the necessities of the consumer as the manufacturer was in trading upon the merchants' clamorous demand for goods. But it does not require any new presentation of facts to demonstrate the evils of the past, nor is there much value of contention as to where the greater responsibility for them lies. These matters are overshadowed by the problem of how to restore the stability of the commercial and industrial edifice. This can be done, we are persuaded, only by rebuilding the undermined foundations of faith, of unquestioned business probity and unswerving fulfillment of engagements. For unless and until this is accomplished there can be no safe superstructure.

Such devices as new tariff regulations, new currency provisions and new credit laws may have beneficial results, but they cannot overcome so fundamental a defect as the weakening of confidence through wholesale repudiation of compacts. The cornerstone of modern business is faith-keeping, the making good of mutual understandings; with that removed or displaced, no matter by what element in the business world, the whole system is dislocated, in danger of collapse.

The widespread cancellation of orders has put in motion a force capable of lasting mischief, of causing universal injury, by obstructing the resumption of normal business. At the moment the manufacturer is the one who suffers, but unless the movement is checked he will not suffer alone. If orders from the trade should lose the sanction of genuine demands for his goods, he will be deprived of the sole basis upon which he finances and operates his enterprise; and it needs no expert knowledge to discern that if industry is halted or embarrassed for this cause the resulting spread of unemployment will react injuriously in every department.

Restoration of Business Integrity

The ablest men in the financial and commercial world are racking their brains to find measures which will hasten the resumption of trade on a sound basis. In our judgment, the foremost place in any effective program must be given to the restoration of the integrity of business engagements, among which orders for goods constitute one of the most important. Fidelity in these matters is not merely a vital factor in the conduct of business; it is the only principle upon which business can be conducted at all.

The gambler's conscience is satisfied with a slender code of ethics; its one inflexible principle is that which makes welching the unforgivable sin. He is impelled to keep his word, at any loss, not merely to preserve his honor, but to safeguard his professional existence, which hangs upon scrupulous fulfillment of his obligations. At the racetrack men who are mere acquaintances will wager thousands with a nod, and each of them is assured that the loser will pay, because not to pay would destroy him and the system upon which he depends. Is it credible that legitimate business can prosper under a code less exacting than that of the gamester?

Legislation alone will never reinvigorate the processes of our commercial life. They will remain uncertain and enfeebled until there is put into them the life-giving force of a restored faith between the producer and the distributor, drawn from a common and individual honoring of the old-time standards of adherence to the given word.—Reprinted from the *Philadelphia North American.*

A Punch and Die for Closing Chain Links

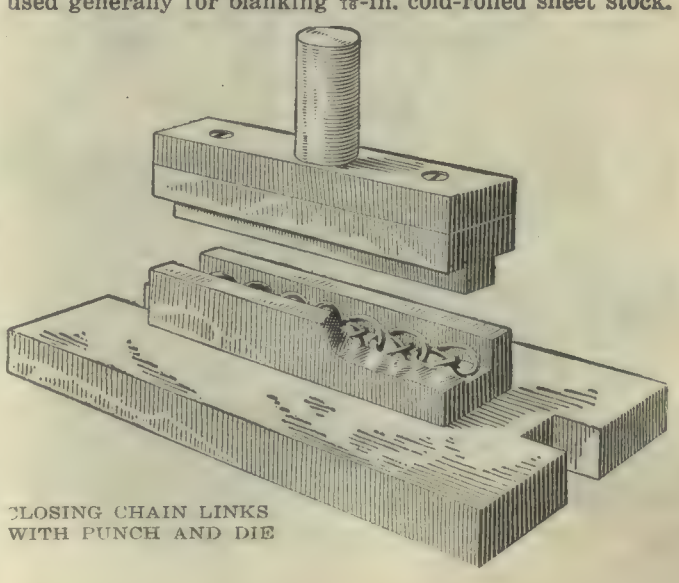
By H. W. Armstrong

We purchased several kegs of chain in 8 in. lengths and found that the links varied quite a little in size. Ordinarily this would make little difference but as we wished to have all the links of about the same size we had to find some method of sizing the chain in quantities at small expense. Our reason for requiring this accuracy was that we wished to fit a small hook having a mushroom head in the links of the chain.

As the chain came to us the hooks would slip completely through the links so that the head of the hook would not catch outside the link. For several reasons we could not enlarge the head of the hook, so we decided to reduce the size of the chain links.

In chain making factories this is usually done by inserting a bar in one end of the chain and stretching it while the other end is held by a pin, but this method is slow and weakens the chain. We made a punch and die as shown in the cut and were able to close about 2,000 lengths of chain per day, the cost per chain being very small.

There is nothing unusual about the punch and die but I believe this method of sizing chain in a punch press to be unusual and may be of interest because of the low cost. A chain of any length can be sized by moving it along under the punch. Of course the size of the chain would make some difference as very heavy chain would require a correspondingly heavy press. The chain used by us is known as 2/0 and is made from wire about $\frac{3}{16}$ in. in diameter. The press was a light one used generally for blanking $\frac{1}{16}$-in. cold-rolled sheet stock.



CLOSING CHAIN LINKS WITH PUNCH AND DIE

SHOP EQUIPMENT NEWS

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and equipment

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

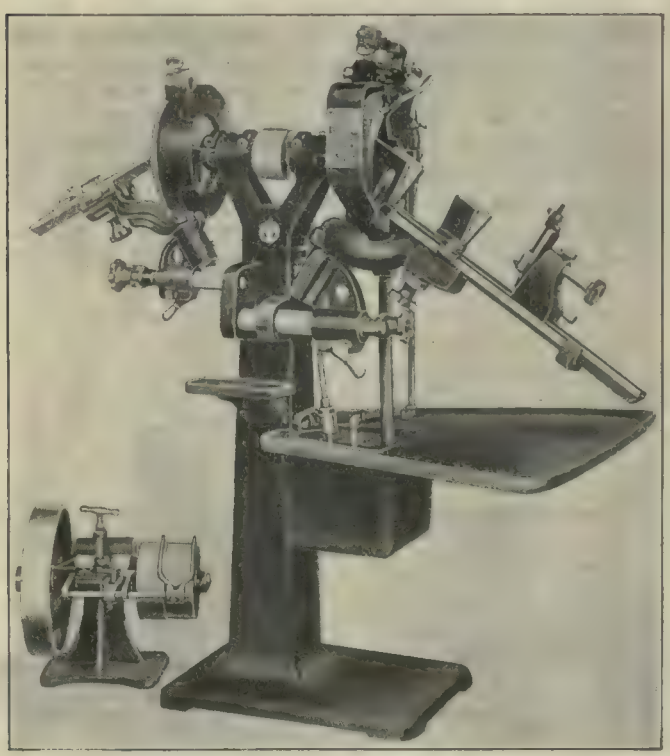
• CONDENSED • CLIPPING INDEX
A continuous record of modern designs and equipment

"Improved New Yankee" Twist-Drill Grinding Machine

The Wilmarth & Morman Co., 1187 Monroe Ave., N. W., Grand Rapids, Mich., recently placed on the market the "Improved New Yankee" twist-drill grinding machine, shown in the illustration. In this machine the basic features of both former types of this company's drill-grinding machines are incorporated. The new machine will grind either straight-, taper- or collared-shank drills without the adjustment formerly required.

For grinding straight-shank drills, the center attachment is not used. For short straight-shank drills the sliding V-support is swung out of the way. For grinding taper- and collared-shank drills the center is used to support the drill. Nine belt- and eight motor-driven styles of machine are offered. These styles can be made up in different combinations from four holders having the following capacities: No. 52 to $\frac{5}{8}$ in.; $\frac{3}{32}$ in. to $1\frac{1}{2}$ in.; $\frac{1}{4}$ in. to $2\frac{1}{2}$ in.; and $\frac{1}{2}$ in. to 4 in.

Each machine is equipped with means for obtaining different clearance angles. A built-in wheel-truing device is also one of the features.



"IMPROVED NEW YANKEE" TWIST-DRILL GRINDING MACHINE

Rearwin No. 6 Die-Filing Machine

W. D. Rearwin, 716 Monroe Ave., Grand Rapids, Mich., has recently added to his line of die-filing machines, the No. 6 size shown in the illustration. The machine is provided with a 20 x 24-in. table, 30 in. high. The head is made from a forging and can handle files up to 14 in. in length. It has a stroke adjustable up to 7 inches. The machine is intended for work of a rather heavy nature, and can handle various sorts of filing and sawing jobs.

The capacity of the machine from the back of the file to the front of the slide is 9 in. Also, it is 9 in. from the top of the table to the under side of the file arm.

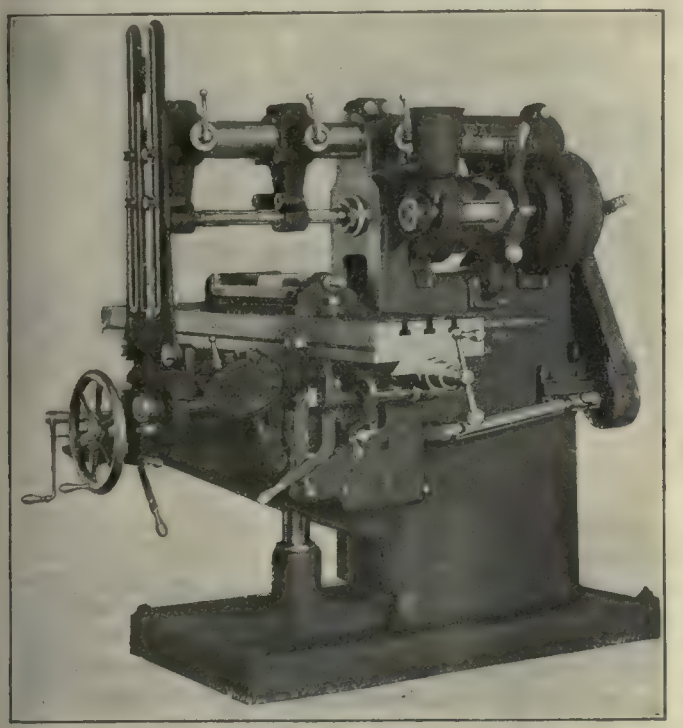
Arms are provided for holding hacksaws, the machine being fitted with one in the illustration, and for the filing of dies or patterns where the under side is closed or has a shoulder. The machine can be furnished with an individual motor, with a countershaft, or be driven directly from a lineshaft. The weight crated is 650 lb., and when boxed 750 lb., the volume of the box being 32 cu.ft.



REARWIN NO. 6 DIE-FILING MACHINE EQUIPPED WITH SAW AND INDIVIDUAL MOTOR

Ford-Smith No. 4 Plain Milling Machine

The Ford-Smith Machine Co., Ltd., Hamilton, Ont., Can., has recently placed on the market a No. 4 plain milling machine, shown in the illustration. The machine is driven by a belt running on a three-step cone pulley and is equipped with double back gears. Eighteen speed changes are provided. It is pointed out that the control is centralized, so that the feeds can be changed from the operator's position at the front of the knee.



FORD-SMITH NO. 4 PLAIN MILLING MACHINE

Specifications: Table: working surface, 71 x 14½ in.; T-slots, ⅝ in.; traverse, 42 in. Saddle transverse movement, 12 in. Knee vertical travel, 20 in. Face of column to brace, 30 in. Center of arbor to underside of overarm, 7½ in. Spindle: diameter at front bearing, 3½ in.; taper hole, No. 11 B. & S.; hole through, 1⅝ in.; speeds, 18 from 14 to 415 r.p.m. Back gear ratios, 3 to 1 and 10.8 to 1. Overarm diameter, 4⅜ in. Belt width, 3½ in. Diameter of large cone, 13 in. Feeds: number, 36; range, per rev. of spindle, 0.002 to 0.390 in. for transverse and vertical, 0.006 to 1.56 in. for longitudinal. Rapid power traverse, in in. per min.: table, 130; transverse, 33; vertical, 11. Countershaft: pulley, 16 x 5 in.; speed, 180 and 220 r.p.m. Floor space, 11 ft. 3 in. x 7 ft. Net weight, 6,500 lb.

Power feeds with automatic trips are provided for all movements.

The column is of box section and is provided with a compartment having a door and shelves for the storage of tools. The spindle is threaded at the front end, and the front bearing is tapered and provided with an adjustment for wear. The knee is of box type, having a solid top, and is braced by means of ribs inside. It can be locked in place on the column by means of a lever at the front of the knee. The cross-feed screw is located near the center of the guides for the saddle, in order to facilitate the movement of the saddle. All feed screws are provided with graduated collars. The knee is elevated by means of a telescoping screw provided with a ball thrust bearing.

The table is stated to have large depth and bearing surfaces. It can be oiled from the front, felt wipers being used on the bearings. The feed box is bolted to an extension of the saddle, being controlled by means of the dial wheel. Twelve changes can be obtained by means of the dial, and 24 more by means of double back gears, controlled by a handle at the side of the machine. Very coarse feeds are provided, for use especially with large face mills, this being done by driving the feed from the cone pinion instead of from the spindle when the back gears are in use. The reversing mechanism for all feeds is contained in the feed box on the front of the machine. The power rapid traverse is engaged only when the control lever is held in the operating position by hand. Moreover, safety trips are provided.

A two-speed countershaft is provided, self-oiling bearings being used. The friction clutches employed in it are of the expanding type. Wrenches, oil pot, cutter arbor and two arbor supports are furnished with the machine.

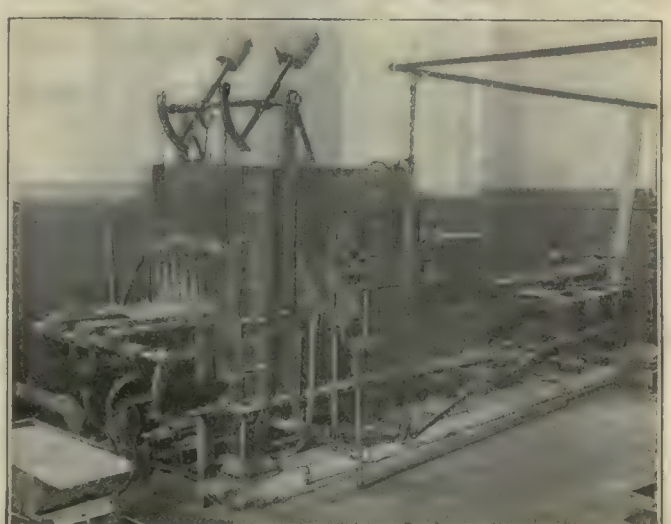
Kunitz Moving-Floor Furnace

An automatic-feed furnace, built by the Advance Furnace and Engineering Co., Springfield, Mass., and intended to heat work for hardening, carbonizing, or annealing, is shown in the accompanying illustration. The operation of the feeding device is intermittent, power being supplied at predetermined intervals by either hydraulic or pneumatic pressure. The moving parts are under control of an electric timing device, and consume no power except during the short period required to make each movement.

The furnace may be of any desired length and the movements of the feeding device made long or short in proportion to the length of furnace, so that long work can be accommodated and pre-heated in successive stages. In the furnace shown there are two steps at which the work rests during the progress of the heat and, as there is a load at each step, a fully heated charge is delivered to the unloading station at each movement after the second.

The work is carried forward by a pair of rails extending clear through the furnace and sliding in grooves in the floor of the heating chambers; these rails when at rest are slightly below the level of the floor and move upon cast-iron balls that, in turn, roll in the channels of grooved track rails placed at a lower level.

The track rails can be raised and lowered by means of a vertical cylinder and system of levers on the side of the furnace, while the work-carrying rails are moved forward and back by a horizontal cylinder at the rear. The lower rails are hollow and arranged for a circulation of water which serves to keep them, as well as the bearing balls and, to some extent, the carrier rails, cool.



KUNITZ AUTOMATIC-FEED FURNACE

The operation is as follows: Work being placed upon the loading station at the rear of the furnace, air or water is admitted to the vertical cylinder, raising the entire mechanism through a distance of 2 or 3 in. and lifting the work clear of the loading shelf. At this point pressure is admitted to the horizontal cylinder and the upper rails move forward to the limit of their movement, carrying the work with them. The mechanism is then lowered until the work rests upon the floor of the pre-heating chamber, when the carrying rails are returned to their original position.

This completes one cycle of movement. At the expiration of the predetermined heating period the cycle is repeated, carrying the pre-heated charge forward and depositing it upon the floor of the high-heat chamber, at the same time bringing in a fresh charge from the loading shelf. The third cycle carries a third charge from the loading shelf to the pre-heat chamber, carries the pre-heated charge forward into the high-heat chamber, and deposits a fully heated charge upon the unloading shelf at the front end of the furnace, the furnace doors automatically raising to allow the charge to pass out.

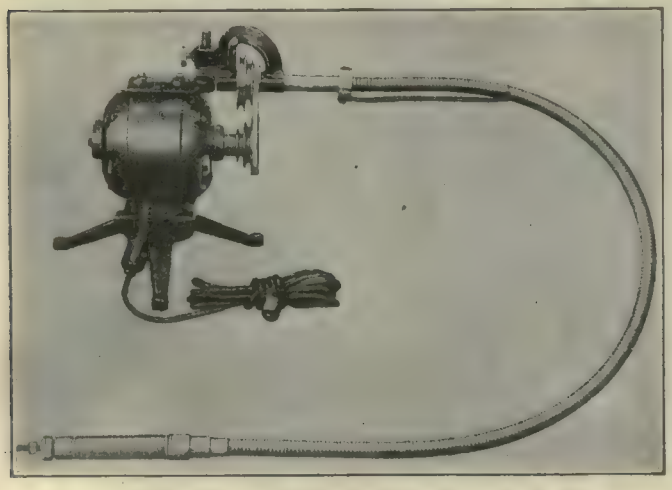
An automatic dumping device to use in connection with small work that can be heated upon trays is operated in conjunction with the carrying mechanism so that the work may be immediately dumped into a quenching bath or be otherwise disposed of.

The timing device is operated by an electric motor of not more than $\frac{1}{8}$ hp., and the control is through solenoid operated valves. The duration of the heating period can quickly be changed to suit any kind of work. Once set, the action is entirely automatic and the attendant's duties are confined to keeping the machine supplied with work. The furnace may be adapted to the use of either gas or oil fuel.

Haskins Flexible-Shaft Machine

The R. G. Haskins Co., 27 South Desplaines St., Chicago, Ill., has recently made some changes in its flexible-shaft machines for die-sinking. The illustration shows the Type H-5 machine. It is fitted with a swivel base mounting which allows it to rotate through a complete circle. In this way considerable bending of the shaft is avoided, since the wheel or tool on the working end of the shaft can be brought without cramping into any desired position.

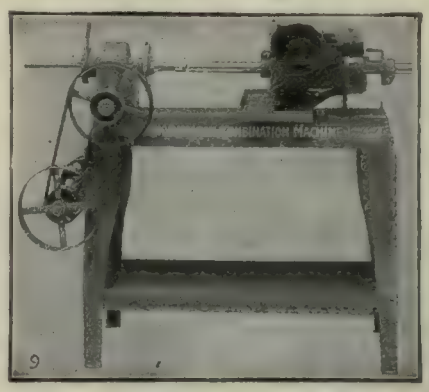
A leaf spring supports the flexible shaft at the motor end, so that the radius of bend is reduced at this place, which is the most common point of failure of flexible shafts. It is claimed that the improvements on the machine decrease the amount of bending and friction in the shaft, thus prolonging its life.



HASKINS FLEXIBLE-SHAFT MACHINE

Wilson Combination Boring Machine

K. R. Wilson, 10-16 Lock St., Buffalo, N. Y., has recently added to his line of tools for automobile repair a combination machine, shown in the illustration set up for boring a cylinder. The machine is intended for work on automotive-engine cylinder blocks and crankcases. It serves as a motor bench for holding the motor while assembling, grinding valves or babbitting bearings. It is adapted to boring, reaming and running-in main bearings. Cylinders can be rebored to any size.



WILSON COMBINATION BORING MACHINE

The machine consists primarily of a stand carrying the power-driven head and the work-holding carriage. It is belt-driven, two speeds being provided. The spindle is worm-driven, with a speed reduction of 20 to 1, ball thrust bearings being used. The boring bar is supported at each end of the cylinder by bearings in stationary guides, its location in the center of the cylinder being determined by means of split taper plugs fitting on the bar. The bar is driven from the head through a universal joint and is fed forward by means of a screw, a split nut being caused to engage the thread on the spindle for this purpose, thus advancing the bar $\frac{1}{16}$ in. per revolution. The boring bar is $1\frac{5}{8}$ in. in diameter, and the cutter is supported close to the point.

Miller & Crowningshield No. 1½ Multiple-Spindle Squaring and Fluting Head

The illustration shows a multiple-spindle squaring and fluting head, with a tailstock, for use on a milling machine table. It is made by Miller & Crowningshield, Greenfield, Mass., and is known as the No. $1\frac{1}{2}$ machine. It can be furnished with either four or six spindles,



MILLER & CROWNINGSHIELD NO. 1½ MUTIPLE-SPINDLE SQUARING AND FLUTING HEAD

Specifications: No. of spindle, 4 and 6. Combined length of two blocks, 17 in. for 4 spindles, 24 in. for 6 spindles. Width of headstock, $8\frac{1}{2}$ in. for 4 spindles, $11\frac{3}{8}$ in. for 6 spindles. Height to center, $3\frac{7}{16}$ in. Can swing work up to $1\frac{5}{8}$ in. in diameter. Capacity: to square taps, $\frac{1}{4}$ to $\frac{3}{4}$ in. in diameter; to flute taps, $\frac{3}{8}$ to 1 in. in diameter; to flute reamers, $\frac{1}{4}$ to $1\frac{1}{8}$ in. in diameter. Net weight, 130 to 260 lb., depending upon size.

being intended especially for the rapid fluting and the squaring of the ends of taps and reamers.

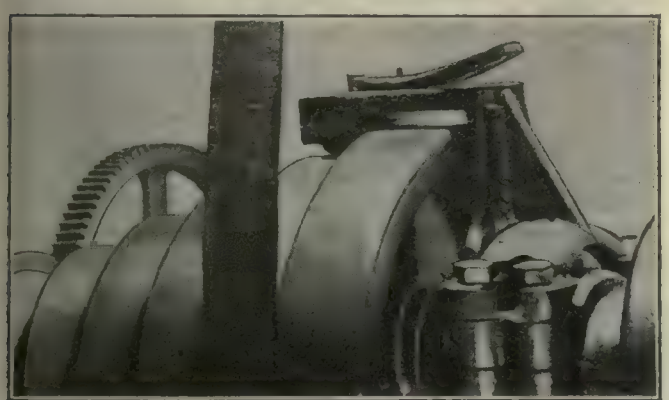
The spindles are driven by worms on the hand-operated shaft, all rotating in the same direction. They are placed close together, so that there is no unnecessary space between the pieces of work. They are provided with taper holes, so that the centers can be removed. The spindles are so connected by equalizing levers, as to allow of a variation in length of $\frac{1}{16}$ in. for the work being milled. All the spindles are clamped by means of one handle, thus making it possible to tighten all of the pieces of work as quickly as one. The spindles and worms are hardened.

One turn of the indexing handle turns the spindle one-quarter turn, this being convenient for squaring work. For fluting work, by gearing the handle to the worm-shaft, one complete turn of the handle can be made to index the work the proper amount for pieces having any number of flutes up to twenty.

The tailstock is separate from the head. One style is solid and the other has separate vertical adjustment for each center. The tail centers are removable and interchangeable. Centers of different types, for holding either round or square stock, can be furnished. A single-spindle squaring head is also made.

Faust Friction Lathe-Brake

Ephriam M. Faust, 136 Lincoln St., Steelton, Pa., has recently placed on the market a friction lathe-brake.



FAUST FRICTION LATHE-BRAKE

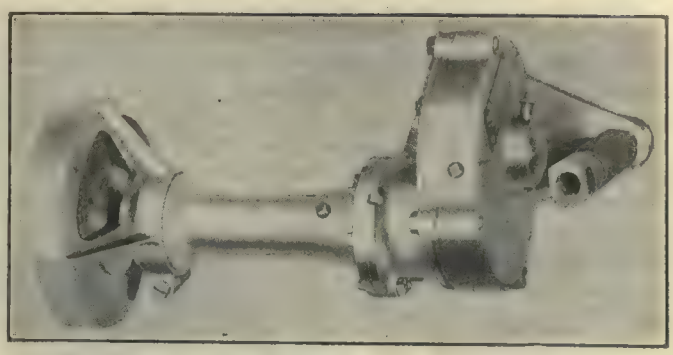
The brake can be fitted to any size cone-driven lathe up to 40-in. swing.

The frame of the brake is bolted to the front spindle cap of the lathe, using the original cap bolts. The frame reaches up and over the gear guard. The braking member, which has a renewable leather contact, engages on the face of the large cone pulley. The normal position of the brake lever is parallel to the spindle. When the brake lever is released, a cail compression spring disengages the braking member automatically.

Turbine Air-Operated Grinder

The Turbine Air Tool Co., 710 Huron Road, Cleveland, Ohio, has recently placed on the market the pneumatic hand-portable grinder shown in the illustration. It is intended especially for cleaning castings, but can carry wire brushes and buffing and polishing wheels, besides grinding wheels. It is fitted with a throttle at the point where the hose attaches, and the housing between the wheel and the motor provides a grip for the operator.

The housing is made of aluminum, and the turbine



TURBINE AIR-OPERATED GRINDER

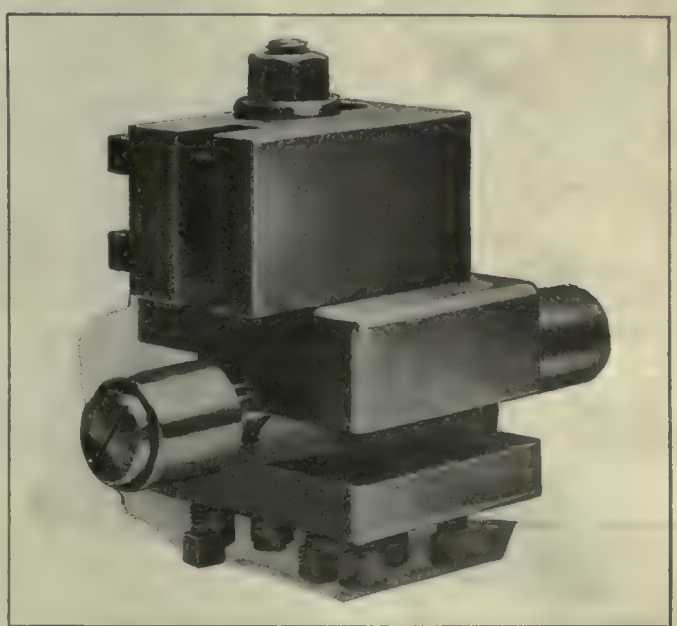
of an aluminum alloy of high tensile strength. The gears are made of chrome-manganese steel. Ball bearings are used. The tool weighs 16 lb. when equipped with a 6 x 1-in. wheel. It consumes 30 cu.ft. of free air per minute at from 80 to 100 lb. pressure. It is claimed that the grinder will maintain the proper speed for the wheel when grinding. The tool is said to have but few parts and to be compactly made, to have perfect speed control and to be free from vibration.

"Ashmac" Combination Toolholder

The Ashley Machine Works, 714 University Ave., Rochester, N. Y., recently added to its line of products the "Ashmac" combination toolholder. The holder is intended to reduce machining operations performed on turret machinery. It is furnished with a toolblock, a pilot stem, and a pilot bushing of any standard size, and is made in two sizes, Nos. 1 and 2.

The No. 1 holder has a $1\frac{1}{4}$-in. shank and carries $\frac{1}{2}$-in. tools. Two pilot stems Nos. 3 and 5 are made for this size. The No. 3 pilot stem is used for bushings ranging from $\frac{5}{8}$ to $\frac{7}{8}$ in., inclusive, by $\frac{1}{16}$-in. steps. The No. 5 pilot stem is used for bushings ranging from $1\frac{1}{8}$ to $1\frac{1}{2}$ in., inclusive, by $\frac{1}{16}$-in. steps.

The No. 2 holder has a $1\frac{1}{2}$-in. shank and carries $\frac{5}{8}$-in. tools. Two pilot stems Nos. 4 and 6 are made for this size. The No. 4 pilot stem is used for bushings ranging from 1 to $1\frac{3}{4}$ in., inclusive, by $\frac{1}{16}$-in. steps. The No. 6 pilot stem is used for busings ranging from $1\frac{13}{16}$ to 3 in., inclusive, by $\frac{1}{16}$-in. steps.



"ASHMAC" COMBINATION TOOLHOLDER

"Small" Pocket Calculator

The pocket calculator shown in the illustration has been placed on the market by Small, Small & Co., Waltham, Mass. The device is intended primarily for performing such calculations as are ordinarily performed on a slide rule. It consists essentially of a 6-in. logarithmic slide rule, with the scales bent into a circle, so as to form a compact and small instrument. It is composed of a baseplate carrying continuous scales on its periphery and lower face; a moveable top plate, or rotor, arranged to turn on the hub of the first member and carrying similar scales on its periphery and face; a slotted hub nut to keep the rotor in place and to adjust the friction, a runner with a hair line, and pointers to be used in setting and reading the values.



"SMALL" POCKET CALCULATOR

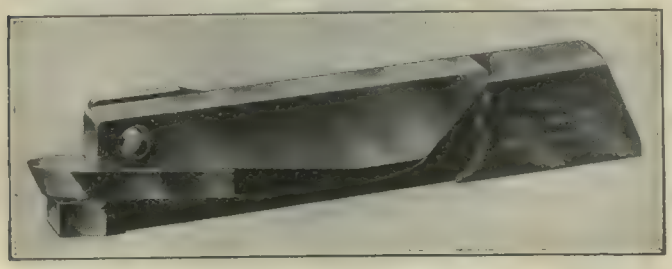
The device is made chiefly of hard non-corrosive metal, the runner being oxidized German silver. The main bearing is slightly tapered and provided with a spring washer to take up play and to cause friction.. The scales are graduated in black on white celluloid, the circular scales being seamless. The scales give the functions of angles, as well as logarithmic reciprocals and square roots.

The calculator is held in one hand while in use and can be operated by the same hand or with the other hand. It is stated that the device is not affected by temperature or humidity, that it is accurate and that the results cannot occur off the scale, because they are continuous. The edges are roughened and serve to grip the paper when the device is used for measuring distance on maps and drawings.

The device is made in two models, No. 1 having the ordinary slide rule scales, while the No. 2 model, intended for architects and structural designers, has scales for determining the strength of steel and wooden beams. A leather case and an instruction book are furnished.

Brooke "Mike" Toolholder

The Brooke Tool Manufacturing Co., Ltd., Birmingham, England, has recently placed on the market the toolholder shown in the illustration. It is known as the "Mike" toolholder and is intended to hold the toolbit without the use of a setscrew or auxiliary clamping device. The screw of the toolpost serves both to secure the holder and to grip the toolbit.

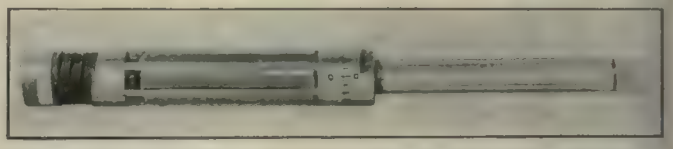


BROOKE "MIKE" TOOLHOLDER

The holder is self contained and there are no detached parts. Either end of it can be passed through the toolpost. The screw presses on the top of the wedge-shaped clamp, which at the rear end rests on an inclined surface and at the front end upon the toolbit and is held by a pin. The clamp bears on the tool for the greater part of its length, and the point of the tool is supported by a projection of the holder. The tool is made in three sizes. The No. 0 size takes toolbits $\frac{1}{4}$ in. square and is $\frac{13}{32}$ x $\frac{7}{8}$ x 5 in. in size; the No. 1 is for $\frac{5}{16}$-in. toolbits and $\frac{1}{2}$ x $1\frac{1}{8}$ x 6 in. in size; and the No. 2 size holds $\frac{3}{8}$-in. toolbits and is $\frac{5}{8}$ x $1\frac{3}{8}$ x 7 in. in size.

Kylin Adjustable General-Purpose Reamer

The illustration shows the Kylin adjustable reamer made by the Foster-Johnson Reamer Co., Elkhart, Ind. A feature of this reamer is that its size may be adjusted by turning a single nut on the shank end of the body. This nut is graduated in thousandths of an inch. A helical spring is used on the lower end of the tool to back up the blade collar. It is claimed that the uniform compression obtained by the use of the spring permits closer adjustment, prevents springing or distortion of the blades, and prevents the blades from collapsing. The spring compresses slightly as the diameter over the blades is expanded, and when the reamer is contracted the spring causes the blades to move inward as they travel upward on the body. The compression on the spring can be regulated by a nut on the lower end of the reamer body.



KYLIN ADJUSTABLE GENERAL-PURPOSE REAMER

American Shafting Cleaner

The American Metal Products Co., 72 W. Adams St., Chicago, Ill., has recently placed on the market the shafting cleaner shown in the illustration. The device consists of a ring which fits loosely on the shaft and, due to the rotation of the latter, travels back and forth on it, keeping it clean and polished.

The device is made of heavy-grade nickel-plated sheet zinc in four duplicate stampings. The joints are spaced 90 deg. apart, the parts being locked together by four wide staples of the same material as the rings. The staples are clinched by means of a pair of pliers when the ring is installed. The cleaner can be put on shafting that is already in place, and it is easily removeable. The swelled portion at the inner diameter is filled with felt, which distributes along the shaft any oil that strikes it. The metal of the cleaner is said to be non-corrosive.



AMERICAN SHAFTING CLEANER



NEWS SECTION

F. A. E. S. To Hold Meeting in Syracuse

It is announced that Herbert Hoover will be the principal speaker at a two-day gathering of leading engineers, technical men and educators in Syracuse, N. Y. Steps will be taken at this meeting toward welding the engineering forces of the nation into one great organization, the aim of which will be to focus technical and scientific effort on the solution of social, political and economic problems.

On. Feb. 14 the executive board of the American Engineering Council of the Federated American Engineering Societies will hold sessions, culminating in the evening in an address by Mr. Hoover, who, it is expected, will outline the new council's plans for dealing with industrial relations and particularly with human waste.

Mr. Hoover will sound the keynote of the American engineer in urging co-operation with Congress, with labor organizations, chambers of commerce and other bodies in the campaign planned by the council to remedy economic ills.

On Feb. 15 the national council of the American Society of Mechanical Engineers will convene with the society's new president, Edwin S. Carman of Cleveland, presiding. This society has placed its resources and membership of 13,000 behind the movement to federate the country's engineering skill under Mr. Hoover through the American Engineering Council.

"How to get America's idle back to work, and keep it at work, is the task which the engineer has set for himself," said L. W. Wallace, who has just taken up the duties of the American Engineering Council's new committee on the Elimination of Waste in Industry. Mr. Wallace, who has been director of the Red Cross Institute for the Blind in Baltimore, was selected by Mr. Hoover to organize the council's work in industrial relations.

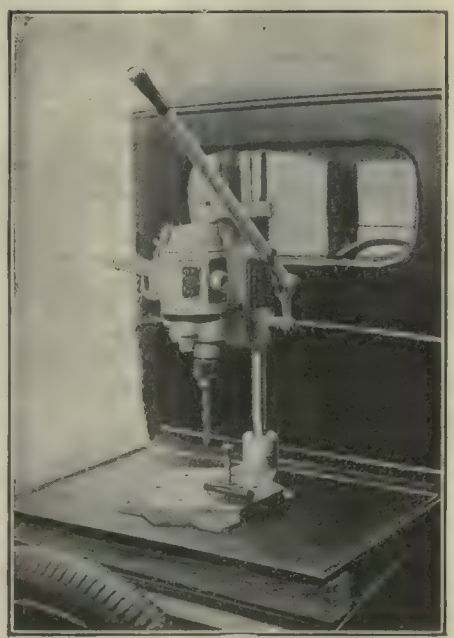
The Syracuse meetings will bring together engineers from every industrial center in the country. Delegations will go from New York, Albany, Utica, Buffalo, Rochester, Schenectady, Troy and other cities. The engineering societies of Chicago, Cleveland, Boston, St. Louis, Pittsburgh, Detroit and other places will be represented by officials of the two councils.

On the board of the American Engineering Council the American Institute of Electrical Engineers is represented by Calvert Townley of New York, vice-president of the Westinghouse Co.; the American Institute of Mining and Metallurgical Engineers, by J. Parke Channing of New York; the American Society of Mechanical Engineers, by Dean Dexter S. Kimball of Cornell University, and the Associated Engineering Societies of St. Louis, by William E. Rolfe.

The Syracuse meeting will mark the beginning of a movement to organize the engineers on a territorial basis. As a result of a report submitted to the council by Mr. Hoover, the council will probably encourage the formation of state engineering councils.

A Constructive Sales Idea

The photograph shows how Fritz Kline, salesman for the H. C. Roberts Electric Co., Philadelphia, Pa., mounted a B. & D. bench drilling stand on the rear of his Ford coupé. In making his calls on garages, Mr.



Kline ran his car right into the garage, plugged in on the nearest electric light socket and demonstrated the bench drilling stand so effectively that in one week he secured orders for six bench drilling stands and four drills. The stand and drill are protected from dust and the weather when the car is on the road by means of a simple slip cover made from automobile top material.

Ordnance Plans for 1921 Explained

In explaining to the Committee on Military Affairs of the House of Representatives the use to which the appropriations for the next fiscal year are to be put, Brigadier-General W. S. Peirce, the assistant chief of ordnance, made an explanatory statement as to the manufacturing establishments under the jurisdiction of the Ordnance Department. In his testimony before the Committee, he revealed that the Amatol Arsenal, N. J., is to be salvaged.

The Chicago storage depot is to be held as a reserve plant for the manufacture of the steel parts of ammunition. The machinery necessary for this plant is to be stored in the buildings and held in readiness for an emergency.

At the Rock Island Arsenal, General Peirce testified, the work is being concentrated largely on the manufacture of infantry rifles and mobile-artillery gun-carriages. The machinery and the space are being held in readiness at that plant for the manufacture of machine guns. He revealed that it also has been decided to concentrate at that arsenal the manufacture of tanks and tractors.

At the Springfield Arsenal practically all of the work is devoted to the making of small arms. At the present time the plant is occupied principally in overhauling the model 1917 rifle. A small number of new rifles is being made.

At Watervleit the principal work is on sea-coast guns and the heavier mobile guns. At Watertown the arsenal is engaged in making sea-coast projectiles, medium-caliber projectiles and gun-carriages. At the Frankford Arsenal the activity is largely in the manufacture of small-arms ammunition and the various types of fire-control instruments. A large reserve of machinery for this type of manufacturing also is kept at the Frankford Arsenal.

The Ordnance Department is retaining the howitzer plant at Erie, Pa., for the manufacture of 155-mm. howitzer's and 4.7 guns. Requests have been made on two occasions, however, that the Erie plant be sold and that activity transferred to the Watervliet Arsenal, which is the main cannon manufacturing center. Thus far, however, Congress has failed to authorize an appropriation to permit of the necessary enlargement of the Watervliet Arsenal.

Business Conditions as the Big Banks of the Country See Them

National City Bank of New York Sees Improvement in Spite of Heavy Losses

The general business situation is marked by greater confidence than was manifest in the last weeks of 1920, and there are tangible evidences of improvement. The apprehensions and rumors of impending trouble which are always a demoralizing influence when the credit situation is under strain, have been largely cleared away. The irresponsible talk about a "panic" has been silenced. The epidemic of business failures predicted for the end of the year did not come. The number of reported bankruptcies has increased, but has not been alarming, and the cases have been mainly of small concerns of mushroom growth, who extended their business rapidly upon small capital while prices were rising and did not have the reserve resources to meet the losses that were inevitable when reverses came. The substantial business structure of the country is unshaken, and whatever anxiety there may have been upon that score has been relieved.

Few Important Houses Failed

This does not mean that heavy losses have not been taken. Only the fortunate or sagacious few who began to trim their sails early in the year, and deliberately restricted their business escaped. Some made good profits in the first six or nine months and lost most of them in the last three months, while many have come out of the year not only without a return upon the investment, but with an impairment of capital. Official price regulation, which curtailed profits while prices were rising, and prevented the creation of a cushion to absorb the losses while prices were falling, is held largely responsible for the dissipation of capital. Heavy taxation, of course, had a similar effect. Nevertheless, the leading business concerns of the country had been building up reserves for years in conservative fashion, and the proportion of important houses that have failed or been seriously embarrassed has been smaller than in any previous crisis approaching this one in gravity. This is a very reassuring circumstance and promises well for recovery.

The Crops Moving

The movement of the crops, particularly of grain and live stock has increased notably during the past month, in fact, it is practically normal. The receipts of wheat at primary markets are now running over those of the corresponding weeks of last year. Prices have been somewhat stronger than in December, wheat at one time reaching a figure about 25 cents per bushel above the low point in November, but most of this gain was lost at the end of January. Premiums over Chicago quotations amounting to about the freight charge from Kansas City to the Gulf ports have ruled at the latter upon the grades desired for export, and have helped local prices in the Southwest materially. Cotton rallied several cents early in the month, but lost it in the last week. The coarse grains have been heavy, owing to the big crop of all of them in 1920. Nevertheless, with products actually moving in the Middle West, the money situation relaxing, the reserve banks getting into better shape, and a fair degree of trade revival, the whole situation is looking better.

Brazilian Business Men Face Serious Situation with Confidence

Those who seek to know the exact condition of business in Brazil need not look far beyond their own boundaries for comparison, according to a report just received from Allen Walker, manager of the International Trade Service of the Guaranty Trust Co. of New York, who is at present making an extended trip of investigation through South America. Commerce in Brazil is much the same as nearly everywhere else in the world, and, to a large degree, for kindred reasons. There is in every port of Brazil an accumulation of merchandise purchased—mostly under contract—at prices which no longer afford opportunity for sale at a profit to the distributor. Exchange rates aggravate the difference in prices of goods; hence repeated requests for extensions. Mr. Walker's report, contained in "American Goods and Foreign Markets," the Guaranty Trust Co.'s semi-monthly survey of international trade, continues in part:

Import of U. S. Goods

"Shipments which have been coming forward for the last two months are largely in response to orders placed in the United States six, seven, and even ten months ago. The domestic demand in the United States at that time, and for several months after, was so great that the American manufacturer was either unable to supply the foreign market, or, as is known to be true in very many cases, the foreign market was neglected for the sake of nearer and allegedly safer consumption, and payment. The Brazilian importers, being unable to procure promise of prompt delivery, and failing to find suitable merchandise in adequate volume in their former European markets, placed duplicate orders with a number of American manufacturers or agents for the same goods, just as they had done during the war, expecting that if quick delivery was not possible from one source, it would be from another. More or less suddenly conditions in the United States changed. The domestic demand decreased sufficiently to leave some surplus in the hands of the producers, and the latter then—almost simultaneously, of course—sent to the South American market merchandise which they had not been able to ship before.

"And so the Brazilian importer began to receive his goods, not merely from one of the sources he had tried, but from many or all of them, and all at the same time, or at least within a few weeks of one another. The result was heavy congestion and inability to meet demands for payment. The American exporter whose goods were most satisfactory from every point of view was preferred. The others received notification of 'refusal to accept' or, where the obligation was difficult to escape, requests for 'extensions.' The ever rising dollar produced demands for further and still further 'extensions,' many of which—because of tight money and restricted credits at home—ended in compromises which permitted the Brazilian importer to take his goods out of customs at salable prices.

Brazil's 1919 Trade Balance Was Misleading to Buyers

"By the placing of duplicate orders, as a means of procuring shipment during last spring and early summer, the Brazilian importers, as goods came through in the rush of mid-summer and early fall, found themselves heavily 'overbought.' It could scarcely be otherwise, as there was every temptation to over-buy. The end of 1919 saw a favorable trade balance for Brazil of more than $250,000,000, indicating a condition of prosperity as abnormal as it was misleading to the less thoughtful business man. Instead of conserving credits, the Brazilian merchants continued to buy, although exchange rates rose steadily.

"It would be misleading to indicate that this state of things was without local exceptions. There are, of course, as everywhere, quite a number of solid importing firms here who neither have overbought nor have suffered impairment to their credit. There are importers and distributers—long-established and experienced—who have not cancelled, repudiated or reduced a single shipment from the United States. Likewise, there are exporters in New York, Boston, San Francisco, Philadelphia, Baltimore, New Orleans, etc., who, because of their long experience, did not

neglect their foreign buyers, shipped promptly and regularly, and who have not suffered in consequence. These are the firms that have spent money to send capable and responsible men to select their agents here, to study the field, and who have been content to grow slowly and conservatively in this as in other new and distant fields of commerce.

"Notwithstanding the severity of conditions here, the people refuse to be discouraged. While many of their institutions and their bases of civilization are much older than ours, the people feel that in most respects their country is young, their resources are unlimited; they look forward to the future with an optimism which is at once an inspiration and a handicap—the latter because the people are not presently thriftful. They instinctively know their own wonderful recuperative powers. Theirs is a land of promise and boundless opportunity. They are adaptable in the extreme. The Brazilian who has tasted riches can, if he has to, most speedily and not unhappily, return to the condition in which he lived before his wealth came to him. He sees immigrants coming in hundreds by every European boat, and disappearing into the interior to till the soil and build roads for the production of more prosperity for all concerned. And to his temperament the silver lining is more vivid than the cloud which overshadows his present condition.

Italian Discount and Trust Co. Reviews Italian Situation

While the general trend of events in the economic and industrial situation in Italy seems to be marking time, so to speak, it may be stated with authority that the nation, as a whole, is in a much better frame of mind than it has been for many months past. The people are showing a steadily increasing respect for law and order, brought about by the influence of the better element of the population, and also, no doubt, by the firmer stand which the government has taken in enforcing its rulings.

Some of the outstanding factors which have contributed to the improved sentiment in Italy may be summed up thus:

Premier Giolitti has formulated for legislative action a bill embodying, as equitably as is possible under the present circumstances, the major terms of the agreements recently entered into by the workers and the employers in the various trades. While the plan is more or less tentative, it is hoped and believed that it may act as the forerunner, at least, of really stable and satisfactory conditions for all concerned.

The culmination of the long-drawn-out dispute between Jugo-Slavia and Italy, as officially established by the Treaty of Rapallo, has re-acted favorably on the peoples of both countries. From all reports, Italians are evincing their satisfaction by a display of renewed activity in their daily work, realizing, as they do, that the increased business which will come to their country is bound to result in greater prosperity for them, as individuals.

The situation with regard to coal is improving every month, and there is fair assurance that this improvement will be maintained, if not increased, in the immediate future.

The one disquieting element in the nation's life at this time is the bread problem. While the government's action in raising the price of bread to the people is looked upon as a further temporary hardship, the more intelligent part of the population sees in this movement an eventual betterment of the country's finances, and a resultant improvement in individual prosperity. This long-range view is undoubtedly the correct one, but it is not an easy matter to convince the people already heavily burdened that one more burden is going to be good for them. The official figures show that from July 1, 1914, to Dec. 31, 1920, the loss to the Italian government on foreign cereals imported and national cereals requisitioned amounted to the astounding total of 15,542,000,000 lire. This is an appalling deficit, which will have to be met, until conditions right themselves, by increased agricultural production, a higher-priced loaf, and stiffer taxes.

Italy's total consumption of wheat for the agricultural year 1920-21, is reckoned at 40,000,000 quintals. Of this amount, only about 12,000,000 quintals will be available for requisition, because of the failure of the local crops this year. As a consequence, 28,000,000 quintals of wheat will have to be provided by imports at prices considerably higher than those fixed for the domestic product.

Italian-American Trade Situation

Trade between Italy and the United States shows a falling off. The value of the goods shipped from Italy to the United States in November, 1920, was about $5,320,000, compared with about $11,000,000 in November, 1919. The imports to Italy from this country in November last were valued at about $27,000,000, as against $37,000,000 in November, 1919. For the eleven months ended November, 1920, the merchandise sent from Italy to this country was valued at $70,600,000; for the corresponding period in 1919, $51,820,000; while the imports to the Kingdom from the United States totalled $340,000,000 for the first eleven months of 1920, as against $403,290,000 for the first eleven months of 1919.

Coal received into Italy during last November amounted to about 520,000 tons, of which quantity the United States sent 225,000 tons. Great Britain and Germany furnished the remainder.

Compound duties are placed upon all motor cars, or in general on all automotive vehicles, weighing 2,500 kilos or less. Heretofore, taxes on imports into Italy have been figured on specific charges—weight, measure, etc. Vehicles subject to this newly fixed duty, however, pay in addition to the specific rates, according to weight, an ad valorem duty of 35 per cent. The Italian customs authorities have fixed the value upon which the duty is levied as based upon the value stated in the invoice, plus the transportation charges to the Italian frontier. When the invoice value is expressed in foreign currency, the conversion into lire is effected at the so-called official "average" rate of exchange sent to all Italian customhouses every day by the authorities. H. C. MacLean, U. S., commercial attaché at Rome, gives this interesting example, re. an American automobile:

Invoice value	$1,000
Transportation charges to Genoa	100
Total value taken for customs	$1,100
Average rate of lira-dollar exchange—lire to the dollar	27
Equivalent of total value, $1,100 in lire	29,700
Amount of ad valorem duty, or 35% of lire 29,700	10,395

In the hypothetical case just cited there would be the specific duty on the weight in addition to the above ad valorem surtax.

National Bank of Commerce in New York Gives Figures on Money Rates and Manufactures

There is a more confident feeling throughout the country and developments since the first of the year support improved sentiment. The gradual liquidation in many directions has materially lessened the strain on bank resources and the general credit position is improving. However, the importance of export demand in the marketing of many American products makes it inevitable that present unstable financial conditions throughout a large part of the world will be reflected in the United States for some time to come. In addition, the readjustment from war-time price levels to those of a more normal character has been progressive and has affected different commodities in turn. While it has been practically completed in some lines, a further series of readjustments must necessarily occur in others before business can be properly realigned to new conditions and each has its bearing on the entire situation. The effect of these successive readjustments should neither be an occasion of general pessimism nor should undue optimism be engendered by unrelated improvement in special localities or lines of business.

Money Rates

The reserve ratio of the Federal reserve banks now stands at 48.1 per cent as compared with 42.7 per cent at the middle of October, when the fall requirements were at a maximum, and with 45.1 per cent a year ago. Money

rates which continued at the levels previously current until well after the beginning of the new year have now become somewhat easier. The ruling rate on commercial paper has declined from 8 to 7½ per cent with a limited supply available and an active demand from country banks. Rates on bank acceptances have likewise declined sharply under the influence of liberal buying. The volume of time loans on securities has been small while the rate has declined from 7½ to 7-6 per cent. Call loans made on the stock exchange ranged from 7 to 6 per cent, while private sources were reported as having made loans as low as 4 per cent.

Improvement in the textile industry is evidenced by the partial resumption of operations by some mills both in New England and in the South. Operations are for the most part on part time and in practically all cases the wage scale is lower than that prevailing during 1920.

Wool consumption in November, the latest month for which data are available, was 28,096,000 lb., grease equivalent, compared with 38,510,000 lb. in October and 60,593,000 lb. in November, 1919. Cotton consumption in December was 294,851 running bales, 37,206 bales less than the preceding month. This is the smallest monthly consumption so far recorded.

Pig-iron production in December was 2,703,855 tons, the smallest since April and a decrease of 231,053 tons from November. Steel production for about 85 per cent of the industry decreased from 2,638,670 gross tons in November to 2,340,365 gross tons in December. The largest interest continued during December to operate at about 90 per cent of capacity, but some of the smaller plants are not operating at over 25 per cent of capacity. The industry is now feeling the effects of curtailed orders from almost all lines of manufactures.

Unemployment is widespread. As an indication of this, returns to the State Industrial Commission of New York show decreases in employment in every branch of manufacturing, with the exception of three minor industries. The number of workers employed in factories in the state in December was 8 per cent less than during the preceding month, the volume of employment being the lowest for any December since 1914. In the nine months from March to December approximately 20 per cent of the factory employees in the State of New York had been laid off. Wage reductions of from 10 to 25 per cent are reported from nearly every section of the country.

Locomotive Makes Record

Officials of the Virginian Railway, Roanoke, Va., claimed a new record when locomotive No. 711 hauled eighty loaded coal gondolas containing 9,200 tons of coal from Victoria to Norfolk unaided. The 125-mile trip was made in nine hours and fifty minutes, with four water stops. The engine consumed 40,000 gal. of water on the way.

Conditions in Great Britain Industries Still Bad—Association Reports—Foreign-Trade Outlook

By I. W. Chubb, London Correspondent

London, Jan. 21, 1921.

General conditions in Great Britain remain much as previously reported, the gloom simply deepening. There is, however, one brighter feature to note. The cost of living, as officially estimated, declined during December by four points, leaving it at the beginning of January 265 as compared with 100 at the outbreak of war. Even this has its depressing side, as the decline is due to falling away in demand, which is steadily being realized by the leaders of combines and rings who control selling operations, both wholesale and retail. Some few indications show a return to competition, but not many. The reduction in living costs in due course will automatically affect the wage rates of about one and a half million people, particularly civil servants, municipal employees, members of the wool industries and railwaymen.

The Engineering Industry in Poor Condition

Meanwhile the engineering industry on the whole is in very unhappy circumstances, and the machine-tool industry in particular is suffering. Dealing with the general position, W. B. Lang, of the well-known Johnstone lathe firm, has written regarding British machine-tool firms that "responding to the tremendous necessities of the war situation, many firms increased their facilties beyond the requirements of normal times. They are now left with large establishments and heavy overdrafts from the bank instead of with the necessary liquid capital which is required at all times to carry on their business. In addition they are faced with the difficulties of high interest, and in some cases with the Treasury Department demanding excess profits where only buildings and plant exist, and where the capacity for production now exceeds the demand. Incidentally the writer may be pardoned for mentioning that he knows very few machine-tool firms which have made excess profits, although large numbers have increased their output to two or three times that of pre-war conditions." He refers to the fact that American machine-tool makers were not controlled during the war as in Great Britain and, he adds, "judging by the prices charged and paid by this and other countries it can be realized that they are now in a financial position which compares very favorably with British machine-tool makers. On the other hand, German machine-tool makers, operating from a country which lost the war, are now placed in an extraordinarily favorable position owing to the abnormal rates of exchange." After reference to difficulties caused by the trade unions, Mr. Lang appeals to the British engineering industry to see that British machine-tool makers are supported and that Great Britain does "not become to any serious degree dependent on the United States and Germany for supplies." In fact he seems to urge that the British machine-tool industry should be treated as a key industry.

Report of Machine Tool Trades' Association

The annual report for 1920 of the Machine Tool Trades' Association shows that some £8,250 was received on account of profits arising from the exhibition held in September last at Olympia, W. To judge by the statements made at the annual meeting, referred to later, the total profit is £9,500. Following the voting, it was settled by the council that the next exhibition to be organized by the association at Olympia, W., should not be held in 1923, and the general meeting decided that the period should be the autumn of 1924. Apart from the users of complimentary tickets, season and single admission, 90,066 visits were made to last year's exhibition. Regarding the Canadian customs' tariff, using once more the words of the report, "the association has informed the Board of Trade that in view of the strong American competition, due to its favorable geographical position, the preference of one-third on the existing Canadian tariff on machine tools is not sufficient to enable British machine-tool makers to compete effectively in the Canadian machine-tool market."

Association's Advice on Advertising

The paragraphs relating to advertising, also one of the prime interests of the association, are as follows: "From time to time the attention of members has been drawn to the fact that they were advertising in journals not approved by the association. These firms were reminded that the advertising policy of the association had prevented members from being exploited by unnecessary publications, and had, in the past, undoubtedly saved members many thousands of pounds. From the replies received from the members concerned in one case it appeared that the advertisements had been inserted without the knowledge of the members concerned. In their own interests, members are again urged not to support any new publications without first obtaining the views of the association. There are indications of a totally unnecessary increase in the number of technical publications and the executive committee wishes very emphatically to state that in its opinion there is no room for new journals and that none should receive any advertising support. The members are also reminded of the recommendation not to support journals publishing advertisments of German goods."

We may add that the membership now stands at 162. Twenty-two new

firms were admitted during the past year, and six firms were refused admittance.

Standardization

The British Engineering Standards Association has been informed that the Machine Tool Trades Association is in favor of an attempt at standardization in regard to "(1) devices for holding cutting tools; (2) devices for holding work and fixtures; (3) high-speed tool sections for use in making cutting tools; (4) operating movements, e.g., direction of rotation of handles of feed screws; (5) nomenclature of machine parts; (6) taper shanks and sockets of larger dimensions than it was customary to use before the war; (7) standardization of spindle noses for lathes; (8) standardization of metal slitting saws."

Do Not Fear Foreign Competition

At the meeting of the Machine Tool Trades Association held in London on Jan. 19 the resolution put forward by the council but moved personally on his own responsibility by Sir Alfred Herbert, to the effect that no member of the association shall be permitted to deal in German machine tools, was very decisively rejected by 35 to 11. So that the whole question of free or other trade should be raised J. P. Barker, of Greenwood & Batley, Ltd., Leeds, moved an amendment to the effect that the words "or American" be inserted after the word German.

The decision of the meeting was noteworthy, for in the past at least it had been safely assumed that most members of the industry were protectionists. It would appear that despite the present depressed condition of the industry the British machine-tool maker does not unduly fear competition whether from Germany or elsewhere. At any rate, he does not fear it sufficiently to debar the engineering industry as a whole from participating in advances made in production means and methods in other countries.

Reports of Motor Companies

Regarding the motor industry, apparently the Austin Co. last year delivered 4,320 cars and 2,026 tractors, the net sales for the 12 months amounting to £4,283,000. The firm has stated that contracts for 1921 amount to nearly £8,000,000, and the prices for cars now quoted "are standard and will be maintained."

On the other hand, the Daimler Co. announces a drop of £225 (now £900) on their "Light Thirty" six-cylinder chassis, and of £150 (now £1,000) on their "Standard Thirty" six-cylinder chassis. Trouble with one of the magneto firms seems probable.

Reference has been made in these columns to the export credit scheme being formulated by the Board of Trade. It appears that negotiations have taken place between that board and representatives of the insurance companies and banking interests, but not without opposition. Neither the banks nor the insurance people are willing to accept the risks or lock up capital in non-liquid assets.

Inquiries More Frequent in Iron and Steel Trade

At the last meeting of the London Iron and Steel Exchange, according to the official report, business showed no material expansion but inquiries are more frequent. The failure of the overseas demand was noted and the impossibility of meeting continental competition on present costs of production is mentioned. A very definite reduction in prices is nevertheless rumored. Prices have, in fact, been reduced of late, and it is asserted that continental makers who are desirous of ready money are selling steel bars at but a very few shillings beyond the price of steel billet. Special competition is expected from the Lorraine works, now controlled by the French. They have been working full time, with the result that stocks have accumulated, including, it is stated, pig iron and partly and fully manufactured iron and steel. The French market being unable to absorb the output, an attempt is, it is stated, to be made to export, and a fresh campaign in price cutting has been suggested. In fact, the French themselves have no objection to German products, as was mentioned incidentally in the course of the Machine Tool Association meeting by a British firm which has been dealing openly with Germany, buying steel castings at many pounds less than the British price and selling them just as openly to the French.

The United Brassfounders & Engineers, Ltd., is in liquidation, but this is voluntary as a new company is being formed under the title of the United Brassfounders and Engineers (1920), Ltd., in view of the greatly enlarged operations. The nominal capital will be 1½ million pounds. The whole of the liabilities and assets of the old company will be taken over. Five works are concerned in this amalgamation.

Returns on Overseas Trading Satisfactory

The official returns regarding overseas trading during 1920 are satisfactory when money values are considered, though it is not possible to say quite the same regarding quantities. Imports during last year totaled £1,936,742,-120; exports, £1,335,569,027, and reexports, £221,405,957. The increase in imports during the year was about 310 million pounds, and in exports and reexports about £594,600,000, showing an improvement on previous years. The total apparent balance against Great Britain last year was, say, 378 millions, or less than had been estimated, and the sum is thought to be quite covered by the shipping and financial services forming the so-called invisible exports. Both as regards imports and exports the greatest advance was in the section related to manufactured goods. It has been estimated that in total weight the imports last year amounted to, say, 45,542,000 tons, as against 56,023,000 tons in 1913. As regards exports, dealing only with machinery, the total last year was 229,000 tons down as compared with 1913, while the weight of foreign and colonial merchandise exported last year has been estimated at 1,666,000 tons, as compared with 1,821,-000 tons in 1913.

Industrial Conditions in Soviet Russia

By H. O. Herzog, Berlin Correspondent

The conditions in Soviet Russia are an enigma even to her immediate neighbors. Most news coming from Russia appears in the shape of rumors and is very contradictory. Fugitives report disastrous conditions. Soviet emmissaries on the other hand are eager to spread rosy views. Of Russian newspapers very few find their way abroad, and as they are edited under the strict control of the Bolshevist authorities, their contents are highly flavored. Still they form the only source of reliable news, as verbal reports can rarely be trusted. It seems almost unnecessary to dig deeper for news because what the Bolshevist newspapers are allowed to print is sufficient to confirm the worst apprehensions of the country's interior conditions. They are chaotic and only a slight pretence of order is maintained. The Bolshevist government has made strong efforts, with surprising energy from the side of the leaders, to effect improvements but it is easy to recognize that instead of progress the process of dissolution is continuing.

This view is upheld by no less an authority than a group of German radical leaders, who have visited Russia on the invitation of the Bolshevist government, and who have been given an opportunity to look up a party of some hundred German workmen who had volunteered to work in Russia more than a year ago. These workmen, themselves of decided communistic leanings, have transmitted tales of strongest disappointment and misery. Their enthusiasm and hopefulness have suffered a complete reverse and they are unanimous in the opinion that the country is utterly and hopelessly ruined.

Manufacturers and dealers all over the world will do well to keep these facts in view, especially because during the last months rumors have been spread of enormous orders for manufactured articles which are said to have been placed in Germany and elsewhere. It is a fact that several emissaries from Russia have visited continental countries and negotiated with manufacturers for the purchase of machines and finished products of all descriptions. Some orders have even been given and alluring pictures drawn of further orders which were to follow. None of these orders, however, has been ex-

ecuted, because they all suffered shipwreck when it came to the point of settling the mode of payment.

Russia's Ability to Pay for Manufactured Goods Doubtful

Russian buyers when entering into negotiations always hold out that payment will be made in gold, but when it comes to actual arrangements to be made they have to confess the absolute impossibility of doing so. They then propose to pay by raw products, of which they say they have enormous quantities in store, which need only shipment. Manufacturers in continental Europe have however, become very skeptical toward such tales. German manufacturers have even been invited to Rusia to inspect stores of raw products, but have come back entirely unconvinced. Such stores of merchandise as Russia can spare for furnishing against foreign purchases are widely scattered over the country with no possibility within sight of shipping them to the frontier.

Transportation in Russia is unable to cope with the stringent requirements of the distribution of food and fuel within the country. There is now transportation of regular goods. The railroads are in a state of decay; fuel and rolling stock are lacking everywhere. Over 80 per cent of existing engines are out of repair and they have lately been put out of commission at the rate of 200 a month. Repairs are carried out in a slipshod manner, as time is pressing. The same applies to cars. Visitors to Russia are struck with the number of cars out of repair or completely wrecked which are clogging the side tracks of the stations. The decay of the roadbeds is continually increasing, and the railroad bridges are in an appalling condition. As no rails are produced repairs of the metallic bed are made by taking rails from side tracks and even from main lines. The mileage of roadbeds in service is therefore steadily decreasing. Over 2,000 miles of track were thus broken up in 1919 for repair purposes. On account of bad fuel and inferior repairs engines cannot produce sufficient steam. Even passenger trains travel at a speed of from four to nine miles per hour only.

The Bolshevist government is fully aware that before an improvement of the country's economic conditions can take place, transportation has to be improved. For this reason it formed a while ago groups of engineering works, mostly engine and car factories, called "advance groups," which receive special attention in the matter of supplies of raw material, fuel and food for the workmen. One of these groups is comprised of the largest and best developed mills, locomotive and car works; that is, the locomotive factories in Sormorow, Kolomna and Brjansk, steel mills in Wyksa, and the wagon works in Twer and Moscow. This group of works was given a specific task to perform in the way of construction of rolling stock. Reports on the result of the work of the first half year have lately been made public, which show that this task, although very modest, has not been nearly completed.

The Work of Railroad Repair Groups

The works in Sormorow for instance were commissioned to produce within six months eight new engines, thirty extensive engine repairs, and a specified number of duplicate parts. These works, which employ 8,500 workmen, carried out the following work: New engines none, repairs fourteen, and roughly 80 per cent of the duplicate parts.

The works in Kilomna employing 4,100 workmen were ordered to produce in six months six new engines, ten narrow-gage engines and eighteen repairs. The result was: One new mainline engine, five narrow-gage engines and five repairs. This factory produced in pre-war times thirty engines a month.

The Moscow wagon works employing 2,500 workmen in 1914 produced per half year in peace time 1,500 trucks, spare parts for another 1,200, 150 new passenger cars, 120 street railway cars and sixteen motor cars. The works management states the present output of the last half year to have been 120 trucks and no passenger cars. Of snow-ploughs, which in pre-war times were a specialty made in large numbers, the management of these works says that preparations for their manufacture have been completed and, "one snow plow is actually being assembled."

Fuel and Efficient Workmen Lacking

All managers' reports are unanimous in their opinion that fuel, lack of workmen and their inefficiency are responsible for the poor results. The works in Moscow are furnished only with a poor sort of lignite; pit coal is not obtainable even for those which have the special attention of the country's rulers. It is significant that it has been impossible to procure for the works mentioned above the requisite number of workmen, which was to be 50,000. The actual number of workmen remained behind this figure by 18,000. It is said that none of the laborers work full time, the actual working hours having been only sixty per cent of the regulation time. One works-manager states that the output per man and working-day equals the output of 1½ hours of the pre-war standard.

Water Transportation

The same deplorable conditions prevail in water transport. The complete fleet of barges for petroleum traffic on the Volga consists now of only 190 units, which is insignificant considering that in pre-war times, from 900 to 1,000 such vessels were constantly moored in the harbor of Nishni-Novgorod only.

Reports from other manufacturing works show that the diminishing of the number of productive workers in Russia is general. From labor statistics recently published it is seen that in thirty-five government districts 6,090 factories employing 1,250,000 workmen were running in 1918. In 1920 only 5,800 of these works employing 860,000 workmen were in business. The most strenuous efforts of the Bolshevist government to increase the army of workmen, even the strong compulsion which is exercised, are unable to take effect. Most of the workmen have hired themselves to peasants, or have become administrative officials, of which there exists now one for every six heads of the population.

The Granting of Concessions to Foreigners

It is an open secret that the Bolshevist leaders have long become conscious of the utter failure of their methods. This recognition does not find expression in public, but is proved by certain measures which have been taken lately. One of them is a bill passed recently regulating the conditions under which foreign private capital and enterprise is admitted into the country. The object of this bill is stated to be the improvement of the country's production and it creates facilities for foreign business men individually or organized in companies, in the shape of concessions. Holders of such concessions shall have the right to export part of their production. They shall receive privileges if they introduce such new methods which will raise the production.

Such concessions will be given for a long period and the Soviet government gives a guarantee not to interfere with them in any way either by nationalization or confiscation. The Soviet government is trying to give this matter wide publicity in order to attract capital and enterprise from all sides, but the opinion of continental business men is so far highly unfavorable toward the scheme. Foreign capitalists and business men lured into embarking in the scheme are believed to take a heavy risk, as the Soviet government is hardly able to observe their guarantee even if they were willing to do so.

Second Annual Marine Exhibition

The second annual marine exhibition was held in Grand Central Palace, New York City, during the week of Jan. 23-29, 1921.

The opening address was delivered by Harry H. Herrick, president of the Mississippi Valley and Great Lakes Trust Co. of Chicago. Mr. Herrick was escorted by 100 students of the New York Nautical School under command of Lieutenant-Commander J. S. Bayles.

The two floors of the palace were literally "chock a block" with everything belonging to ships of the present day—much of it bewildering to a "landlubber"—but for the old salts, the men who "went down to the sea in ships" in the days when "sailors were sailors," there was but little to bring back the memories of bygone days.

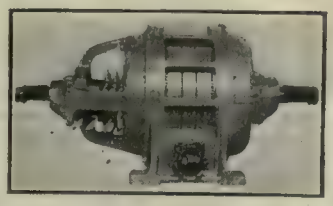
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Induction Motor, "M. T. C."

General Electric Co., Schenectady, New York

"American Machinist," Jan. 6, 1921.

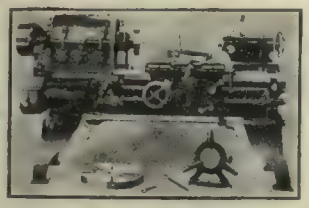


This motor is smaller in diameter and greater in length than motors of the same horsepower of the company's former designs. As to the electrical characteristics, at rated frequency and voltage, it is stated that the maximum stationary torque is twice the running torque. All the motors of 40 hp. and less are rated on a basis of a temperature rise of 90 deg. F. (50 deg. C.) in 30 min., and those of 50 hp. and larger of the same rise in 60 min. A resistor has been developed for work with the motor that leaves enough resistance in the rotor circuit, when the controller is on full, to cause the motor to run at approximately 89 per cent of full-load rated speed when delivering full-load torque.

Lathe, Engine, Geared-Head

Lehmann Machine Co., St. Louis, Mo.

"American Machinist," Jan. 6, 1921.

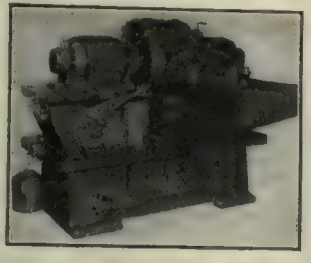


Specifications: Sizes, 14, 16, 18, 22 and 24 in. Maximum distance between centers with 9-ft. bed: 16- and 18-in. lathes, 5 ft.; 22- and 24-in., 4 ft. Travel of tailstock spindle, 7½ to 12½ in. Maximum gear ratio: 16- and 18-in. lathes, 57.1:1; 22- and 24-in., 70.6:1. No. of spindle speeds, 16. Range of spindle speeds: 16- and 18-in. lathes, 10.5 to 412 r.p.m.; 22-in., 8.5 to 330 r.p.m.; 24-in., 8 to 310 r.p.m. Feed, 16- and 18-in. lathes: number, 56; range, 2½ to 280 per in. Feed, 22- and 24-in. lathes: number, 63; range 1⅞ to 180 per in. Motor: speed, 1,800 r.p.m.; hp., 3 to 10. Weight: net, 3,450 lb. for 16-in. lathe; 8,200 lb. for 24-in.; boxed for export, 4,120 lb. for 16-in.; 9,000 lb. for 24 in.

Grinding Machine, Disk, "No. 220," Equipped for Leaf-Spring Eyes

Badger Tool Co., Beloit, Wis.

"American Machinist," Jan. 6, 1921.

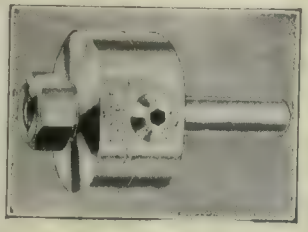


The machine can be furnished with belt drive, but is here shown completely motor driven, each spindle being equipped with a built-in, fully inclosed, 5-hp. motor. The motors slide on ways and drive 16-in. cylinder wheels held in chucks. A ½-hp. motor drives the coolant pump in the rear of the machine. The weight of the machine equipped for spring grinding is 3,800 lb. When grinding the eyes of springs to length, the attachment shown is used. It consists of a support carrying a sliding carriage to which motion is imparted by means of a rack and a pinion driven by a crank. The two grinding wheels are brought up to stops, and the spring passed back and forth between them.

Boring Head, "Micro-Adjustable"

Porter-Cable Machine Co., Syracuse, N. Y.

"American Machinist," Jan. 6, 1921.

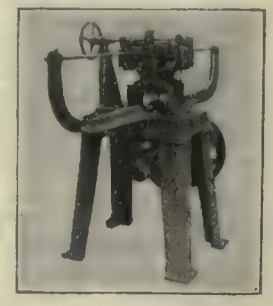


The body of the head is provided with a ¾-in. shank. To it is gibbed the cross-slide, controlled by an adjusting screw, the head of which is graduated to read in thousandths of an inch. The micro-adjusting screw is at all times entirely enclosed and protected from chips and dirt. It is stated that, because of the ample length of the bearings and the construction of the nut it is impossible for the screw to bind. The boring tools are held in a ¼-in. draw-in chuck on the cross-slide, thus providing a simple means of changing them. On account of the adjustability it is possible to utilize tools having long lips.

Straightening Machine, Rotary, "No. 00"

Kane & Roach, Niagara and Shonnard Sts., Syracuse, N. Y.

"American Machinist," Jan. 6, 1921.

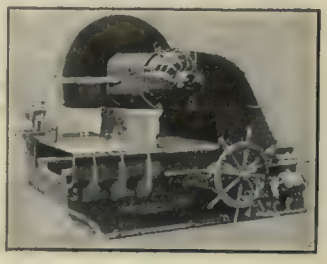


The machine is intended for straightening round stock in sizes from $\frac{1}{32}$ to $\frac{5}{16}$ in. in diameter. The stock is put into the machine through a tube, shown in the foreground, and it then passes through the rolls in the center of the machine. There are two hardened steel rolls that revolve the material and also feed it through automatically. It is stated that the stock travels through at a rate of 50 to 75 ft. per minute, and that nearly all material is trued at one pass. The handwheel at the side of the machine can be used to adjust the position of the rolls for the diameter of the work. Stock anywhere from 8 or 10 in. in length up to 25 or 30 ft. long can be straightened. Floor space, 24 x 60 in.

Saw, Friction, High-Speed

Jos. T. Ryerson & Son, Chicago, Ill.

"American Machinist," Jan. 6, 1921.

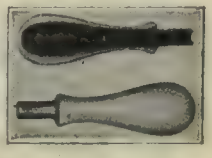


The machine is intended for the cutting of structural steel, and particularly adapted to shops where a large volume of cutting is done. The cutting is done by means of a soft steel disk running at high speed and cooled by a jet of water. Specifications: Built in four sizes, Nos. 1, 2, 3 and 4. Capacity to cut I-Beams: No. 1, 12 in., 40 lb.; No. 2, 18 in., 65 lb.; No. 3, 24 in., 80 lb.; No. 4, 24 in., 100 lb. Diameter of saw: Nos. 1 and 2, 46 in.; No. 3, 52 in.; No. 4, 56 in. Size of motor, 25 to 120 hp. Height, 6 ft. 3 in. to 7 ft. 5 in. Floor space, 7 ft. 2 in. x 5 ft. 2 in. to 12 ft. 8 in. x 6 ft. 6 in. Weight with power feed; net, 5,740 to 12,650 lb.; boxed for export, 7,300 to 15,450 lb. Export box, 294 to 625 cu.ft.

Handle, Machine, Hollow, Pressed-Steel

The Rockwood Sprinkler Co., 34 Harlow St., Worcester, Mass.

"American Machinist," Jan. 6, 1921.

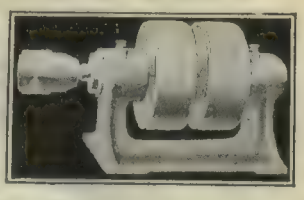


The handle is of pressed steel, made by a special process and combines lightness of weight with ample strength to resist any strain to which such a part might legitimately be subjected. It is made in ten sizes and is especially suitable for the operating levers and handwheels of machine tools and similar machinery.

Tapping Machine, Bench

Taylor-Shantz Co., 478-86 St. Paul St., Rochester, N. Y.

"American Machinist," Jan. 13, 1921.



The machine has a capacity up to $\frac{5}{16}$-in. taps. When the work is pressed against the tap, the spindle turns in the direction necessary to cut the thread; but when it is pulled away, the direction of rotation is reversed, so as to withdraw the tap. The reversal is accomplished by means of a leather-faced friction disk between the pulleys. The cushioning action of the disk is said to minimize the danger of tap breakage. The machine can be driven directly from the lineshaft by an open and a crossed belt. Specifications: Maximum capacity of chuck, $\frac{5}{16}$ in. Pulleys, 5 x 1¼ in. Lengths of spindle and chuck, 12¼ in. Size of base, 7⅝ in. x 5 in. Total height, 6¾ in. Weight, 21 lb.

Clip, paste on 3 x 5-in. cards and file as desired

C. H. Wills & Co. Begins Delivery On Its Motor Cars

C. H. Wills & Co., Maryville, Mich., announces that it has entered the production period and is ready for deliveries of the Wills Sainte Claire motor cars. This car is built throughout of molybdenum steel. The motor is of the V-type, eight cylinders, set at an angle of 60 deg. The valves and camshafts are of overhead construction. The wheel base of the car is 121 in. and its total weight about 3,000 lb. It is said that a score of patents are contained in the vehicle.

Giant Steel Aëroplane

According to a recent report from Reuter's, Paris, a giant aëroplane is being built by the Breguet Co., which, when completed, will be a veritable aërial ship. It is constructed with an engine room in the nose of the machine, the total motive power being 1,000 hp. A comfortable saloon for passengers has been arranged in the fuselage. The wings are of a new design and the machine is being built entirely of steel. It has recently been inspected by M. Flandin, under-secretary of state for air.

Obituary

MOSES L. OBERDORFER, president of the M. L. Oberdorfer Brass Co., of Syracuse, N. Y., died recently at his home in that city. He was seventy years old.

MELVILLE P. HAYWARD, who has for some time been assistant purchasing agent of the American Bosch Magneto Corporation, Springfield, Mass., handling machine tools, factory supplies, equipment, etc., died recently at his home, from pneumonia.

Business Items

The first national conference of the district sales managers of the Hart & Crouse Foundry Co., of Utica, N. Y., was held here on Jan. 25 when about twenty-five of the employees of the local company came together from all over the country to attend a day of conference and discussion, and a banquet held at Hotel Martin.

The annual meeting of the stockholders of the Rome Brass and Copper Co. was held on Jan. 25 at the offices of the company at Rome, N. Y. At a subsequent meeting of the trustees, the following officers were elected: President and general manager, Barton Haselton; vice president, J. J. Armstrong; secretary and sales manager, H. J. Rowlands; treasurer and assistant general manager, H. D. Wolfe; assistant secretary, J. J. Russell; assistant treasurer, N. S. Thomas; works manager, Weston Jenkins; executive committee, B. Haselton, J. J. Armstrong, F. A. Ethridge, H. T. Dyett.

At the annual meeting of the stockholders of the Rome Hollow Wire and Tube Co., Rome, N. Y., the following officers were elected: President and general manager, F. J. De Bisschop; vice president, James A. Spargo; secretary and treasurer, F. M. Shelly.

The annual election of officers of the Economic Iron Works was held in Utica Jan. 25. G. W. Andrews was elected president; Gilbert Lorenz, vice president and treasurer; Louis Rieben, secretary.

The Weige Machine Tool Co., of Peru, Ind., has increased its capital stock from $115,000 to $145,000.

The Marion Fence Machinery Co., of Marion, Ind., has been organized. It manufactures machines for fence making. The company has a capital stock of $75,000.

The Yale & Towne Manufacturing Co., of Stamford, Conn., plans to increase its capital stock to $25,000,000.

A $200,000 plant, including shops, is to be constructed in the immediate future at Anniston, Ala., by the Automatic Specialty Manufacturing Co., a corporation recently organized by C. H. Rutherford of Atlanta, Ga. The company will manufacture automobile accessories, specialties and parts.

The Gilbert & Barker Manufacturing Co., Springfield, Mass., announces the following recent additions to its sales forces: H. L. Rice, Greenville, Tex.; E. P. Kimbrough, Dallas, Tex.; H. S. Colton, Springfield, Mass.; G. R. Thurber, Springfield, Mass., and H. P. R. Glad, San Francisco.

The Western Reserve Machinery Co., Cleveland, Ohio, has been incorporated. The amount of money invested in the business is approximately $200,000.

Personals

ROBERT M. EAMES has been appointed general sales manager of the Bryant Electric Co., Bridgeport, Conn., to fill the vacancy caused by the resignation of Frank V. Burton.

ARTHUR H. ABBOTT, 88 Broad St., Boston, Mass., has been appointed New England representative of the Ohio Electric and Controller Co., Cleveland, Ohio, for the sale of Ohio mill-type lifting magnets and Ohio ball-bearing fractional-sized motors.

C. E. ANDERSON is now designer for the American Machine and Foundry Co., of Brooklyn, N. Y. He was formerly engineer for the E. W. Bliss Co. of Brooklyn.

J. G. MELBROD, after four years' charge of the foundry of the Titanium Bronze Co., has assumed control of the foundry of the Hills-McCanna Co., 2025 Elston Ave., Chicago. Mr. Melbrod's previous experience in handling aluminum bronze and other difficult metals will be devoted to furthering the development of the foundry practice in lines additional to the present output of the Hills-McCanna Co.

FREDERIC GRIMMER, formerly superintendent of the Columbia Hoist and Machine Co., Flushing, L. I., N. Y., is now general manager of the National Indicator Co., Long Island City, N. Y.

JOHN J. MUIR, who until recently was connected with the United States Shipping Board, Emergency Fleet Corporation, has opened offices in Seattle, Wash., to practice as a consulting engineer in marine and general engineering work.

RAY L. SOMERS has recently resigned his position as plant engineer for the Greenfield Tap and Die Corporation of Greenfield, Mass., and opened an office as industrial engineer in Providence, R. I.

ALBERT KINGSBURY will henceforth conduct his business of designing, manufacturing, and selling of Kingsbury thrust bearings under the name of Kingsbury Machine Works. His new office and factory are located at Frankford, Philadelphia, Pa.

CHARLES D. H. KELLOGG, formerly manufacturing engineer for the Coe-Stapley Manufacturing Corporation, West Haven, Conn., is now with the Steele & Johnson Manufacturing Co. of Waterbury, Conn.

JOHN M. PERKINS, manager of the Kewanee (Ill.) Works of the Walworth Manufacturing Co. of Boston, Mass., resigned his position on Dec. 31. Mr. Perkins was also a former works manager of the plant of the Gilbert & Barker Manufacturing Co., Springfield, Mass.

WILLIAM A. KIMBALL was recently appointed general superintendent of the Bristol plants of the New Departure Manufacturing Co., Bristol, Conn. Mr. Kimball has been with the New Departure company fourteen years as purchasing agent.

Forthcoming Meetings

The National Civic Federation will hold its twenty-first annual meeting at the Hotel Astor, New York City on Feb. 14, 15 and 16, to discuss International, European and American labor problems.

The National Foreign Trade Council will hold its eighth annual convention in Cleveland, Ohio, on May 4, 5, 6 and 7. J. G. Hammond, care of the Council, 409 Park Bldg., Cleveland, is secretary.

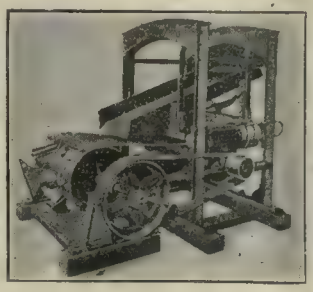
A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The Spring Convention of the National Machine-Tool Builders' Association will be held on Thursday and Friday, May 19 and 20, at Hotel Traymore, Atlantic City, N. J. The general manager is Ernest F. DuBrul, 817-818 Provident Bank Building, Cincinnati.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Magnetic Separator for Molder's Sand
Rapid Magnetting Machine Co., Ltd., Birmingham, England
"American Machinist" (European Edition), Sept. 18, 1920



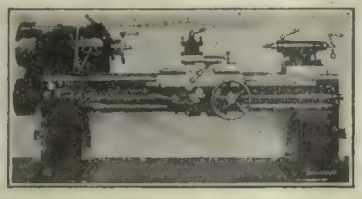
This machine is especially intended for removing iron and steel from molder's sand or from crushed furnace slag. Circular magnets held in a drum are employed in the machine, the current being conveyed to the magnet windings by slip rings. Direct current, 3.2 amp. at 100 volts is required. The belt is 2 ft. in width and travels at 150 ft. per minute around the drums. The magnetic teeth are arranged in rows, four feelers to a row. Thirty tons of sand can be handled in a day, the smallest particles of iron and steel being separated.

Sprue Cutter, ¾-In.
Roberts Bros., Dukinfield, Manchester, England
"American Machinist" (European Edition), Sept. 18, 1920



This machine will cut through ¾-in. square gun metal; it takes steel cutters 1¼ in. square in section. The bottom cutter can be adjusted for height to allow for wear. The top cutter is set in motion by the foot lever. The cutters may be set in line with or at right angles to the main spindle. The distance from the cutters to the column is 9 in. The height from the floor to the spindle center is 5 ft., the gap between being 8 in. deep. Floor space, 2 ft. 9 in. x 2 ft.; weight, 15 cwt. A sprue cutter of similar design, but gear driven, cuts gunmetal bars up to 1⅛ in. square.

Lathe, V-Bed, Quick-Change, Geared Head
Colchester Lathe Co., Colchester, England
"American Machinist" (European Edition), Sept. 18, 1920



The lathe will swing work 17 in. over the bed, 12 in. over the saddle and, with a 7-ft. bed, admit 3 ft. 4 in. between centers. The all-geared head gives eight speeds, from 18 to 305 r.p.m. The drive is by fast and loose pulleys, 10 in. in diameter by 3¼ in. wide. The spindle has a hole through it to take 2-in. rough bars. The saddle is 24 in. long. The gear box gives 32 feeds for screw-cutting, the range being from 4 to 60 threads per inch and from 8 to 120 rev. per inch. Weight, 25 cwt.

Shear, Hand-Operated, "Hunton"
New Fortuna Co., Ltd., Bristol, England
"American Machinist" (European Edition), Sept. 18, 1921



The machine is capable of cutting through a ¼-in. mild-steel plate of any length or width and will trim ⅝-in. mild steel with the pull of one hand. The blades are removable, being held by two bolts, and the bearing for the fulcrum is at the back of the machine, the strongest part of the frame.

Grinding Machine, General-Purpose, "Taylor No. 1"
C. H. Joyce, Ltd., Southwark St., London, S. E., England
"American Machinist" (European Edition), Sept. 18, 1920



Specifications: Working surface of table, 30 x 7 in. Longitudinal traverse of table, 15 in.; cross movement, 6 in.; swivel, 45 deg. each way. Distance between dead centers, 18 in. Wheelhead swivels around column and can be locked parallel or at right angles to table. Vertical travel of wheelhead on column, 9 in. Largest grinding wheel, 8 x ¾ in. Maximum distance from center of wheel spindle to universal head, 9½ in.; from wheelhead center to dead centers, 8½ in. Height of universal-head center, 5½ in. Spindle nose is threaded with a 1½ in. Whitworth thread and bored with a No. 3 Morse taper. Hole through spindle, ¾ in.

Truck, Industrial, Electric, Two-Ton
Greenwood & Batley, Ltd., Leeds, England
"American Machinist" (European Edition), Sept. 18, 1920



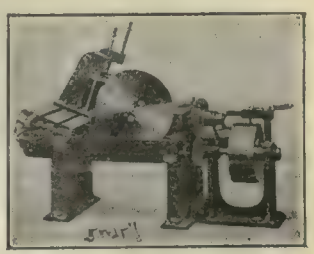
The truck is of steel. It may be fitted with a wood or steel platform, or tipping arrangement. The motor employed is totally inclosed and of the series-wound type with series-parallel control. The controller is of the drum type, inclosed and self-returning to neutral. The pedal must be depressed before the circuit can be made, the action also releasing the brake. The capacity of the battery is 28 volts, 210 amp., with 5-hr. discharge. The turning radius is 8 ft. The wheels are 12 in. in diameter. The chassis is of 3 x 1½-in. steel channel, bent to shape and welded. The length overall is 8 ft. 7 in and the height of the platform 20 in. The weight is 18 cwt.

Toolholder, Lathe, "Mike"
Brooke Tool Manufacturing Co., Ltd., Birmingham, England
"American Machinist" (European Edition), Sept. 18, 1920



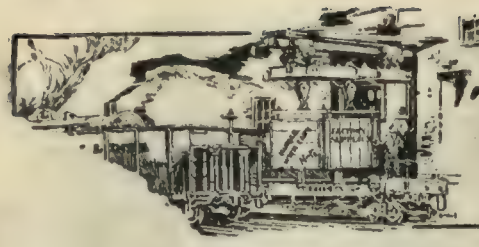
The illustration shows the toolholder with the side of the shank removed, so as to illustrate the wedge piece, secured loosely by a pin in position for clamping the cutting tool. Tightening the toolpost screw causes the wedge to grip the bit, besides securing the toolholder. The toolbit is supported right to the cutting end by a projection on the shank. The toolholders are made in three sizes, suitable for bits from ¼ up to ⅝ in. square.

Saw, Girder
Isaac Hill & Son, Derby, England
"American Machinist" (European Edition), Sept. 18, 1920



This machine is suited for sawing all sections of girders up to 10 x 6 in., though the saw is only 18 in. in diameter. The canting-table arrangement, which is worked by a screw and slide, brings the girder into the best position for sawing, where it can be locked by bolts. The drive to the machine is by pulley and countershaft through steel gearing to the main shaft which runs in a ball bearing at the driving end and a phosphor-bronze bushing at the other end. A worm drives the saw spindle and slides with the saw carriage.

Clip, paste on 3 x 5-in. cards and file as desired



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Year Ago
CINCINNATI		
No. 2 Southern	$38.50	$36.60
Northern Basic	34.50	34.00
Southern Ohio No. 2	34.00	36.55
NEW YORK—Tidewater Delivery		
2X Virginia (Silicon 2.25 to 2.75)	40.41	39.40
Southern No. 2 (Silicon 2.25 to 2.75)	44.26	41.40
BIRMINGHAM		
No. 2 Foundry	34.00	33.00
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25–2.75 sil.	36.00	38.10
Virginia No. 2	40.00	39.10
Basic	34.00	34.60
Grey Forge	34.00	34.60
CHICAGO		
No. 2 Foundry local	35.00	36.25
No. 2 Foundry, Southern	40.60	38.00
PITTSBURGH, including freight charge from Valley		
No. 2 Foundry	36.96	28.15
Basic	31.96	34.40
Bessemer	33.96	35.40

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	*Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.73	$3.80	$3.47	$3.58	$3.32	$3.58	$3.47
Soft steel bars	3.93	3.70	3.52	3.34	3.52	3.48	3.52
Soft steel bar shapes	3.93	3.70	3.52	3.48	3.82	3.48	3.52
Soft steel bands	4.33	4.65	4.22	6.25	....	....	....
Tank plates	3.93	4.00	3.67	3.78	3.62	3.78	3.67

*Add 10c for trucking charge to Jersey City and .15 to New York and Brooklyn from warehouse.

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$2.60	$3.50
Warehouse, New York	4.75	3.52
Warehouse, Cleveland	3.52	3.42
Warehouse, Chicago	4.12	3.52

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York *Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55	4.83	5.50–6.00	4.50	4.68
No. 12	3.60	4.88	5.56	4.60	4.73
No. 14	3.65	4.93	5.92	4.65	4.78
No. 16	3.75	5.03	6.02	4.75	4.88
Black					
Nos. 18 and 20	4.20	5.68	6.80–7.80	5.30	5.55
Nos. 22 and 24	4.25	5.73	6.85–7.85	5.45	5.60
No. 26	4.30	5.78	6.90–7.90	5.50	5.65
No. 28	4.35	5.88	7.00–8.00	5.60	5.75
Galvanized					
No. 10	4.70	6.23	6.50	5.95	6.10
No. 12	4.80	6.33	6.60	6.05	6.20
No. 14	4.80	6.33	6.60	6.05	6.20
Nos. 18 and 20	5.10	6.63	6.90	6.35	6.50
Nos. 22 and 24	5.25	6.78	7.05	6.50	6.65
No. 26	5.40	6.93	7.20	6.65	6.80
No. 28	5.70	7.23	7.50–9.00	7.95	7.10

AUTOMOBILE SHEETS—Patent level stock for automobile bodies and fenders. Prices in cents per pound for 100 lb. lots at warehouse, New York and Chicago—No. 16, 7.48; No. 18 20, 7.53; No. 22-24, 7.58.

*To these prices .10 must be added for delivery in Jersey City and .15 for New York and Brooklyn.

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.50	$5.25	$4.84
Flats, square and hexagons, per 100 lb. base	6.00	5.75	5.34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Co'd rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55
Special Nickel and Alloys			
Malleable nickel ingots	45		
Malleable nickel sheet bars	47		
Hot rolled rods, Grades "A" and "C" (base)	60		
Cold drawn rods, grades "A" and "C" (base)	72		
Copper nickel ingots	42		
Hot rolled copper nickel rods (base)	52		
Manganese nickel hot rolled (base) rods, "D"—low manganese	64		
Manganese nickel hot rolled (base) rods "D"—high manganese	67		

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 3/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	6.50	8.00	9.00
Spring steel (light)	10.00	7.00	12.00
Coppered bessemer rods	9.00	8.00	7.00
Hoop steel	4.65	4.04	4.18
Cold-rolled strip steel	9.50	8.25	9.25
Floor plates	5.75	4.00	6.03

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
BUTT WELD					
⅛ to 3	54–57½%	41½–44%	⅛	15½–25½%	+1½–11½%
			¼	19½–29½%	1½–11½%
			⅜ to 1¼	24½–34½%	8 –18½%
LAP WELD					
2	47 –50½%	34½–38%	1½		
2½ to 6	50 –53½%	37½–41%	1¾		
7 to 12	47 –50½%	33½–37%	2	20½–28½%	6½–14½%
13 to 14	37½–41 %		2½ to 6	22½–30½%	9½–17½%
15	35 –38½%		2½ to 4	22½–30½%	9½–17½%
			7 to 12	19½–27½%	6½–14½%
BUTT WELD, EXTRA STRONG PLAIN ENDS					
⅛ to 1¼	52 –55½%	39½–43%	⅜ to 1¼	24½–34½%	9½–19½%
2 to 3	53 –56½%	40½–44%			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	45 –48½%	33½–37%	1½		
2½ to 4	48 –51½%	36½–40%	1¾		
4½ to 6	47 –50½%	35½–39%	2	21½–29½%	8½–16½%
7 to 8	43 –46½%	29½–33%	2½ to 4	23½–31½%	11½–19½%
9 to 12	38 –41½%	24½–28%	4½ to 6	22½–30½%	10½–18½%
			7 to 8	14½–22½%	2½–10½%
			9 to 12	9½–17½%	5½–+2½%

Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅛ to 3 in. steel butt welded	44%	28%	42½%	33½%	57½%	44%
2½ to 6 in. steel lap welded	39%	24%	44½%	29½%	53½%	41%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 6%. Cast iron, standard sizes, 65% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	14.00	15.00	19.50
Tin in 5-ton lots	32.00	34.25	62.75
Lead	5.50	5.75	8.75
Zinc	6.00	7.00	9.55
ST. LOUIS (In carload lots)			
Lead	5.00	6.25	8.575
Zinc	6.00	6.75	9.225

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	21.00	22.50	29.00	23.00	31.00	26,50	36.00
Copper wire (carload lots)	16.00	17.00	28.25	19.00	29.50	24.00	27.00
Brass sheets	18.75	20.25	25.50	24.00	29.00	30.00	27.00
Brass pipe	23.50	25.00	32.00	25.00	34.00	23.25	35.00
Solder (half and half) (case lots)	22.50	27.25	35.00	26.00	40.50	21.00	38.00

Copper sheets quoted above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill, 1,000 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	18.25	23.75
New York	16.75	23.75
Cleveland	20.00	29.00
Chicago	21.25	26.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f.o.b. mill + less 8% for carload lots..... 11.50

	Warehouse			
	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	13.70	14.50	14.30	15.00
New York	13.00	13.00	14.50	14.00
Chicago	14.50	15.00	14.95	15.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	6.00	10.25
Chicago	6.50	10.50
Cleveland	7.50	11.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	*New York			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	11.50	18.50	10.00	10.50
Copper, heavy, and wire	11.00	16.50	9.50	9.50
Copper, light, and bottoms	9.00	14.50	9.00	8.50
Lead, heavy	4.00	7.25	4.00	4.00
Lead, tea	3.00	5.25	3.00	3.00
Brass, heavy	7.00	9.50	7.00	10.00
Brass, light	5.50	8.00	5.00	5.50
No. 1 yellow brass turnings	6.00	9.50	5.50	6.00
Zinc	4.00	5.00	3.00	3.50

* These prices nominal because of dull market.

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb.	28.30@28.50	24.50	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	28.00	34.00
Chicago	24.50	29.00
Cleveland	22.00	32.00

BABBITT METAL—Warehouse price per pound:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	70.00	90.00	46.50	68.50	35.00	70.00
Commercial	30.00	50.00	15.50	17.25	9.00	15.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at from 16.00 to 20.00.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	List	List	$1.00	$1.00	+ 1.15	1.45
Hot pressed hexagon	List	List	1.00	1.00	+ 1.15	1.45
Cold punched hexagon	List	List	1.00	1.00	+ 1.15	1.05
Cold punched square	List	List	1.00	1.00	+ 1.15	1.05

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	60%	70-5%
Chicago	70%	50%
Cleveland	70%	60-10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in.	45%	60%	50%
1¼ and 1½ in. by 3 in. up to 12 in.	25%	50%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York....$4.50 Cleveland....$3.50 Chicago....$2.50

For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:

New York....$6.00 Cleveland....$4.60 Chicago....$4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅜ by 6 in. and smaller	+40%	50%	40%
Larger and longer up to 1 in. by 30 in.	+40%	40%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	30%	30%	10%	30%
Chicago	net	10%	net	10%
New York	50%	10%	25%	10%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	45%	50%	45%
Tinned	45%	50%	30%

Structural, ⅞, ¾, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York...$5.20 Cleveland...$5.25 Chicago....$5.08 Pittsburgh...$4.00

Boiler, same sizes:

New York...$5.30 Cleveland...$5.35 Chicago....$5.18 Pittsburgh...$4.10

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	24.50	27.00	29.00
Brass	23.50	24.00	28.00

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼-2 in. inclusive in rounds, and ½-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.50 per 100 lb.

In Cleveland—$8.50 per 100 lb.; New York price is 8@8½c.

COTTON WASTE—The following prices are in cents per pound:

	New York		Cleveland	Chicago
	Current	One Year Ago		
White	7.50@13.00	13.00	13.00	14.25
Colored mixed	7.00@11.00	9.00–12.00	10.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.00	$2.00	$2.25
Philadelphia	2.75	2.75	2.00
Cleveland	4.00	3.00	2.50
Chicago	2.50	2.75	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.70	$3.50	$3.40
Philadelphia	3.65	3.65	4.625
Chicago	4.50	3.85	4.125

COKE—The following are prices per net ton at ovens, Connellsville:

	Current	One Month Ago	One Year Ago
Prompt furnace	$5.00@$5.50	$6.00@$7.00	$6.00@$7.00
Prompt foundry	6.50@7.00	7.00@8.00	6.00@7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

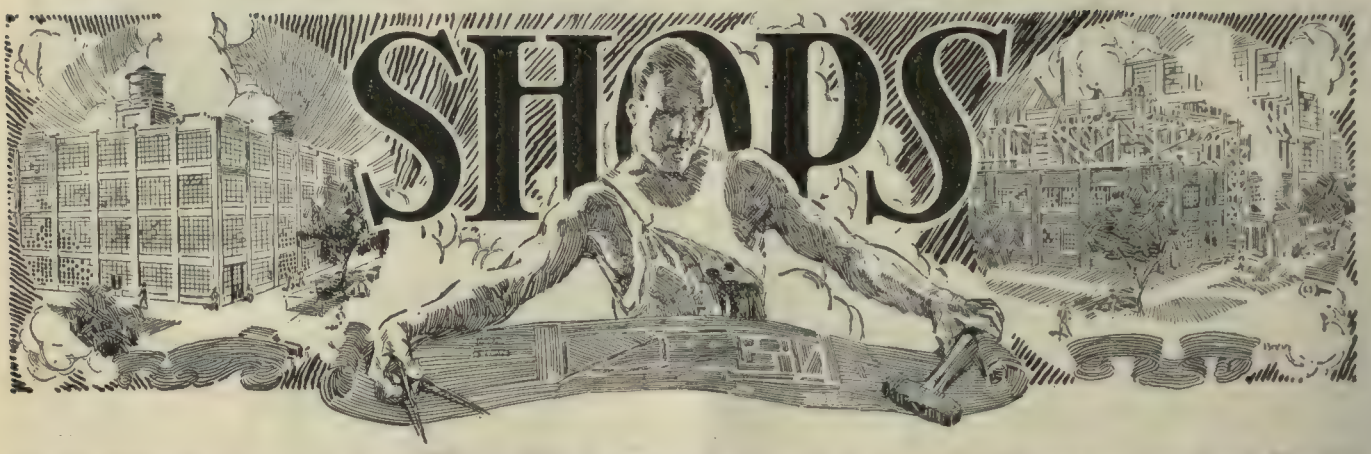
	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels, (5 bbl. lots)	$0.80	$1.80	$0.90	$2.00	$0.83	$1.98
5-gal. cans	1.03	2.00	1.15	2.25	1.08	2.23
1-gal. cans (2 to case)	1.03	....	....	....	....	....

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	14.50	15.50	13.00	14.50
25 and 50-lb. kegs	13.25	14.75	14.75	15.75	13.25	14.75
12½-lb. keg	13.50	15.00	15.00	16.00	13.50	15.00
5-lb. cans	15.00	17.50	15.00	17.50	16.00	16.50
1-lb. cans	18.00	19.50	16.00	18.50	18.00	17.50

500 lb. lots less 10% discount. 2,000 lb. lots less 10-4% discount. 10,000 lb. lots less 10-7½% discount.

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Conn., Waterbury—The Waterbury Tool Co., East Aurora St.—one No. 31 Lucas horizontal boring mill, in firstclass condition.

N. Y., Rochester — The Artcraft Broom Co., 51 Cole St., T. Allen, Purch. Agt.—wire bending machinès.

N. Y., Rochester — The Harrison Mchy. Co., 144-146 Platt St., J. Harrison, Purch. Agt.—24 in. shaper and 16 in. lathe.

N. Y., Rochester—The Rochester Barrel & Mchy. Co., St. James Pl., J. M. Teal, Purch. Agt.—key slotting machine.

Pa., Erie — The Buffalo and Lake Erie Traction Co.—air compressor, 50 ft. capacity, also lathe, 16 in. x 5 ft. betwen centers (used).

Pa., Waynesboro—The Victor Tool Co., 4th St.—machine to tap 1 in. x 18 in. cast iron flanges.

Pa., Carnegie — The Union Tool Co.—One heavy duty drill, to be at least 30 ft. from table to spindle and to drill to center of 36 in. work.
One 24 in. Steinle Standard turret lathe.
One Napier metal cutting saw, suitable for cutting up to 8 in. sq. stock.

La., New Orleans — The Isaac Delgado Central Trade School, H. G. Martin, Dir.—will soon receive bids for—
Two shapers, 16 in. stroke.
One sensitive drill 12 in. or 14 in.
One upright drill centre 20 in. circle.
Two milling machines, range, longitude 32 in.; hrizontal 7 in.; vertical 18 in.
One lathe minimum swing 14 in., belt driven.
Two lathes, heavy duty, 14 in.
Four geard head lathe 14 in.
One speed lathe minimum swing 8 in.

Ga., Macon — The standard Handle Co., Division St., manufacturers of farming tool handles, etc., W. A. Raush, Secy. and Treas.
Two bolt saws, one righthand and one lefthand.
Two rip saws.
Two equalizers.
One swing cut-off saw.
One 125 hp. steam engine.
Two Ober lathes, No. 10 special and larger.
Four belt sanders, etc.

N. C., Newbern — W. M. Pinnix — machinery for the manufacture of plow handles.

Va., Richmond — The Hackley Morrison Co., 16½ North 9th St., H. Morrison, Purch. Agt.—
3 punches presses, approximate dimensions, stroke 1⅛ in., bed opening 4 x 6, weight 750 lb.
1 Byers auto crane with clamshell bucket.
Machinery for crushing feldspar and mica.

W. Va., Huntington—The H. T. Lambert Co., 1018 1st Natl. Bank Bldg., E. A. Thomas, Secy. and Treas.—$20,000 worth of machinery and equipment for the manufacture of frogs, switches, etc.

W. Va., Clarksburg—The Concrete Steel Bridge Co., J. M. Newlon, Purch. Agt.—portable electric cutting machine suitable for cutting small sizes of structural steel.

Ill., Chicago—The Active Realty Co., 416 South Western Ave.—garage equipment.

Mich., Detroit—W. J. Decker, 1802 Baldwin Ave.—No. 1 or No. 2 punch press (used).

Mich., Detroit—The Franklin Auto Sales & Service Co., 3745 Cass Ave.—equipment for automobile service dpartment.

O., Columbus — Cusins & Hearn Co., 48 West Spring St.—bench drill.

Wis., Milwaukee — The Badger Sanitary Case Co., 587 8th Ave., manufacturers of metal medicine cabinets, W. C. Krause, Purch. Agt.—medium size punch press.

Wis., Milwaukee — The Wisconsin Machine Products Co., 539 31st St., J. Van Vechten, Purch. Agt—small boring mill and radial drill.

Wis., Oshkosh—A. Streich & Bros. Co., 663 West Lake St., manufacturers of wagons and sleighs—one small power driven splitting shear, similiar to style D 14, D 16 or D 18 built by the Rock River Machine Co.

Kan., Atchison—The Cooper Fdry. Co., 1001 Commercial St.—one 14 in. swing engine lathe, about 9 ft. between centers.

Minn., Minneapolis—The Hudson Mfg. Co., 324 3d Ave., N., H. D. Hudson, Purch. Agt.—machine tools for the manufacture of dairy barn equipment and hay tools (for plant at Janesville, Wis.).

Mo., St. Louis—G. Sehrt, 3876 Wyoming St., metal polisher—engine lathe, 18 or 20 in. swing.

Ont., London—E. Leonard & Sons, York St., manufacturers of engines and boilers, F. Leonard, Genl. Mgr.—new metal working machinery.

Que., Montreal—The E. F. Phillips Electrical Wks. Ltd., De Gaspe St.—equipment for copper rod rolling mill.

Que., Montreal—The Canadian Natl. Ry. Co., Dorchester St.—machine shop equipment.

Australia, Sidney—S. M. Blackshaw Co., Market and Clarence Sts.—cold heading and rolled threading machines (automatic or otherwise).

Machinery Wanted

Conn., Storrs (Eagleville P. O.) — The Bd. of Trustees of the Connecticut Agricultural College—refrigerator equipment.

Ga., Atlanta—The Southern Locomotive & Equipment Co., 1002 Empire Bldg., R. P. Thompson, Purch. Agt. — Clyde overhead self propelling skidder equipped with steel boom, of modern construction.

Tenn., Bristol—The Southern Brick Plant, M. H. Copenhover Purch. Agt.—induction drykiln fan also dry pan, American preferred, (new or used).

N. C., Charlotte—The Thomasboro Canning Co.—equipment for canning plant.

N. C., Lexington—The United Furniture Co., B. C. Philpot, Pres.— $10,000 worth of machinery.

N. C., Statesville—The Coca-Cola Bottling Co., F. L. Johnson, Purch. Agt. machinery for the manufacture of smoking pipes from fig, briar and apple wood.

Va., Roanoke — The Guarantee Finance Co., Inc., K. C. Patty, Secy.—filters, crowners and all other equipment for bottling plants.

W. Va., Waynesboro—The Lambert Mfg. Co., C. M. Lambert, Pres.—Woodworking machinery, shaper, etc., for planing mill.

Mich., Detroit—M. R. Algers, 7042 West Fort St.—welding outfit and all equipment.

Wis., Eau Claire — The United States Switch Co., Chippewa Rd.—one oil burning oven furnace, suitable for carbonizing, heat treating and annealing, (used).

Wis., Fond du Lac—The Excel Candy Co., 865 South Brooke St., H. Marion, Purch. Agt.—motor driven candy making machinery.

Wis., Green Bay — J. Wilcox, 413 East Walnut St.—machinery for the manufacture of wooden boxes.

Wis., Hazelhurst—J. G. Schwartz, Chn. of the Purch. Com., of Oneida County—elctric loading crane.

Wis., Janesville—The Shurtleff Ice Cream Co., 108 South Main St., H. Shurtleff, Purch. Agt.—motor driven candy making machinery.

Wis., Kaukauna—The Moloch Co., manufacturers of stokers—brass foundry equipment, including ovens.

Wis., Rio—Maas Bros.—planer and other woodworking machinery.

Wis., Oshkosh—The Gould Mfg. Co., 10th and Main Sts.—woodworking machinery.

Wis., Wilton—The Wilton Canning Co.—canning machinery.

Tex., Corsicana — The Corsicana Ice Plant—modern machinery for the manufacture of ice.

Tex., Weatherford—The Bd. of Educ.—manual training equipment.

Metal Working

NEW ENGLAND STATES

Conn., Norwalk—The Amer. Insulator Co., New Freedom, Pa., will soon award the contract for the construction of a 2 story factory, on Main St., here. Estimated cost, $75,000. E. A. Barth, New Freedom, Engr. Noted Jan. 20.

Conn., Storrs—(Eagleville P. O.) The Bd. of Trustees of the Connecticut Agricultural College, plans to build a 1 story forge shop on the campus. Estimated cost $25,000. Architects not selected.

Mass., Worcester — The Amer. Steel & Wire Co., Grove St., will build a 3 story, 120 x 144 ft. addition to its electric cable department. Estimated cost, $150,000.

R. I., Pawtucket—The Mexican Petroleum Corp., 161 Allens Ave., plans to construct a 1 story, 32 x 132 ft. garage on Taft St. Estimated cost, between $18,000 and $20,000. Private plans.

R. I., Pawtucket—The Fales & Jenks Machine Co., 320 Dexter St., has awarded the contract for the construction of a 3 story, 30 x 46 ft. addition to its plant, for the manufacture of textile machinery. Estimated cost, $15,000. Private plans.

MIDDLE ATLANTIC STATES

D. C., Washington — G. H. Bright, 4917 13th St., is having plans prepared for the construction of a garage at 1426 Irving St., N. W. Estimated cost, $50,000. W. B. Wood, 816 Conn. Ave., Archt.

Md., Baltimore—A. R. White, 2 East Lexington St., has awarded the contract for altering his auto service station on Charles and 20th Sts. Estimated cost, $20,000. Private plans.

Md., Baltimore—The Wizard Check Indorser and Printing Machine Co., Inc., 457 Calvert Bldg., will soon award the contract for the construction of the first unit of its manufacturing plant, 102 x 384 ft. F. A. Fletcher, 407 North Charles St., Archt.

N. J., West Hoboken—A. D. Greene, 195 Palisade Ave., has awarded the contract for the construction of a 2 story, 63 x 100 ft. garage on Palisade Ave. and De Mott St. Estimated cost, $50,000.

N. Y., Batavia—The Batavia Car Wks., Inc., 501 5th Ave., New York City, will soon award the contract for the construction of a factory, here. Private plans.

N. Y., New York (Borough of Brooklyn)—E. Leiberman, 758 Ocean Ave., will build a 1 story, 75 x 150 ft. garage on Prospect Ave. near 11th Ave. Estimated cost, $75,000. S. Millman, 26 Court St., Archt. and Engr.

N. Y., New York (Borough of Manhattan)—B. Johnson, c/o Maynicke & Frank, Archts. and Engrs., 25 Madison Ave., will build a 2 story, 110 x 175 ft. garage at 625 West 49th St. Estimated cost, $100,000.

Pa., Bridgeville—The Flannery Bolt Co., Forbes St., Pittsburgh, will soon award the contract for the construction of a 1 story, 50 x 160 ft. factory. Estimated cost, $25,000. Private plans.

Pa., Hazelton—The Tunnessen Mfg. Co., McKinley and 7th Sts., manufacturers of lamps, has had plans prepared for the construction of a 1 story, 48 x 172 ft. garage and manufacturing plant. Estimated cost, $50,000. W. Tunnessen, Mgr. Private plans.

Pa., Braddock — Fire recently destroyed the machine shop of The Sterling Steel Fdry., 8th Ave. along Monongahela River. Estimated loss, $75,000.

SOUTHERN STATES

Ky., Paducah — The Southern Textile & Machy. Co., 433 South 3d St., will soon award the contract for the construction of a 1 story, 90 x 200 ft. factory. Estimated cost, $40,000. G. T. Smith, Jr., 201-202 Trueheart Bldg., Archt.

Va., Portsmouth — The McEwen Lumber Co., Old Key Rd. and 4th Ave., plans to rebuild its machine shop which was recently destroyed by fire. Estimated loss, $35,000. A. McEwen, Pres.

W. Va., Huntington — The H. T. Lambert Co., 1018 1st Natl. Bank Bldg., recently incorporated with a capital stock of $200,000, plans to construct a 60 x 200 ft. plant for the manufacture of frogs, switches, etc. Estimated cost, $25,000. E. A. Thomas, Secy. and Treas.

W. Va., Itman—The Pocahontas Fuel Co. plans to build a machine shop and coal tipple. E. L. Hash, c/o owner, Engr.

W. Va., Wheeling—The Welty-Buick Co., 1500 Market St., plans to construct a 2 story garage at 76-82 16th St.

W. Va., Wheeling — The West Virginia Motor Sales Co., 930 Market St., plans to construct a garage and repair shop.

MIDDLE WEST STATES

Ill., Chicago—The Staver Motor Co., 100 West Garfield Blvd., has awarded the contract for the construction of a 2 story, 140 x 171 ft. auto service station and office building, on the corner of State St. and Garfield Blvd. Estimated cost, $150,000.

Ill., Chicago—The Active Realty Co. 416 South Western Ave., will soon award the contract for the construction of a 80 x 156 ft. garage at 2517 West Van Buren St. Estimated cost, $30,000. M. L. Cobie, 415 North Western Ave., Archt.

Ill., Wilmette — The Marble Furniture Storage Co. will soon award the contract for the construction of a 1 story, 50 x 135 ft. garage on Railroad Ave. near R.R. Station. Estimated cost, $70,000. Westcott Eng. Co., 111 West Washington St., Engrs.. C. A. Westerlind, 179 West Washington St., Chicago, Archt.

Ind., Anderson—The Fulton Tractor Mfg. Co. plans to build a 1 story tractor factory. Estimated cost, $100,000. Architect not selected.

Ind., Indianapolis — C. and A. Potts & Co., 816-28 West Washington Ave., manufacturers of brick and tile working machinery, plans to build a 1 story foundry on Blake St. Estimated cost, $45,000. Architect not selected.

Ind., Indianapolis—The Duesenberg Auto & Motors Co., 515 Lemcke Bldg., will build a 1 story, 90 x 500 ft. auto factory on West Vermont St. Estimated cost, $150,000.

Mich., Detroit — The Belle Isle Boat & Engine Co., 2096 East Jefferson Ave., plans to build a 1 story, 90 x 150 ft. factory. Architect not selected.

Mich., Detroit—The Franklin Auto Sales & Service Co., 3745 Cass Ave., plans to build a 3 story sales and service station. Estimated cost, $150,000. Architect not selected.

O., Defiance—The Smith & Patten Motor Sales Co. is having plans prepared for the construction of a 1 story, 144 x 144 ft. addition to its factory on Clinton St. Estimated cost, $200,000. A. M. Strauss, Shoaff Bldg., Ft. Wayne, Ind., Archt.

O., Cincinnati—C. Schiear, 9th and Sycamore Sts., has awarded the contract for converting a building at 308-312 Hunt St., into a show room, garage and service station. Estimated cost, $20,000.

O., Cleveland—T. Teachout Co., 331 Prospect Ave. has awarded the contract for the construction of a 3 story, 80 x 128 ft. garage at 3204 East 90th St. Estimated cost, $75,000. Private plans.

O., Cleveland—The Hertner Electric Co., 1900 West 112th St., is having plans prepared for the construction of a 1 story, 50 x 250 ft. factory and warehouse on Berea Rd. Estimated cost, $100,000. P. Schmidt, 4500 Euclid Ave., Archt.

O., Cleveland — M. Goldstein, 2562 East 40th St., will soon award the contract for the construction of a 1 story, 50 x 60 ft. addition to his garage, here. Estimated cost, $20,000. M. Altschuld, 5116 Woodland Ave., Archt.

O., Cleveland — Lumbardo Bros., 2611 Orange Ave., are having plans prepared for the construction of a 1 story, 35 x 72 ft. addition to their garage on East 27th St. and Orange Ave. Estimated cost, $15,000. F. A. Azgarello, 2500 East 20th St.. Archt.

Wis., Cedarburg—Lanterbach Sales Co., c/o J. Lanterbach, has purchased site and plans to build a 2 story, 60 x 182 ft. garage on Washington Ave. Estimated cost, $75,000. Architect not selected.

Wis., Hartland — F. Tessman, Merton, is having plans prepared for the construction of a 1 story, 50 x 70 ft. garage and repair shop, here. Estimated cost, $48,000. A. C. Eschwieler, Goldsmith Bldg., Milwaukee, Archt.

Wis., Plymouth—E. Miller plans to build a 1½ story, 80 ffl 150 ft. garage on Mill St. Estimated cost, $75,000. Architect not selected.

Wis., Sheboygan Falls — Boland & Beningham, c/o C. W. Beningham, 1030 Lincoln Ave., Sheboygan, plans to build a 2 story, 110 x 120 ft. garage on Main St.. Estimated cost $75000. Architect not selected.

WEST OF THE MISSIPPIPPI

Kan., Argentine—The Atchison, Topeka & Santa Fe R. R., Kerckhoff Bldg., Los Angeles, Cal., has awarded the contract for the construction of a 1 story, 102 x 115 ft. addition to its machine shop, here. Estimated cost, $45,000.

Kan., Newton—The Atchison, Topeka & Santa Fe R. R., Kerckhoff Bldg., Los Angeles, Cal., will soon award the contract for the construction of a 40 x 72 ft. blacksmith shop, here. Estimated cost, $10,000.

Mo., St. Louis — The Highland Dairy Farms, Wainwright Bldg., has awarded the contract for the construction of a 1 and 2 story garage, stable and salesroom, at 4816-24 Delmar Ave.

Tex., Ranger—The Wichita Falls, Ranger & Ft. Worth R.R., will build a (6 stall) roundhouse, turntable, etc., here. Estimated cost, $100,000. H. F. McFarland, Jr., Ranger, Ch. Engr.

Wyo., Casper—The City will soon receive bids for the construction of a 2 story, 40 x 80 ft. fire station and a 1 story, 35 x 140 ft. garage on South David St. Estimated cost, $75,000. Garbutt, Weidner & Sweeney, Oil Exch. Bldg., Archts. Noted Feb. 3.

CANADA

Ont., London—E. Leonard & Sons, York St., manufacturers of engines and boilers, are having plans prepared for the construction of a 1 story, 100 x 190 ft. factory addition. Estimated cost, $40,000. F. Leonard, Genl. Mgr.

Que., Montreal—The E. P. Phillips Electrical Wks., Ltd., De Gaspe St., will soon award the contract for the construction of a copper rod rolling mill to have a daily capacity of 100 tons. Total estimated cost, including equipment, $175,000.

Que., Montreal—The Canadian Natl. Ry., Dorchester St., will soon award the contract for the construction of 2 story, 25 x 50 ft. machine shop on Sherbrooke St., E. Estimated cost, $35,000.

General Manufacturing

NEW ENGLAND STATES

Conn., New Britain — The New Haven Dairy Co., 201 Hazel St., has awarded the contract for the construction of a 1 story, 50 x 50 ft. addition to its dairy, and for the conversion of same into an ice cream plant. Estimated cost, $18,000. Noted Feb. 3.

Conn., Storrs—(Eagleville P. O.) The Bd. of Trustees of the Connecticut Agricultural College, plan to build a 1 story carpentry shop on the campus. Estimated cost, $20,000. Architect not selected.

Mass., Charlestown—E. R. Whitman Co., Sullivan Sq., manufacturers of store fixtures, will make repairs to its plant on Dorrance St., which was recently damaged by fire. Estimated cost, $30,000. Private plans.

Mass., North Adams — The Trojan Ice Cream Co., 276 5th Ave., Troy, N. Y., will soon award the contract for the construction of a 2 story, 36 x 50 ft. ice cream plant, here. Estimated cost, $60,000. W. J. Clark, Cannon Bldg., Troy, N. Y., Archt.

N. H., Concord — The Rumford Printing Co., Railroad St., plans to build a new factory. Kilham & Hopkins, 9 Park St., Boston, Archts.

R. I., Newport — The Newport Bakery Co., 96 Thomas St., plans to remodel newly purchased buildings on Bway., and equip same for its own use. Architect not selected.

MIDDLE ATLANTIC STATES

N. J., Atlantic City—The Atlantic City Tire & Rubber Corp. has awarded the contract for the construction of a 1 story, 90 x 168 ft. tire factory. Estimated cost, $50,000.

Pa., Lemoyne — The West Shore Dairy Co., c/o F. W. Erway, Pres., 35 South 2d St., Steelton, has awarded the contract for the construction of a 2 story, 70 x 70 ft. dairy on Market St., here. Estimated cost, $45,000.

Pa., Wilmerding—The Thatcher Ice Cream Co. is having plans prepared for the construction of a 1 story, 30 x 65 ft. ice cream plant. Estimated cost, $25,000. The McCormick Co., Inc., Century Bldg., Pittsburgh, Archts.

SOUTHERN STATES

Fla., Kissimmee—The Tucker Brick Co. is rebuilding its mixing plant which was recently destroyed by fire. Estimated cost, $15,000.

Fla., Live Oak—The Live Oak, Perry & Gulf Ry. plans to rebuild its machine shops which were recently destroyed by fire.

Ga., Macon — The Standard Handle Co., Division St., manufacturers of farming tool handles, etc., plans to rebuild its plant. W. A. Raush, Secy. and Treas.

N. C., Lexington—The United Furniture Co. has acquired the plant of the Atlas Furniture Co. and plans to construct an additional building. Estimated cost, $10,000.

Va., Roanoke — The Roanoke Coca-Cola Bottling Co. will soon award the contract for the construction of a 70 x 106 ft. plant. Estimated cost, between $15,000 and $20,000. G. D. Whitesell, Mgr.

Va., Waynesboro—The Lambert Mfg. Co., will construct a planing mill to replace the one which was recently destroyed by fire. Estimated cost, between $15,000 and $20,000.

Va., Danville—The Liggett & Myers Tobacco Co., 212 5th Ave., New York City, has had plans prepared for the construction of a factory here. Estimated cost, $200,000. Francisco & Jacobus, 511 5th Ave., New York City, Archts.

MIDDLE WEST STATES

Ill., Chicago — The Creamery Package Mfg. Co., 61 West Kinzie St., is having preliminary plans prepared for the construction of a 4 story factory on Curtis Ave. and Division St. M. Tullgren & Sons, 425 East Water St., Milwaukee, Wis., Archts.

Ill., Chicago — J. T. Cunningham, 2231 West Van Buren St., manufacturers of ice cream, will soon award the contract for the construction of a 2 story, 125 x 125 ft. addition to his factory at 2445-55 West Van Buren St. Estimated cost, $80,000. J. E. Bristle, 5660 Ridge Ave., Archt.

Ind., Delphi—The Farmers Co-operative Packing Co. plans to build a packing plant. Estimated cost, $500,000. Architect not selected.

Ind., Griffth — The Leonard Tractor Co., Gary, will soon award the contract for the construction of a 1 story, 100 x 140 ft. tractor factory. Estimated cost, $75,000. I. H. Warringer, Gary, Archt.

Ind., Hammond — The McIlroy Belting Co.—machinery for its plant at Kingsville, Ont.

Mich., Flint—The Flint Spring Water Ice Co., 2125 South Saginaw St., has awarded the contract for the construction of an ice making plant. Estimated cost, $60,000.

O., Akron—The Kuhlke Baking Co., 36 South Bway., has had plans prepared for the construction of a 100 x 125 ft. plant on Tarbell and Ravine Sts. McCormick Co., Inc., Century Bldg., Pittsburgh, Pa., Archts.

O., Cleveland — The Putman-Martin Co., 1555 Columbus Rd., manufacturer of novelties, plans to build a 2 story factory on Ridge Rd. Estimated cost, $100,000.

O., Dayton—The Allsteel Ridewell Tire & Rubber Co., 513 Lindsay Bldg., is having plans prepared for the construction of a 3 story, 70 x 130 ft. tire factory, on Dayton St. Estimated cost, $350,000. Osborn Eng. Co., 2848 Prospect Ave., Cleveland, Archts.

O., Gibsonburg—The Kelly Island Lime & Transport Co., c/o J. A. Kling, Pres., Leader-News Bldg., Cleveland, has awarded the contract for the construction of a 1 story, 50 x 130 ft. hydrating lime plant. Estimated cost, $50,000. Private plans.

Wis., Fond du Lac — The Excel Candy Co., c/o X. O. Frisque, Pres., 86 South Brooke St., plans to build a 4 story, 75 x 125 ft. candy factory. Estimated cost, $75,000. Architect not selected.

Wis., Suring — A. C. Kubiak, Main St., Sobieski, and J. Wilcox, 413 South Walnut St., Green Bay, plan to build a 2 and 3 story, 60 x 125 ft. box factory, here. Estimated cost, $50,000. Architect not selected.

Wis., Watertown—The Luce Sugar Cane Harvester Co. plans to build a 1 story, 80 x 100 ft. shop. Estimated cost, $75,000. Private plans.

Wis., Wilton — The Wilton Canning Co. has awarded the contract for the construction of a 2 story, 60 x 85 ft. canning factory on Main St. Estimated cost, $75,000. Private plans.

WEST OF THE MISSISSIPPI

Ark., Hartford—The Hartford Valley Oil & Gas Co. will construct a gas plant. Estimated cost, $15,000.

Ia., Buffalo Center—The Bd. of Educ. is having plans prepared for the construction of a 2 story, 82 x 145 ft. school, to include a manual training department. Estimated cost, $125,000. G. L. Lockhart, 294 Endicott Bldg., St. Paul, Minn., Archt.

Tex., Lockhart—The Bd. of Educ. is having plans prepared for the construction of a 2 story high school, to include a manual training department. Estimated cost, $200,000.

Tex., Weatherford — The Bd. of Educ. plans to build a 2 story high school, to include a manual training department. Estimated cost, $200,000. Architect not selected.

WESTERN STATES

Cal., Torrence—The Western Glass Co., 939 East 1st St., Los Angeles, has purchased a 10 acre site here, and plans to construct a plant for the manufacture of cooking utensils. Estimated cost, $50,000.

Cal., Reedely—The Bd. of Educ. plans to construct a group of high school buildings, including a manual arts building. Estimated cost, $400,000. N. F. Marsh, 211 Bway. Central Bldg., Los Angeles, Archt.

CANADA

B. C., Port Mellon—The Western Canada Pulp & Paper Co. is building a pulp plant, to have a daily capacity of 40 tons. H. Helin, Mgr.

B. C., Prince Rupert—The Prince Rupert Pulp & Paper Co., Vancouver, recently incorporated with $4,000,000 capital stock, plans to build a plant near here, for the manufacture of pulp and paper, to be in conjunction with general lumbering business.

Que., Montreal — The Kraft-MacLaren Cheese Co., Ltd., is building a cheese factory on Place Royale. Estimated cost, $200,000.

Ont., Kingsville — The McIlroy Belting Co., Hammond, Ind., has purchased a plant here, and plans to remodel and equip same for its own use.

Ont., Kitchener—The Twin City Arena Co. plans to build a 1 story artificial ice rink and ice plant. Estimated cost, $250,000. Architect not selected.

Ont., Kitchener — The Twin City Arena Co.—refrigerating machinery for the manufacture of artificial ice.

Ont., Beamsville—The Beamsville Basket Co. plans to rebuild its plant which was recently destroyed by fire. Estimated loss, $50,000.

Ont., Toronto—The Imperial Oil Ltd., 56 Church St., plans to build a 1 story, 50 x 60 ft. oil service station on Dundas St., W. Estimated cost, $20,000. J. L. Havill, 56 Church St., Archt.

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February 17, 1921 American Machinist Vol. 54, No. 7

Gorton Toolroom Planer

Especially Designed for Work on Dies, Jigs and Fixtures—Built in Two Sizes—Furnished with Side Head—Special Features and Specifications

By J. V. HUNTER
Western Editor, *American Machinist*

TO MEET the demand for a toolroom planer suitable for handling the best work of that class, the George Gorton Machine Co., Racine, Wis., is building its No. 10-A planer. Two sizes of the machine have been brought out; these are 24 x 24 in. and 30 x 30 in. Among the new features, the maker claims that the addition of the side-head on the right-hand housing is an innovation on this type of planer. The side-head should be of service to an operator who has two or more sides of the work to plane up as it will assist in eliminating one or two set-ups of the work. The machine can be furnished with one head on the cross-rail, as shown in Fig. 1, or with two when so desired.

The bed casting has a solid top, except at a point in the center where the drive gears are located. At this point the casting forms a case with cast walls and bottom that make an oil-tight compartment. This compartment is kept partly filled with oil in which the gears dip. The bed is designed with a heavier section of metal at the center where the strains are greatest. In order to add to its strength and rigidity the depth of the bed has been extended to the floor instead of mounting it on legs as has been common practice. With this design no special foundation is required unless the floor or underlying soil is yielding. The bottom of the bed is planed in order to make it easier to skid and level up. The rollers used for lubricating the ways are simple and efficient. They are interchangeable and may be removed for cleaning and replaced without regard to the pockets that they originally occupied.

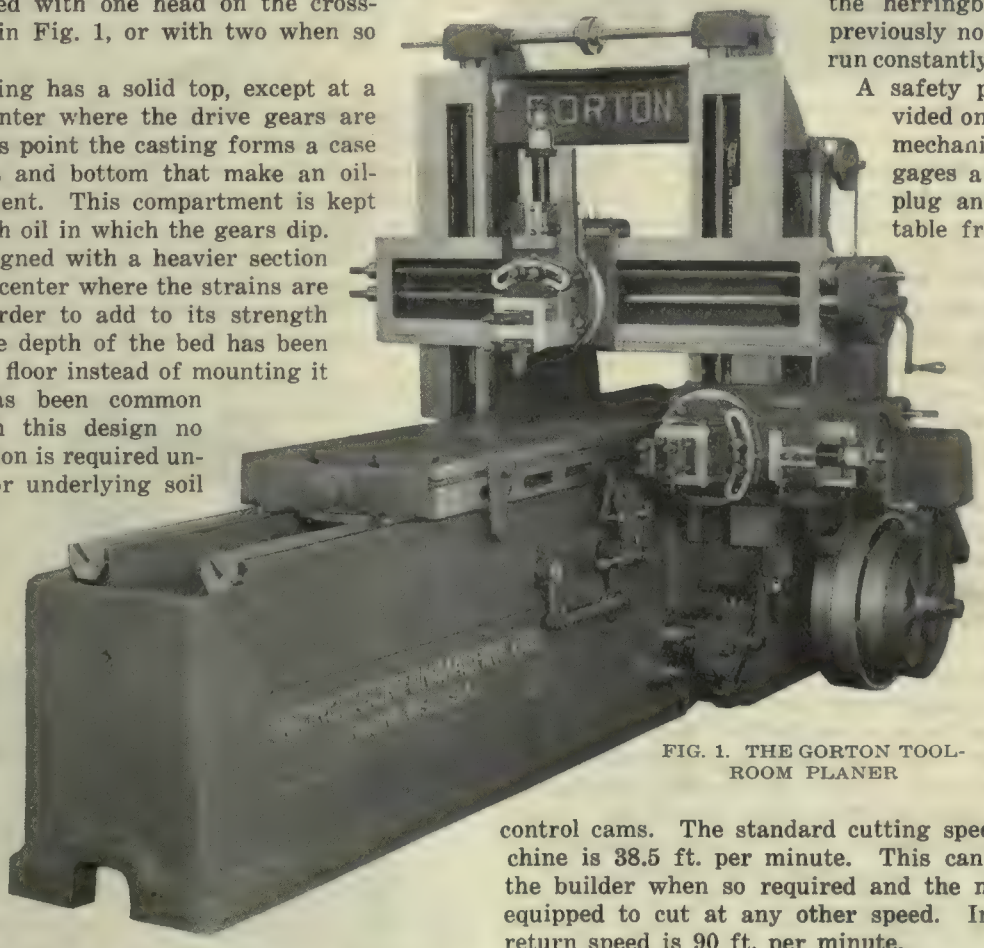


FIG. 1. THE GORTON TOOLROOM PLANER

The shaft bearing hubs on the bed are cast solid with the bed. They are bored and reamed by use of a jig to insure accuracy of the gear centers. The bearings are bushed in a manner such that the bushings are supported for their entire length.

The table is of box-section and is entirely closed on top and bottom. Openings are cored in the sides for the removal of chips. The top surface and T-slots of each table are finished while working on its own bed before the planer is shipped from the shop. This final finishing insures that the table is parallel with the ways and in correct relation to the cross-rail. The T-slots are finished to standard gage. A jig is used for reaming the pin-holes in order to insure more accurate spacing and standard size.

The interior of the compartment enclosing the table drive is shown in Fig. 2. In order to create a smooth drive the first two pairs of gears in the train are of the herringbone type. As previously noted these gears run constantly in a bath of oil.

A safety plunger is provided on the table drive mechanism that engages a hardened steel plug and prevents the table from starting accidentally. The table can be run out on the front end of the bed by raising the pawl which controls the return movement of the table. The table can be controlled from the left side of the machine, Fig. 3, by means of a lever suitably connected to the belt control cams. The standard cutting speed of this machine is 38.5 ft. per minute. This can be altered by the builder when so required and the machine can be equipped to cut at any other speed. In any case the return speed is 90 ft. per minute.

The maker has designed the housings with the intent that they should have both a massive section and an exceptionally wide face. The face on the housing upon which the side-head is mounted is 9 in. in width. The housings are held in alignment with the bed by tongues and grooves, together with large hardened and ground taper pins, and are bolted on with heavy cap-bolts.

It is claimed that the cross-rail has an exceptionally wide face. When two heads are ordered on a machine

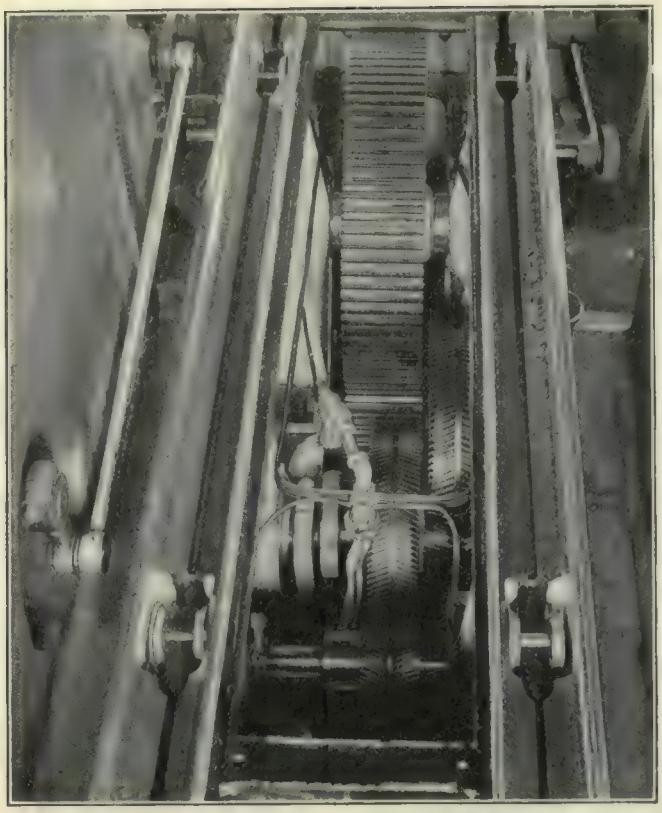


FIG. 2. INTERIOR OF GEAR CASE OF TABLE DRIVE

the cross-rail is lengthened at the left end. This will permit the left-hand head to be run out on the end of the rail and give the right-hand head full travel between the housings.

The cross-rail is raised and lowered by hand. The bevel gears for the raising mechanism are mounted on ball-bearings and are enclosed in oil-tight boxes for retention of the lubricant.

The toolheads are made right- and left-hand. The vertical feed-screws on the slides are mounted so that they are in tension at all times. The screws have ball-thrust bearings to make the feed slide movement more sensitive. For adjustment the screws have micrometer collars that read in one-thousandths of an inch. All heads have attached scales, graduated in thirty-seconds of an inch, that give a convenient means for setting the tool where extreme accuracy is not required. The heads can be adjusted either horizontally or vertically from either end of the cross-rail. The toolblock swings on a large hardened and ground taper pin. This pin has grooves milled on its outer surface to carry oil that is supplied through an oil cup pressed into its outer end. The swiveling member is locked to the slide by a screw that pulls the slide tightly against the swivel. This makes a firm joint and prevents any spring from occurring between the two when they are in service.

The Side-Head

The side-head is arranged so that the tool will be in the same plane as the tool in the cross-rail head. This is an advantage on small sizes of planers because so much of the work is run on short stroke. Manifestly, a planer run on short stroke with one tool set 3 or 4 in. ahead of the other would waste considerable time. Both vertical and power feeds have been incorporated in the design in order to give the operator all advantages found in larger planers. The head is counterbalanced.

The driving pulley is made of aluminum. It is clamped to a steel hub by means of capscrews and the hub in turn is keyed to the shaft. It is claimed that the lesser centrifugal force of an aluminum driving pulley, together with the high belt speed used, gives a quicker reverse action with greater accuracy and more production. The idler pulleys are bronze bushed and are fitted with grease cups for lubricating. The large idler pulley is not mounted directly on the shaft, as is customary, but has a bearing on the end of the large shaft bearing sleeve. The latter is bolted to the bed and projects out through the housing. This arrangement permits the driving pulley to be pressed on the shaft directly against the bearing.

The belt-operated cams are cylindrical in shape and engage hardened and ground conical rollers that are adjustable for wear. The belt arms have pressed-in hardened and ground bushings. These work on hardened steel studs and also have finished bearing surfaces close to the edge of the brackets. This arrangement takes part of the weight of the arms off the studs and makes the arms easier to shift. When shifting belts, neither belt shifts to the driving pulley until the other has passed over to its loose pulley. The shifting action is stated to be quiet and easy. The entire shifting mechanism is inclosed by a cover, Fig. 1, that gives it a neat appearance and keeps it free from dirt.

The Feed Mechanism

The feed-box is of the friction type and is entirely inclosed to exclude chips or dirt. The maker claims that adjustments of the tension of friction disks or driving band are as much of a detriment as they are a benefit, therefore none are provided.

In considering the oiling system it has been previously stated that the center portion of the bed is cast with a solid bottom and sides making an oil-tight case. In this compartment the table gears are located. It

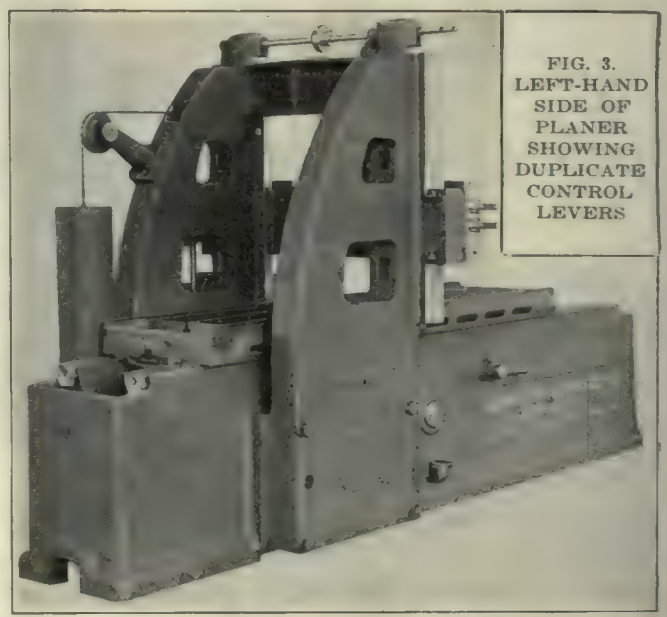


FIG. 3. LEFT-HAND SIDE OF PLANER SHOWING DUPLICATE CONTROL LEVERS

Specifications: built in two sizes: 26 x 26 in. and 30 x 30 in. Respective: Distance between housings, 25, 31 in. Height under cross-rail, 25, 31 in. Shortest length of table between pockets, 6 ft. 0 in. Proportion of bed to table length, 1⅛ to 1. Height of table top from floor, 33¼ in. Distance between centers of Vs., 14 in. Width of V-ways, 3 in. Table, width, 22 and 28 in.; thickness, 4⅜ in. Width of housing face, 9 in. Depth of cross-rail face, 12 and 13¾ in. No. of T-slots, 3. Length of down feed, 10 in. Size of tool in block, 1⅜ x 2½ in. Length of saddle bearing on rail, 16 in. Bull-gear and rack, face 4⅜ in., pitch 4 in. Width of cutting belts, 2 in. Countershaft, speed, 450 r.p.m.; pulleys, 16 x 4¾ in. Motor recommended, 7½ hp., 1,200 r.p.m.

holds about ten gallons of oil in which the gears dip, thoroughly lubricating themselves and the table rack. The outer ends of all shaft bearings are plugged, with the exception of the feed end of the intermediate shaft and the outer end of the pulley shaft. The latter bearings have collars for preventing waste of oil.

The table ways are oiled by a plunger pump that forces a constant stream of oil to them. This obviates the necessity of watching the oil-roller pockets and avoids the danger of these running dry. The surplus oil on the table rack and V-slides is removed by wipers and runs into pockets on the ends of the bed. These pockets prevent any waste of oil on the floor. The oil is strained before it runs back into the main gear box. The only gears that do not run in oil-tight boxes are the feed gears on the end of the cross-rail. These are inclosed in a substantial cast-iron shield.

Both the tool and rail clamping bolts are made from heat-treated nickel-steel. They are threaded on centers to insure greater accuracy. All other important studs and screws are likewise held on centers for threading. The Acme form of thread is used for all screws and these are fitted with bronze nuts. The drive gears and table rack, together with oil feed and elevating gears, are made from semi-steel castings. The spur gears are cut on Fellows gear shapers and the bevel gears on Bilgram generating machines. All shafts subject to torsion are made of high carbon steel and ground to finish.

Meeting the Present Emergency

BY THE TREASURER OF A LARGE EASTERN MACHINE TOOL COMPANY

DURING late months we have suffered the cancellation of an exceedingly large amount of machine tools as made for stock, some of which have been cancelled arbitrarily with no regard to our wishes who have engaged to deliver them; while others have been cancelled by customers who have developed a credit character of an inferior sort. However great the cancellation evil has been in the case of our own customers we believe a great many customers have not cancelled because they have wished to stand back of their agreement to accept delivery.

There is a growing tendency to stand by orders once given, with a willingness to recognize the rights of the party who has engaged to deliver the goods. When criticisms are made as to the cancellation evil itself it is well to recognize that progress is being made.

Our working force has been greatly reduced during late months and is now being engaged only three and four days each week. As deliveries are being accomplished doubtless our working force will have to be reduced still more.

The more a business is developed on a manufacturing basis, as has been the case in the machine-tool industry during the last twenty years or more, the more is organization itself of vital importance. Hence during slack times such as are upon us it is important that the skeleton of the employing force be kept together and utilized to its best until larger manufacturing operations can be performed. Doubtless all manufacturers of machine tools have before them the importance of keeping their organizations. It is certainly a good time to make repairs to equipment and to reorganize systems where any changes are needed, for there is no better time than a rainy day to prepare for the busy times.

In our opinion the machine-tool industry is in for a period of dull times, the extent of which no man can predict. Some relief may be effected in a relatively short period, and then again there may be a prolonged period of dullness, reaching into 1922, or beyond.

As for the automobile trade, which has been such a factor in the prosperity of the machine-tool business in years past, it has achieved a temporary recession but the necessity for improved equipment must be resumed to some extent before a long period elapses. The automobile trade will be more of a normal one in future time, and in so far as it is the machine-tool business will be more healthy.

As for the matter of wages in the industry, if the cost of living continues to recede throughout the country as is freely predicted, this lowering of prices must of necessity mean a cheapening in cost of production, which of itself means a lower wage scale. Without any doubt, the employees in the machine-tool industry will have a lower remuneration in comparison with those of other industries throughout the land. The extent to which this will affect the particular classes in machine-tool labor is unknown, but the general impression is that common labor, as such, has been paid much more than will be the case when business tends to resume.

We have every confidence that the relations between the employers and employees in the machine-tool industry will be on the same high plane which they have enjoyed in time past. There is no industry where there has been employed to a greater extent those systems of payment which reward the individual worker according to his accomplishments.

BY A SMALL-SHOP MANAGER

WE ARE still running full time with nearly full force. Have laid off no one but have not replaced any who might leave. We are "filling the reservoir with stored labor" by making up parts for our machines which require the least outlay for material and have the greatest proportion of labor in their cost, and which require the least storage space. We are assembling units and groups of parts as far as possible so that when an order comes in we can complete the machine with the least possible delay.

We know the need for our machines is very great and that many shops are using old wrecks of machines which should be replaced by new ones. A goodly number of shops which have no machines at all of our type should have our machines. They need them badly and do not know what they are missing by not having them. This gives us confidence to continue to operate as we are doing just as long as we can possibly afford to do so, because we know when confidence is restored our machines will be wanted faster than we can turn them out if we have not prepared a reservoir to draw from.

Perhaps one reason we can afford to keep going is that we haven't a big "overhead" to pull us down. This, with a large highly organized plant, is a serious item when there is nothing going out to pay for the expense. Today the "small shop" stands vindicated.

What Is the Business of a Safety Department?

Safety Beneficial from Both Humanitarian and Productive Viewpoints—Just What the Industrial Manager Should Expect of His Safety Department—Business Details

By HENRY LANDESMAN, M.E.

REALIZATION has come to the executives in the industrial field that safety considerations must find a very important place in organization and management. Newspapers, magazines, professional journals and books appear at frequent intervals displaying well-written articles on safety that do their share toward bringing before the factory officials propaganda on the safety movement. Each one presents one or more thoughts which materially aid the good cause. As the executive in his busy moments reads or skims over the articles, he agrees with them but usually sends them along to the chief foreman or to some file or perhaps to the waste basket. If he could have the time to devote to this subject at any one period and if he could digest the nucleus of all these thoughts at one time he would learn that most writers on safety subjects agree on many conditions affecting safety. He would find that not only do they point out losses in industrial plants due to certain definite causes but that they all offer at some time or other means for cutting accident losses in factories and industrial plants. It is for the purpose of presenting a few thoughts offering a specific program for handling the safety problems that this article is presented by the writer.

There are instances wherein a manager has learned of the terrible industrial losses due to accident and has decided that something ought to be done in his plant.

The idea usually dies with that conviction, for he has never thought of just what could be done in his plant to cut down accident losses. In some cases he appoints a committee of from one to five men or more, depending on the size of his plant. This body meets at definite intervals, has a general discussion and as a result a few safeguards are suggested. This is a step in the right direction but it is a very small one. No one checks up the committee's work and there is usually lacking the requisite engineering skill and experience. There is also lacking a safety man—one who devotes his time, energy and knowledge to the promotion of safety means. It is fast dawning on the minds of our industrial chiefs that a concentrated effort must be applied emanating from the activities of a thorough and systematic safety director.

SAFETY DEPARTMENT AC

Month	Total Number of Accidents	Number of Lost Time Accidents	Number of Employees	Total Number of Hours Worked	Possible Number of Hours Based on Full Time	Number of Hours Lost Due to Accidents	Amount of Compensation Paid Due to Accidents	Amount of Doctor Fees Paid Due to Accidents	Number of Accidents per Hundred Employees	Severity Rate or Number of Accidents per 1,000 Hours Worked	Per Cent Increase (+) or Decrease (—) No. Accidents Over Previous Month	Per Cent Increase (+) or Decrease (—) Accidents per 1,000 Hrs. Over
January												
February												
March												
April												
May												
June												
July												
August												
September												
October												
November												
December												

MONTHLY AVERAGE

REMA

A recent investigation into the details of operation of the safety departments of a dozen or more important industrial plants has helped the writer to outline a few of the qualifications necessary in the safety head. He should be an executive, a practical engineer, a good salesman, a student of human nature and possessed of such personality that every man and foreman in the plant will co-operate with him in his every effort. It is here that the factory head hesitates and is reluctant in taking on an engineer because he feels that the engineer ought to know all that is necessary to properly operate a safety department. Unfortunately, we are not yet able to get experienced safety engineers. This condition will no doubt be improved, because the engineering societies are now encouraging their members to take hold of the safety problems. The writer believes that the time will soon be at hand when each college of engineering will include a course on safety in its curriculum and every thoroughly educated technical man will learn fundamental safety principles as well as his calculus.

At the present time, then, it would be of advantage to point out just what the industrial manager should expect of his safety department. This is another way of expressing what the new safety engineer or director should do in the plant where he has been appointed to look after the safety work. The principles which are hereinafter outlined are formulated to apply to a small or large plant alike. It must be borne in mind, however, that every plant will offer individual problems. Of course in a very large plant the safety director or engineer will have his lieutenants and inspectors and will have the benefit of several minds helping to work out his problems. Their tasks will form, nevertheless, a part of the program outlined for all plants.

Before presenting the program it must be stated that it is a paramount essential to the success of any safety department to first have the safety requirements "sold" to the management. Without this advantage any safety department must suffer set-backs and be hampered in producing good results. Furthermore, if the management falls down in co-operating with the safety department then but little co-operation can be reasonably expected from the foremen and help.

The exact place of the safety man in any organization depends upon the general main organization of the plant. The organization under the safety head is measured by the size of the plant, its condition from the viewpoint of hazard, the past attention safety has received and on the activities which the management will approve. In one plant of 500 employees the writer found that one engineer with one assistant carried out the safety program efficiently and showed excellent saving in losses due to accident. However the scale on which his safety efforts were expended was not large enough to include a doctor, a statistician, inspector, etc. In another plant the writer found for an organization of 30,000 employees a safety organization consisting of twenty-seven men, about eighteen of whom were engineers drawing salaries of $3,600 per annum or more.

ENT RECORD, 1920–1921

Cost of Compensation per 1,000 Hrs. Worked	Cost of Compensation Plus Doctors per 1,000 Hrs. Worked	Cost of Compensation Plus Doctors per Accident	Cost of Doctor Fees per 1,000 Hrs.	Per Cent Increase (+) or Decrease (—) Cost Accidents per 1,000 Hrs. Worked	Dept. Having Most Accidents per 1,000 Hrs. Worked	Number of Fatalities Due to Accidents	Temporary Disability Under One Week	Temporary Disability Over One and Under Two Weeks	Temporary Disability Over Two Weeks	Number of Permanent Disability Cases	Amount of Pay Roll	Compensation Plus Doctor Cost per $1,000 of Pay Roll

BOVE TWELVE MONTHS

In this plant the same program is carried out as in the small plant except that it is on a large and detailed scale. There are inspectors, sub-inspectors, doctors, dentists, statisticians, adjusters, draftsmen, designers. The plant boasts of no fatalities in ten years and carries its own accident insurance.

Having obtained the proper man with the endorsement for safety work by the factory heads, then the following work is offered for the purpose of carrying on efficiently a safety department. The scale of the work includes nine major headings or divisions. These are: (1) Educational, (2) Mechanical Safeguards, (3) Inspections, (4) Safety Orders, (5) Fire Prevention, (6) Sanitation, (7) Statistical, (8) Safety Committee, (9) Hospital.

Educational Work

Educational work includes:

(1) *Safety Pamphlet*—Issuing either a general safety pamphlet for distribution to all employees or a one-page set of rules for each department, to be posted or distributed among the employees.

(2) *Safety Signs*—Determining necessity for location, size, type, etc., of all safety signs for the plant.

(3) *Bulletins*—The timely distribution of all bulletins and notices on safety matters throughout the plant. These may be designed by the safety department or obtained from the National Safety Council or other sources. Much thought should be given as to what type of bulletin is displayed. For example, the safety council bulletins cover the field of safety generally and many of them would not deal with subjects applicable to a given plant. Bulletins which are "localized"—original ones especially—have greatest effect.

(4) *Safety Talks*—The safety director can accomplish much good by a few minutes' safety talk at foremen's meetings, at employee's gatherings and even at executive conferences, if it be permitted. Outside speakers, usually new to any aggregation of employees, always get an attentive ear and can accomplish much. Safety directors should exchange "pulpits" and talk once in a while at neighboring plants to help ont. There are a number of public department safety officials who at very small expense are available for beneficial talks. If the plant has a suitable place it is quite desirable to have these talks sometimes given with appropriate lantern slides.

(5) *Moving Pictures on Safety Subjects*—All plants are not adaptable to such an undertaking. It is suggested that in the case of a small town and a small plant the town movie theater be asked to co-operate. The films can be obtained at small expense from the American Safety Museum.

(6) *Articles and Letters on Safety*—A live safety head can give his work a personal touch by directing an occasional personal letter to his foreman calling attention to some matters on safety that apply to his department. It should not be a formal letter, merely one on a "friendly" basis. The publication of a well-timed article on safety has a good psychic effect on the employees and if a successfully written article by the director appears in some town paper, periodical, trade journal or factory house organ the employees know that the safety man knows something about his job.

(7) *Subscriptions to Safety Papers, Periodicals, etc.*—The subject matter of many of these papers is indispensable to a properly regulated safety program. Attention is called to the fact that articles should be routed to reach executives and later should be accessible in the library to all employees. Frequently some good article may be copied for general distribution, giving due credit to the publication, in which it appeared.

(8) *Membership in Various Recognized Safety Organizations*—Prominent among these are the American Society of Safety Engineers, National Safety Council, National Safety Council Engineering Section and American Safety Institute. The director who affiliates himself with safety associations not only gets the benefit of all safety discussions and papers but receives from other safety engineers a knowledge which will help his job and will aid much in cutting down accident losses in his own plant.

(9) *Attendance at Safety Meetings*—The director, to get full benefit of his association memberships, should arrange his work so that he may attend as many meetings as possible. The same is true in respect to all local or plant safety meetings.

Of course the conditions of any particular plant will determine the extent of the educational features but the above outline applies to any plant and covers specifically the educational work as applied to the safety program. Authorities estimate that as much as 40 per cent of accidents may be prevented through proper educational work.

Mechanical Guards

(1) The heading "Mechanical Guards" includes the study of machines and plant to determine the *requirements*. This is the job of a keen observer, a mechanical man and a practical engineer.

(2) The *design* requires an experienced draftsman or engineer. Experience and skill will assist much in this function of safety work. It is suggested that the safety department work in close touch with the mechanical and engineering departments. Approval of all designs by the departments who must build and erect the mechanical safeguards will assist much in the maintenance of an efficient safety department. Furthermore, it would be good practice for the designs to be submitted to the foreman of the department wherein the guard will be used.

(3) The *construction* should come under the supervision of the mechanical shops; approval should rest with the safety department. Drawings and specifications should be clear and the safety department of necessity responsible for their accuracy.

(4) The safety department should *issue all orders* to shops and should make them clear, consistent with drawings or specifications and in accordance with the order or requisition system in vogue at the particular plant.

(5) The *follow-up* of all orders requires the tact and experience of a good production man. Some large plants issue a rule directing the shops to give all safety orders precedence. However, in these days of labor shortage and production requirements the safety director must use much discretion in following up the orders of his department.

(6) *Erection* is in the hands of the shops but requires that the director co-operate with the production department to see that the most propitious time is selected for installation, and to see that the machinery is stopped and cannot be started during installation.

(7) *Inspection* should be made by the safety department before acceptance or final closing of safety order is permitted.

(8) The safety department should make itself responsible for the *maintenance* of any safeguard.

(9) Much good work can be accomplished by having *close contact* between the safety and engineering departments.

Inspections

Under this heading should be included:

(1) *Safeguards*, hoists, trolleys, cranes, industrial trucks, shafting, pulleys, belts, etc. In every case the inspection should be periodical and records should be kept.

(2) *Sanitation*, including yard, storerooms, floors, toilets, sewer systems, drinking water, janitor service, pits, trenches, oil drip pans, sinks, drinking fountain, etc.

(3) *Bulletin Boards*. Keep live and fresh bulletins well displayed. Change them often.

(4) *Elevators*, including machinery pits, hoists, cables, doors, locks, brakes, etc.

(5) *Fire System*, including alarm system, sprinkler system, hose houses, hose, valves, hydrants, extinguishers (location and operation), fire doors, fire pails and other fire-fighting apparatus. This feature of the work should include the organization of a fire brigade, of drills, tests, brigade meetings, etc.

(6) *General inspection* of all of the above at irregular intervals as a check.

Safety Orders

Safety work can be most beneficially conducted if the safety department will issue its own orders, consistent with the plant requisition system. The order must be carefully formulated. The department should (1) issue, (2) follow-up, (3) make final inspection of and (4) classify its orders so that the files and orders will readily show if an order originated through (a) a fire insurance company recommendation, (b) boiler inspector's recommendation, (c) flywheel inspector's recommendation, (d) elevator inspector's recommendation, (e) safety committee recommendation, (f) other sources of recommendation.

Fire Prevention

Under fire prevention is included the work of (1) inspector, (2) orders, (3) drills, (4) tests, (5) brigade organization and (6) records of meetings, etc.

Sanitation

Sanitation covers many details conducive to a healthful plant with its incidental accident-prevention tendencies. It should include: (1) An organized number of sweepers responsible to a head janitor, each one to have a definite territory in the plant to keep clean. (2) A set of cleaners for pits, trenches, oil drip pans, waste cans, etc. (3) A yard gang to look after rubbish, yard scaffolding, yard fences, sheds, walks, roadways, etc. (4) The procuring semi-annually of samples of drinking water for chemical tests. (5) Weekly sterilization of drinking fountain and bubblers. (6) Proper distribution of ice for the drinking-water system, with economic ice storage. (7) Bulletins, notices and talks on health and sanitation including distribution of health pamphlets and talks by doctors. (8) Garbage disposal. (9) Leaks in all piping systems. (10) Cleaning of windows. (11) Illumination, maintenance and cleaning of lamps and shades. (12) Cuspidor cleansing and distribution. (13) Painting. In a plant of 3,600 employees, which the writer visited and inspected, there was an organized sanitation department under a Chief Sanitary Officer. He had one assistant, eighteen sweepers and four cleaners in addition to his yard gang. There was an incinerating plant for garbage with a trolley-bucket system for carrying the garbage to it. Cuspidors were distributed daily. They were of the paper type and the old ones of the previous day were burnt with the garbage. The sanitation officer claimed a saving of over $3,000 a year in labor and breakage against the system of cleaning old-type cuspidors. In the history of another plant of 2,700 employees drinking water was twice found bad. Now they have their own sterilizing chlorine plant and have had no fever cases since its installation.

Statistical

Statistics are valueless unless they give definite information as to how things stands in the safety work and show the progress made in preventing accidents. It should be required of the safety director or engineer to post the manufacturing executive at least monthly concerning every phase of the safety work. The report should be clear and show much at a glance. I submit a chart showing the information that would interest the manufacturing executive and which would show him every phase of the results effected by the safety department. To intelligently compile the required information there should be kept: (1) Daily complete accident reports, one for each accident, giving all information required by state industrial board and safety engineers; (2) weekly accident report; (3) lost-time cases report; (4) compensation-cases report, showing amount of compensation; (5) accident report, monthly, by causes; (6) accident report, monthly, by departments; (7) monthly activity reports, showing all orders issued, inspections made, alterations, repairs, recommendations; (8) competitive departmental charts showing severity-accident rates by departments compared; (9) résumé or survey of all statistics for manufacturing executives—monthly.

A study of the chart will show number of accidents, departments, severity, costs, increases or decreases in costs, number of accidents, etc.

To gain the co-operation of the other departments, to obtain the advantage of additional trained observers and to make better contact between the safety department director and other closely allied executives, it is recommended that there be a safety committee consisting of (1) president, vice-president or manager; (2) master mechanic or superintendent of maintenance and shops; (3) chief engineer; (4) manager industrial relations; (5) doctor or head of hospital; (6) safety director.

This may be varied with the size and conditions of any plant. The reason for the above selection should be obvious. It is suggested that the committee meet once a month and discuss the safety director's reports, make new suggestions and recommendations and discuss orders and inspections.

Every plant should have some place set aside in charge of a nurse or doctor or someone at least capable of giving first aid. This place may have only a phone, a rest cot, running water, a waste can, some first-aid bandages, a stretcher, couple of chairs, etc. The size

of the plant will determine the hospital equipment. In some plants there are fully equipped hospitals in charge of a capable physician who may have several assistants and nurses. In one plant employing 7,000 I saw a fully equipped hospital with wards, X-ray equipment, special rooms for the sick and for examining prospective employees and a dental laboratory with two dentists. There were six doctors in constant attendance. In one month these doctors made 5,300 treatments and examinations. In another plant of 35,000 employees I found 21 doctors, six nurses and four dentists. This department should keep records of all accident cases and submit daily reports, "return to work" slips, industrial accident reports, monthly survey sheets with classification of accidents by causes, comparison charts against previous month, sickness records, lost-time account of sickness and accident, and equipment records and should have representation in the committee.

This concludes the program for an industrial health sanitation and safety department. It can be applied to any plant regardless of size. The recommendations are made as the result of a consensus of the opinions of important safety directors.

Report forms and similar details have been omitted, as this article is intended to form only a foundation.

Flow of Metal in Deep Drawing

SPECIAL CORRESPONDENCE

The illustrations herewith show the effect of deep drawing on metal sheets and the way in which the metal is drawn in as the punch descends. Fig. 1 shows the blank used in drawing the piece illustrated in Fig. 2, the latter indicating how the metal is drawn in from each side to flow into the place of deepest draw. After a variety of experiments, it was found that a blank shaped as in Fig. 1 gave the best results, as it produced a clear, smooth drawing with all of the wrinkles and distortions in the flat plate itself. This piece is for the cover of an electrical safety switch.

Figs. 3 and 4 show a somewhat shallower drawing and the way in which provision is made for the metal to flow into the pan or depression. In Fig. 3 the pan is drawn from a rectangular sheet, both sides being drawn in, as can be seen in the lower part of the illustration. In Fig. 4 the blank is cut wide in the center so that, after the draw takes place, the outer edges will be approximately square on all sides.

These examples are offered simply as suggestions which can be modified for various other conditions.

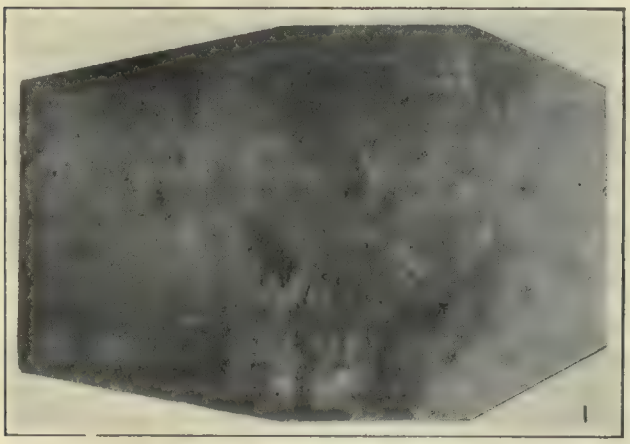


FIG. 1. BLANK FOR DEEP DRAWN COVER

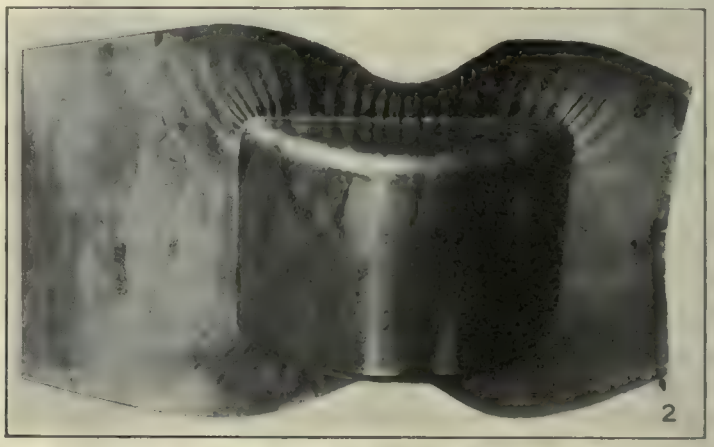


FIG. 2. AFTER THE DRAWING OPERATION

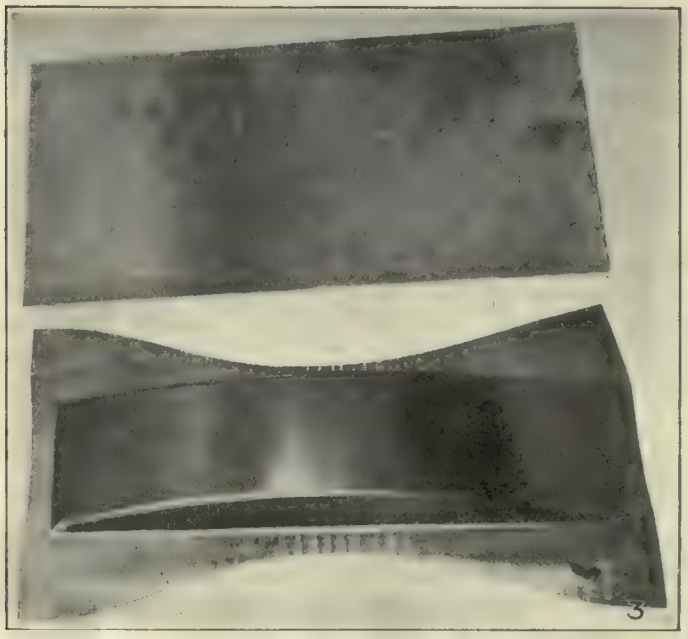


FIG. 3. DRAWING FROM A RECTANGULAR BLANK



FIG. 4. HOW A SPECIAL SHAPED BLANK AFFECTS THE FINISHED WORK

Magnetic Chucks—II

By ELLSWORTH SHELDON
Associate Editor, *American Machinist*

(Continued from last week's issue.)

The rapidly extending use of the magnetic chuck inevitably attracted the attention of other inventors to itself and in the same year (1912) we find a patent upon both flat and rotary chucks granted to Louis W. Downes, of Providence, R. I. This is the beginning of the now well-known D. & W. chuck.

A feature of chuck construction which seems to have concerned Mr. Downes was the difficulty of replacing a defective coil. Now that magnetic chucks had real work to do there seems to have been more or less trouble from "grounding" and burnt-out coils and the Downes chuck was so designed as to make it practical for anybody to replace such a coil without putting the chuck out of service for more than a few minutes, whereas with other chucks a defective coil almost necessitated the return of the tool to its makers for repair.

The subjects of the Downes patent, both flat and rotary, are shown respectively in Figs. 24 and 25. A base of "cast" or "wrought iron" is made in such manner as to be bolted to a grinding machine or planer table or screwed to the spindle-nose of a lathe as the case may be, and provided with shouldered studs driven into it at regular intervals to form the cores of the magents.

A thicker plate, having holes in it to correspond to these cores but larger in diameter, is laid over the cores and attached to the baseplate with screws. The upper ends of these holes are counterbored to a depth equal to the length of the shoulder on the upper ends of the cores. An annular space is thus left between each core and the body plate to receive the coils and the shoulders provide a bearing for an annular retaining plate of brass which is held in place by small flush head screws tapped into the body of the chuck.

Is Still of the Single Magnet Type

It is easy to see that this chuck, though having a multiplicity of poles, is still a member of the single-magnet class, for the upper ends of the cores, be they

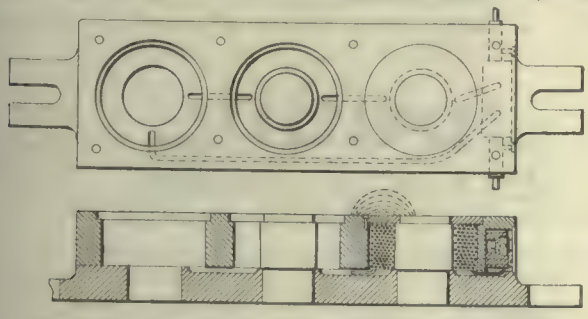


FIG. 24. THE FIRST DOWNES PATENT 1912

one or many, are all of the same polarity while the body of the chuck supplies the opposed pole. It would seem that the advantage of easy replacement of defective coils was more than offset by the necessarily wide air-gap which the work would be obliged to span in order to develop maximum holding power. Nor would such construction be proof against the entrance of water or grinding compound. The joint between the annular brass plates and the adjoining metal both inside and outside the ring would allow water to seep through and fill each cell: a condition that would quickly and certainly lead to defective coils.

Reverts to the Older Construction

The patentee evidently experienced this trouble for little more than a year later, Nov. 25, 1913, patent Number 1,979,546 was issued to Louis W. Downes and

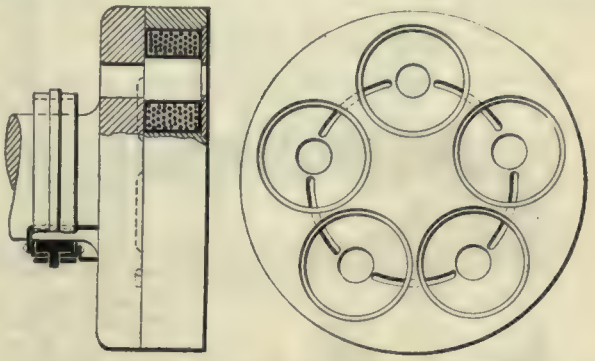


FIG. 25. THE DOWNES ROTARY CHUCK

Alfred W. Faxon of Providence, covering the chucks shown in Figs. 26 and 27.

In these chucks the multiple-coil with its easy replacement feature has been abandoned for the single coil, and the central core is of cast iron with extension polepieces of machinery steel either forced into slots milled across the upper end of the core or set in the mold and cast in place. The top plate or grid which forms the opposed pole may be cast as a grid, or as a frame; in the latter case the cross-bars, also of machine steel, are set into milled slots.

Because of the polepieces being made of bar stock instead of cast metal, and having a much higher degree of permeability, they can be narrower than would otherwise be the case and still carry the same amount of magnetic flux. The shape of the air gap, too, is such as to prevent as much as is possible the leakage of lines of force across the joint below the surface of the chuck.

The Patton Chuck

On Dec. 16, 1913, a new name is entered on the lists. R. C. Patton, of Providence, R. I., is granted a patent on that date to cover still another form of construction. Mr. Patton's chuck, shown in Figs. 28 and 29, follows somewhat the style of the original Walker, except that the pole pieces are disposed of at an angle other than 90 deg. to the longitudinal dimension of the chuck.

This angular disposition of the polepieces is a principal feature of the claim. It was also a feature, though not specifically claimed, of the Downes and Faxon patent issued a month earlier. However, as both these patents were immediately assigned to the D. & W. Fuse Co. there was no trouble from conflicting claims.

Ancther feature of the Patton patent was the "caulking joint," where the casing, or shell, joined the base, for the purpose of keeping out water. This joint is shown enlarged at *A* and is designed to "receive and

retain hemp, twine, or the like, which is rendered impervious to water by water-proofing material such as paint, pitch, shellac, varnish, or similar materials."

Not only is a special "caulking joint" provided to keep water out at the bottom but the shapes of the cast polepieces and grid provide for a sort of bead of the filling material supposed to prevent leakage at the top. This shape is the subject of a separate patent.

In July of the following year (1914) Louis W.

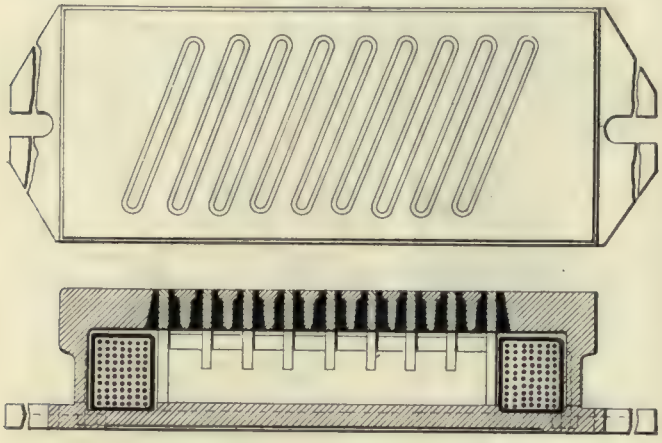
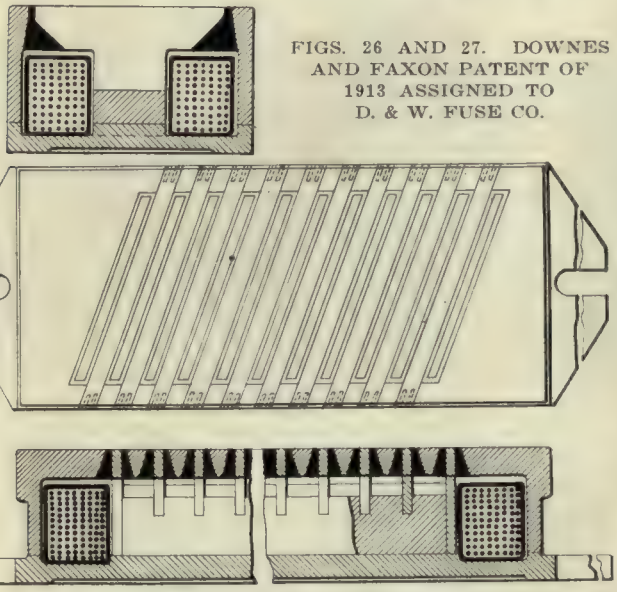


Fig. 26.



FIGS. 26 AND 27. DOWNES AND FAXON PATENT OF 1913 ASSIGNED TO D. & W. FUSE CO.

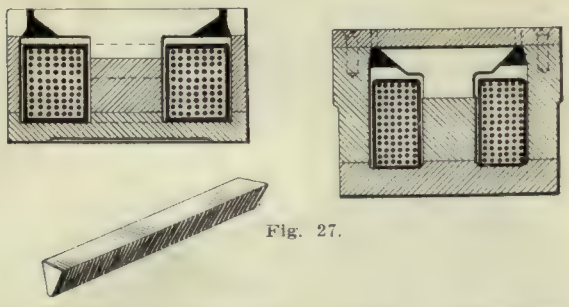


Fig. 27.

Downes took out a patent covering a chuck with an extension auxiliary plate designed to adapt the rotary chuck to the grinding of ball races. While the chuck is incidental to the patent, it shows some interesting features. It is, like the other devices from the same inventor, a single-magnet chuck, having four "heart-shaped" cores with separate polepieces extending through to the working surface. No attempt is made

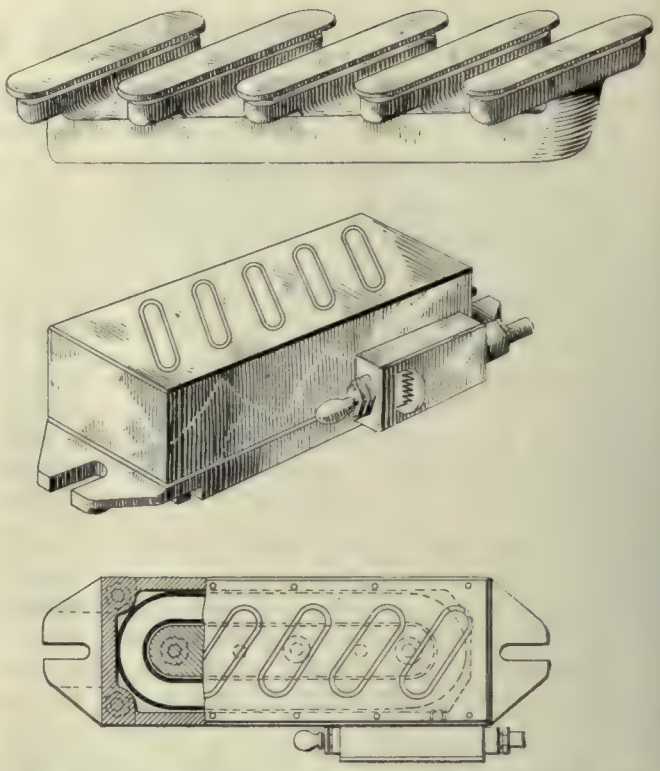


FIG. 28. CHUCK PATENTED BY R. C. PATTON IN 1913 ALSO ASSIGNED TO THE D. & W. FUSE CO.

to distribute the polepieces over a finely divided area for the reason that the chuck is designed to act only as the retainer for the separable plates and these, whatever the disposition of the polar faces may be on the outside (corresponding to the particular piece of work for which each is intended), are made on the reverse side to match the four heart-shaped cores of the chuck face. The chuck is shown in Fig. 30.

Though the Walker patent of 1912 included a detachable piece for special purposes this Downes patent seems to be the first one aimed directly at the auxiliary plate, unless we except the Hansen patent of 1911, which sought to make the top plate removable so that one plate could be unloaded and reloaded while the work on another was undergoing operation.

From 1873 to 1914 inclusive, a period of 42 years, there had been recorded in the United States Patent Office fourteen patents dealing directly with magnetic

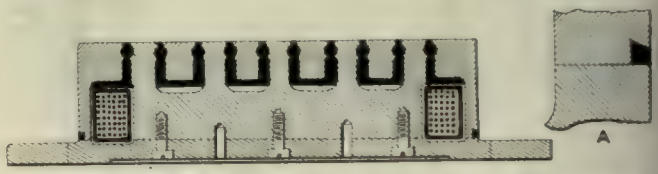


FIG. 29. A SECTIONAL VIEW OF THE PATTON CHUCK

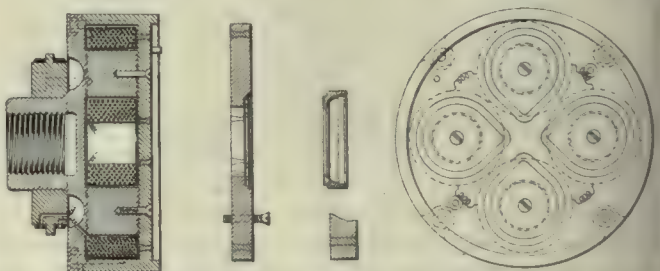


FIG. 30. ROTARY CHUCK WITH SEPARABLE TOP PLATE PATENTED 1914 BY L. W. DOWNES

chucks. During the four following years and up to May, 1920, fourteen more patents were issued, showing that the magnetic chuck as a business proposition is rapidly becoming recognized.

From 1896 to 1914 but one holding principle has been apparent; all chucks have been of the single magnet type. This designation, however, does not place a limitation upon the number of cores that the chuck may possess but is based upon the disposition of the poles.

All magnets must of course have two poles, but in the single-magnet type of chuck the poles at the upper ends of the cores, be they one or many, are all of the same polarity. The opposed pole of each core therefore depends upon the shell or body of the chuck to bring its power of attraction to the upper surface where it will be available for holding work. The original chuck did not belong to this class even though it consisted of but a single magnet, for that magnet was so constructed as to present both its poles directly to the working surface and the chuck body was not a necessary part of the magnetic circuit.

The first departure from the single-magnet type appears in the patent granted early in January, 1915, to H. K. Spencer, an engineer in the service of the Blanchard Machine Co., of Cambridge, Mass. Mr. Spencer's

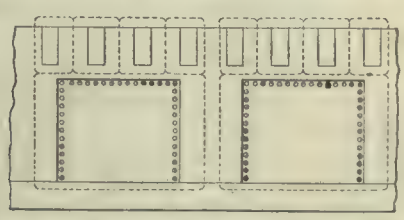


FIG. 31. DETAILS OF BLANCHARD CHUCK

device was designed not to compete with other chucks, but as an adjunct to the Blanchard Grinding Machine. Its constructural details will be explained in a later article under the title "The Blanchard Chuck."

The Blanchard Chuck

The Blanchard chuck is hard to classify. It is "multiple-magnet" in that the main cores are in pairs of alternate polarity, yet the shell is distinctly a part of the magnetic circuit: indeed, as will be shown later, the device is practically all in one piece, there being only a cover plate (and that on the bottom) to retain the coils and to exclude water. The main cores are annular rings of solid steel formed by cutting deep square-sectioned grooves of successively increasing diameter into the face of a forged disk of mild steel.

The drawing, Fig. 31, shows a partial section of the Blanchard Chuck. (This cut is the same as that used for Fig. 13 which was erroneously printed wrong side up in our Feb. 3 issue.) Electric current flowing in the large coils of wire induce magnetic flux in the intervening walls of steel; and the lines of force, being prevented by the brass dividing rings from making a complete circuit within the metal of the chuck body, are compelled to pass into whatever pieces of work may be laid upon the surface.

The Heald Chuck

Later in the year 1915 a patent was granted to Winfred S. Griffiths of Worcester, Mass., upon a magnetic chuck in which the pole-pieces were individual magnets instead of being merely branches of a common magnet; and in which the shell, though still a part of the same casting as the magnet cores, was not depended upon as a carrier of magnetic currents.

The cores were arranged in pairs, each pair with its individual pair of coils constituting a complete active magnet independent of any or all other pairs. If we except the Blanchard, patented by Mr. Spencer, we may

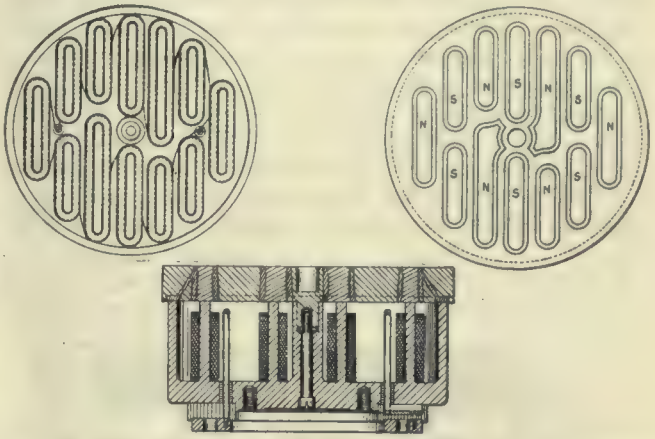


FIG. 32. THE "MULTIPLE MAGNET" CHUCK OF GRIFFITHS, NOW THE HEALD CHUCK

consider this to be the first of the multiple magnet class of chucks.

Mr. Griffith's chuck was a rotary, and like the Blanchard, was the outcome of an endeavor to supply a vertical grinding machine with a more efficient work-holding table. It was designed for, and the patent immediately assigned to, the Heald Manufacturing Co. of Worcester, Mass., manufacturers of grinding machines, and will be hereafter spoken of as the Heald chuck.

The drawings of the Griffith patent are shown in Fig. 32 and show the arrangement of the coils, cores

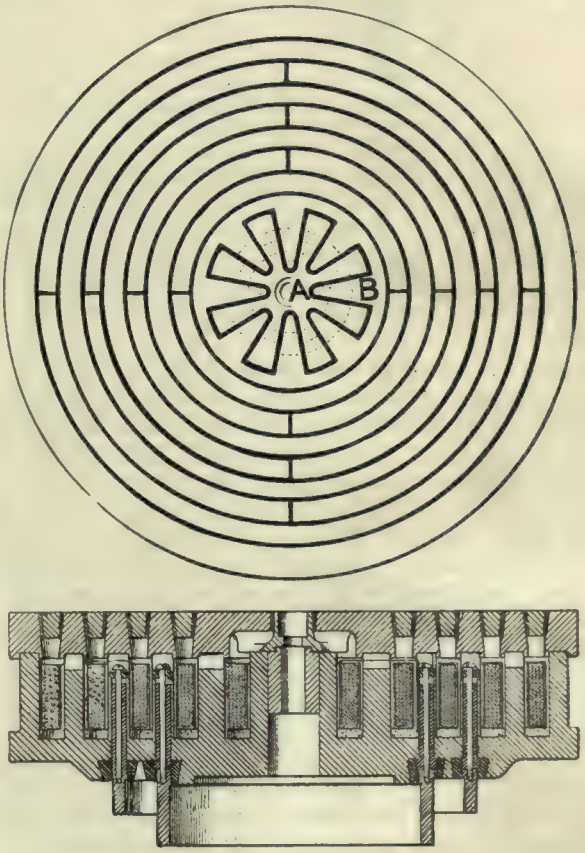


FIG. 33. A WALKER MULTIPLE MAGNET CHUCK

and polepieces as originally disposed. Though the principle is still retained the disposition of the poles has been greatly modified and will be considered under the constructional article dealing with the Heald chuck.

Making the Chuck Watertight

With the advent of high-powered grinding machinery, of which both the Blanchard and the Heald machines are examples, the problem of keeping water away from the coils of the chuck became one for serious consideration. The Patton chuck of 1913 was the first to make the waterproof feature the subject of patent claims, but the chuck makers, without saying anything about it, had been making more and more strenuous efforts to keep the interior of their chucks dry.

It was not enough protection that the coils should be impregnated with moisture-proof compound—chuck

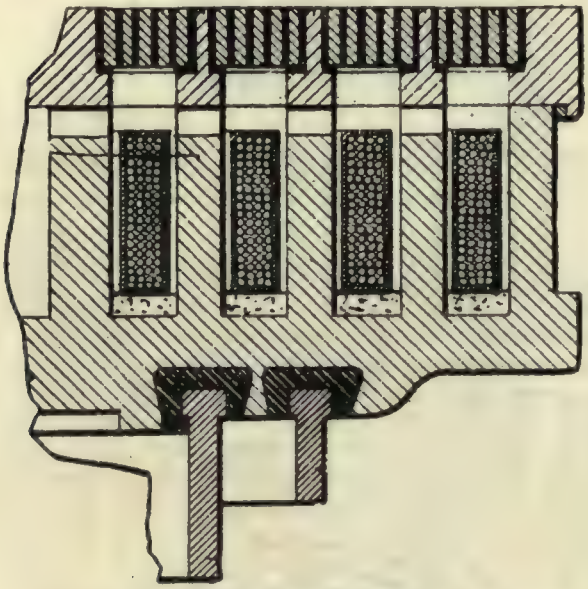


FIG. 34. SECTION OF MODIFIED TOP PLATE OF WALKER CHUCK

manufacturers were by this time alive to that necessity—but the impregnating material must also be protected against the action of the alkaline solutions with which practically all grinding operations were flooded or there would be chemical reactions that would eventually disintegrate the compound and work havoc with the insulated wires.

There are practical difficulties in the way of securing the close affinity between solder or lead alloys and cast iron necessary to effect an absolutely and permanently water-tight joint in the top plate. Though the soft metal separators between parts of opposed polarity were staked solidly in place; though the extra soldering of joints with chemical fluxes and the filling of all superfluous space with wax were resorted to; though unbroken gaskets of tin were interposed between the coils and the cover plate, there was still trouble from short circuits, blown fuses and burnt out coils.

A breakdown of insulation that allowed any current-carrying part to come into electrical contact with the metal of the chuck body would quickly bring about trouble, if it did not produce it immediately. Sparks would fly, or fuses would be blown out; or if the ground were only partial the effect was quite apt to be "shocking" to the poor operator every time he got hold of the wrong place.

The Blanchard was perhaps the first to practically eliminate these troubles. This chuck, as has been before stated, is "dug out" of a solid steel forging. There

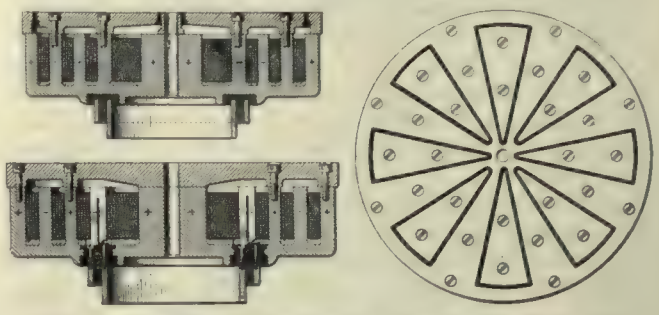


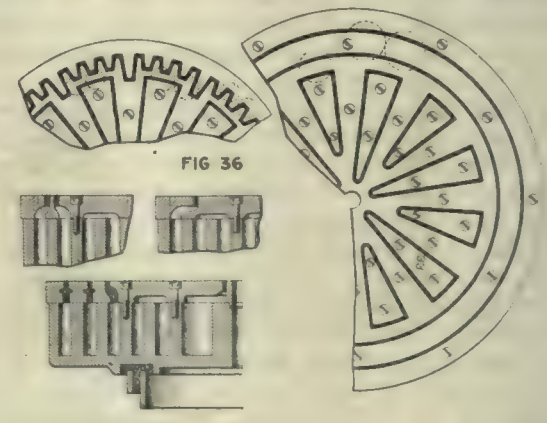
FIG. 35. WALKER AND WILLIAMS CHUCK OF 1916

are absolutely no openings to its interior except from the bottom, and this is closed by a single flat plate of steel ground to place. The coil cells, before closing the chuck, are filled full of moisture proof compound, so that if water could by any possibility pass the double water guard of the machine and then seep through the ground joint of the chuck (against the action of centrifugal force) it would still have to pass upward through a quarter of an inch of compound before it could get into a place where it could commence to do damage.

Another Walker Chuck

Another Walker patent, April, 1916, follows the Blanchard to some extent in the disposal of its main cores and the arrangement of its working surface. The annular coil chambers are similarly located but they are let into the upper face, and the cover is on top. The body too, instead of being made from a solid steel disk, is a casting. The cover, which constitutes the working surface of the chuck, is built up as shown in Fig. 33 of semicircular sections of steel, *brazed* together.

A peculiarity of this construction is that the surface is not all actively magnetic; each alternate ring is neutral, and depends for its holding power upon magnetic flux that has passed the adjacent gap of non-magnetic metal



FIGS. 36 AND 37. MODIFIED TOP PLATE CONSTRUCTION OF WALKER & WILLIAMS CHUCK

through pieces of work so laid as to cover the gap. In his specifications Mr. Walker admits a decreased total holding power but claims that the narrow rings, by providing many closely spaced sections each separated from all others by a non-magnetic gap, will hold to better advantage a large number of small pieces of work.

To make the chuck capable of holding small pieces close to the center of rotation and thus utilize the working surface to a fuller extent than would otherwise be possible, the central part of the chuck is differently constructed. In fact, this central part may be considered as a small single-magnet chuck, entirely independent of the surrounding parts. The inner annular core of the large chuck may be taken to represent the shell of the smaller one; the central hub, the magnet core; and the top plate to be made up of the branched polepiece *A* resting entirely on the central core, and the skeleton plate *B* in contact only with the shell.

A modification of the work holding surface, shown in Fig. 34, is included in this patent. The modified surface is built up in practically the same manner as in Fig. 33, but of an increased number of rings of correspondingly less thickness; the idea being to make an increased number of non-magnetic gaps and consequently increase the capability of the chuck to hold small pieces.

Further development of the same idea is exemplified in a patent granted in October of the same year (1916) to Mr. Walker and Isaac Fowler Williams which covers mainly modifications in the construction of the top plate with a view to securing greater and more uniform distribution of holding power. The same shape of shell with its annular cores is retained, but the cover or top plate consists of a skeleton plate cut away on the under side in such manner as to rest upon but two of the four annular main cores; and inserted polepieces so formed as to establish magnetic contact with the two remaining main cores. The construction is shown in Fig. 35. In Figs. 36 and 37 are shown other modifications in the manner of construction; both being covered by the same patent as the previous one. These forms involve an extra main core in the shell and a serrated ring is added to the top plate enclosing the radial polepieces which were a feature of Fig. 35.

In the sectional views it will be noted that the non-magnetic filler is cast in with a bead on either side which is evidently intended as an extra precaution against the intrusion of water.

(Part II will be concluded next week.)

When You Have Trouble With the Tool Steel You Are Using

By GEORGE A. RICHARDSON
Midvale Steel and Ordnance Co., Cambria Steel Co.

WHEN you have trouble with the tool steel you are using, is it your first impulse to lay the blame on the steel itself, or the manufacturer, or do you go further and stop to consider the almost innumerable causes that may entail partial or entire failure?

It is admitted, in raising this question, that it is perfectly possible for a defective bar of steel to get out from the hands of a manufacturer despite every precaution. No one who has had anything to do with the manufacturing or selling end would deny this. Nevertheless experience shows that where a high-grade product has been specified and is being used, by far the greatest number of difficulties encountered are due to causes that can easily be located by systematic investigation and are not the fault of the steel. They are causes that can readily be eliminated or corrected at great profit to the user.

Every manufacturer of tool steel, at one time or another receives complaints in regard to his product. This is practically inevitable. It remains for him either to prove the quality of the material he is selling or else make some adjustment. To do this it is necessary to have very complete information in regard to the way in which the steel is being used and the purposes for which it is intended.

Several years ago, while actively identified with the tool steel department of a well-known manufacturer, the writer found it expedient to get up a table that would facilitate the securing of information from the field that would have a bearing on complaints that were made from time to time. It was designed to give, in outline form, as many as could be suggested of the causes that would have a bearing on the performance of tool steels in general. This table, which was copyrighted at that time for distribution to the salesmen of the company only, has proven unusually useful and valuable; so much so in fact that it seems opportune to give the information wider circulation.

In using this outline, it should be remembered that the causes of failure are not confined to any one phase of the handling and treating of tool steels. They can be found at every stage. Hence any investigation of a trouble that is encountered should be carried along systematically step by step.

(I) Preliminary Investigation.
(*a*) Is proper kind and grade of steel being used? Kind of tool and nature of work.
(*b*) Examine steel or tool for self-evident defects.
(1) Manufacturing defects such as seams, cracks, piping and fins will be occasionally met with. It should be borne in mind, however, that as a rule improper handling, rather than inherent defects, is at the root of most troubles.
(2) Nature of fracture. A coarse crystalline grain usually indicates improper heat treatment.
(3) Cracks that form in forging may be due to failure to properly preheat or working too cold.
(4) Cracks in the finished tool may indicate improper quenching, grinding, or use of water at machine.
(5) Ability to touch hardened steel readily with file may indicate that decarburized surface material has not been removed before hardening operation.
(6) Improper grinding angles cause trouble.
(7) Is tool properly designed?
The remainder of this outline treats of the various sources of trouble, step by step. When the preliminary investigation does not definitely indicate the cause of difficulty, it will be well to follow this.
(II) Grade or Kind of Steel Used—Occasionally steel is taken from the wrong bar and is of the wrong kind or grade. In the absence of identification marks this is usually only disclosed by chemical analysis. Rough and ready tests such as spark test, relative weight and examination of fracture may afford a clue.
(III) Manufacturing Methods.
(*a*) In the case of forged tools, note:
(1) Cutting steel from bar. Method used?
(2) Forging. Temperature as indicated by color. If possible, watch blacksmith carefully while making a number of tools similar to failed one. Forging temperature may be too low, though seldom. Heating too hot is a common source of trouble when work is done on a piece-work basis. Is steel slowly pre-heated and brought to temperature? This is important in case of all steels and especially high speed steels. Does blacksmith heat the steel to a high temperature and allow it to cool back to forging temperature? A few steels will stand this; the majority will not. Does he attempt to do too much work with one heat? Steels with narrow temperature ranges should be brought back to temperature several times in the course of working, if necessary. Carbon steel heated to danger point, throws off bright scintillating sparks. Remember, however, that overheating of any kind, no matter how small, impairs the working efficiency, and may ruin the tool.
(3) Reducing size of bar stock. Slow heating to uniform temperature is of prime importance. Note method of reducing.
(4) Look for careless workmanship. Poorly made tools cause

trouble. A carelessly formed heel, preventing adequate bearing of tool in support, is a frequent cause of brittle steel tools breaking off in machine.

(*b*) Machining. If steel is machined before treatment, note whether cut taken is deep enough to remove decarburized surface material.

(*IV*) *Hardening and Heat Treating.*

(*a*) Annealing. It is advisable to anneal all the better classes of tools before hardening. This applies not only to forged tools, but to tools that have been machined from annealed stock.

(1) Temperature at which work is annealed.

(2) How brought up to temperature? Fast or slowly? From cold furnace? If hot furnace, is piece pre-heated in any way?

(3) How long allowed to remain at temperature? Work should soak thoroughly.

(4) Is work really at temperature of thermo-couple? Determine by sight test, *i.e.*, work being heated should be of the same color as the thermo-couple. An inexperienced operator can make lots of trouble through improper management of furnace and pyrometer or potentiometer.

(5) How cooled? Furnace, lime or other medium. Imperfect covering of piece to be annealed may cause hard spots. Is annealing material perfectly dry?

(*b*) Hardening.

(1) Is decarburized surface material entirely removed before hardening?

(2) Watch method of heating and bringing to temperature as before.

(3) Quenching medium. If air blast, see that it is dry. If liquid, what kind? If oil, see that it is free from water. Is quenching liquid kept at uniform temperature?

(4) How quenched? Method of dipping in the case of thin and complicated shapes? In the case of large pieces, is any precaution taken to break up the surface steam?

(5) Does material have any chance to chill before reaching the quenching medium? Cold tongs, etc.

(6) If case-hardened, what method? What compound used? How packed, heated, etc.?

(7) How is furnace flame? It may produce an oxidizing effect if too much air is supplied.

(8) Sweating. How performed?

(*c*) Tempering.

(1) Method?

(2) Color or temperature used?

(3) Time, in the case of oil drawing?

(*V*) *Pyrometers and Potentiometers.*

(1) Type used?

(2) In the case of thermo-couple types, is correction made for cold junction?

(3) Location of couple or couples in furnace?

(4) Are readings correct? How frequently calibrated?

(5) Are contacts clean and well made?

(6) As mentioned before, experience is necessary to make pyrometer readings of value. A piece that has not soaked long enough, will be much lower in temperature than the reading shows.

(*VI*) *Thermometers and other Temperature Measuring Devices.*

Have these been properly calibrated and checked?

(*VII*) *Tests.*

(1) File test of little value unless made properly. Any hardened piece of steel can be touched with a file, if it is used in a certain manner, and hence test may give wrong impression.

(2) Scleroscope Tests. What precautions taken in making? Steady support, proper point (for hard or soft materials) and smooth, clean surface essential. Be familiar with limitations of scleroscope. Under certain conditions its readings are of little value except when compared with a special standard.

(3) Brinell Tests. Brinell or Impression Tests. We prefer this method of hardness testing and would like to have it used whenever possible.

(*VIII*) *Grinding Tools.*

(1) Are proper angles used? In the case of drills, are cutting edges made equal in length?

(2) How is grinding done? Is tool dipped in water to cool?

(*IX*) *Tools in Use.*

(1) Is tool set properly in holder? Too much overhang or failure to back tool up properly will cause breakage.

(2) Position in reference to work.

(3) How does operator handle? Is he careless and does he jam tool into work, etc.?

(*X*) *Design.* Avoid sharp corners of all kinds. Many tools fail because there are sharp corners where radii might have been provided. Also avoid sudden changes from thick to thin section, etc., as irregular cooling sets up strains that cause trouble. Give careful consideration to the operation for which tool is intended. Cases have come to our attention where slight faults in design tended to transmit forces in directions quite different than intended.

(*XI*) If everything else fails, send in sample of material for chemical analysis. Still better, if possible, send along a piece of material that has stood up satisfactorily, so that a comparison can be made.

DECEMBER 1, 1915.

Reamer Grinding Attachment

BY EUGENE E. HENRY

The accompanying illustration is that of a reamer grinding device which has been in constant use in an up-to-date shop.

We found on all our cutter grinding machines that it was impossible to swing our reamers around in the centers provided with the machines and get up to the wheel to grind a 45-deg. corner or bevel, as is required for the cutting points of reamer blades.

It is also impossible to handle reamers of any length on small cutter grinding machines as the distance is too short between centers or the table does not have enough travel endways to get by the wheel.

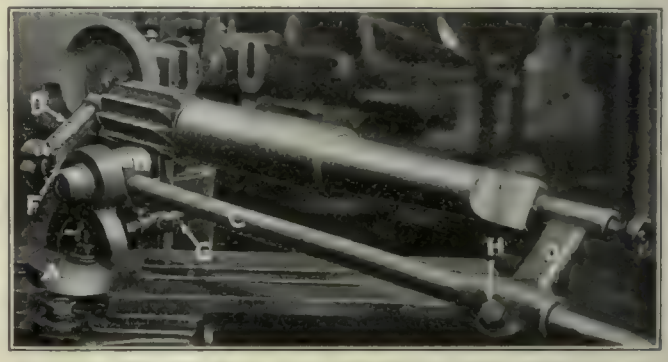
The device shown is self-contained in that the base, bar, centers and stop are all in one combination and entirely independent of other parts of the grinding machine equipment. In other words, just as it sets in position on the grinding machine table it can be straightened around parallel with the table or can be pulled around or across the table at any angle up to 90 deg. Also the device can be tilted up or down in relation to the table which is sometimes very desirable.

We handle spiral reamers of any kind and back off or grind the ends to any desired angle or bevel; also, reamers when there are two, three or more on the same shank and all of different sizes, different numbers of blades and even some spiral and some straight. Reamers with shanks up to 4 ft. long can be ground by using an extension on bar *C*.

This device is also handy for backing off twist drills and sharpening the teeth of end mills. It is shown here as used on a No. 1 LeBlond cutter grinding machine holding an ordinary straight reamer in position for grinding the end to about a 45-deg. angle.

A is the base held to the table by a T-headed bolt that fits into the lengthwise slot. The top of the bolt has a pin through it so that it can be turned crosswise or lengthwise with the slot in the table as desired.

Through the top of base *A* is a swiveled part *B*, the



ATTACHMENT FOR GRINDING REAMERS

front of which adjustably clamps bar *C*, and the rear end being threaded, contains a nut that holds *B* in any desired position. Bar *C* is provided with centers that are contained in the outer ends of arms *D* and *D*, the one next to the grinding wheel being stationary; the other one being adjustable the entire length of bar *C*, and held in any desired position by clamp screw *H*.

The arm *F* is adjustable up or down and lengthwise on bar *C*. This arm *F* supports stop *G* which sets directly under the flute or blade of the reamer in contact with the wheel and is easily adjustable for any amount of clearance. This stop acting directly on the blade being ground gives a uniform size to all blades whether evenly or unevenly spaced. Arm *F* being supported on bar *C* the whole device can be turned to any angle or position without changing the set up.

In grinding spiral reamers the stop is placed on the grinding machine head and the reamer travels over it and gets the desired twist or spiral. In grinding straight reamers the stop does both for the end and side and travels with the reamer.

We use some reamers that have blades that run straight, some with left- and some with right-hand spirals all on the same shank, but we handle them easily with this attachment.

Altogether this is about the handiest, quickest and greatest labor-saving device we have known.



The Foreman and His Job

Suggestions for live foremen who wish to go up the ladder; and for firms who want better shop executives

By FRED H. COLVIN
Editor, American Machinist

THE successful foreman must realize that he represents the firm to the men and that this involves both authority and responsibility. He must not forget nor let the firm forget, if he is to interpret the policy of the management to the men, he must first know what that policy is. This is even more important than interpreting or explaining the proper way of doing the work to be done. For it is the things which appeal to men's minds more than their hands, which make a shop successful or otherwise.

Many firms make the mistake of not explaining their policies clearly to the foremen. Where this occurs it is up to the foreman to try and find out the ideas or policies of the firm. This should be done diplomatically, and in fact diplomacy is the best asset a foreman can have.

If it is the policy of the firm to prefer men of 35 years or over, the foreman should know it. He should know its policy as to apprentices, as to the training of operators and the advancement of men as they show improvement. No firm can do better than to see that its foremen know its policies in all details.

Some firms are holding classes to be sure that the foreman do know their policies and are finding it profitable.

These policies should be stated in sufficient detail to be thoroughly understood by all. It is not enough to say "we stand for the square deal," for that is, unfortunately, capable of many interpretations. Everything should be definitely stated in plain English.

A policy might be stated as follows: "The Blank Manufacturing Co. advances its own men to more important positions whenever possible.

"No man will be discharged without a fair hearing. No favoritism will be permitted. Any man can appeal from what he considers an unfair decision.

"Suggestions and questions are welcomed and will be carefully considered. Decisions and answers will be made as promptly as possible.



THE OLD DAYS OF "DO AS YOU ARE TOLD AND ASK NO QUESTIONS," ARE GONE, AND IT IS BETTER SO

"Any man in the plant can have a hearing on any subject pertaining to the business. No official of the company is too big or too busy to see a man or men when it is really necessary, when the request comes through the proper channels.

"This is a real open shop and there is absolutely no discrimination as to what organization or societies to which a man belongs, nor need he belong to any."

These are only suggestions as to policies which may be encountered. Whatever they are, the foreman should know them and be sure that he interprets them fairly to the men. If he finds a grouch, it is best to get it aired at once instead of letting it smolder and grow. Many grouches arise because the men cannot see the reasons for certain rulings of the management. The "why" should always be explained where possible. The old days of "do as you are told and ask no questions" are gone, and it is better so. Men do more and better work and live happier and more contented lives when they can take an intelligent interest in their work. The foreman should never forget that, besides being workers, his men are also citizens, whose votes help decide the welfare of the community or the nation. An intelligent understanding of his own work helps to make every man a better citizen.

Nothing helps a foreman get thorough co-operation from his men like absolute fairness in every detail. One of the best ways is to admit a mistake freely when it is made, and we all make them. As old Prof. Sweet used to say: "The man who never made a mistake never made anything else." Any pretence of being infallible, or any attempt to shift the blame to some one else, is fatal in securing loyalty and respect from your men.

Above all things give every man full credit for his work and his assistance. If anyone invents or devises a tool or fixture or method of doing work, do not fail to give him credit for it. If you show it to a visitor, and it is a good plan to do so when opportunity presents, be sure and mention who made it and point him out or

even ask him to explain it to the visitor. One of the most successful managers the writer ever knew was not a mechanic but he was an excellent judge of men and he was absolutely fair. He made it a point to ask his men to show visitors new devices and to tell them of their value.

Fair Play Means Co-operation

It is of course possible to overdo this sort of thing, but even this is far preferable to the practice of some foremen and superintendents in claiming every improvement as their own. This is a very bad practice in every way and will do more to antagonize men than almost anything else that can be done. It is simply another case of playing fair in every way as the best way to secure the co-operation which means bigger production.



THE MAN WHO NEVER MADE A MISTAKE . . .

It is only fair to the foreman, however, to call attention to the fact that in some cases the management seems to think that the foreman should have all the brains in his department. With this idea at the top it becomes a matter of self preservation on the part of the foreman to make those at the top think that he is indispensable because of his many ideas. But when a foreman finds himself in this kind of a plant he should immediately hunt a new job. It is no place for a man who wants to grow into a really big executive.

The management that holds this kind of an attitude is depriving itself of many valuable ideas and is sure to be left in the race for bigger production. We are learning that the foreman or other executive who gathers around him men with ideas and encourages them to suggest new and better devices and methods, will soon have a surprisingly efficient department. And it is equally valuable in maintaining interest and securing the best kind of co-operation. When ideas and suggestions are encouraged and full credit given, with such rewards as seem suitable and fair, there is almost no limit to the good which can be accomplished. And in the same way, the opposite attitude will kill initiative and make every man feel that there is no use in bothering to think about anything except quitting time and pay day.

Setting Diamonds

By A. D. Hallet

I have not noticed many articles in the *American Machinist* relative to setting, re-setting and care of bortz diamonds. With several years' experience in this work I would like to help anyone having trouble in this line.

The best shape of diamond is an octahedron or eight sided crystal having six good points. These are the most readily set and can be reset several times always presenting a natural point.

Another important consideration is the color or rather lack of color, as with only one exception are the colorless stones the hardest; the Brazilian bortz, apple green in color, has no equal for hardness. All colors in stones, gray, brown, blue or black, denote softness, the deeper the shade the more impurities, and the softer the stone.

Nearly all stones used as tools have physical flaws such as cracks, honeycomb, and interior black spots, all of which tend to shorten their lives. If a crack runs at a right-angle to the axis of the point, that alone renders the stone useless. Other cracks parallel with the axis of the point are not so harmful.

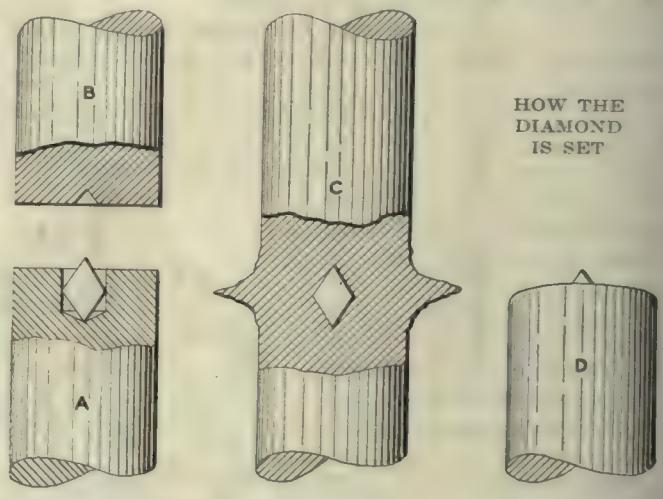
When the stone has been selected with consideration as to shape, color, and lack of destructive flaws, the manner of setting should be chosen that will hold it firmly without the possibility of loosening under shock. Stones that are held in copper by peening or are brazed into steel holders may do on light work, but cannot give the results of a stone properly imbedded in steel.

The following method was adopted for setting about a thousand stones: Use $\frac{7}{16}$-in. cold-rolled steel, cut in 6-in. lengths, for holders, this length allowing them to be used several times.

A Welding Job

Pass the stone through a drill gage and select a drill the next size larger. The holder, shown at *A* in the accompanying illustration, should be drilled so that when the stone is put in the hole it will project about $\frac{1}{32}$ in. Place the stone in the hole with the selected point in an upright position and stake lightly with a center punch or by sawing and crimping the holder, the former being most successful on stones up to one carat in size. Spot piece *B* with drill just deep enough so that it will clear the stone when butted to the holder, and butt weld as shown at *C*, care being taken to line up both pieces so that the stone will not slew or roll. The end *A* should be marked before welding. It is then an easy matter to expose the stone as shown at *D* by turning off the surplus metal.

Proper care in welding gives wonderful results as the molten steel shrinks in cooling and holds the stone firmly. With this method there is a total absence of blowholes such as found in the steel casting method. Two



HOW THE DIAMOND IS SET

thousand dressings per setting, when used on 20 x 4-in. wheels, are common. Compare this with results from stones set when purchased and draw your own conclusions. In use, be sure that the stone is presented at right-angles to periphery of the wheel and a little above the center. Also make sure that the setting, holder and bracket are firmly held. Keep accurate records of service rendered by each stone and the results will be surprising.

The Hartness Automatic Lathe

A Machine Intended for Large Production—Head Placed at an Angle—Groups of Tools Carried by Two Bars—All Movements Controlled by Single Cam-Drum

SPECIAL CORRESPONDENCE

THE Hartness automatic lathe, recently developed by the Jones & Lamson Machine Co., Springfield, Vt., is distinguished from other machines of this class primarily by its inclined bed. There are, however, a number of other distinguishing features which become apparent on closer examination. Among them is the use of round bars for holding and controlling the sets of tools. This feature is quite unusual, although it is used in a few other cases. The bars move endwise for axial feed and turn or swing to secure the proper depth of cut, to present new tools to the work and for cross feeding or facing.

The inclined bed gives many of the advantages of the vertical type of machine. The angle of the bed, combined with the open-ended construction, allows the work to rest in the chucks without being held while tightening. It also makes it easy to see and to get at both the work and the tools. Accessibility of all parts is, in fact, one of the main considerations in the design.

The unit type of construction has been given special consideration. The bed, the spindle- or work-head, and the gear or transmission units are all entirely separate. The work-head carries the work spindle, the two feeding bars, the cam-drum and the levers which automatically produce the various movements of the tools at work.

The tool-carrying heads are so designed as to be readily removed without disturbing the set-up of the tools. This makes it easily possible to have toolheads which are always set up for special jobs and which can readily be fastened into place when occasion requires. These heads can be put on the machine with a minimum of time and effort and make it economical to use the machine on comparatively short runs.

The outstanding feature made possible in the design is the grouping of tools with relation to the work, so that only very small tool movements are necessary. The working length is only 6 in. for diameters up to 12 inches.

A good idea of the appearance of the machine can be had from Figs. 1 and 2, in which the parts are lettered and named in the caption. The base has three doors on each side, giving ready access to the driving mechanism at *B*, the work lubrication system at *C*, and the change gears at *D*. This last feature is shown more clearly in Fig. 7.

The illustrations show how the arrangement permits the use of short, "stubby" tools, which are very rigid. The tools are grouped in heads on the ends of large bars which are guided by long and substantial bearings in the main frame. This frame also carries the work spindle, so that alignment can be easily maintained between them. The bearings support the bars beyond the face of the chuck, as can be seen in Fig. 3. This tool support is practically in line with the cutting thrusts and provides the most rigid control of the tools with relation to the work spindle.

The upper bar carries the boring and turning tools. Its longitudinal movement is controlled by the forward portion of the cam-drum *J*, while the cross motion, which presents first the roughing and then the finish-

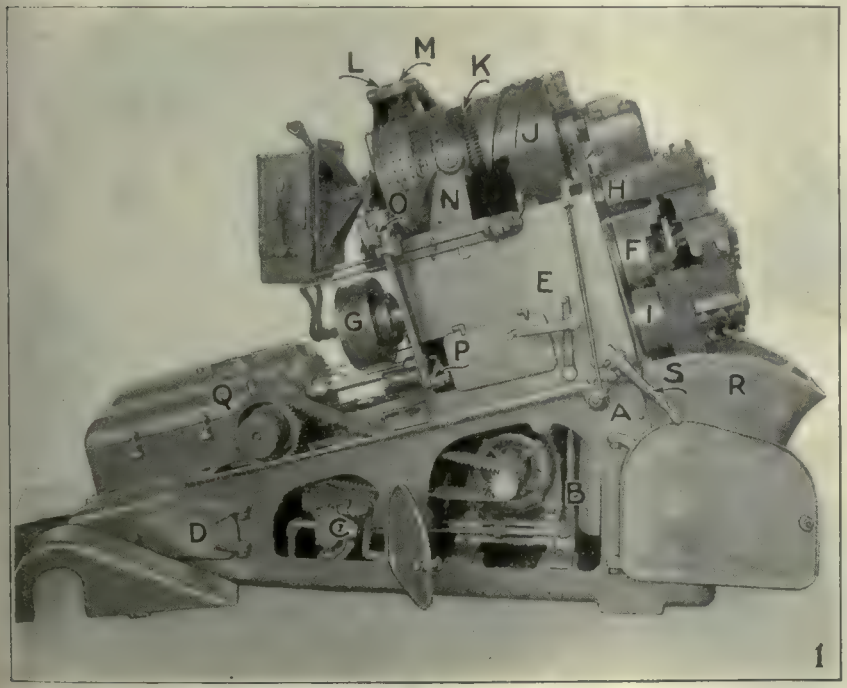


FIG. 1. FRONT VIEW OF HARTNESS AUTOMATIC LATHE

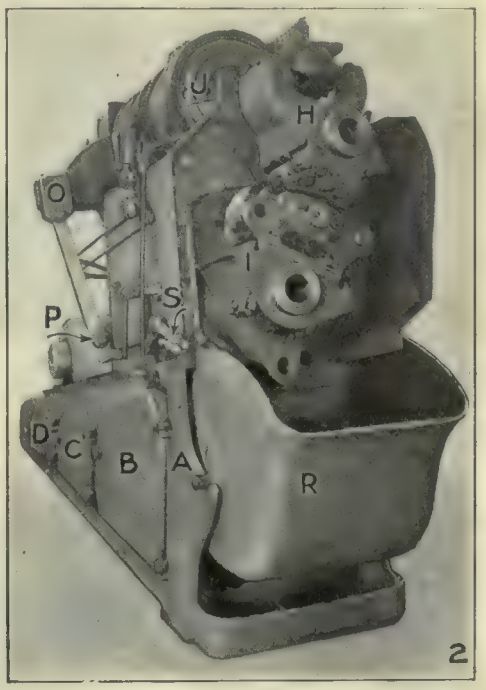


FIG. 2. CUTTING END OF HARTNESS LATHE

A—Base of machine. *B*—Motor compartment. *C*—Work-lubrication system. *D*—Change-gear compartment. *E*—Work-head. *F*—Chuck on spindle. *G*—Air chuck. *H*—Boring and turning bar. *I*—Facing bar. *J*—Forward cam-drum. *K*—Worm for driving cam. *L*—Speed control of cam-drum. *M*—Speed control of work spindle. *N*—Rapid-movement arm for bar *I*. *O*—Adjusting slide for face movement. *P*—Lower arm for movement of bar *I*. *Q*—Transmission unit. *R*—Chip pan. *S*—Starting lever.

ing tools to the work, comes from the face cam on the front end of the drum.

The lower bar is moved lengthwise by the back part of the drum cam, and its cross motion, used for facing the work, is secured by cams at the back end of the drum and the lever arms *O* and *P*, Fig. 1. The amount of the cross movement is determined by the position of the slide *O* on the arm. The lower toolhead is moved out of the way after completing its work, so as to leave the chucks clear for removing and replacing the castings or forgings. This movement is transmitted from the back part of the cam-drum by means of the lever *N*, the amount of the movement depending on the cam used.

Securing Accurate Feeds

Another interesting feature of the machine is the turning or swinging of the tool-carrying bars to secure feeds or to bring another combination of tools into operation. This action, combined with the fact that the turning movement of the tools may be called tangential instead of radial, with reference to the work, makes possible a degree of accuracy which it would be difficult to secure in any other way.

With the tool movement on a tangent, or on a tangential arc, to be more exact, a considerable movement of the tool affects the diameter but very little. The effect can be seen in Fig. 4, which shows a tool set up for a ring gear. The figure has been so drawn as to emphasize the tools and the work, leaving the other details in the background. It shows how the finishing tools can be brought into position after the roughing cuts, and also how different tool combinations can be readily brought into play. The plan makes for accuracy of the work by minimizing any error in the cams themselves. In this particular job, the head does not swing, but the effect of a swinging action can be seen.

To make the accuracy doubly sure, however, a very substantial guiding device is provided above the upper bar, so that the cam action need not be depended upon to hold diameters accurately to size. The device can be seen at *A* in Fig. 5. The toolbar guide has adjustable shoes *B* and *C*, which can be easily set. The guide proper is controlled by the face cam of the drum, which can be seen behind it, and is available for the different tool combinations in the toolhead. In some cases, the guide *A* has several faces, one for each position of the toolhead, so that a guide is provided for each diameter.

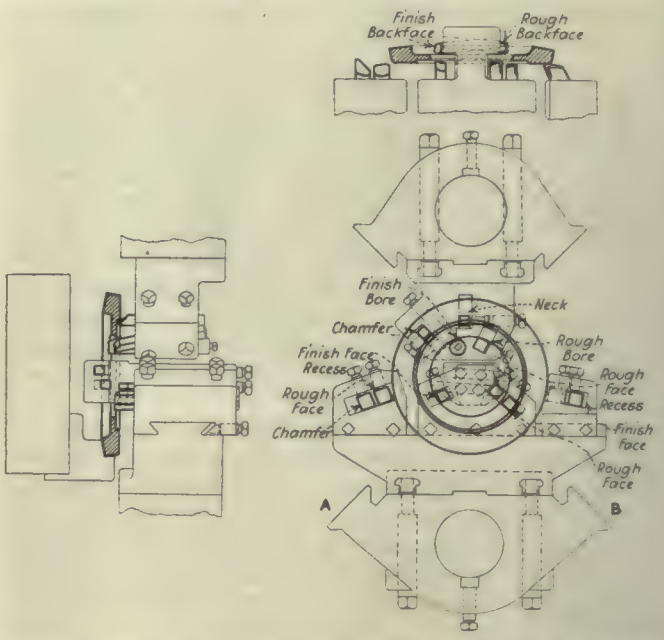


FIG. 1. FIRST OPERATION ON A RING GEAR, SHOWING POSITIONS OF TOOLS

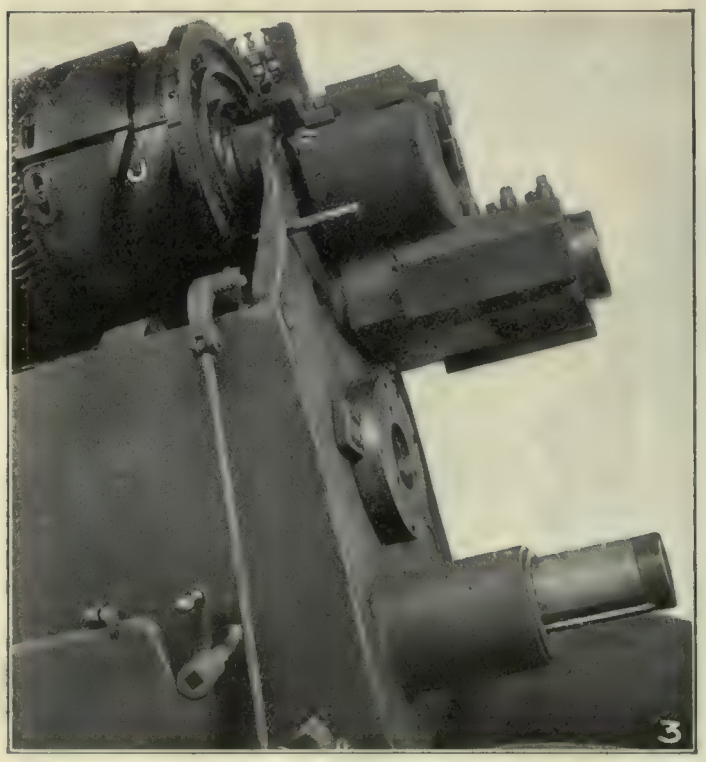


FIG. 3. ARRANGEMENT OF THE TOOL CARRYING BARS

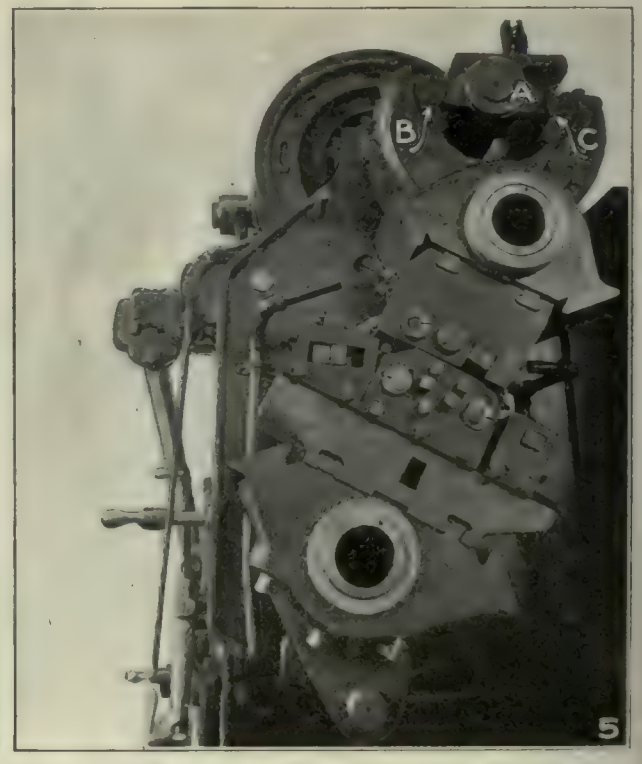


FIG. 5. VIEW OF TOOLING ARRANGEMENT FOR RING GEAR

A different type of guide or stop is provided for the lower bar, when it is desired to hold the facing cut to close limits, as in cutting a recess on the face of a piece of work or in facing down to a shoulder. The abutments are shown at *A* and *B*, Fig. 4, but the adjustable stops which fasten to the front of the work spindle head, are not shown.

Taking up some of the features of the machine in detail, we find the cam-drum of special interest, because on it depends the proper sequence of the tooling operations, as well as the results secured. The cam-drum carries four separate sets of cams, two on its cylindrical surface and one on each end. The cylindrical cams control the length feed motion of the tools, while the face cams bring different tool combinations into the work and also provide a crossfeed. The rear end of the cylindrical surface carries cams which control the speed of the cam-drum and of the work spindle. Fig. 6 shows the location of these cams and the simplicity of their construction.

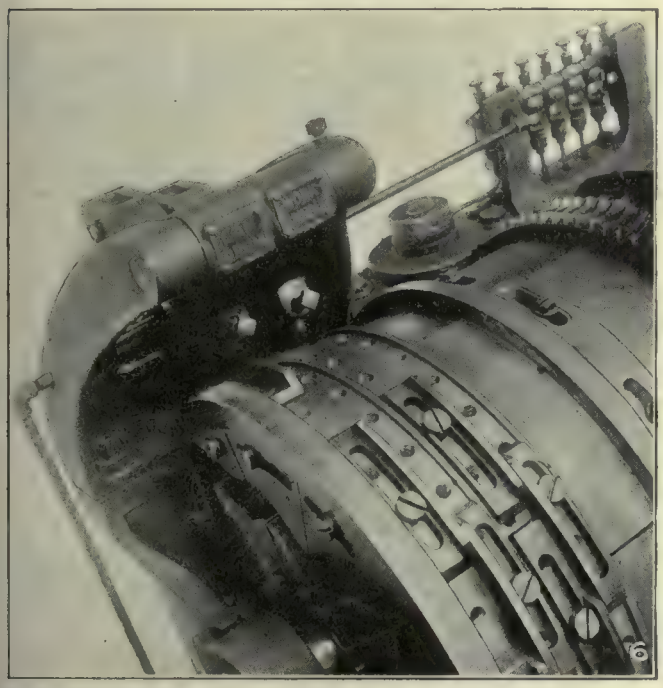


FIG. 6. REAR END OF CAM-DRIVE

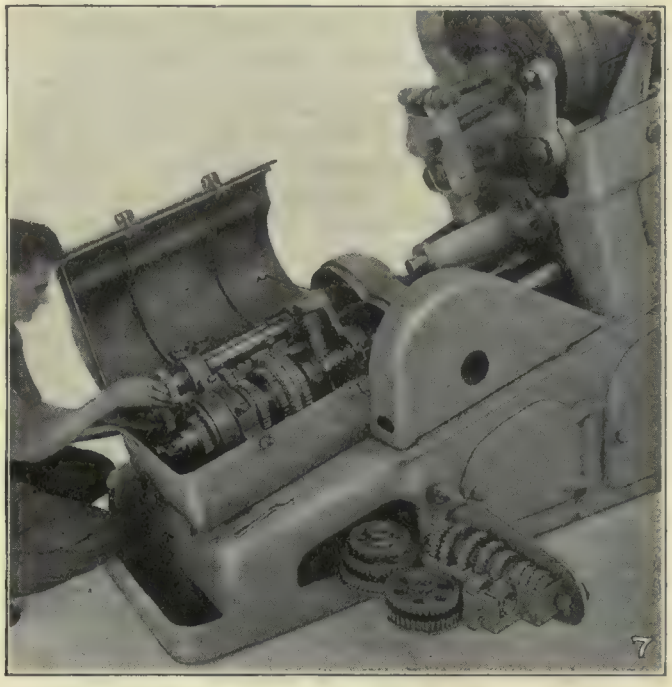


FIG. 7. REAR END OF MACHINE

By providing a separate cam for each motion, it is possible to make any desired variation in the effects produced by them. This can be done either by the adjustment or re-arrangement of the standard cams or by the use of special cams when necessary. The standard cams, however, can handle a large variety of work.

The gear box, shown at *Q* in Fig. 1 and in detail in Fig. 7, is readily accessible. Lifting the cover exposes the entire gear units. The change gears which control the speed of the work spindle and of the cam-drum are carried in a convenient place on the inside of the door, and can be readily changed as shown. Provisions are made for two speeds of the work spindle and three speeds of the cam-drum. Two length feeds and a quick return can be secured.

There is no rigid connection between the transmission units and the head, power being transmitted through flexible connections, which obviate the necessity for exact alignment between the two units.

Lubrication of the working parts is taken care of by a pump in the transmission case. The oil is forced from the reservoir in the lower end of the box through a pipe across the upper end. The pipe is perforated and sprays the oil over the gears and shaft bearings. The same pump forces oil up to the group of oilers on the head. These oilers have pipes leading directly to the spindle, to the drum bearings and to the tool-carrying bars. The top of the view, Fig. 7, shows the cam at the back end of the drum and the arm which gives the movement to the facing tool. To the right of them is the lever controlling the quick end-motion of the facing bar, so as to get it out of the way of the chuck at the end of the operation. The simplicity of the cams used and their adjustment is apparent.

The Operation of the Machine

After putting a piece of work in the chucks and clamping it, either by air or screw pressure, the power is thrown on by the handle *S*, Fig. 1, thus engaging a clutch inside the large sprocket wheel and starting the work spindle and the cam-drum, which are both positively driven.

The upper bar, with its roughing and finishing tools for both boring and turning, immediately gets to work. The roughing tools start to feed in, or toward the head. When this cut is finished, the toolbar turns slightly so as to bring the finishing tools into position, and these tools feed back across the work with no loss of time.

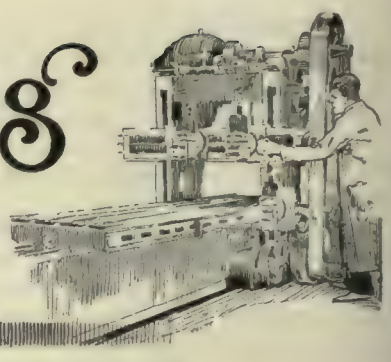
In the meantime, the tools in the lower head are brought to their facing position by the rapid-motion cam, and begin work. They face by swinging across the work, arms *O* and *P* transmitting the power from the rear cam-drum to the facing head. When the cuts are finished, the quick-acting cam moves the bar to its outer position ready for the next cut and leaves the work accessible.

The toolholders are shown in the various views. They are held to the toolheads on the bars by the T-head bolts shown. This arrangement makes it easy to remove and replace them when it is deemed advisable to keep complete tool set-ups in the toolroom.



Metal Cutting Tools.

By A.L.DeLeeuw



IV. Boring Tools: General Considerations*

Analysis of the Twist Drill—Chip Formation and Disposal—Method of Grinding for Drilling in Various Materials—Why Drills Break

THE most difficult of all mechanical operations is the boring of a correct hole. A number of independent requirements must be met simultaneously. These requirements are the following:

1—the center of the hole must be located in the correct position; 2—the axis of the hole must be a straight line; 3—the axis of the hole must run in the proper direction, so that the end, as well as the beginning of the hole, shall be in the proper location; 4—the hole must be round; 5—the section of the hole must be uniform; 6—the hole must be of correct size.

Note; requirements 5 and 6 might be combined, because if the hole is of correct size, it must be uniform. However, there are cases where the exact size of the hole is not of prime importance, but where uniformity of size is absolutely necessary. For this reason, these two requirements were mentioned separately.

The various operations which can be grouped under the heading "Boring" are:

1—drilling; 2—boring; 3—reaming.

(Note: reaming is, in a certain sense, boring with a modified boring tool, but in practice it is so different from the ordinary boring operations, that it is considered here as a distinct operation.)

Drilling is boring a hole in solid material. In Fig. 53, *O* is the center of the hole to be drilled, and *OA* is the cutting edge or lip of the tool which is going to do the work. If this lip should be shorter than the line *OA* or radius of the hole, as shown in Fig.

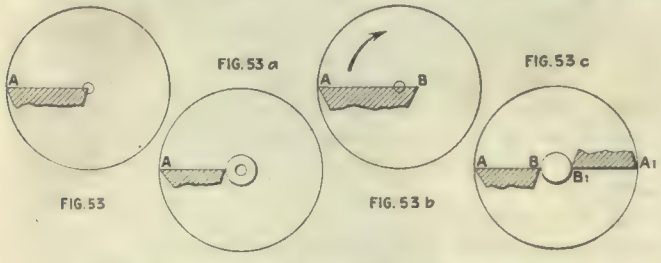


FIG. 53. VARIOUS TYPES OF DRILL LIPS

53A, a small column of material would be left in the center of the hole. If the lip were longer than the line *OA* and if it moved, as it should, in the direction of the arrow shown, the portion *OB* of the lip would do no cutting but would drag over the work and the tool would be destroyed in a short time.

This is the first difficulty we encounter when we try to drill a hole out of the solid. If the hole were very large in diameter, it would be perfectly feasible to have a one lip drill, but the difficulty of making this drill cut to the exact center, neither more or less, would be a very serious one. As a matter of fact,

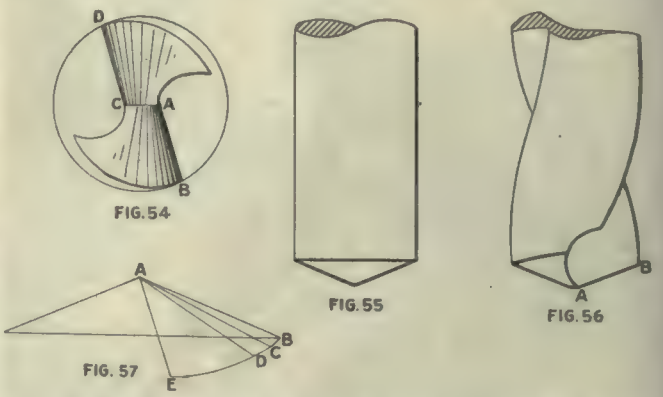


FIG. 54. END SECTION OF TWIST DRILL. FIG. 55. WHAT A SOLID TWIST DRILL WOULD LOOK LIKE. FIG. 56. EFFECT OF THE GROOVING. FIG. 57. THE CONICAL PORTION OF THE DRILL

practically all drilling of holes in the solid is done with a two lipped drill. Even with a two lipped drill the difficulty of coming to the exact center is just as great as with a one lipped drill, but in a two lipped drill the lips are joined and the material joining the two lips is made of sufficient strength to crush the remaining column which would be left in the hole if the two lips alone were at work without this connecting bridge. In practice we do not first remove the material at the outside of the hole, and then crush the remaining material by the connecting bridge because the connecting bridge projects slightly beyond the cutting lips, so that the material in the center of the hole must be crushed first before the cutting lips enter the work. The other way would probably be somewhat easier as far as cutting is concerned, but if we did so we would have to give clearance at *B* and B_1 (see Fig. 53C); in other words, we would have to grind the insides of the lips, which would be an exceedingly difficult operation.

The most common tool used for drilling is the twist drill. The twist drill is a two lipped drill of a section as shown in Fig. 54. The lines *AB* and *CD* are the cutting lips. The portion *AC* is the connecting bridge which is to crush that portion of the metal which is not cut away by the lips. As the drill feeds in the direction of its axis it will be seen that there are

*For the author's forthcoming book. All rights reserved.

really two broad-nosed tools at work at the bottom of the hole. These tools must have the proper angles in order to work correctly: they must have clearance and rake. The rake is formed by the spiral or twist of the drill, whereas the clearance is formed by grinding the bottom of the drill in the proper way. If a twist drill were solid instead of grooved, and if the bottom were not ground to the proper angles, it would consist of a cylinder with a cone attached to the bottom as shown in Fig. 55. Grooving the drill will make it appear as shown in Fig. 56, in which part of the cone has been removed. Such a drill, formed as shown in Fig. 56, would have a cutting edge *AB* with the proper rake due to the groove being at a spiral, but it would have no clearance; in other words, in order to feed further down into the hole the entire surface of the cone would compress the metal but would not be able to penetrate. It is therefore necessary to grind the metal of the cone away from line *AB*. In Fig. 57 the cone alone is shown without grooving and without the body of the drill. The line *AB* is the cutting edge, or rather will be the cutting edge after the grooving is completed. The grinding of the cone for clearance will have to be done in such a way that the next element of the cone *AC* will be an element of a somewhat steeper cone, the element *AD* still steeper, etc., so that, after this grinding is completed up to the point *AE*, the ground portion of the cone will appear as shown in *ABE*. This grinding can be accomplished by revolving the drill around an axis different from the geometrical axis of the body of the drill. The angle which this axis makes with the axis of the body will then be the angle of clearance. This angle can be made to vary according to the requirements of the work but the angle of rake is fixed by the angle of the spiral, so that, if it should be necessary to have a different rake from that which was formed by the twist, the lip should be specially ground as shown in Fig. 58. In Fig. 58A the drill is shown without special grinding and the angle *APB* represents the angle of rake. In Fig. 58 showing the specially ground drill the line *AP* is again tangent to the spiral, but the rake angle this time is the angle *BCD*.

If the body of the drill were a true cylinder it would bind in the hole. For this reason twist drills are made somewhat smaller in diameter at the shank than at the point. As a rule, this difference is 0.001 in. in diameter for every inch in length. This causes a variation in the size of the hole, according to whether the hole has been drilled with a new or an old drill. However, this is not of much importance, as drilling with a twist drill is either a roughing operation, preparatory to more accurate boring, or else is used for holes which require no great accuracy.

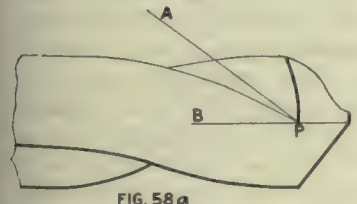


FIG. 58a

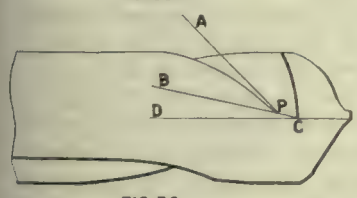


FIG. 58

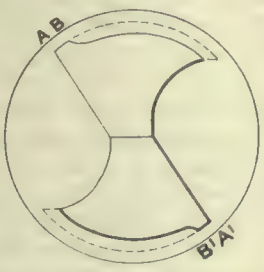


FIG. 59

FIG. 58. RAKE ANGLE OF SPECIALLY GROUND DRILL. FIG. 58A. RAKE ANGLE OF REGULARLY GROUND DRILL. FIG. 59. CLEARANCE OF TWIST DRILL BODY

Twist drills are made with constant or with increased twist. This latter method of making a drill is for the purpose of facilitating the egress of chips. As such it has some small value. On the other hand the variation in twist also causes a variation in the rake and this variation may be sufficient to compel a change in the amount of feed per revolution. Therefore, where a twist drill is used on manufacturing operations where large quantities of pieces have to be drilled and where the elements of the operations are well studied out, it is advisable to use twist drills with constant twist in order that the maximum amount of feed may be used at all times without depending on the knowledge and reasoning power of the operator.

Increasing Clearance

In order still further to increase the clearance between the body of the drill and the hole, the drill is not kept entirely circular in section but is made as shown in Fig. 59. The section shown is not taken at the point where the drilling takes place, but some distance farther toward the shank, and the clearance caused by the taper of the drill body is very much exaggerated. Instead of maintaining the circular section as shown in dotted lines, part of the drill is ground away, leaving only a small land, *AB* and *A, B*.

If we consider a drill 2 in. in diameter, and if we should think for a moment that the lip comes clear down to the center, then we will see that various points of the lip have various amounts of work to do. An element of the lip near the center removes during one revolution the metal lying on a circle of very small diameter, whereas an element near the circumference removes during that same revolution an amount of metal many times greater, so that the work done by an element near the circumference is very much greater than that done by an element near the center.

Fig. 60 shows what might be called a conventionalized twist drill with the two lips, *AB* and *CD*, attached to a central core. The lips themselves are so thin that they have practically no strength where they are attached to the shank, and they are dependent on the central core for strength and rigidity. The moments of the pressures against the lip *AD* are shown by the arrows which become smaller as they approach the center. The total amount of work done is directly proportional to the area of the section of the drilled hole, that is, it is directly proportional to the square of the diameter. The central web of the drill or, as we have called it, the connecting bridge or core, must therefore be heavier for a large than for a small drill. As the amount of work done by a 2-in. drill would be four times as great as that done by a 1-in. drill, the diameter of the core would have to be twice as great.

This central core, or web, cannot do any true cutting, but must, as was pointed out before, crush the metal before the lip can begin to drill. If we should take an extraordinarily large drill we would have such a large core that the pressure required for crushing would become enormous. As a matter of fact such extraordinarily large drills have been made and used, for instance, for the drilling out of ingots preparatory

to hollow forging on a mandrel. It was found that to make a 26-in. drill penetrate into a solid steel forging a feed pressure of 300,000 lb. was required. This matter of heavy feed pressures may become a very serious consideration, especially when relatively large holes have to be drilled with relatively light machinery. In such cases it is well first to drill a much smaller hole. If, for instance, a 2-in. hole had to be drilled with a relatively light drill press, we would first drill a ¾-in. hole, and then follow

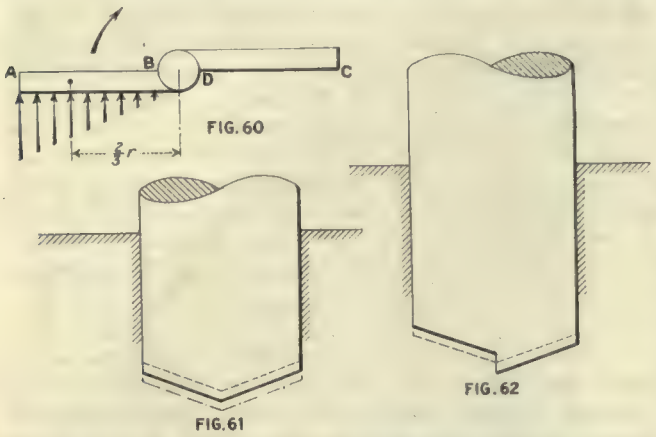


FIG. 60

FIG. 61

FIG. 62

FIG. 60. DIAGRAM TO SHOW WHY HEAVY CORE IS NECESSARY. FIG. 61. ACTION OF PROPERLY GROUND DRILL. FIG. 62. DRILL WITH ONE TIP TOO LONG

up with a 2-in. drill. There are many cases where this method is followed, even though the machinery has ample power to drill the hole in one operation. The drill point, that is, the part that has to do the crushing, is the weak part of the drill and breaks down first, provided of course that the drill is properly ground and operated. When large and expensive drills are being used time and tool cost can be saved by drilling the smaller hole first.

Just as with planing and turning tools the proper action of a drill depends primarily on its cutting angles. If a twist drill is properly ground, and drills a hole in steel or in some other material which does not readily crumble, a long chip will be formed which will resemble a corkscrew. At any part of the lip of the drill a chip will be formed with a speed proportional to the radius at that point, so that, if the lip of the drill is a straight line the particles of the chip removed when the drill has turned through a small angle will also be lying in a straight line. They will not interfere with each other and therefore the chip will not break up into small pieces. This is a matter of great importance because the long, corkscrew-shaped chip will travel through the groove and come out of the hole without clogging it. The only part of the metal which does not form into a long chip would be the metal crushed by the central core, and even a large portion of this is compressed into the chip and carried away by it. This matter of carrying the chip out of the hole is one of the most important things in drilling. In the great majority of all drilling operations the drill spindle is vertical and the work is below the drill, so that, unless there is some way of carrying the chip out of the hole, the hole would soon become clogged, the chips would wedge in between the drill and the hole in a solid mass and offer so much resistance to the drill that it would break. This is especially so with the smaller drills and is the source of a great percentage of all breakages. When drilling cast iron or any other brittle material the chip will not form into a corkscrew but is broken up and soon fills the hole. But these chips do not have the same tendency to pack together, so that with large or medium-sized drills a fairly deep hole can be drilled in cast iron or brass or aluminum. When it comes to drilling holes in soft steel, copper, or certain bronzes, however, the drill will choke very readily unless the corkscrew chip is formed.

If the cone at the end of the drill is flat, that is, if the sides of the cone form an angle with the axis approaching 90 deg., then the convolutions of the chips will be close together and if the feed should be heavy, so that the thickness of the chip is quite considerable, it may become difficult for this chip to crowd through the groove in the twist drill and it will have a tendency to break up. If, on the other hand, the cone should be steep, that is, if the angle between the side of the cone and the axis is small, then the convolutions of the chip will be far apart and it will be easy for the chip to move through the groove of the twist drill so that there will be no tendency for the chip to break up in small pieces. It is advisable, therefore, to have a sharp point or steep cone when the drill is used in soft material and with heavy feed, whereas a flatter cone can be used with light feeds, or with harder material. On these considerations is based the practice of making all standard twist drills with a relatively flat cone, and to change the drill to a steeper cone when soft material such as wrought iron or copper, must be drilled, particularly if one wants to use heavy feeds.

Basis of Considerations

All the above considerations are based on the assumption that the lip of the drill is straight, in which case there is no distortion of the chip along the cutting edge. But if this lip is a curved line, either concave or convex, we have a different proposition. If the lip is concave the outside particles of the chip will be crowded toward the center and the inside particles toward the circumference so that the chip will be broken up into small pieces thus clogging the hole. If the lip is convex the outside particles of the chip will be crowded toward the outside and torn off the remainder of the chip, the inside particles will be crowded toward the center web and will be torn off the chip, and again the particles of the chip will clog the hole. The convex lip does not break up the chip quite so readily as a concave lip of the same curvature, so that, if we wish to obtain a continuous chip we should take for first choice the straight lip, as second choice the convex lip, and last, the concave lip. Twist drills with constant twist are grooved in such a manner and at such an angle that when the lip is ground in the proper way it will form a straight line. Suppose for instance the angle of the spiral with the axis to be 27½ deg., the angle at the tip of the cone 120 deg. and that we will obtain a straight lip. If we have a variable twist and part of the drill is used up, we will come to a point where the angle of the spiral is different from 27½ deg., but the shape of the groove will still be the same, and as a result the lip will be different from a straight line, if again we should grind the cone to an angle of 120 deg. In order, then, always to obtain a straight lip, it would be necessary to measure the angle of the spiral every time the drill must be resharpened and to calculate a corresponding angle of the cone and grind it accordingly. Such a procedure would be entirely impractical. For that

reason also it is advisable to use drills with a constant twist.

It is not only important to form the corkscrew chip for the sake of preventing clogging and consequent breakage of the drill, but also because the chip carries with it a large portion of the heat generated by drilling. If the chip breaks up into small pieces, the heated particles remain in the hole and the point of the drill becomes unduly heated much sooner. This will prevent the use of as high a drill speed as would otherwise be possible. Furthermore, when we use a coolant the small chips at the bottom of the hole would prevent the coolant from penetrating to the drill point or cutting edge. This objection also disappears when we have brittle material such as cast iron, because as a rule a coolant cannot be used when cast iron is being drilled due to the fact that the water (or coolant in general) would form an abrasive mixture with the gritty material of the chip and would soon dull the cutting edge.

Another Point in Grinding

Another point to be observed in grinding a drill is that the two lips of the drill must be ground in such a way that they will take an equal chip. Suppose we have a properly ground 1-in. drill, drilling a hole with a feed of 0.010 in. per revolution; then each of the two lips should remove 0.005 in. per turn. Fig. 61 shows a drill which is not supposed to rotate. It has been forced by direct vertical pressure into the metal to a depth indicated in the drawing—in which the dotted lines show the bottom of the hole and the full lines the lip of the drill after penetration. Now if we should turn this drill through half a revolution it would remove all of the metal between the full and the dotted line. If at the same time it should have a feed motion, it would, during this half revolution, penetrate to the position indicated by the compound line. In other words during the entire operation of drilling, and while the feed is on, each of the two lips would be embedded in the material to a depth equal to half the feed. This will happen if the drill is properly ground, that is, if the two cutting edges are situated on one cone. But if the two cutting edges should be situated on two different cones then the condition would be different. Fig. 62 illustrates this condition in exaggerated form. In this illustration one lip is so much lower down than the other that the higher lip does no work at all. It will often be noticed that, when drilling steel, a large and well-formed corkscrew chip comes out of one of the two grooves, while either a small chip or nothing at all comes out of the other groove. When that is the case one lip does all the drilling. If the drilling machine is set for 0.010 in. feed per revolution the acting lip will have to do as much work as if the drill had been properly ground and as if the feed were 0.020 in. per revolution. Sometimes the drill is ground as shown in Fig. 63 where the two lips come together properly in the center, but where they form different angles with the axis. The full line again shows the form of the drill and the dotted line the form of the bottom of the hole. The illustration shows how the left-hand lip takes a chip over its entire length whereas the right-hand lip takes a chip near the center only.

To sum up: the two lips should be ground to the same depth and to the same angle. There are at the present time many machines in existence which, when operated with reasonable care, will produce excellently ground twist drills.

Due to the fact that there must be a central web in order to give the drill the necessary strength, it is not possible to have the two lips come together in the center. The fact that the relatively large amount of metal is left in the center of the drill makes it necessary to exert heavy end pressure on the drill in order to make it penetrate. This end pressure is very apt to break the drill, especially the smaller sized drills, and in order to overcome this breakage, it is quite customary to grind away a part of the central section somewhat as shown in Fig. 64 in which the dotted line shows the original form of the drill and the full line shows how part of the center web is ground away.

If the breakage of the drill is caused by the heavy end pressure this makeshift is very likely to overcome the trouble. At the same time the shape of the lip has been changed and the drill will no longer form a perfect corkscrew chip, so that a new danger comes to the foreground, namely, that the hole might be clogged and the drill will break again. This makeshift cannot be employed without carefully considering all the conditions; for instance if a rather shallow hole has to be drilled on a drill press, or a somewhat deeper hole on a horizontal drilling machine so that it is not necessary that the chip should be a perfect corkscrew in order to escape and if it is desirable to have a heavy feed which is apt to break the drill, then this makeshift might do very well. If on the other hand a deep hole has to be drilled on an ordinary drill press so that the main consideration is to keep the chip continuous, then this makeshift would not help and the drill would still break—though for a different reason. The only remedy in that case would be to reduce the feed.

In the foregoing it was assumed that material like steel, wrought iron or bronze was being drilled. If cast iron is being drilled the above-mentioned makeshift

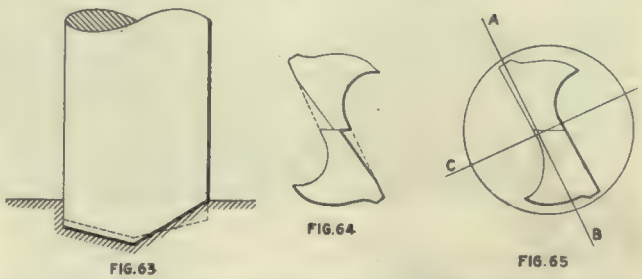


FIG. 63 FIG. 64 FIG. 65

FIG. 63. DRILL WITH LIPS GROUND AT DIFFERENT ANGLES. FIG. 64. DRILL WITH PART OF CENTER WEB GROUND AWAY. FIG. 65. WHAT MAY HAPPEN TO A DRILL GUIDED BY A JIG EYE

would not be necessary at all. On the other hand if the drill should be ground as in Fig. 64 and if it should be used for drilling cast iron, the fact that the drill lip is not a straight line would not have very serious objections. Cast iron, brass or aluminum would not require such a heavy end pressure so that there is no object in reducing the section of the central web, but, on the other hand, as a continuous chip cannot be formed anyhow there would be no great objection to grinding the lip to a curved line.

As a rule it is desirable to produce the corkscrew chip when drilling in steel, but not always. Drills used in automatic machinery, or small drills, often break because long corkscrew chips are being formed. These chips are apt to wrap themselves around the drill and unless the operator is at hand and succeeds in breaking up the chip the drill is liable to break.

Various means are employed to overcome this diffi-

culty. In automatic machines the feed may be retarded from time to time, so that the chip will break up into shorter lengths. Where heavy drills are used notches or so-called chip-breakers may be made in the lips, the notches on one lip being placed so as not to correspond with the position of the notches on the other lip. When using small drills in automatic machines the point is often ground as shown in Fig. 64 so as to prevent the formation of the long chip. Any of these various means necessarily cuts the feed down, as in order to obtain the greatest rapidity of drilling through steel or any other tenacious material, the drill should be ground theoretically correct.

Locating the Hole

Various means are employed to locate the beginning of a drilled hole correctly. The old-time method (a method still used when a single hole has to be drilled) is to locate the hole by the intersection of a couple of locating lines and to make a prick punch mark at that point of intersection. A couple of circles, or sometimes three, are struck around this center, the smaller one being somewhat less in diameter than the hole to be drilled, the next larger being the exact size of the hole, and the third one somewhat larger again. The operator feeds the drill into the material with the point of the drill as nearly as possible to the prick punch mark. Before he has drilled to the full diameter of the hole, he withdraws the drill and notes whether the hole is concentric with the small circle. If not he will chip a small amount out at the point of the hole so as to guide the drill more nearly central, and he repeats the operation until he is satisfied that the hole will be located sufficiently accurate.

Use of the Jig-Eye

If the drilling of the hole is to be conducted as a manufacturing operation—that is, if a large number of pieces have to be drilled—a jig is constructed in which the piece is properly held and in which the drill is guided by a bushing. As a rule this method is sufficiently accurate for practical requirements. It should be observed here, however, that a jig eye cannot possibly guide the drill with any high degree of accuracy. Fig. 65 shows on an exaggerated scale what may happen when we attempt to guide a drill in a jig eye. The full lines show the drill in the opening of the jig eye. A slight amount of clearance is shown between the metal of the jig eye and the land of the drill. Such a slight amount of clearance is unavoidable as otherwise the drill could not turn. If we use a drill which is no longer new but of which 3 in. have been used up, then the diameter of the drill will be 0.003 in. smaller than its original or nominal size so that this amount of 0.003 in. must be added to the running clearance. This means that not only can the drill move 0.003 in. in the direction *AB*, but that it can move considerably more in the direction *CD*. Taking for example a 1-in. drill and allowing a clearance of 0.003 in. the movement in the direction *CD* would be 0.059 in. which is quite considerable if an accurate hole has to be made.

Of course, if the jig-eye is made long enough, so that at least one-fourth of the lead of the spiral is in the jig-eye, this excessive amount of movement will not take place, and the greatest amount of movement would be only the amount of clearance $\times \sqrt{2}$.

(Part IV to be continued next week.)

A Portable Keyseating Machine

By P. Geil and E. McGinn

The portable keyseat milling machine, shown in Fig. 1, was designed and built in the shops of the De LaVergne Machine Co., New York City, for milling keyseats in crankshafts for oil engines. The shafts vary from 6 to 13 in. in diameter with keyseats from $\frac{3}{4}$ to 2 in. in width, and up to 14 in. in length. The machine is not limited to keyseating but can be used for milling flats, drilling, reaming and tapping, owing to the range of movements as indicated by the arrows in Fig. 2.

A body *A* is attached to the work by the clamp *B* and bolts *C*. The end mill *D*, is fed up or down by the

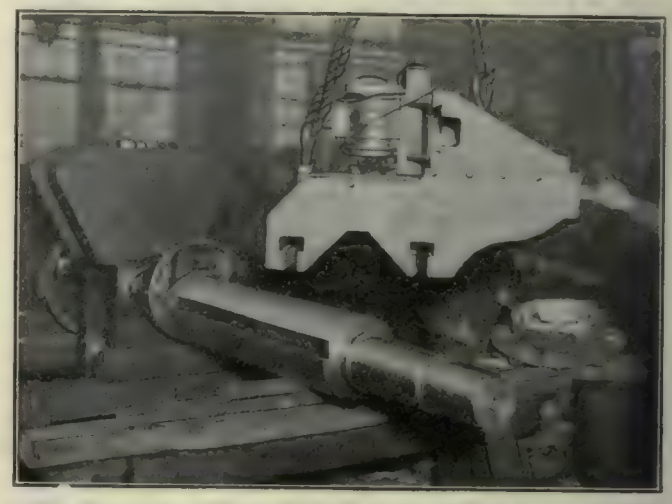


FIG. 1. PORTABLE KEYSEATING MACHINE SUSPENDED FROM A CRANE

handle *E*, and horizontally across the frame by the handle *G*. Adjustment for centering the cutter with the work is by means of the handle *H*. Graduated collars for micrometer adjustments are provided at *J*, *K*, and *L* and eyebolts for attaching a crane sling are located at *M*, *N* and *O*.

The original design called for an automatic feed, but as it would necessitate the use of several gears and a clutch, the idea was rejected in favor of the simpler arrangement shown.

The end mill is direct driven by a 3-hp. motor, the armature shaft of which serves as the machine spindle. The speed of the motor is from 100 to 150 r.p.m.

While the machine was designed primarily to relieve the overcrowded condition of the milling machines, it has been found that by taking the machine to the work rather than the work to the machine, the output has been increased and the cost decreased.

The weight of the machine is about 1,500 pounds.

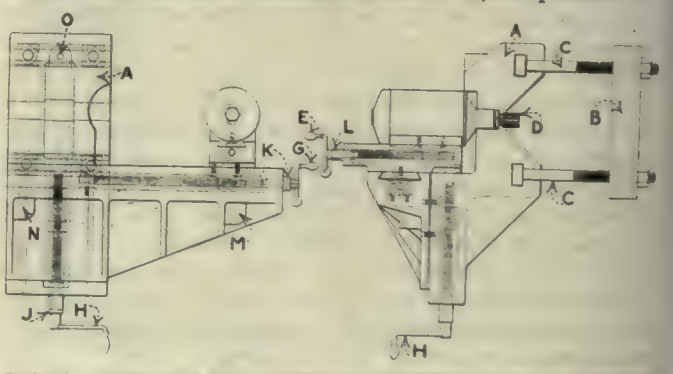


FIG. 2. DETAILS OF PORTABLE KEYSEATING MACHINE

The Repair of Steel Freight Cars

Repair Often More Difficult Than Construction—Methods Developed To Suit Conditions—Rivet-Buster, Acetylene Torch and Straightening Machine Extensively Used

By J. V. HUNTER
Western Editor, *American Machinist*

THOSE who have seen the clean-up of a freight wreck in the old days will recall that all badly damaged wooden cars were burned by the side of the right-of-way. That was far simpler and cheaper than attempting to rebuild. Less seriously damaged cars were cared for by the carpenter gang, with the help of the stock from the lumber pile.

The coming of steel cars has brought totally different problems. They cannot be burned in order to get them out of sight; then, too, in the past few years they have become far too costly to neglect the thought of salvage. Moreover, steel cars are used because they have shown an ability to withstand far greater punishment and still be suitable for repair. As a result, a string of cripples comes daily to the shop for repairs and overhauling; and the layman cannot help but wonder at what point the shop man begins when he sees such a wreck as the unfortunate shown in Fig. 1, a car that had just been brought into the Bloomington car shops of the Chicago & Alton Railroad Company.

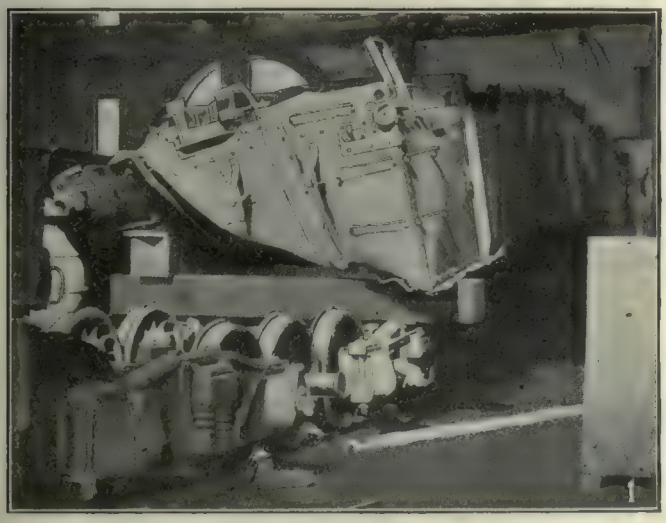


FIG. 1. A STEEL CAR COMING INTO THE SHOP FOR OVERHAULING

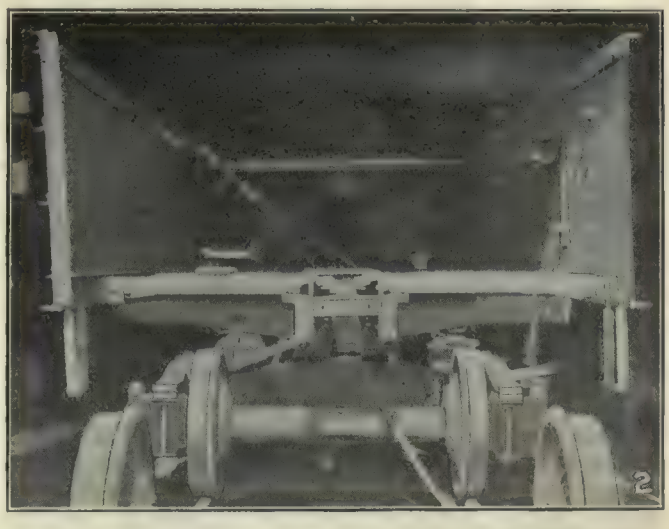


FIG. 2. ALL BADLY DAMAGED PORTIONS REMOVED, READY FOR STRAIGHTENING SIDES

Such a cripple would be first righted, and, if necessary, lifted from its trucks while the latter go to the truck shop for overhauling. The early repair work is largely a matter of "busting" rivets, as the gang removes the bent plates, gussets and angles to send them to the straightening presses, since but few of them are straightened in place. Usually, a car is soon stripped down to the condition shown in Fig. 2, whereupon jack-screws and turnbuckles are applied to the side angles and to some under-frame portions that can be pulled straight while remaining in place.

Straightening Bent Under-Frames

Sometimes the main frame channels on hopper bottom cars are found to be bent or sagged, so that they must be raised in the center in order to straighten them. While doing this, both ends of the car are fastened down to the rails by steel cables and clamps passing over the draw bars or end sills, Fig. 3. Two methods are used for raising the centers of the channels, it being frequently done with hydraulic jacks, as shown in Fig. 4. However, the steel-car shop building at Bloomington once served as the locomotive "back shop," and the crane that formerly lifted locomotives is sometimes called upon for these straightening operations. On the car shown in the illustration it will be noted that new transverse stringers have been inserted in the center portion.

Cutting Out Bad Plates

The acetylene welding outfit plays a prominent part in repair work on steel cars, and sometimes vies in importance with the rivet-busting tool in the removal of damaged portions. Used as a cutting torch it serves constantly for the removal of weak sections in plates, so that they may be replaced or patched. A large proportion of one type of car that comes in for overhauling or repairing has end-plates which are rusted through near the bottom of the car. This damage is caused by the sulphur in the coal handled, and by the moisture in loads of wet cinders. Before patching, a section about 12 in. high is cut out from the bottom of the end plate with a torch, as shown in Fig. 5.

A Special Truck for Gas Tanks

A special form of truck has been devised in the Bloomington shops for handling the gas tanks and welding torch equipment. As can be seen in the illustration, the operator's tools are carried in a steel box mounted on trunnions between the tank and handle; and with this mounting the box will swing so as to remain always in an upright position.

Holes that have been accidently punched through the

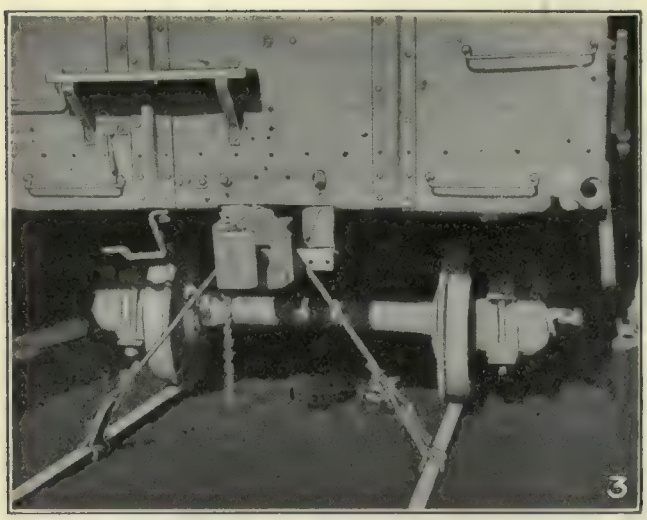


FIG. 3. ENDS CLAMPED TO RAILS WHILE STRAIGHTENING CENTER STRINGERS

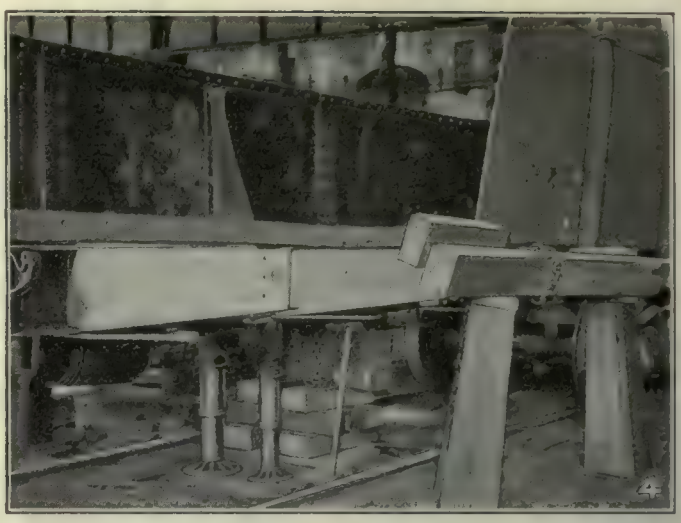


FIG. 4. TAKING SAG OUT OF CENTER FRAME CHANNELS WHILE ENDS ARE HELD DOWN

side or end plates, leaving ragged corners projecting, are cut out with the torch to a round or oval opening, and patches are applied of sufficient size to permit riveting in place. It was noted that frequently these patches were made and punched for rivet holes and then tacked to the plate by means of a few welded spots, thus holding them so that it was a very simple matter to drill holes in the plate and place the rivets. In some cases small patches are applied solely by welding.

Straightening Distorted Members

Gusset plates, end sills and all similar parts that require straightening before they can be replaced on the car are taken to an adjacent blacksmith department for this work.

Parts that cannot be straightened cold are heated in a large oil furnace that was built in the shops, or else in a second furnace of similar size and type but of Ferguson make. Both furnaces are provided with air cylinders for lifting the doors.

Straightening of hot or cold parts is done on the table of a large air-cylinder press, shown in Fig. 6. Its ram is used both for straightening and for holding work while portions are sledged into shape. The latter method is shown in the illustration being employed on an end sill.

There are two presses of this character in the shop, the second one being shown more completely in Fig. 7. It is used largely for new work, in other words, for the bending of angles, gussets and plates that are made up from new material. Several parts of each sort are usually made at a time so as to keep up a small stock of repair-parts. It will be noted that the ram and table are fitted with a pair of V-blocks for bending angles.

The frame of the press is made of structural steel with transverse beams both on top of the column, so as to support the air cylinder, and beneath the table, to counteract the tendency to lift the top members. The cast-iron air cylinder is 20 in. inside diameter and its heads are held in place by bolts that pass entirely through the flanges of both heads.

An Air-Operated Vise

Large plates requiring flanges are held in the air-operated vise, Fig. 8, while the edges are sledged over. The vise consists of two heavy cast-iron beams served by two 12-in. air cylinders, one mounted on each end.



FIG. 6. STRAIGHTENING PRESS USED FOR HOLDING WORK



FIG. 7. LARGE AIR-CYLINDER PRESS USED FOR STRAIGHTENING AND BENDING STEEL PARTS



FIG. 5. EQUIPMENT FOR CUTTING BAD SECTIONS OUT OF PLATES

The thrust of the cylinders is used either for raising the upper casting of the vise or for clamping the two beams together. The force that can be exerted by this arrangement is not sufficient to bend plates by using solely the power of the press.

A Rivet Buster

A powerful rivet-busting device, Fig. 9, has been devised for separating draw-bar yokes from coupler castings. The weight of the parts to be handled is such as to require two men for handling them. A coupler and yoke are shown set in position for cutting the rivets, and held in place by the clamp of a vise *A*. The clamp is simple in design, but large enough to hold all drawbars that come into the shop, so that the spacing blocks to be seen in place are required to aid in clamping the smaller drawbars in position. A shear blade *B* is carried on a ram worked by the lever arm *C*. The latter is pivoted on top of the column *D* that constitutes a portion of the frame. The piston of a 20-in. air cylinder, located in the rear, operates the lever. Even the toughest rivet heads do not stick when this ram descends, but snap off with a report like that of a gun.

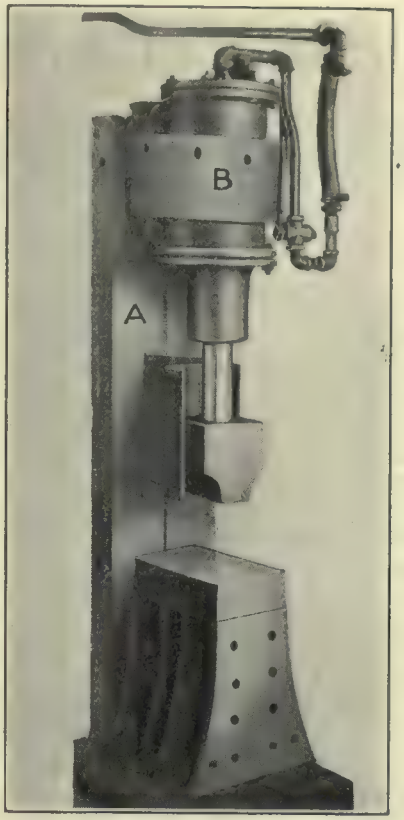


FIG. 10. AN AIR-CYLINDER POWER HAMMER BUILT IN THE SHOP

The only power hammer in the shop, Fig. 10, is one which was built there. The men say that it operates quite satisfactorily and is in almost constant service. The frame column *A* is a heavy steel channel bolted to a base that appears to be a portion of an old locomotive casting. The top surface of the base is faced with a steel die. A 9-in. air cylinder is the power unit, and has been drilled with exhaust ports that are covered with the steel deflector band *B* to keep the exhaust from blowing into the workman's face. The guide for the upper die is a piece of ⅝-in. steel plate flanged over to form a channel. A treadle controls the supply of air to the cylinder.

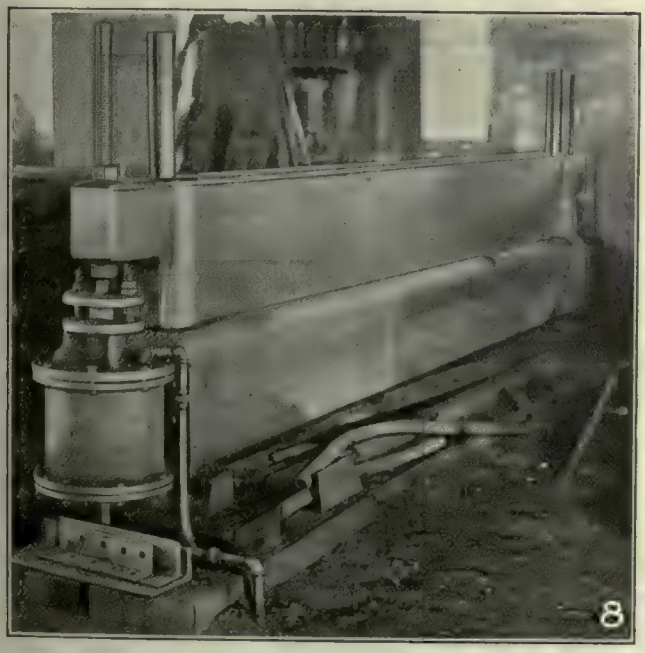


FIG. 8. AIR-OPERATED VISE FOR HOLDING PLATES WHILE FLANGING

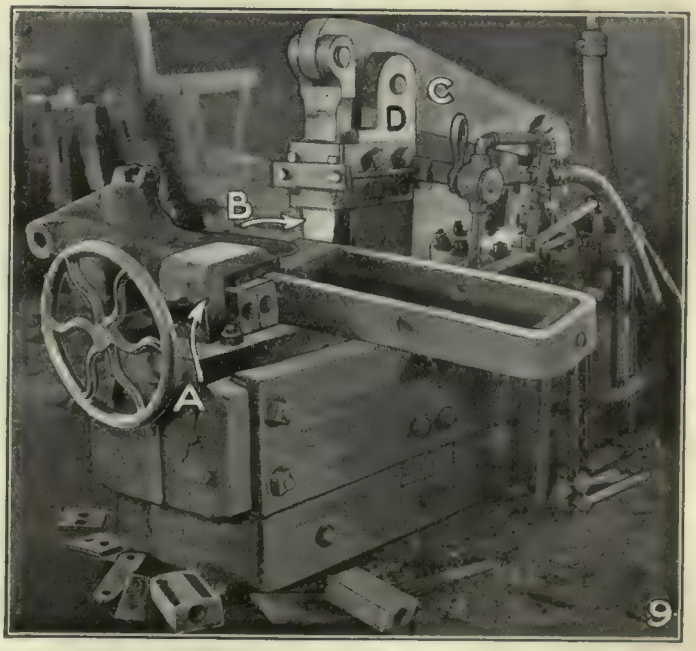


FIG. 9. MACHINE FOR "BUSTING" RIVETS IN DRAW-BAR YOKES

Application of Inserts to Die Castings

Division of Application of Inserts Into Four General Groups—Various Methods of Providing Inserts with Anchors—Locating Points

By M. STERN
Mechanical Engineer, Doehler Die Casting Co.

COMMERCIAL die castings are made from the alloys of white metals, such as tin, lead, zinc and aluminum. They command such an important place in modern production methods, that engineering societies have appointed committees to investigate the alloys used in this branch of the non-ferrous industry.

The field for die castings has been broadened because of the better understanding of the physical properties of the alloys used, and the better knowledge of the most efficient application for varying conditions. The proper use of inserts has also helped greatly to increase the field of application.

Inserts may be defined as metal parts usually of bronze, iron, steel, etc., and have a higher melting point than the white-metal alloys which are die-cast around them. They supply certain properties which die castings may lack, and are also used to provide more efficient means of assembling.

The application of inserts is divided into four general groups: (1) To provide electrical properties; (2) to provide mechanical properties such as greater durability, strength, etc.; (3) to provide economical assemblies; (4) to provide lubricating facilities.

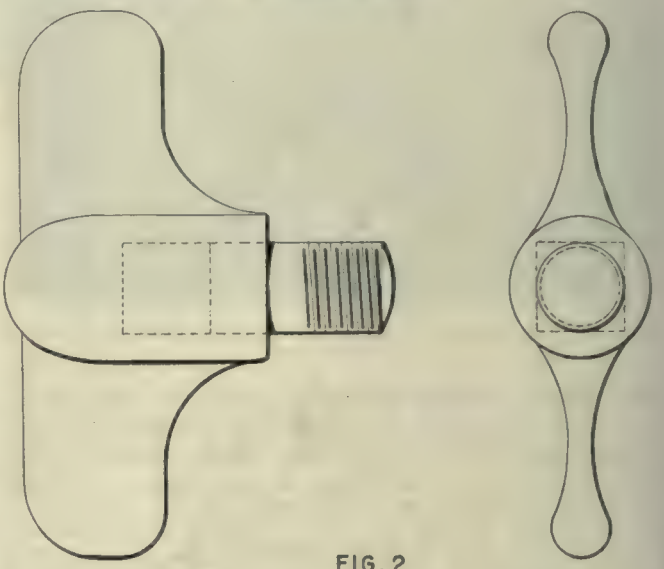
Electrical Properties

Under the first group may be mentioned magneto frames, in which the polepieces are cast in place. They are made either of cast iron or laminated iron and so furnish the required magnetic field, which the white metals cannot supply. (See Fig. 1.)

Mechanical Properties

Under the second group may be classed thumbscrews, consisting of die-cast heads with threaded steel or brass screws as inserts. (See Figs. 2 and 3.) Phonograph-arm bases are usually cast with a steel pin on top of which the arm pivots. (See Fig. 4.) Die-cast metal would not be strong enough to withstand the side pressure which this pin is called upon to withstand.

Fig. 5 shows a valve for a natural-gas meter. The body is die-cast in tin alloy to resist the corrosive action of impurities in the gas. For the same reasons the insert is made of monel metal, thus insuring a free running fit for its exposed part.



FIGS. 2 AND 3. THUMBSCREWS WITH DIE-CAST HEADS

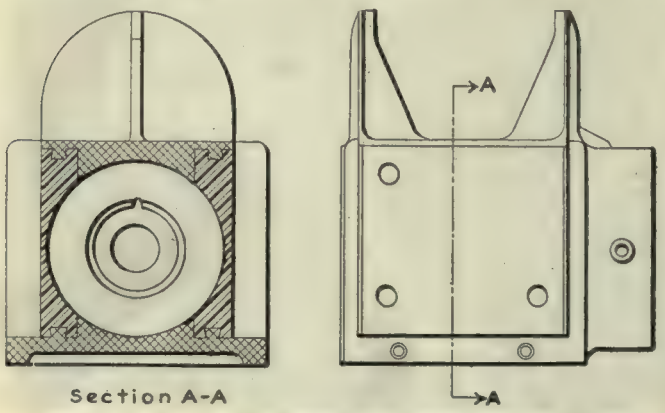


FIG. 1. MAGNETO FRAME WITH POLEPIECES CAST IN PLACE

Where shafts are intended to revolve at high speed, bronze bushing inserts should be used in order to furnish better wearing surfaces. (See Fig. 6.)

Tapped holes which are subjected to considerable strain and wear are taken care of by using steel or brass inserts.

Economical Assemblies

A good example of the use of inserts for economical assemblies is shown at Fig. 7. It represents a group of four aluminum coin deflectors for vending machines. The shaft is placed in the die, and all the deflectors are cast around it at one time, thus insuring correct relationships with one another.

Fig. 8 shows the assembly of a handle knob, used extensively on closed bodies for automobiles. The in-

sert is given a coating which helps to loosen it easily after the casting is made. The knob will therefore turn freely but will not pull off due to the shape of the insert. This produces a very neat and economical assembly which would be hard to duplicate by any other method.

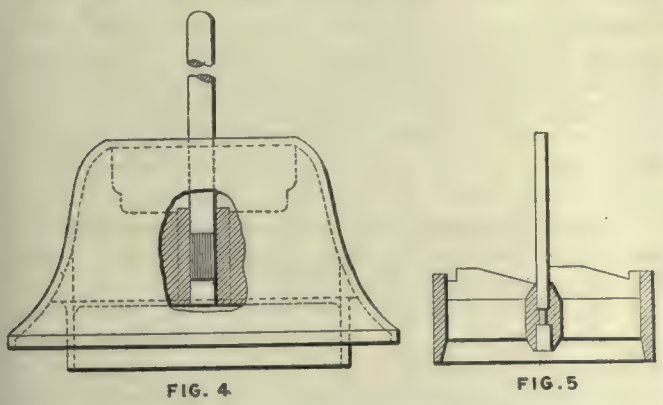


FIG. 4. BASE FOR PHONOGRAPH TONE-ARM
FIG. 5. VALVE FOR NATURAL GAS METER

Lubricating Facilities

On certain castings such as magneto end plates, it is sometimes necessary to lubricate some inaccessible bearing, and the required oil channel in itself may be so placed by necessity that it can neither be cast nor drilled. This problem has often been solved by forming a brass tube to the required shape and casting it in position as an insert. The oil can thereby be led to any desired point.

Fig. 6 also illustrates an insert method of lubrication. The tubes are brazed onto the bushing and handled in the die as a unit. The larger tube carries a wick for lubricating the upper bearing while the longer tube conveys the oil to the lower bearing. The oil hole is drilled through the top of insert after the casting is completed.

Inserts must be provided with suitable anchorage so that they will not pull out or turn while in use or during subsequent machining operations. Fig. 9 shows a variety of methods used in actual practice, and the choice is usually dictated by the available equipment one has for making inserts.

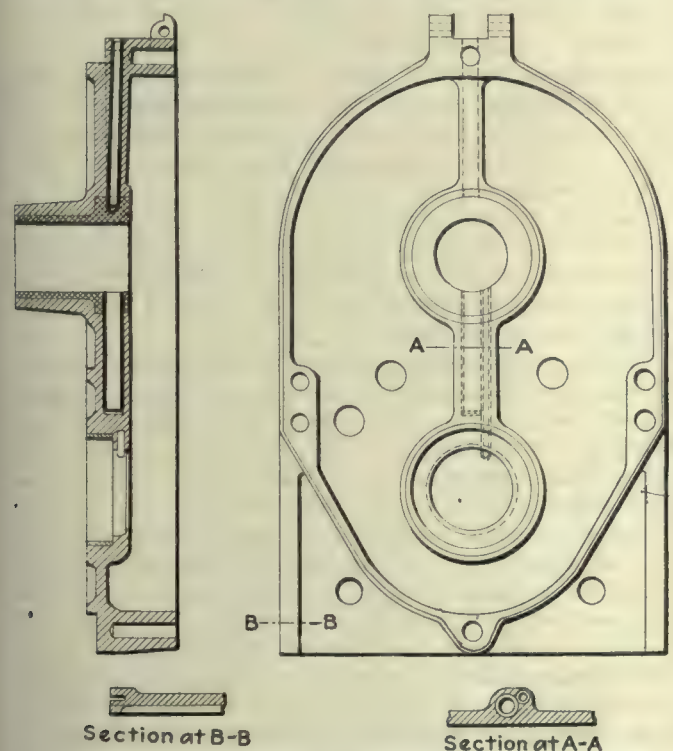


FIG. 6. CASTING WITH BUSHINGS AND OIL TUBES CAST IN PLACE

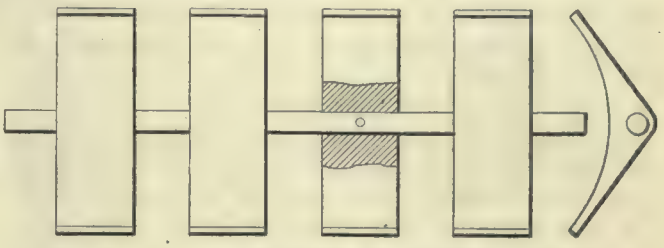


FIG. 7. ALUMINUM COIN DEFLECTORS CAST ON STEEL SHAFT

At *A* is shown an insert made from a sand casting the hole and ends being finished. The outside is left rough, with small projections.

At *B* and *C* are shown inserts made from brass tubing. Heavy cross knurling or holes may be used for anchorage.

At *D* is shown a threaded insert, used extensively on magneto bases. It is made from hexagon bar stock and the groove in the center makes it withstand a heavy pull. It is usual to tap the thread after it is cast in place, the tap size hole being used for locating.

The insert shown at *E* is used for the same purpose as that shown at *D*. This construction applies where the holes are drilled through the insert after the casting is completed because of exceptional accuracy

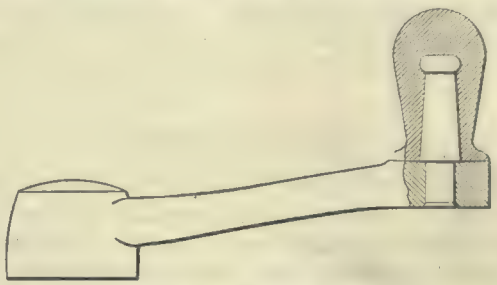


FIG. 8. LOOSE KNOB CAST ON HANDLE

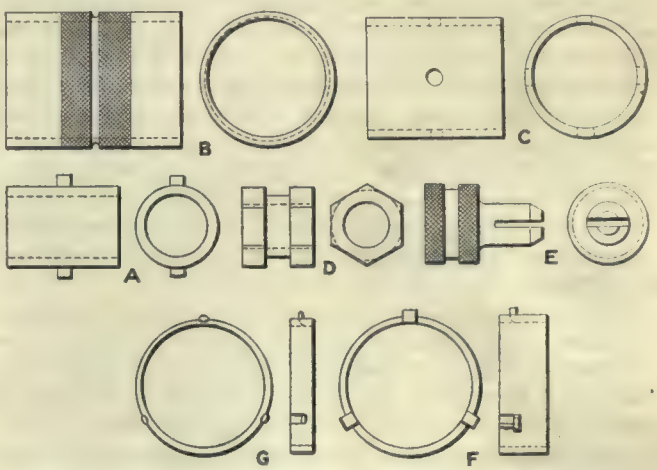


FIG. 9. VARIOUS METHODS OF PROVIDING INSERTS WITH ANCHORS

required in the spacing of the holes. The two prongs are used for locating in the die and are cut away afterward.

The designs at *F* and *G* are used for bushing inserts of short length and large diameter. The lugs can be formed in a punch press. The lugs on the insert shown in Fig. 3 can also be formed in the same way. At Fig. 2 is shown an insert for the same purpose as that in Fig. 3, but is made on a screw machine from square bar stock.

Fig. 1 shows a method of anchoring polepieces for magneto frames.

Locating Points

The surfaces used for locating inserts must be accurately machined and free from burrs. The locating points on a bushing insert would be the bore and ends. The bore should be held to plus or minus 0.001 in. as the flow of the metal has a tendency to tilt it in proportion to the play between the bore and core in the die.

If the hole in the insert is machined afterwards, more liberal limits can be provided. The length should be held to within 0.010 in. and preferably 0.005 in. Oil holes should not be drilled in inserts to be used for bearings as they will fill up with die-cast metal. They can be drilled through after the casting is completed.

The diameter of the bore in an insert should never be less than the established low limit or it will not go over the locating core pin in the die. For similar reasons the outside diameter of pins and other inserts which are located by holes in the die must never exceed the high limit.

The locating points on the polepieces in Fig. 1 are the curved and flat faces and the two holes diagonally opposite. The third hole acts as a safety so that the insert may be located in the die one way only in case the insert is not symmetrical. The curved surface must be machined accurately with relation to the flat surface, the distance between the two being held to very close limits.

Business Faith

By John T. Slocomb

The business depression we are now passing through has no doubt been greatly caused by a lack of business faith. Business men will set themselves up as prophets and allow their own prophecies to frighten them. I know a prominent business man who, for the past seven years, has had almost a stereotyped phrase of "Remember the bottom will drop out of business very soon." This puts me in mind of a phrase in a certain story where a Swede who, representing that he could not speak English, but who answered all questions with just this: "I tank it is going to blow pretty hard pretty soon." This business man's prophecy, I have no doubt, contributed much of his share toward the present business depression. We must have faith in our own business, in our own country, and in ourselves.

There always have been, and there always will be, ups and downs in business, but there is always a fair average business. Depressions do not last very long and in an experience of about thirty years I have never known a serious one to last over six months.

In manufacturing a staple line of goods there need not be any great fear of carrying too large a stock. The tendency today is to build and equip factories with a capacity for a very large production so that goods can be made in large quantities on order and avoid carrying goods in stock. This sort of thing is very much like a large water mill with a very small mill pond. It can run fast for a little while but it has no reserve. There are dry times and flood times on the stream. A business man, with plenty of business faith, will build a large dam and provide for a large storage of water, even so far as going to the head waters of the stream and damming the outlet of a lake to provide further storage. Such work is often carried on in a very substantial manner providing for the future and for the benefit of generations to come. It is an example of business faith.

Now, when a business man will do this, why should he hesitate to make up a stock of staple goods during a period of depression to provide for future sales? A small factory, run steadily through good times and bad, can be made to supply the market without rush seasons when everything must be done in such an extravagant and reckless manner.

One of the largest manufacturers in the United States has always followed the policy of doing its building and making its general improvements during periods of depression when labor and material are cheap and when work can be carried on in a much more satisfactory manner than during rush periods.

A factory making goods on orders only is apt to give uncertain employment which is not favorable to the employment of first-class help. People must live and they should be steadily employed. A period of business depression is one of the best times to find good help, and a factory that has a reputation of running continuously through good times and bad, stands in a very advantageous position for obtaining the best help.

There are, of course, some lines of goods that it would not be wise to stock very largely on. That is, such goods as are affected by styles, etc., but there are very many kinds that are staple and on which there is practically no risk in stocking up.

When the sale of an article is once established, it is not easy to break it down: For example, the old-fashioned jam die-plate for screw cutting, and the square taper taps for which there was a steady demand for a great many years after improvements had made them obsolete.

I have always followed the policy of making use of dull periods for replacing machinery; building; stocking up with goods and generally getting ready for the rush of business that is sure to come, and I have never failed in this practice.

The present business depression is unusual because it involves a readjustment of prices and this, of course, makes the problem of stocking up with goods much more difficult, but ordinarily there is no such problem and a business depression or panic is brought about by loss of faith which is largely due to prophecies, the fulfillment of which the prophets have contributed to.

Look back to the early history of the United States, then follow along through the years and you find that business on the average has been good and has been growing steadily larger. With our population calling for necessities and luxuries to a very large extent, there is never going to be a very long period when the demand for staple goods will cease. The country is not "going to the dogs" and we should take a more cheerful view of the future.

A boy starting to school or to work—whistling a merry tune, shows a right spirit and a right faith. A business man going about with the stereotyped phrase "Remember the bottom will drop out of business very soon," does not show a cheerful mind or a proper business faith. A man who spends all his earnings on luxury and in gambling and has no means left to carry on his business or to make the necessary improvements in time of depression, is certainly not doing his part toward the world's necessary work.

Getting the Right Man Through the Help Wanted Columns

By Harry Senior

Under the above heading, on page 892, Vol. 53, of the *American Machinist*, A. W. Forbes tacitly confesses to a tinge of pessimism touching the intelligence of the average seeker of jobs when he inquires how to so write an advertisement for help that only the qualified men will reply.

Mr. Forbes propounds an unanswerable query; unanswerable because it is only the unqualified man who does not suspect his lack of qualifications. The more "unqualifieder" he is, the more sure will he be that he is the very man who will meet all requirements.

The intelligent man—which is only another way of saying the capable man—knows better than anyone else his own limitations, and when such a man reads an advertisement or otherwise hears of an opening that he might, perhaps, fill to his own and his possibly prospective employer's advantage, he is quite likely to submit himself to a self-examination much more searching and comprehensive than would be that of any prospective employer who really desired his services.

It is quite difficult indeed to interest a really qualified man with the bare announcement that you have a job for him; he generally has one himself, and though few men, even capable men, are wholly satisfied with their lot, before flying from the "evils that be to the evils they know not of" the capable man will want to make a pretty thorough canvass of those evils he suspects and stack them up against the evils he knows all about, for purposes of comparison.

There is another thing to consider. The capable man may not believe the old adage about the rolling stone and the moss, but he knows perfectly well that the man who is continually jumping from job to job soon acquires a reputation; and it is not a desirable one, either. Therefore, before he leaves the job he has (and it's a safe bet he has one) to take the one you have to offer you've got to prove to him that it is good business on both sides.

An error, common to employers, is that the new man has all to gain and nothing to lose. That is not true! The employer, by getting the wrong man, stands to lose a few paltry dollars that he can make up on his next month's sales. The man, by getting the wrong employer, stands to lose weeks, months, perhaps years, out of his life; and *they* don't come back.

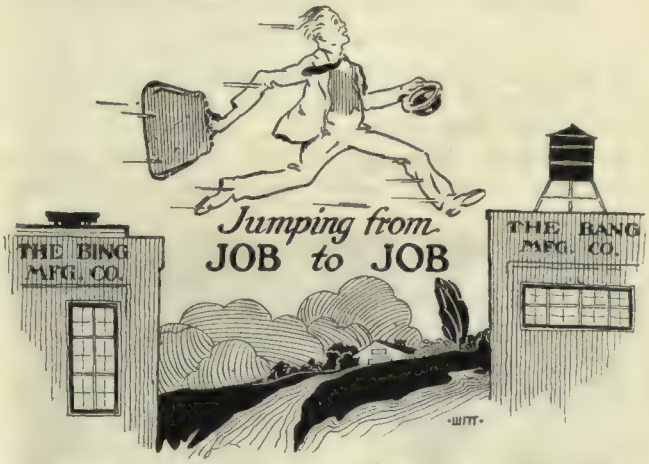
What this all amounts to, Mr. Forbes, is this: that if you want to get a good man you have got to go after him. He won't come to you waving his arms and shouting, "Here I am! take me." His brother, the indifferent man, will.

Good men are not scarce! Do not think because you happen to live in Rhode Island (if that is where you live) that all the good men are in California and that you can't afford to go to them. The man you want probably lives around the corner of the block in your home city; has been living there for years, and you have never heard of him.

The manager who says, "I can't get good men," needs training in the art of getting good men; he knows all about getting the other kind. For example: A friend of mine, manager of the mechanical department of a shop employing six or eight hundred men, once said to me: "For the love of Mike, where can I get a man to take charge of our toolroom? Since Ed died a year or so ago I have had three men in there and none of 'em was any good. Either they didn't know their business or they couldn't get along with the boys, or both. Things are going to the bowwows and I don't know how to stop 'em."

"Why don't you get Bill Jones," I said.

"Who's Bill Jones?"



"Feller lives down on your street; toolmaker up at the Jarnley works."

"What experience has he had as a foreman?"

"None."

"How do you know he can boss forty men?"

"By the looks of him."

"I'll get him."

He "got him" and Bill has for several years "bossed" forty (or more) men with every appearance of success.

I did not know Bill very well. I had seen him several times, heard him talk to others, and talked with him myself once or twice on subjects having no relation whatever to his business. But I knew his reputation as a man and toolmaker; I knew what his friends and associates thought of him; I knew what his employers thought of him. I even knew what his enemies (all capable men have them) thought of him, and I had no hesitation in recommending him to a place I knew he could fill.

It is not hard to find good men. There are probably plenty of them in your own home town if you look in the right place for them. Getting them is another matter. You have to go after them as you would go after an intelligent customer and convince them that your goods are better than the other fellow's. My manager friend could have had all the information I possessed about Bill and a hundred others if he had devoted as much time to really looking for that kind of men as he did in cussing because they wouldn't come to him.

There is no way, Mr. Forbes, to write the kind of advertisement you desire. You *might*, of course, get a good man by advertising for him. You might also get struck by lightning; the chances are about even.



Turning Drilling Machine Spindles

By E. A. Suverkrop

In the lathe department of our shop some fairly rapid work is being done in connection with the rough-turning of drilling machine spindles.

The spindles are made of black stock 0.50 carbon nickel steel. The bars are 1⅛ in. diameter and 17 in.

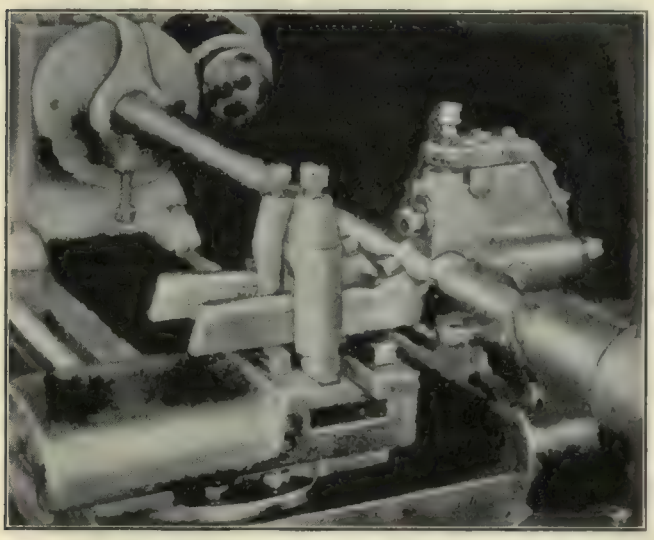


FIG. 1. ROUGH-TURNING DRILLING MACHINE SPINDLES

of their length is reduced to ⅛ in. diameter in one cut using two tools as shown in the illustration, Fig. 1.

The cut is taken dry. It will be noted that there is a special follower rest located between the two tools. The follower rest shoe is cast iron and is kept thoroughly lubricated with a good grade of machine oil.

The work is run at a speed of 170 r.p.m. and the 17 in. in length is reduced from 1⅛ in. to ⅛ in. in a little less than 12 minutes. At this speed the work becomes so hot that by the time the tools reach the center of their traverse the lubricating oil on the steadyrest takes fire.

The speed given was attained only after considerable experiment with tools of different shapes. The tool shape adopted is shown in Fig. 2. In spite of its slender appearance this tool stands up well and gives excellent results in every way. Almost any of the high-grade high-speed steels will give equally good results, but the bulk of our work has been done with Toledo Special and Dreadnaught brands.

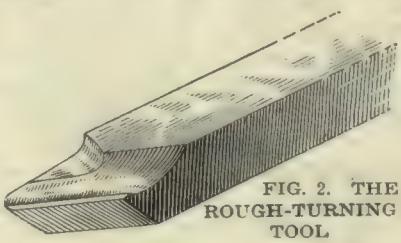


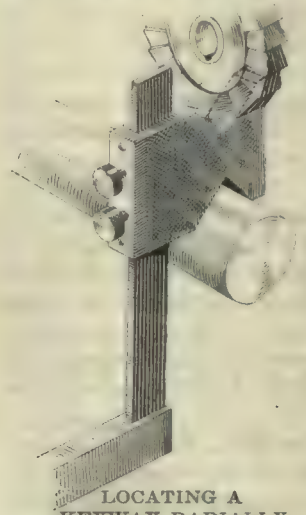
FIG. 2. THE ROUGH-TURNING TOOL

The final finishing of the spindles is, of course, done on the cylindrical grinding machine.

Center Finding Tool

By Harry Moore

To find the center of shafts in the shaper and milling machine, I have made the attachment shown in sketch herewith. It is made of ⅜-in. flat stock, milled out to take the blade of a square, a cover being screwed over this slot and held by two knurled screws which serve to tighten up the blade. The center of square stock as well as round, may be found with this device.



LOCATING A KEYWAY RADIALLY

A Pair of Old Pulleys

By J. Globisch

Referring to the article under the above title, on page 1161, Vol. 53, of the *American Machinist*, I would like to suggest an idea as to why the V-groove was put there, although I have not come across any such arrangement in my experience.

I believe the groove was put there for the purpose of keeping the oil from the loose pulley (which was thrown out by centrifugal force) from running onto the face of the tight pulley. This would cause loss of power and be a means of increasing deterioration in the belt.

The Antiquity of Centrifugal Casting

By E. A. Dixie

I was talking to a friend in Birmingham, England, regarding modern developments in shop methods in the United States.

Among other things mentioned was the application of centrifugal force to the casting of automobile piston rings, which I cited as something novel in casting methods.

My friend came back at me with the statement that about the year 1876 while Dr. Gatling, the gun inventor, was experimenting at Colt's Armory, Hartford, Conn., he developed a method and machine for casting bells under pressure, the pressure being obtained by rapidly rotating the mold. So the method is old in principle; the novelty being in the special application and the employment of cast iron in place of bell metal.

Hollow pewter toys and ornaments have been made by a modification of the centrifugal method for a hundred years at least. The molten metal is poured into the mold which the skilled caster twirls rapidly. This throws the fluid metal against the sides of the mold and they, being comparatively cold, chill the metal in a thin wall. The caster then turns the mold upside down and the uncongealed metal is allowed to flow out leaving the thin shell of congealed metal in the mold. The mold is then opened and the casting taken out.

What is the Difference Between Roller and Ball Bearings

By H. N. Parsons

Chief Engineer, U. S. Ball Bearing Manufacturing Co.

I have read with interest the article "What Is the Difference Between Roller and Ball Bearings?" by A. Danielson, appearing on page 857, Vol. 53, of the *American Machinist*.

A bearing is an element in the construction of a machine. The two main divisions into which bearings, when classified, naturally fall, are based upon the mechanical action existing in the mechanism of the bearing itself. Bearings are, therefore, either "sliding bearings" or "rolling bearings," depending on whether the action is one of sliding or of rolling, in which cases the phenomenon of friction resulting is spoken of as either sliding or rolling friction. Sliding bearings are spoken of as plain bearings, and rolling bearings as anti-friction bearings.

In sliding bearings, the coefficient of friction is greater than in rolling bearings. Therefore, the resulting wear of the parts of the bearing is greater, and easily replaceable wearing surfaces are provided in the usual form of babbitt, bronze, lead, or even silver and gold linings, each of which has its individual coefficient of friction when used in conjunction with other metals to make up the other half of the journal. In rolling bearings use is made of rolling elements between relatively moving parts of the journal, and the coefficient of friction depends on the shape of the rolling elements, the material from which they and the surface on which they roll are made, and the finish of these various surfaces. Therefore, we find in rolling bearings, as Mr. Danielson points out, rolling elements of a variety of shapes.

All so-called anti-friction bearings are rolling bearings, whether they are designated by familiar phrases such as ball bearings or roller bearings. In rolling bearings we may have any shape of rolling element or roller. They may be spherical, spheroidal, cylindrical, conical, ellipsoidal, or paraboloidal; and we can, by a stretch of imagination, have other shapes of rollers, formed by any of the more complicated surfaces of revolution such as the hyperboloid, ovoid, torus, etc. Segments of the above shapes, forming disks, rings, frustums of cones, etc., also may be used.

We commonly speak of bearings having spherical rollers as ball bearings; those with cylindrical rollers and conical rollers as roller bearings or tapered roller bearings. These are names that have come into common use, and are not accurately descriptive, but the definition of any designated bearing is easy when the above classification is borne in mind.

Should Jigs and Fixtures Be "Designed"

By John Mark May

The article under the above title by P. A. Fredericks, on page 26 of *American Machinist*, suggested to me, as it probably did to many others, that where the advisability of such a procedure is questioned, there must be very competent mechanics employed.

The pattern makers who are capable of making patterns for jigs and fixtures that will prove handy, accurate and capable of efficient service, without plans to work from other than those made by themselves, must necessarily be more than just pattern makers. They must have a very good knowledge of machinery and machine shop practice, in fact they must be capable jig and fixture designers. Although they are not called such, yet they are actually designating the equipment.

The toolmaker who takes up the next step, that is, does the machine work and assembling, must possess knowledge such as has been used by the pattern makers but not to as great an extent, due to the fact that the form of the pattern often determines the way that the jig or fixture must be used, and will not allow any change of method. But both the pattern maker and the toolmaker are doing work outside of their craft and are workmen capable of adapting themselves to the needs of the hour to a much greater extent than the average, even among the high-grade workmen of their respective trades. They are consequently in a class that is much sought, but of which our present day practice produces a smaller percentage than former practice did.

In the plants referred to as building a fairly heavy machine tool, it would seem that the new jig and fixture work would be mostly along the lines of those formerly made, rather than a radical departure from this particular plant's regular practice, and therefore somewhat easier for an experienced man in this line of work than in some other shops where a larger variety of work is done.

I would expect the shop that makes jigs and fixtures which are not first regularly designed, has this work done by employees who have spent considerable time with the concern.

For the reasons given by Mr. Fredericks, and those enumerated above, it seems to the writer quite feasible for some shops to do such work without regularly made designs. But for the vast majority of shops as equipped in these days, it would seem both an inefficient and costly method to build jigs and fixtures without first making designs. The elaborateness and simplicity of the work involved should determine how nearly complete the drawings should be.

Milling Operations on Herbert Lathes

In an article under the above title on page 950, Vol. 53, the output stated in the second line of the second column should be "40 pieces per hour" instead of "per minute." On page 949 in the same article, line 12 in the first column is a repetition of line 9; but it should read, "The wedge-shaped pieces removed are used on the planers for packing and setting-up strips."

IN THIS ISSUE

AGAIN we begin the issue with a description of a machine recently placed on the market. This week we describe the Gorton toolroom planer, a machine designed especially for work on dies, jigs and fixtures.

The viewpoints of a large and a small shop on meeting the present emergency are given on page 259. Some very good sentiment is expressed by both. Says the large shop man: "It is certainly a good time to make repairs to equipment and to reorganize systems where change is needed, for there is no better time than a rainy day to prepare for the busy times." And the small shop man says: "We are filling the reservoir with stored labor, making up parts for our machines which require the least outlay for material and have the greatest proportion of labor in their cost and which require the least outlay for storage space." These methods of procedure surely indicate a goodly amount of the right kind of faith in the future.

Beginning on page 260 there is an article which summarizes the fundamentals of a safety department. It is an argument against any hit or miss system of safety and furnishes a sample form on which an analytical record of all accidents should be kept in order to know at the end of the year the amount of work done by the department and wherein it fell down. The article as a whole is broad in scope, taking into consideration educational work, mechanical guards, inspections, safety orders, fire prevention, sanitation, statistics and other subjects.

The continuation of Sheldon's second article on magnetic chucks begins on page 265. In general it treats of the history and development. We find that there has not been a great deal written on magnetic chucks and therefore believe in the advisability of faithfully following these articles.

George A. Richardson, of the Midvale Steel and Ordnance Co. (Cambria Steel Co.) has made available a table which was compiled to facilitate securing information from the field that would have a bearing on complaints that were made from time to time regarding tool steel. While admitting the possibility that a defective bar of steel can get out from the manufacturer, the author says: "Nevertheless, experience shows that where a high grade product has been specified and is being used, by far the greatest number of difficulties encountered are due to causes that can easily be located by systematic investigation and are not the faults of the steel." It is for the purpose of such investigations to locate causes of trouble that the chart is valuable. Page 269.

In his story on the foreman and his job this week, page 271, Colvin shows that the foreman represents the firm to the men and that he must, therefore, be fully acquainted with the firm's policies. He also has something to say regarding the policies themselves.

The Hartness automatic lathe recently developed by the Jones & Lamson Machine Co. is described on page 273. Among the features of this machine are the use of round bars for holding and controlling sets of tools; inclined bed; the necessity for only small tool movements.

Part IV of "Metal Cutting Tools," with the subtitle "Boring Tools: General Considerations," begins on page 276. DeLeeuw gives an analysis of the twist drill, treats of chip formation and disposal, explains methods of grinding drills for drilling in various materials and tells why drills break. There is so much to boring (and drilling) that it cannot be fully treated in an article of ordinary length. The second part on this subject will be published in the next issue.

Some problems in heavy plate work, which arise in the repair of steel freight cars are taken up by Hunter on page 281. Repair is often more difficult than construction and demands the constant development of efficient methods. Hunter tells of some very good methods used in the shops of the Chicago & Alton at Bloomington.

M. Stern of the Doehler Die Casting Co. tells of the application of inserts to die castings, page 284. Inserts are used to provide electrical properties, mechanical properties, economical assemblies and lubricating facilities. There are, of course, particular methods of anchoring the inserts and of locating them. These several points are covered by this article.

There are several short articles that are instructive, among them: "Flow of Metal in Deep Drawing," page 264; "Reamer Grinding Attachment," page 270; "Setting Diamonds," page 272; "Business Faith," page 286; and "Getting the Right Man Through the Help Wanted Columns," page 287.

See the first item under "News," page 299.

Coming Features

We don't seem to be able to follow our pla to run the magnetic chuck articles on alternate weeks. Parts I and II were so long that they had to be continued in the intermediate issues, so that we have now actually had four install ments on magnetic chucks, although only two parts. As a matter of fact the last of part II is still to come; it will be in the issue of the 24th.

General articles for next week's issue are to be numerous and will treat of a wide variety of subjects: J. V. L. Morris's tenth article on apprentice systems will describe that of the Bethlehem Shipbuilding Corporation, Quincy, Mass. Emanuel Scheyer has written from his viewpoint on patents and his article will carry the title "What's So and What Isn't About Patents and Inventions." Stanley will have an article on grinding in the valves in motor heads. Our railroad article will be by Hunter on the subject of handling tools in railroad shops. Our usual page on "Meeting the Present Emergency" will be a part of the issue and will show how at least one more firm is carrying on.

EDITORIAL

The Question of Price

WHEN business is slack from any reason whatever, every one begins to think of price. Is it too high, will a reduction stimulate business, and if so—how much?

If prices bore a direct relation to costs there would be fewer times of depression. But it seems to be human nature to kill, or at least to chloroform the golden goose whenever opportunity offers. During the abnormal conditions of the war many selling prices soared out of speaking distance with costs of production. Sugar paid dividends of several hundred per cent, other products in proportion. The natural reaction was the "buyers strike," which is breaking, although it has not yet been called off. And, as in all strikes and lockouts, the innocent suffer with the guilty. War, either military or industrial, is no respecter of persons.

Prices of many kinds of products are falling, because they were too high, because of lower cost of production, or because the manufacturers do not know costs and are cutting prices blindly. But price cutting without some evident good reason, such as reduced cost, is frequently taken as an admission of abnormal profits and buyers hesitate, expecting a still further decrease.

The value of a machine when considered from the viewpoint of what it will produce is generally much greater in proportion than the price paid for it. There is nothing to be gained, if a machine is needed now, in waiting for a drop in price, which at best can be but small and is certain to be insignificant when compared to profits lost by waiting.

Before expecting or demanding lower prices, users should make certain that they are too high, not in comparison to pre-war prices, but in comparison to actual production costs. For example, it is futile to expect to obtain machine tools at pre-war prices, which were far too low even at that time. Prices cannot be cut beyond the point where they will yield a fair return on investment. To know when the return is fair, costs must be known. So it would seem that the question of price resolves itself into something definite, namely, "find the cost," which is only another way of saying:

Be sure the prices are right—
and then stick to them.

SHOP EQUIPMENT NEWS

SHOP EQUIPMENT • NEWS • A weekly review of modern designs and equipment

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX A continuous record of modern designs and equipment

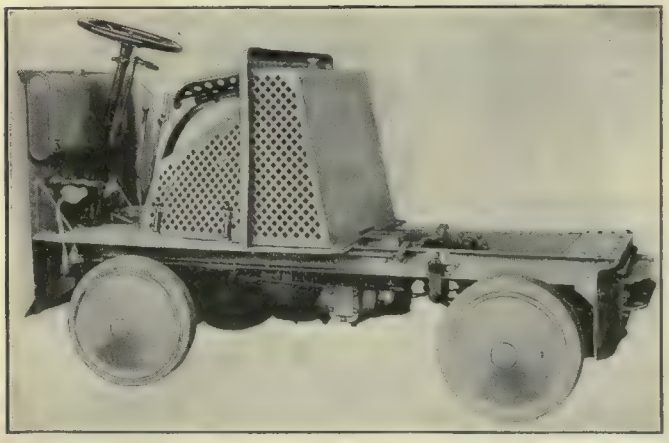
Barrett-Cravens "Powerox" Gasoline Industrial Tractor

The illustration shows an industrial tractor known as the "Powerox" and recently placed on the market by the Barrett-Cravens Co., 169 N. Ann St., Chicago, Ill. The machine is intended for heavy duty in factory or inter-plant service, where a small unit is needed. It can, itself, carry a load up to 3,000 lb., and is adapted to pushing or pulling trucks or trailers. Bodies of different types, such as stake, box and dumping, can be furnished, as well as different kinds of trailers.

The machine is driven by a gasoline engine, having L-head cylinders cast en bloc and equipped with a magneto and a speed governor. The engine, the single-plate clutch and the transmission, which together form a unit power plant, are placed in the front part of the machine. The slanting removable hood covers the engine, and the spring-mounted seat for the operator is placed above it. The radiator is of the fin-and-tube type and is placed at the rear of the engine, is spring mounted and inclosed in a heavy steel-plate housing, thus protecting it from abuse. The frame is made of 4-in. straight steel channels.

The drive is transmitted from the engine through a straight-line propeller shaft equipped with two universal joints. The rear axle and the differential are completely inclosed in one casting, being driven by a bronze worm on the propeller shaft. The front axle is of the Elliot type and has an I-section. The steering gear is mounted in front of the axle, and is, together with the control, of the conventional truck type, the operator having a clear view ahead of the truck. The springs are semi-elliptical and are flat under load. The wheels are cast solid, the webs being smooth and conical-shaped without hubs, so that there are no projections to catch on doorways. They are provided with Timken roller-bearings and solid rubber tires.

The machine is equipped with wide steel-plate bumpers at the front and rear. The large bumper at the front is used for pushings, while the rear bumper carries the coupler for towing. A 5-gal. gasoline tank is located back of the front bumper.

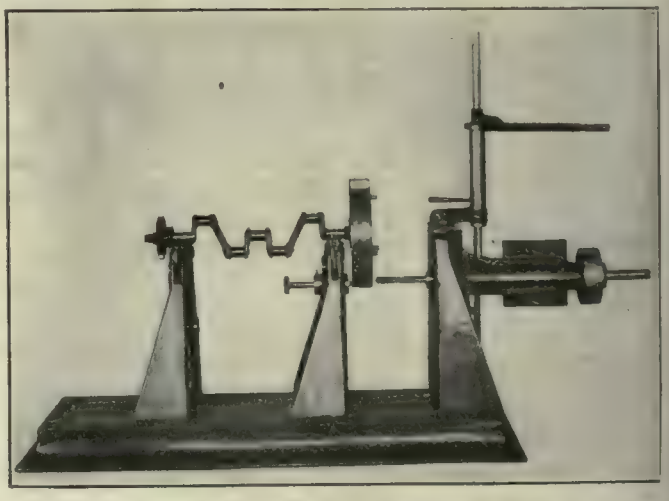


BARRETT-CRAVENS "POWEROX" GASOLINE INDUSTRIAL TRACTOR

Specifications: Carrying capacity, 3,000 lb. Horsepower of motor, 25. Cylinders, four, 3¼ x 4½ in. Speeds, 3 forward, 1 reverse. Wheels: front, 20 x 3½ in.; rear, 20 x 5 in. Tread, 36 in. Wheel base, 60 in. Radiator to rear, 42 in. Width overall, 46 in. Length overall, 98 in. Turning radius, 10 ft. Shipping weight, 2,500 lb.

Sundstrand Style "C" Balancing and Drilling Machine

The Sundstrand Style "C" balancing and drilling machine, shown in the illustration, is an addition to the line of these machines built by the Rockford Tool Co., Rockford, Ill. It is especially intended for balancing and drilling flywheels that are attached to the crankshaft. Another application is for similar operations on flywheels that are carried on a mandrel and supported between the two standards. In this case, the drill spindle can be brought up to the first standard and the drill passed through it, so as to reach the flywheel. The drill passes through a bushing that guides it to the work. The balancing disks are hardened steel and run on ball-bearing spindles of a design which the maker claims



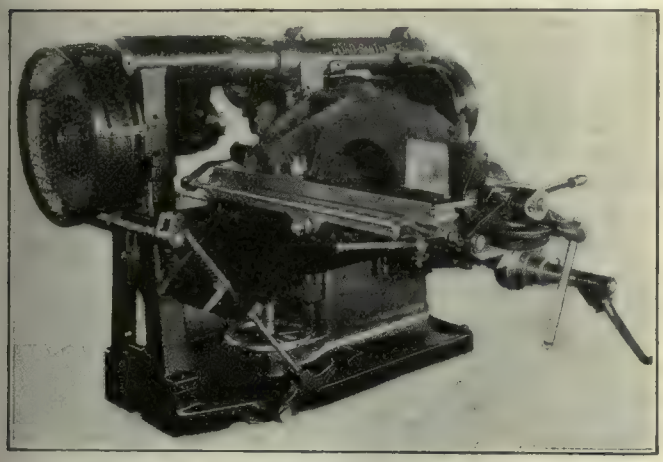
SUNDSTRAND STYLE "C" BALANCING AND DRILLING MACHINE

Specifications: Capacity, 2,000 lb. Maximum swing of wheel on 1 in. shaft, 47⅝ in. Drilling radius: maximum, 18 in.; minimum, 5 in. Maximum distance between standards, 39 in. Spindle traverse, 8⅝ in. Spindle bored for No. 3 Morse taper. Width of belt, 2¼ in. Countershaft speed, 375 r.p.m.; to run spindle, 300 r.p.m. Floor space, 24x97 in. Net weight, 1,135 lb.

insures great sensitiveness. The horizontal drilling spindle is supported by the pedestal at the right. The machine can be arranged for either countershaft or direct motor drive.

Ford-Smith Opposed-Spindle, Semi-Automatic Milling Machine

The Ford-Smith Machine Co., Ltd., Hamilton, Ont., Can., recently built the semi-automatic opposed-spindle milling machine shown in the illustration. The machine is intended for the finishing simultaneously of opposite parallel surfaces, being here shown adapted to the milling of transmission covers. The machine has the general characteristics of a knee-type milling machine; but the special features, such as the two spindles and the revolving type of table, give it a different appearance and make it primarily a single-purpose, production machine.



FORD-SMITH OPPOSED-SPINDLE, SEMI-AUTOMATIC MILLING MACHINE

The machine is said to be built for heavy duty. The column and the knees are practically of the standard type. One spindle is driven directly by a belt on a cone pulley. The other spindle, held in place by a heavy overarm and the outer support, is driven from the first by means of gears and a connecting shaft. The two cutters are thus placed opposite each other, the outer head being adjustable along the overarm, so as to permit of setting the cutters the proper distance apart. This adjustment can be made in thousandths of an inch, it being accomplished by means of a thread on the overarm. Locknuts are provided. There is a flywheel on each spindle, so as to eliminate as far as possible vibration of the cutters. The wheel at the front is inclosed in a wire guard, and it is fitted with a metal brake band around it. Thus, the operator can stop the machine quickly, after shutting off the power, by stepping on the treadle.

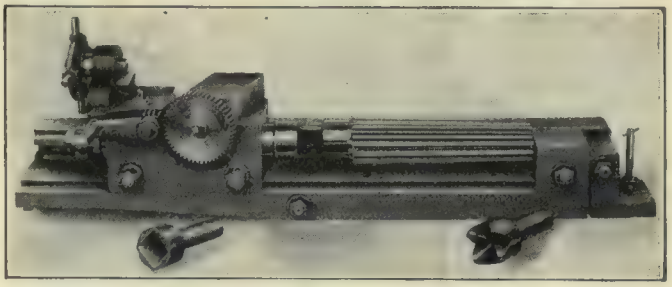
The feed box and the power rapid traverse are driven from the countershaft and not from the spindle, so that the rapid traverse can be engaged to return the table, with the spindle at rest. Three stops are provided on the inner side of the table, one at each end to stop the feed or rapid traverse, and one in the middle to engage the feed at the proper point when the table is being moved in by the rapid traverse mechanism. The handle on the end of the table screw is ordinarily disengaged, so that it does not turn as the table moves. The knee can be moved vertically by means of a hand lever. A transverse adjustment is provided to allow of positioning the work.

The table is low and is provided with a revolving fixture, or turntable, on which two pieces of work can be mounted. While one piece is being machined, the finished piece is removed and a rough casting put in its place. When the cut is finished, the table is withdrawn by means of the rapid traverse, the turntable is unlocked and then rotated about a horizontal axis, so that the unfinished casting is presented to the cutters. The turntable is located by plugs and clamped in position at each end while the cut is being taken, one lever controlling both clamps and another the plugs.

No coolant system is used, the cut being made dry. It is stated that a production of 160 transmission covers in 8 hours has been obtained with the machine.

Miller & Crowningshield Single-Spindle Fluting Center No. 5

The No. 5 single-spindle fluting center shown in the illustration has recently been added to the line of Miller & Crowningshield, Greenfield, Mass. Both centers are carried on a block, which is intended for attachment to the table of a milling machine. The block is pivoted at the center on a rocker that is bolted to the table, and it is clamped at the footstock end. In order to set the center so that a taper is cut on the work, such as a reamer, two nuts can be loosened and the elevating screw turned, thus raising one end of the fixture, but keeping the centers in line with each other.



MILLER & CROWNINGSHIELD SINGLE-SPINDLE FLUTING CENTER NO. 5

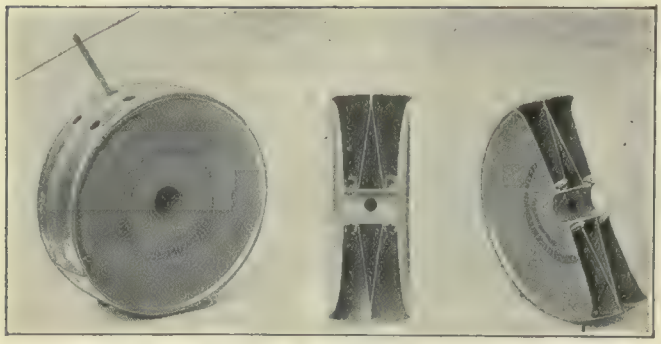
Specifications: Swing, 3 ¾ in. Maximum distance between centers, 18 in. Length, 36 in. Width, 6 in. Taper in head center, No. 10 B & S. Net weight, about 200 lb.

Change gears can be provided, so that it is possible to index the correct amount for work having any number of flutes up to 20, by means of one full turn of the indexing handle. The spindle is driven by a worm on the cross-shaft. Removable centers for holding work of any sort can be furnished. A single-spindle squaring head of similar type is also made.

Worcester "Presteel" Pulley

A sheet-steel pulley, said to combine the advantages of lightness and strength with convenience of manipulation when taking it off or putting it on a shaft, has recently been placed on the market by the Worcester Pressed Steel Co., Worcester, Mass. In addition, the pulley presents a smooth web on each face, leaving no projecting parts to constitute a source of danger to workmen, and having no spokes to cause windage and raise dust. The pulley is entirely self-contained, having no loose parts to fall out. Except for the bolts that hold the halves together on the shaft, it is built entirely of cold-drawn sheet steel.

The illustration shows both the pulley assembled and the two halves which, when joined together, make a



WORCESTER "PRESTEEL" PULLEY

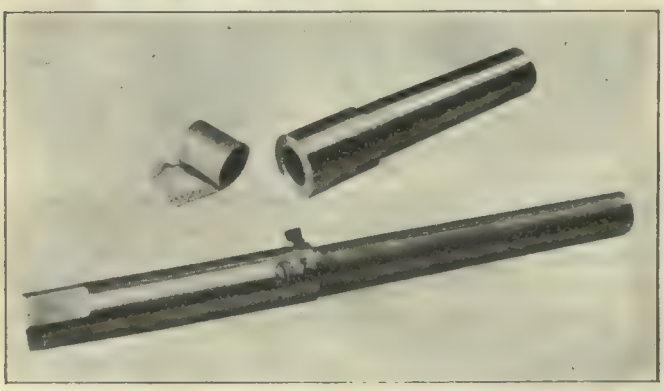
complete pulley. The clamps that hold the two parts together when on the shaft are steel stampings, with nuts welded in place so that they cannot turn when the bolts are tightened or withdrawn. The half-bushings are also steel stampings, held in place by tennons or rectangular projections from the concave edges of the clamps, which projections pass through correspondingly shaped holes in the half-bushings and in the sheets forming the sides of the pulley, and are headed over so as to hold all the parts together.

After assembling the four clamping bolts in one of the pulley halves, they are subjected at the factory to a crimping operation that raises two projections on each bolt shank, thus preventing the bolts from dropping out of the clamps when the pulley is being put in place, though presenting no obstacle to turning them. The ends of the bolts are pointed so that they will enter the nuts properly when the halves are placed together. Four holes pierced in the rim of the pulley to correspond to the position of the bolt heads, provide entrance for the socket wrench that is used to tighten the bolts. These holes are the only openings into the interior of the shell.

Because of the smooth external surfaces presented by the webs, there is practically no "windage" from the pulley when in motion, and there is no place whereon a belt shifter or a belt, accidentally run off the pulley, can become caught. As the holding bolts are manipulated entirely from the periphery, pulleys can be mounted close together on the shaft, as easily as widely separated pulleys. The pulleys can be furnished in all standard diameters from 6 to 18 in. and in any width of face.

Hill "Independent" Boring Bar

A boring bar for small work and that can be used in any lathe, independent of the carriage or cross-slide, has been developed by M. B. Hill, 10 Eden St., Worcester, Mass. The sleeve shown in the illustration is turned to fit the taper of the live spindle of the lathe in which it is to be used, the bore of the sleeve being a running fit for the forward end of the boring bar. The cutter is made from high-speed steel, has rack teeth cut in one side, and can be adjusted for position by a small pinion set in the bar and turned by means of a screwdriver. A clamping screw beside the pinion bears upon the cutter and serves to fix it in position.



HILL "INDEPENDENT" BORING BAR

The illustration also shows a gage of sheet metal that is intended to be slipped over the smaller part of the bar, coming to rest with the graduated scale directly under the edge of the cutter. Since the graduation on the scale is in terms of the hole diameter, the setting should be quickly accomplished.

The taper sleeve, of course, remains in the lathe spindle and furnishes a bearing for the bar, which is supported and fed forward by the tail center, as in the case of a twist or flat drill.

Hill Indexing Fixture for Squares and Hexagons

A device for use on the hand milling machine for cutting squares and hexagons on the heads of screws and bolts or on the ends of round stock of any kind is now being made by M. B. Hill, 10 Eden St., Worcester, Mass. Interchangeable spring collets are provided for holding screws or any size of round stock up to $\frac{7}{8}$ in. in diameter, the work being gripped by the partial rotation of the hardened and ground shell-chuck operated by the upper handle. Four holes in the periphery of the chuck are threaded to fit the handle, which may thus be placed in the position that will be most convenient to operate after the fixture is set up. The indexing device is very simple. The rotating member fits over an upwardly projecting boss that is integral with the base; and in the periphery of this boss are three steel-bushed holes in one plane and two in another, the former being spaced 60 deg. and the latter 90 deg. apart. The height of the center of the series of three holes corresponds to the position in the rotating member in which the locking pin appears in the picture. The two holes in the upper plane coincide with the unoccupied hole seen in the picture.



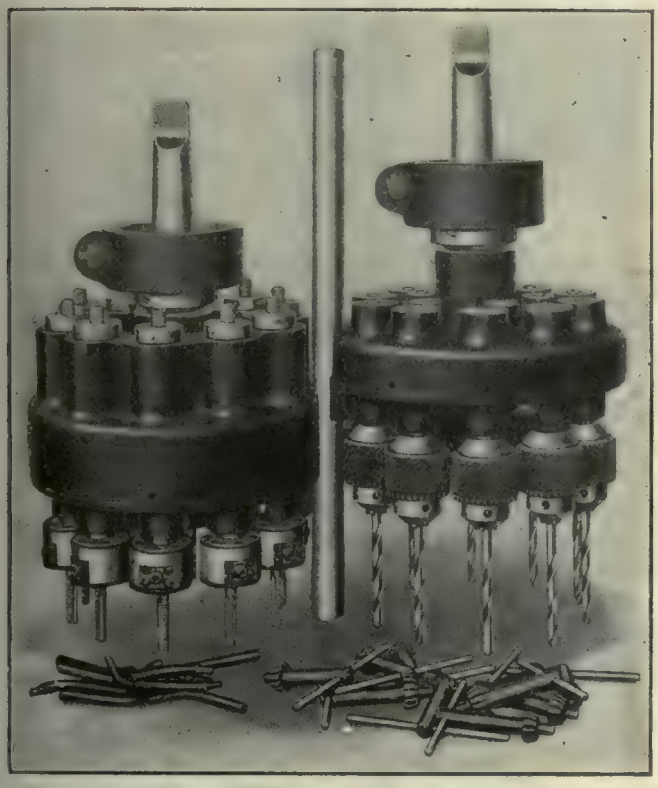
HILL INDEXING FIXTURE FOR SQUARES AND HEXAGONS

The spring-operated locking pin is entirely self-contained and may be unscrewed from the device and thrown on the bench without fear of losing any part. To change from 90- to 60-deg. division it is necessary only to transpose the locking pin and the short screw, a job that should be done with wrench and screwdriver inside of a minute. It is stated that this device is not, of course, intended to compete with more elaborate and automatic devices for accomplishing the same purpose, but that for the small job shop it is a very convenient and inexpensive tool.

Combination of Dorman Drilling and Tapping Heads

The illustration shows an arrangement of a drilling and a tapping head recently made by John H. Dorman & Son, 5148-52 Hudson Blvd. West, West New York, N. J. The device is intended for the drilling and tapping of an automobile bevel gear, being used upon a vertical-turret type of drilling machine, such as the Turner. The gear is held in a fixture on the table of the machine. The drilling head is first brought into use, then the turret of the machine is rotated so as to bring the tapping head over the work.

The heads are of the type previously made by the concern. Jacobs chucks are used on the drilling head



COMBINATION OF DORMAN DRILLING AND TAPPING HEADS

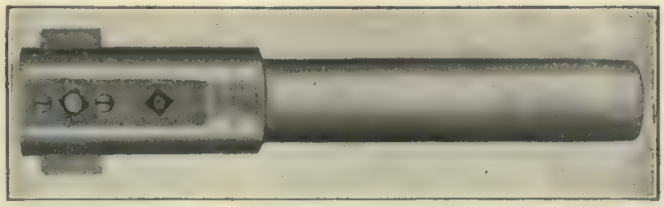
and chucks of the company's own make on the tapping head, the spindles of which are automatically reversible. Ten holes ⅝ in. in diameter and of 24-pitch are drilled and tapped in the web of each gear. The distance between the centers of the driving spindles of the drilling machine is 8 inches.

The rod between the heads is intended to be secured at its top to the center of the turret and at its bottom to the table. The housing of each head is provided with a bearing, so that the heads slide upon and are guided vertically by the rod. When the turret is indexed, the rod serves to properly position the heads.

Murchey Adjustable Boring Bar

The Murchey Machine and Tool Co., 951 Porter St., Detroit, Mich., has recently placed on the market an adjustable boring bar. The tool, shown in the accompanying illustration, can be furnished with any size or shape of shank required. It is made in sizes to bore holes from 1½ to 9 in. in diameter.

The position of the cutters can be adjusted by means of a micrometer screw, which is turned by means of a



MURCHEY ADJUSTABLE BORING BAR

wrench inserted in the hollow head of the screw. It is claimed that the adjusting device provides a positive adjustment either in or out for the cutters, each division of the graduated circle representing a change of 0.001 in. in the diameter of the bored hole.

After the adjustment is made, the cutters are locked in place by means of another screw that actuates a wedge, so as to clamp the cutters in position. A wrench which fits both screws is provided. A facing attachment can be supplied.

F-J Piston Reamer

The illustration shows the F-J piston reamer made by the Foster-Johnson Reamer Co., Elkhart, Ind. The reamer is made in seven sizes, ranging from ⅝ to 1 in. inclusive. It is intended particularly for line reaming



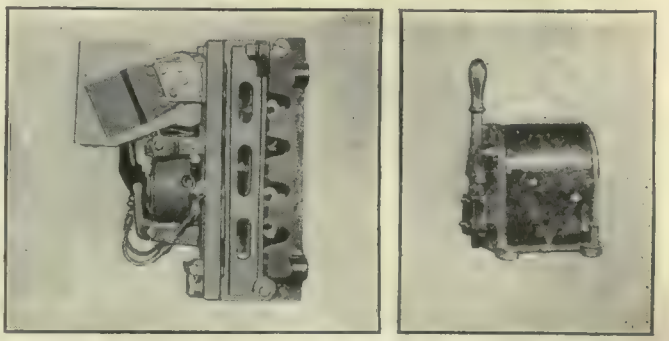
F-J REAMER FOR PISTON-PIN HOLES

Specifications: Made in 7 sizes; ⅝, 0.665, 11/16, ¾, 13/16, ⅞, and 1 in. Limits of adjustment: under, 0.010, 0.010, 0.010, 0.015, 0.010, 0.010 and 0.010 in., respectively; over, 0.035, 0.035, 0.035, 0.035, 0.055, 0.055 and 0.080 in., respectively. Length of blades, 3, 3, 4, 4, 4, 4 and 4¼ in., respectively.

piston-pin holes, in garages and large repair shops. To use, it is first inserted in the hole, and then the blades are "expanded" by means of the knurled screw head at the end until the cutting edges just touch the walls of the hole. After the blades are pushed out an additional 0.001 in., the hole is reamed through. The reamer is then pulled back, and the expanding and reaming operations repeated until the hole is up to the desired size. The size of the hole can be read on the micrometer graduations on the head of the screw.

Ohio Two-Unit Magnetic-Switch Magnet Controller

The Ohio Electric and Controller Co., 5900 Maurice Ave., Cleveland, O., has placed on the market a controller for use with electromagnets, such as used for



OHIO TWO-UNIT MAGNETIC-SWITCH MAGNET CONTROLLER

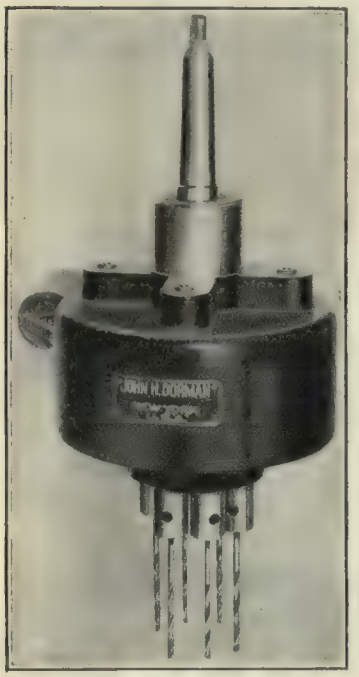
crane service. The device, as shown in the illustration, consists of two units, the magnetic switch at the left and the operator's master switch at the right.

The controller is stated to be small in size, and yet capable of continuous operation and of protecting the magnet from heavy inductive current loads. It makes the circuit for the lift, opens the circuit with magnetic blowout and with resistance shunted across the terminals of the electromagnet so as to reduce the arcing and the inductive current, and it reverses through limiting resistance for quick dropping of the load. The resistance wire in the magnetic switch box is enameled and set in clips mounted in a case back of the slate of the switch. The resistance may be inspected by opening the box, which is hinged at the bottom, it being unnecessary to disturb any wiring to do this.

The operator's master switch is compact and has three positions of the operating lever; forward for turning the current in the magnet, center for shutting it off, and reverse for dropping the load quickly.

Dorman Multiple-Spindle Drilling Head

The illustration shows a type of drilling head recently brought out by John H. Dorman & Son, 5148-52 Hudson Blvd. West, West New York, N. J. The device is of the multiple-spindle, fixed-center type, being adapted to drilling holes grouped closely together. It should be noticed that straight-shank drills are used, being held in the spindles by means of set-screws. On account of the closeness of the holes, adjustable chucks to hold the drills cannot be employed. The bottom plate of the machine is cast iron. The housing is made of aluminum. A lug on it presses against the column of the drilling machine on which the head is mounted, thus preventing rotation of the head. The main spindle is provided with a No. 2 taper and has a large gear on its lower end, four wide-face pinions being driven from it. The pinions drive the gears on the drill spindles, it being necessary to lap the gears over each other because of the closeness of their centers.

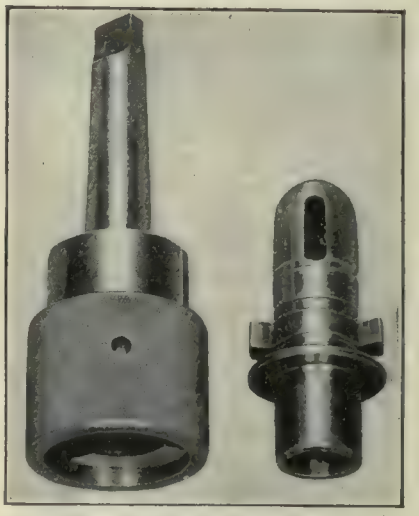


DORMAN MULTIPLE-SPINDLE DRILLING HEAD

The arrangement of the gears and pinions allows of placing the spindles close together, and of driving spindles whose centers are not equally distant from the center of the group. Although the placing of the driving gear in the center of the group of pinions on the drill spindle makes a more compact arrangement than just described, it cannot be used where the holes to be drilled are very close together. A bronze plate above the spindle gears forms the upper bearings for the drill spindles. Fiber thrust bearings are provided. The speed ratio is about 3 to 1.

Dompier Slip-Collet Drill Chuck

The Dompier Chuck Co., 446 Book Bldg., Detroit, Mich., has placed on the market a quick-action slip-collet chuck, intended for use in drilling, boring and reaming. The illustration shows the collet removed from the chuck, which action is accomplished by raising the collar. The collet can be inserted without lifting the collar, thus requiring the use of only one hand. The chuck and collet are made of hardened and ground steel, the wearing parts being chrome-nickel steel. The grip is positive and instantaneous. The chuck is capable of operation at any speed or in any position. It is said to possess accuracy and long life.

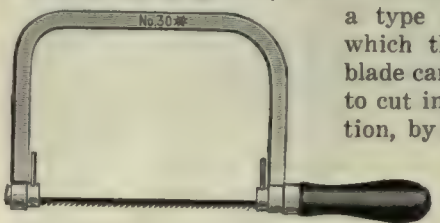


DOMPIER SLIP-COLLET DRILL CHUCK

The chuck is made in four sizes, having from Nos. 2 to 5 Morse taper shanks. The collet is made in sizes to fit the different chuck sizes, and to take from Nos. 1 to 5 Morse tapers.

Consolidated Adjustable No. 30 Coping Saw

The Consolidated Tool Works, Inc., 261 Broadway, New York, N. Y., has recently placed on the market an adjustable coping saw, known as the No. 30. This is a type of coping saw in which the position of the blade can be easily adjusted to cut in any desired direction, by means of the pins at both ends of the blade without shifting the position of the hands. The blades are tightened by turning the handle and may be locked at any angle. The frame is made of flat stock and is nickel plated and polished. The wooden handle is finished in black enamel.



CONSOLIDATED ADJUSTABLE NO. 30 COPING SAW

Johansson Tolerance Plug Gage

C. E. Johansson, Inc., Poughkeepsie, N. Y., has added to its line a tolerance plug gage with replaceable ends, as shown in the illustration.



JOHANSSON TOLERANCE PLUG GAGE WITH REPLACEABLE ENDS

Heretofore, the company has made tolerance plug gages below ¾ in. in diameter in one piece. By making the gage with replaceable ends, it is possible to save the unworn member (No-Go member) and the handle, and simply replace the worn member. The useful life of the gage is said to be extended indefinitely. The measuring members are securely locked in position by locking nuts so that the ends will not unscrew when in use. The gage is made in sizes from ⅛ to 4¼ in. in diameter, inclusive.

"Ashmac" Combination T and Extension Bolt

The Ashley Machine Works, 714 University Ave., Rochester, N. Y., has placed upon the market an extension bolt for use in the T-slots of machine tools. As shown in the illustration, it consists of a short T-bolt and a stud which can be connected to it by means of



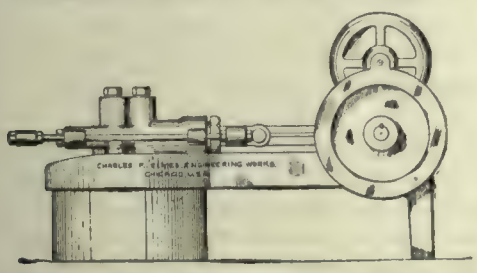
"ASHMAC" COMBINATION T AND EXTENSION BOLT

a nut, so as to give the necessary length. The bolt is fully machined, and is made of heat-treated and hardened alloy steel.

It is stated that the T-bolts and connecting nuts can be used with extension studs of different lengths, so as to provide T-bolts of whatever length is desired for clamping work on a platen. The sets are ordinarily made in ⅝ in. size, the T-bolts being made in lengths from 2 to 4 in. in ½-in. steps, and the studs in even inch lengths from 2 to 10 inches.

Elmes High- and Low-Pressure Hydraulic Pump

The Charles F. Elmes Engineering Works, Morgan and Fulton Sts., Chicago, Ill., has recently placed upon the market an hydraulic pump arranged to provide either high or low pressure, and adapted for use with hydraulic presses. The pump will give a pressure up to 5,000 lb. per square inch by means of the high-pressure plunger, and up to 250 lb. per square inch by the use of the low-pressure plunger. It is so constructed that a ¼-hp. motor, to be seen at the right of the illustration, will operate it at a speed of 100 r.p.m.



ELMES HIGH- AND LOW-PRESSURE HYDRAULIC PUMP

The pump is arranged to automatically shift from the low pressure to the high pressure when the limit of the low-pressure cylinder has been reached. This feature enables the pump to raise the ram of the press up to the work by means of the low-pressure plunger with considerable speed. As soon as the ram reaches the work and the resistance is increased to the amount for which the low-pressure plunger is set, the valve lifting mechanism will automatically permit the high-pressure plunger to come into action and to continue the working stroke of the ram. The pump is provided with a 1½-gal. tank for oil or water and has a motor direct-connected and mounted upon the frame.

A Constructive Immigration Policy*

By William H. Barr
President of the Inter-Racial Council

We have been favored of late with many startling interviews and speeches about the so-called alien hordes that are over-running America, and the fifteen to twenty-five million more immigrants who want to come.

The voices of dispassionate thinkers on this subject, so vital to the nation's welfare, have been drowned by sensation mongers until public sentiment seemed ripe to allow the making of drastic laws that would cut off immigration for a year, laws absolutely without precedent in the nation's history and in violation of all its traditions.

The latest figures on immigration published by the United States Government are from the beginning of the fiscal year, July to November, 1920, inclusive, a period of five months. During this time 472,859 immigrants were admitted, while 181,505 persons left this country. This is an average *net* immigration per month for this period of 58,271 and if this average should continue for the fiscal year of 1921 the total net immigration for the year would be 699,252 or *less* than the immigration for 1913 or for 1914.

As a matter of fact, the immigration during the period of the World War was so small, while the outgo of men of military age was so great, that it will take four or five years of maximum immigration to make up the loss.

In an interview in the *New York Herald*, P. A. S. Franklin, president of the International Mercantile Marine, declared that about a million a year is the maximum capacity of the Atlantic shipping, and at that rate it would take fifteen years to bring over the 15,000,000 refugees. In that time, conditions in Europe would be so settled that the desire to escape from post-war conditions would no longer be a factor.

John L. Bernstein, of the Hebrew Sheltering Aid Society of New York, said it is true that 250,000 Jewish women and children wished to come to America but there are no funds to bring anything like that number, and added that although 2,500 persons stood in line every day before the American passport office in Warsaw, only forty to seventy passports a day were being issued. He also said that, while the desire to emigrate was strong, the desire to remain in Poland was stronger, provided conditions became settled there.

*Abstract from an address before the Pittsburgh Chamber of Commerce.

Immigration obeys, to a great extent, the laws of supply and demand. When wages were at their top notch here, the word went out to Europe, and increased immigration resulted. When news of closing of our mills and shops penetrates the mind of Europe there will be a decline in immigration, law or no law.

A resolution passed in December by the Southern Alluvial Land Association protested strongly against the exclusion of farm laborers. According to Secretary F. D. Beneke of that organization, not more than one-third of the 25,000 acres of rich bottom or alluvial lands in the lower Mississippi Valley are being utilized.

The gist of the resolution was that on account of the farm labor shortage in this country, the farmers experienced great difficulties in making their crops. Also many farms were abandoned and much fertile soil uncultivated because of this farm labor shortage. For these reasons, they petitioned Congress to admit such European immigrants as would hasten the development of America's agricultural resources. From the Northwestern agricultural sections came the same cry—"Help Wanted."

Employers of labor in various industries appeared before the Senate Committee to ask for exception in their own particular lines. The weight of the testimony was to the effect that strict enforcement of the existing laws would shut out the diseased, the mentally, morally or physically unfit, and also those whose anarchistic activities would threaten American institutions. Such laws as exist must be adequately enforced, and provision should be made for their enforcement. This should quiet the alarm of the ill-informed persons who see in every alien a dangerous "red" or a public charge.

Education of Immigrants

In order to help in the process of assimilating the immigrants, I recommend that all legislation providing for the extension of educational facilities for foreign-born residents, including all appropriations that may be made for the purpose of training and appointing competent instructors in co-operation with various states, should be under the general administration of an Immigration Board to be appointed by Congress or by the President.

In general, place in one board all duties of investigation, regulation, supervision, education and naturalization as they concern the admissibility, distribution, citizenship and assimilation of foreign-born distribution.

As a matter of justice to the immigrant as well as to America, the process of weeding out the undesirable applicants should begin on the other side. The European peasant who sells his home and household goods and embarks for this country, only to be rejected at Ellis Island, is in a desperate plight, and, what is more, great numbers of his sort add to the congestion at our ports of entry, a condition that makes enforcement of the immigration laws very difficult.

The day of considering the alien worker as a commodity has passed. We must regard him as a man in all essential respects like ourselves. Discrimination against these people because of their race, is not only an injustice but an insult which they resent. The alien, far from home, thinks of his homeland as one thinks of his mother, and nothing is more apt to excite his resentment than any slur cast upon his race or his native land. The foreman who speaks of his men as "hunkies" or "wops" does not realize that an epithet is as insulting as a blow. If the alien is to be taught to respect America, Americans must learn to respect him.

Perpetual Motion

By H. G. W. Reichenbach

The letter of inquiry on page 1162, Vol. 53, of *American Machinist*, relative to perpetual motion, brought to my mind the recollection of a machine that was on exhibition in the old Globe Museum on the Bowery about 25 years ago, and which was at that time broadly advertised as the wonder of the age. This machine consisted of a big wheel like the paddle wheel of a ferry boat, about 8 ft. in diameter with slides built into it extending from side to side of the face of the wheels. The wheel apparently was operated by 9 wooden balls that were placed in the slides and would roll from side to side. When one ball was taken out the machine would stop. A pulley on the shaft of the wheel drove a fan.

A lecturer described the wonderful invention, and told us awe-stricken rubes that, if the fan was not driven by the machine, the wheel would go so fast that the balls would be thrown out. Later on it developed that a shaft ran through the wall and was connected to a crank handle and coupled to the shaft of the wheel. It was operated by hand on a given signal from the lecturer. This was before the famous "Keely Motor."

About the year 1892 a venerable inventor by the name of S. B. Wortman undertook the task of inventing perpetual motion. His idea was to make a spring motor which would unwind and while so doing wind up another motor.

This machine ran about two days without stopping. In fact it ran until the springs in both motors were dead. Elated in the hope that perpetual motion was a possibility, Mr. Wortman still furthered his ambition and took the matter up with Carl Franck, then head of the New York Pattern Machine and Die Co., Water St., New York, and who was regarded as one of the best mechanics of his day. Mr. Franck realized that he had some job on his hands and after many experiments the project was given up as far as perpetual motion was concerned.

There did, however, culminate from the mechanical ability of Mr. Franck, a clock which would run 100 years after being wound up once.

The machine which operated this clock consisted of 8 drums about 6 in. in diameter, in which powerful springs were mounted. There were gears in abundance within the machine and the whole contrivance was connected with gears to a clock movement which was especially imported from France. It was correctly figured out, that if nothing happened in the form of a breakdown, this clock would operate 100 years and 60 days. This is fact and is the nearest approach to perpetual motion I have ever seen or heard of and, like yourself, pass the buck to other readers.

The Use of Special Fixtures in Grinding

In the article under the above title, which was printed in the Feb. 3 issue, two errors in cut positions occurred. Owing to their similarities Figs. 3 and 4 and Figs. 9 and 10 were transposed.



NEWS SECTION

National Machine Tool Builders' Association Changes Its Meeting Date and Place

The National Machine Tool Builders' Association has advanced the dates for its semi-annual meeting from May 19 and 20 to Feb. 24, 25 and 26, to be held at the Hotel Cleveland, Cleveland, Ohio.

The executive committee has considered a number of enlarged constructive activities which might be undertaken by the association. In order that some of the features of this program may take shape, the executive committee has deemed it advisable to call an earlier meeting of the association for the purpose of discussing this enlarged program of work.

The association also has before it the consideration of the proper principles of cost accounting, this work having been carried on through its preliminary stages by the firm of Scovell, Wellington & Co. It is deemed that an earlier meeting of the association than was at first contemplated will serve to crystallize association opinion concerning the value of this work so that it may reach concrete form as soon as possible. The sessions therefore will be devoted entirely to association business and no guests or outside speakers will be invited.

There will be no printed or formal program. It is announced that topics of interest, however, will be presented by members for discussion, among them the following: The Present Business Situation and How to Handle It, Principles of Sound Financing for the Machine Tool Industry, How to Run a Machine Tool Shop in a Time of Depression.

A Ford Automobile Show

Queens Borough, Long Island City, held its first Automobile Show on Feb. 14-15-16 in the new "Home of the Ford"—just completed at the Bridge Plaza at a cost of over a half million dollars. The show was managed by a group from the Ford Motor Company plant at Detroit under the name of Hellman Motor Corporation and as such generally recognized as the largest distributors of Ford products in Greater New York.

Features of the show were a large and complete display of all the latest models of Ford cars, trucks and tractors; a working exhibit of a model Ford service shop which cost over $40,000 to equip; a contest staged daily between three teams of mechanics direct from the Ford factory to see which could assemble a complete Ford in the shortest time; an exhibition of a blank wall that both hears and speaks, and the best lighted, ventilated, sprinkled and fire proofed service building in the Metropolitan district. All the exhibits and attractions were on one floor covering over an acre of ground.

Hog Island Ends Ship Work

The activities of one of America's greatest wartime achievements, Hog Island Shipyard, officially came to an end recently when Matt C. Brush, president of the American International Ship Building Corporation, turned over to Fred Morris, representing the United States Shipping Board, the "key" to the shipyard.

In the three years from Feb. 12, 1918, the day the first keel was laid, to Jan. 29, 1921, when the last ship was delivered, 32,350 men and women were employed there.

One hundred and twenty-two ships, aggregating a total deadweight tonnage of 956,750, had been delivered to the Government when Hog Island completed its contract last week.

An Interesting Pump Testing Laboratory

An Indianapolis pump manufacturer has recently completed an investigating laboratory for testing pumps. Capacities up to 25,000 gal. per minute or 36,000,000 gal. in twenty-four hours can be handled. Three concrete tanks with calibrated weirs and a deep sump are situated beneath the laboratory. The deep sump is used to test deep well pumps.

Each test is checked by a Venturi meter and mamometer. Motors of various sizes and different speeds and currents as well as steam turbines with torsional dynamometers are part of the testing equipment. About 5,000 sq.ft. of floor space is available in this testing room and the equipment enables five units to be handled simultaneously. This laboratory has been completed by the Mid-West Engine Co., Indianapolis.

America To Establish Its First Airway from Washington, D. C., to Dayton, Ohio

What will prove to be a milestone in the progress and development of both commercial and military aeronautics will be the creation and establishment of America's first model airway from Washington, D. C. to Dayton, Ohio, during the early months of 1921, it is stated in the Air Service News Letter.

The installation of an airway entails the location of landing fields with all accessories, including radio direction finding, radio communication, aids to night navigation, housing and maintenance of equipment. It is undoubtedly true that with properly established airways of this kind cross-country flying, night or day, in good or bad weather, will be safer than auto touring by road; and that with the development and perfection of the machine itself, it will in time surpass in speed, comfort, and safety, the modern comforts of transports. The model airway will become then the first unit in a systematic system of airways throughout the United States which will be started under a policy formulated by the Army Air Service and which will be guided in its organization by the experience gained from the establishment and operation of the model airway.

The Army Air Service is unable of course to purchase any land or make any expenditures in connection with the creation of this airway but will provide such equipment as is available for getting the route established. The small expense attached to the installation of this route naturally should fall on those who will receive the direct benefits of its existence and operation such as the communities, organizations and individuals along the route. The Army Air Service will gladly supply all the advice, specifications, and information relative to the creation of the airway. This information would pertain to such things as landing fields, radio, hangars, and even might include the sending of qualified officers to superintend or consult. Therefore, Chambers of Commerce, Clubs, Lodges, and all civic or fraternal organizations together with public spirited citizens should take immediate action to install a landing field.

Business Conditions as the Big Banks of the Country See Them

National Bank of Commerce in New York Says Boom Period Is Unnecessary to Business Revival

America does not need a boom period to be prosperous, and the substantial factors of our national wealth will eventually bring about adequate revival of industry and commerce, it was declared on Feb. 4, 1921, by James S. Alexander, president of the National Bank of Commerce in New York, speaking at a dinner of the association of Stock Exchange Firms at the Hotel Astor, New York.

"There are at present a number of great business forces clearly at work building a sound business structure for 1921," said Mr. Alexander. "Supply and prices are becoming broadly coordinated to demand. The improvement in the liquidity of credit, which is now in progress, must develop further, but there are signs that improvement there will continue. As these movements are fulfilled, as wages and labor are realigned to new conditions and as business finally absorbs the losses incident to deflation stabilization on the new level will become an accomplished fact.

"The beginning of the year 1921 has auspicious aspects in the rapid, yet orderly, way in which these great corrections are progressing. The year must be judged then, not so much by the volume of business that will be accomplished in it, but rather by the sounder conditions which will prevail, marking the definite return to a new era of business fundamentals.

"Normal activity must come from within business rather than from without. Business cannot idly wait for the public to resume active buying. It must stimulate buying by establishing a wide prevalence of substantially reduced prices for goods which must be based on increased efficiency in production and distribution, and the acceptance of reasonable margins of profits.

Labor Gaining Efficiency

"In this connection the growing tendency of labor to become more efficient and its willingness to accept some liquidation of inflated wages is a most encouraging circumstance. From more than one point of view the readjustment now going on in respect to labor supply and demand is beneficial to the individual worker. The excess of jobs over workers, inflated wages, and lax supervision from employers which characterized the boom period were all influences upon labor contrary to its best interests.

"Radicalism, encouraged by labor scarcity, invaded and depreciated the quality of labor as a component in our national economic life. High wages begot extravagance that soon reacted in rising prices, reducing the buying power of those very wages so that labor's gain was more apparent than real. There also developed a demoralization of individual efficiency because men were not kept on their mettle by competition for work and advancement.

"With the return of more rigorous conditions it is becoming clear that the best interests of conscientious labor are served by a more normally balanced relation between labor supply and demand. Competition for work means the stimulation of efficiency and staunch Anglo-Saxon individualism as opposed to radicalism. An abundance of labor permits employers to choose workmen intelligently and to co-ordinate wages to their proper part in production costs, facilitating the establishment of price levels best for all.

"But employers must play fair and not attempt to lower wages unduly or to enforce greater curtailments than circumstances warrant. They must recognize that, in any country worth living in, the standard of living tends ever upward. Wage earners in the United States are entitled to the opportunity to receive more than merely the means for a bare and joyless existence in return for real work well done. Any other attitude on the part of employers would be a menace not only to the orderly readjustment of existing conditions, but also to sound business progress in the long run.

"I believe we are justified in confidence that these elements of progressive readjustments which are working toward better times are now greatly in the majority. The true need of business is, not stimulation of the forced-draught order, but rather a conservative response to better conditions as they develop. Such conservative, yet confidently progressive course, is the only basis for business success this year, as distinguished from the feverish way in which business was conducted during the war and post-war period."

National City Bank of New York Gives Clear Analysis of Price and Wage Reductions

The fact which stares the retail merchant in the face is the diminished purchasing power of his customers. If he is located in a farming district he sees it in the diminished values of farm products and hears of it over his counters every day. If he is located in an industrial center he is obliged to take account of the fact that the industries generally are running on shortened time and with much reduced pay rolls.

The important thing in this readjustment, as we have endeavored to set forth from month to month, is the maintenance of the equilibrium in industry, so that the various branches of industry will continue to be mutually supporting. The market for the products of each industry is with the people employed in the other industries. This means that the prices of products must maintain a fairly uniform relation or distribution will be interrupted and production will have to be curtailed. This is the essential thing in keeping the industries running and in maintaining employment for the workers. It is not simply a matter of fair play between the industries, although that is something to think of; the balance between the industries is as necessary to prosperity on one side as the other.

Notwithstanding that the compensation of some classes lagged behind in the rise of wages and prices, on the whole goods and services went up fairly well together. The failure of some classes to keep up in purchasing power was made good by the great foreign demand and increased governmental expenditures. There is general cooperation in putting prices up; people may grumble, but they look for compensation through getting their own pay increased, a game at which the gains of some are at the expense of others, and which cannot go on indefinitely. When it comes to putting prices down, there are almost infinite difficulties and obstructions to be overcome. Everybody fights it so far as his own products or services are concerned, and by doing so delays the restoration of the equilibrium, without which he himself must suffer loss.

It does no good to be ill-tempered or harshly critical in discussing wages and prices. People are naturally biased in favor of their own interests, and if they really understand their own interests the results will not be bad, because the economic law is such that interests do not in fact conflict nearly so much as is commonly supposed. The point we are urging is that the highest degree of prosperity for every industry is to be had when all are on a common basis.

The Fall of Prices in 1920

On page 301 we give a table showing the prices of thirty-two important commodities, for an average of several months of 1914 prior to the outreak of the war, at the close of 1919 and the close of 1920.

This table is made up mainly of staple commodities, none of which represent an advanced stage of manufacture. As a rule they have suffered heavy declines, although in a few instances there are advances due to abnormal market conditions.

Material	Pre-War Months 1914	Close 1919	Close 1920	Decline During 1920
Steel billets—Pitts.	20.50	48.00	43.50	09⅓%
Pig iron—Pitts....	13.75	36.00	33.00	08⅓%
Copper, elect—N. Y.....	.1425	.1875	.13	30⅔%
Lead—N. Y.....	.0395	.075	.046	39 %
Spelter—N. Y....	.052	.0885	.056	37 %
Cotton—N. Y....	.132	.3925	.1475	62½%
Silk, raw. N. Y...	.94	13.20	.75	56½%
Wool, Cape, scoured—Boston.	.55	1.50	.68	55 %
Hides, No. 1 steer, Chic.....	.18	.42	.20	52⅓%
Rubber, latex, N. Y.....	.60	525	.16	70 %
Coffee No. 7 Rio, N. Y.....	.0912	.15	.0625	58⅓%
Sugar, raw, N. Y..	.0311	.0728	.0539	26 %
Wheat No. 2 Red, Chic.....	.92	2.16	1.73	20 %
Corn—Chic.....	.67	1.45	.68	53 %
Oats—Chic.....	.395	.82	.47	42⅔%
Rye—Chic.....	.63	1.83	1.56	15⅓%
Rice—dom., N. Y.	.055	.125	.0525	58 %
Apples, bbl. 10's, N. Y.....	3.50	5.00	4.00	20 %
Flour, spr. Pat. N. Y.....	4.65	14.00	9.00	35⅔%
Coal, bit.—Pitts...	1.30	2.35	3.75	*60%
Petroleum—Okla..	.85	2.75	3.50	*27%
Livestock — top steers—Chic....	8.75	14.50	9.00	38 %
Hogs, bulk—Chic.	8.20	14.25	9.50	33⅓%
Pork, mess—N. Y.	23.00	47.00	29.00	38⅓%
Lard, prime—Chic	.1052	.2377	.1265	47 %
Linseed oil—N. Y.	.54	1.87	.80	57 %
Cocoanut oil—N. Y.	.115	.19	.1175	38 %
Butter, extra—N. Y.....	.245	.70⅞	.565	20 %
Burlap, heavy—N. Y.....	.059	.165	.0565	58 %
Prt. cloths, 28-64x 64—N. Y.....	.0338	.1425	.06	58 %
Sheetings, 36-48x 48—N. Y.....	0598	.28	.0725	74 %
Cement, bbl.—N. Y.....	1.58	4.40	3.70	16 %
Average decline during 1920 for the commodities listed.....				36%

* Denotes increase.

The compilation of retail prices by the Bureau of Labor, Washington, D. C., for a number of cities is instructive for the classification it makes of articles of common consumption and the percentage of average family expenditure for each group. The table below is the Bureau's table for Chicago:

Item of Expenditure	Per Cent of Total Expenditure	Per Cent of Increase from December, 1914, to — Dec., 1915	Dec., 1916	Dec., 1917	Dec., 1918	June, 1919	Dec., 1919	June, 1920	Dec., 1920
Food.....	37.8	2.7	25.2	53.4	78.7	73.3	93.1	120.0	70.5
Clothing—									
Male.....	.....	8.5	26.5	51.9	137.1	146.1	211.8	207.7	166.5
Female.....	.....	6.2	21.2	50.0	141.3	164.2	232.9	202.6	150.3
All clothing.....	16.0	7.5	24.2	50.6	138.9	157.1	22.0	205.3	158.6
Housing.....	14.9	*0.1	0.7	1.4	2.6	8.0	14.0	35.1	48.9
Fuel and light.....	6.0	*0.9	6.6	19.3	37.1	35.7	40.1	62.4	83.5
Furniture and furnishings...	4.4	5.9	20.0	47.5	108.9	126.9	176.0	215.9	205.8
Miscellaneous.....	20.6	3.0	19.5	41.8	58.7	61.7	84.3	87.5	96.5
Total.....	100.0	3.0	19.5	41.8	72.2	74.5	100.6	114.6	93.3

* Decrease.

An Uneven Decline

If this table is compared with the table above it will be seen that there is ground for the farmer's complaint that his staple products as he sells them are back nearer to pre-war prices than they are at retail, or than most of the goods he is obliged to buy. Foodstuffs at retail in December, according to the Bureau of Labor, were 70.5 per cent above 1914 prices. Clothing for which the farmer furnishes the cotton and wool, at little above pre-war prices, is 158 per cent above the pre-war level, while furniture and furnishings are 205 per cent above that level.

Taken as a whole this comparison between raw materials and food at wholesale and common articles of consumption at retail shows that the readjustment of prices has not proceded far enough to allow a general resumption of industry or to furnish the basis for a state of prosperity. The producers of the raw materials cannot sell them at the prices they are receiving and buy the finished goods at the prices prevailing for them, and keep the latter industries employed.

The makers of farm implements are sensitive about criticisms leveled at them for maintaining prices. They say that the biggest single item in their cost is steel, and point to the fact that it is higher than one year ago. Another important factor is fuel, also higher, and another, freight charges, likewise higher, and finally labor, upon which there has been little or no reduction.

The independent steel producers have reduced wages about twenty per cent. Their prices had been above those of the United States Steel Corporation, but have been reduced to that level, and in some instances below. The big concern has made no move as to wages, and little change in prices as yet. The independents say that with wages as they are, fuel, freights and supplies as they are, they can make no further important reductions in prices.

The price of coal is affected by the wage increases granted to miners, by higher freight charges, higher equipment costs, and higher prices for supplies, while the cost of railroad service is due to the high cost of coal, wage increases, high cost of equipment and supplies.

The clothing manufacturers say that while there are reductions upon cloth, that is a minor factor in the cost of a suit of clothes, and that nothing else is lower. The manufacturers of cloth admit that their raw material is lower, and they have reduced wages 20 to 30 per cent, the reduction throughout New England being 22½ per cent. But wages are still more than 100 per cent above the pre-war rates, while fuel, freight, taxes, machinery, repairs, and supplies of all kinds are still on the high level.

If we go around the industries we find them all in a like situation, elevated upon an abnormal basis of costs, and with costs so interlocked that none seems to be able alone to make any important reductions. All plead helplessness, and particularly their wish to avoid wage conflicts, wages being the chief item in each case.

That spirit is commendable. The subject of wages is one that should not be dealt with arbitrarily, but on the contrary should be dealt with considerately, carefully and after full conference with all concerned. But the question how to get back to full employment and general prosperity will press for settlement, and fundamental principles will have to be taken into account.

It is not agreeable to disturb wages, but the fact is that wages have been disturbed by forces over which nobody has control. When millions of wage-earners have already lost their jobs, and many of the others are working only part time, it is apparent that wages have been reduced. The unfortunate thing is that they have been reduced in a manner which accomplishes nothing. The ability of wage earners to buy for consumption has been reduced without reducing cost in the industries and without corresponding reductions of their own living costs. They are getting the farmers' products at less than formerly, but not getting the full benefit of the reductions that the farmer has suffered, because of increased freight charges and the higher cost of all the intermediate services, which are due in the main to higher wages for somebody. For instance the baker cannot reduce the price of bread to correspond with the reduction in flour, because flour is only one item in his costs. His labor, delivery costs, machinery, coal, freight charges, supplies, etc., which mainly represent labor, have not come down to correspond with wheat or flour.

The disposition is to lay too much emphasis upon wage-rates over active wage-payments. The employers and employees in a given industry may agree harmoniously upon a given scale of wages, but if that scale involves an increase in the cost of the product to consumers, and consumption falls off, employment will fall off, and the total sum disbursed to wage-earners may be less than if the wage-rates were lower. There is a certain price for every product which promotes the largest distribution and a certain adjustment of relations between the industries which promotes a free, full, exchange of commodities and results in the largest demand for goods and services. That is the situation which gives prosperity, while a description of such relations results in a deadlock.

The advances in railroad wages may have been necessary at the time they were made, to keep that group of workers in balance with the others, but it necessitates an increase of freight and passenger charges which has become a serious burden to industry. Moreover, traffic has fallen off until the railroads are realizing only about 60 per cent of the net income which the new charges were intended to assure. The railroads cannot be maintained on the basis of present income, but evidently the remedy is not in further advances, but in a drastic reduction of operating costs, and they have set themselves to that task by laying off thousands of employees. So the evil effects of a wage-scale out of harmony with conditions after being felt in all the other industries come back upon the railroad employees themselves.

The building industry is marking time, although the need for construction work is greater than ever before, because the high costs are prohibitive. If building should go on under these conditions the costs would be chargeable in the form of high rentals largely for labor to pay.

The decline in the prices of agricultural products and other raw materials has effected a substantial reduction in living costs. It is not these things that are obstructing the way to a general readjustment, and a revival of industry. Nor is it the profits of employers that are obstructing the readjustment. Profits have been largely eliminated. The condition of easy sales, which makes a sellers' market, has passed. The high cost of living of which the wage-earners now complain, is in their own wage scales, which, however, are largely nominal, not yielding real results, because of the amount of lost time.

This is the situation which everybody is side-stepping, while looking hopefully from day to day for better times. The times cannot get materially better while industry remains in this unbalanced state. It would be as well to expect a factory to make a satisfactory record in production without having its several departments in balance and working harmoniously.

Of course if a miracle should advance the prices of farm products and all raw materials, and thus restore the buying power which about one-half the people of this country have lost, we could resume industrial activity where we left off, but these prices are dependent largely upon world conditions and we can do little to influence them. Furthermore, if that was to come about, the wage-earners would be no better off than they would be with the balance restored upon a lower level. Their wages would buy no more than if wages and all prices were readjusted upon the present level of farm products, with full employment for all.

One way or another, the equilibrium must be restored. It may be done speedily by understanding and co-operation, or it may take years while industry languishes. The question is larger than an issue between wage-earners and employers. It is a question of adjusting relations between groups of producers so that a full exchange and consumption of products can go on.

National Bank of the Republic, of Chicago, on Foreign Trade

It is apparent that there is a growing sentiment against the erection of a high protective tariff wall, inasmuch as having extended heavy loans to foreign countries in their pressing necessity, and for expenditure in this country, we are normally bound to accept their goods as their only means of repayment. The situation is further complicated by the fact that adverse exchange rates are virtually a discount on all we buy from abroad. Hence a tariff enacted to equalize foreign competition during a period of adverse exchange rates, and without adequate provision for eliminating the exchange disparity from the equation, would speedily amount to prohibition as these rates approached parity. The result, unquestionably, would be a new era of high prices for many commodities in this country through the elimination of all foreign competition, and a strengthening of prices in general. On the other hand, possible retaliation by other countries against our products, and our inability to carry on a one-sided foreign trade in exports alone, would ultimately react upon our own industries with the consequent intensifying of competition within our own borders. While our industries are by no means uniformly over-developed, yet there cannot be any question that our industrial capacity as a whole has far outstripped our growth in population or in ability to consume. Although the situation is complex in the extreme, the probable solution lies in the application of two measures which have been discussed widely for many months—the unremitting efforts of our manufacturers and producers to institute rigorous economies in their producing operations, and the vigorous furthering of the plans, already instituted, to replace our present system of short-term credits to Europe by a system of adequate long-term loans.

Emergency Tariff Law Urged by the South

Enactment by the United States Congress at the earliest possible date of the emergency tariff law with the Senate amendments and enactment of a permanent law that will afford both revenue to the Government and protection to agriculture and industry was urged by the Southern Tariff Association in resolutions adopted at the last day's sessions of the second annual conference, held in Atlanta recently.

It was also decided that the association will immediately establish headquarters at Washington and continue to carry on its work in the effort to secure a protective tariff on all Southern products. There were forty industries represented at the conference and these voted a fund of $50,000 for continuing the work.

The attendance at the second annual congress of the Southern Tariff Association included the governors of several Southern states, industrial and commercial leaders and bankers, state officials and representatives of all important chambers of commerce and industrial associations throughout the South. Several hundred women were also in attendance members of the women's division of the association.

The resolutions adopted by the congress consisted of three main groups on which protection was asked, the first being agriculture, the second industrial, and the third mineral. The industrial group included virtually all of the important manufactured products of the South; under the mineral group were placed a long list of minerals produced in the South, and in this connection the resolution urged the passage of a mineral tariff schedule now being sought in Washington by the mining interests.

The following excerpt from a message to be sent to President-Elect Harding and to the members of Congress, expresses the purpose of the association and the end it hopes to ultimately accomplish:

"This convention, called by sixteen Southern governors and composed of delegates from eighteen Southern states, represents every important Southern industry, and truly reflects the thought and aspirations of the people of the South regarding the great economic question now confronting the country.

"Due largely to foreign competition, all of the Southern industries represented at this convention are in a desperate condition, including agriculture, live stock, mining, manufacturing and forest products. These industries are all essential to the prosperity of our country in peace, and to its success in war. The producer has been encouraged to increase production in order to meet the world's demands for food, clothing and other products. He has done so at a great cost.

"He is now unable to market his product at a living price or to obtain the credit to hold it for a better market. This condition will inevitably lessen future production and cause great hardship and sacrifice.

"We are for the full employment and for a living wage for the wage earner, a living price for products of the farm, the mine and the factory. We believe that it is essential for the endurance of prosperity to have an adequate tariff that will protect the product and industry of our people against foreign competition. In the long run this will mean cheaper cost of living to the consumer, as well as greater buying power.

"We therefore petition the President and Congress:

"To enact at the earliest date possible the emergency tariff law with the Senate amendments and to enact a permanent tariff law that will afford both revenue to the government and protection to agriculture and industry."

To Designate Its Subdivisions by City in Which Each Is Located

The American Brass Co., Waterbury, Conn., announced as effective after Jan. 1 various changes in names of the company's plants. Hereafter each plant will be designated by the name of the city or town in which it is located. The two main Waterbury plants, the Benedict and Burnham and Waterbury brass branches, will be consolidated in name only and will be known as the Waterbury branch. The Coe Brass branch at Torrington will be the Torrington branch. The other plants of the company, in Ansonia, Conn., Kenosha, Wis., and Buffalo, N. Y., are already known as the Ansonia, Kenosha and Buffalo branches respectively. The changes as announced apply only to the designations of the several branches and do not in any way affect the management.

Federal Reserve Board Approves Foreign Trade Financing Corporation

On Friday, Jan. 28, 1921, the Federal Reserve Board approved the articles of association and organization certificate of the Foreign Trade Financing Corporation, a corporation organized under the provisions of Section 25(a) of the Federal Reserve Act, commonly known as the "Edge Act." The capital of this corporation is $100,000,000 and its home office is in New York City. It is incorporated for the purpose of engaging in the business of international or foreign banking or other international or foreign financial operations. Pending the issue of a final permit to commence business, the corporation has authority to exercise only those powers which are incidental and preliminary to its organization.

Urge Railroad Labor Board To Kill "National Agreements"

The following resolution on "National Agreements" was passed by the January convention of the National Conference of State Manufacturers:

NATIONAL AGREEMENTS

WHEREAS, Hearings upon the question of the perpetuation under private operation of railways and certain "National Agreements" made by the Railroad Administration and the Railroad Labor Brotherhoods under Government control are being held before the Railroad Labor Board in Chicago; and,

WHEREAS, The perpetuation of these national agreements would be highly inimical to the welfare of the manufacturing industries and the people of the United States, be it

RESOLVED, By the National Conference of State Manufacturers' Associations in convention asembled that we urge the Railroad Labor Board to render a decision that the national agreements are no longer in effect and, in so far as its legal jurisdiction may extend, authorizing the managements and the employees of the various individual railways to enter into agreements regarding working conditions which shall be adapted to promote in their local circumstances the greatest practicable efficiency of railroad operation.

We oppose the perpetuation of the existing national agreements and favor local agreements between the individual railways and their employees for many reasons, among which are the following:

1. The circumstances under which the railways are operated and under which their employees work in the various parts of the country differ widely, and therefore to standardize conditions of employment throughout the country as the existing national agreements do is unreasonable in principle and prevents the railways from being operated with the greatest practicable economy. Furthermore, the standardization of working conditions on the railroads must tend to standardize working conditions in manufacturing plants and other industries throughout the country, and since the conditions under which manufacturing and other business concerns must be conducted vary widely, any influence which tends to cause rigid standardization of working conditions in them must have a tendency to reduce industrial and productive efficiency throughout the country.

2. The existing national agreements have destroyed methods and practices which always have been recognized as promotive of efficiency, such as the system of piece work in the shops. The continued prohibition of piece work in railway shops will not only tend to increase railway expenses but to make it more difficult to maintain piece work in other industries and thereby to reduce efficiency and increase the expenses of operation of other industries.

3. The existing national agreements compel the railroads in innumerable cases to pay men for work which is not done, or to pay them two or even more days for one day's or less than day's work, thereby causing the absolute waste of many millions of dollars annually which the shipping and traveling public of the United States must finally pay in freight and passenger rates.

4. The existing national agreements require the railways to promote and lay off men in the order of seniority of their employment, thus rendering it impossible for them to promote the most competent men, or, when business is slack, to lay off the least efficient men.

5. The existing national agreements are so restrictive in their application that they prevent the railways from obtaining a sufficient number of employees in certain departments, thus limiting the output of their shops and causing delays in the movement of traffic.

6. The greatest efficiency in railroad operation and the greatest harmony between each railway and its employees can be secured only through arrangements regarding working conditions made by each railway with its own employees.

WHEREAS, The insistence of the railway labor organizations upon the establishment of national boards of adjustment is related to their insistance upon national agreements, and which national boards of adjustments, if established, would have a further tendency to nationalize the railways,

THEREFORE, Be it resolved that because of our unalterable opposition to any step or steps which have a tendency to nationalize the transportation system of the country, we do hereby record our opposition to national boards of adjustment.

This question of national agreements and national boards of adjustment on the railways is of such importance that we urge organizations of farmers and business men throughout the country, for their own protection and that of the public, to protest to the Railroad Labor Board and to the railroads against them.

Alabama Pig-Iron Production

A total of 2,354,803 tons of pig iron was produced in Alabama during 1920, according to authoritative figures obtained by the Southern Metal Trades Association, this being an increase of 224,711 tons over the production of 1919. There will probably be some slight changes in these figures when the official announcement of production for 1920 is made by the American Steel and Iron Institute.

Production of pig iron in Alabama went to 2,587,852 tons in 1918, while the maximum was reached in 1917 with 2,953,705 tons. Production was considerably retarded the last three months of 1920 because of the break in the market, but a strong pace early in the year accounts for the increase over 1919. On the last day of December sixteen furnaces were reported in blast in Alabama. Men connected with the industry are optimistic as regards the 1921 outlook, and while operations are expected to undergo still further curtailment during the first and probably the second months of the year, there is every indication that pig-iron production in 1921 will excel the 1920 total when the final figures are compiled at the end of the year. Several furnaces throughout the state that have been idle for some time have been repaired and in many cases relined, and are ready to start operations again as soon as the present lull has passed.

A. S. M. E. Spring Meeting To Be Held in Chicago

May 23 to 26 inclusive has been set as the date of the spring meeting of the American Society of Mechanical Engineers. It will be held in Chicago at the Congress Hotel.

Sessions are planned by the professional sections on Aeronautics, Fuels, Management, Material Handling, Machine Shop, Power, Forest Products and Railroads.

Brazilian Protection of Trade-marks Registered Through the Havana Bureau

According to the decree of Dec. 9, 1920, a translation of which has been transmitted by Ambassador Morgan under date of Dec. 17, the Brazilian government has decided to extend protection to trade-marks transmitted by the trade-mark bureau established at Havana under the terms of the Buenos Aires convention of 1910. It will be recalled that the convention provides for the establishment of two bureaus, one at Havana to have charge of the registration for the northern group of countries, and the other at Rio de Janeiro for the southern group. The bureau at Havana has been in existence for over a year, but the one at Rio has not yet been established owing to the failure of ratification of the convention by the required two-thirds of the states in the southern group. In its decree the Brazilian government expresses the opinion that the creation of the bureau at Rio de Janeiro is unnecessary in order to obtain protection in the southern countries for the trade-marks registered through the bureau at Havana, provided such countries have ratified the convention.

"Journal of Electricity" Enlarges Its Scope

Enlargement of the editorial scope of the *Journal of Electricity* and a change in its name to *Journal of Electricity and Western Industry* were announced at a dinner given on Feb. 1 in the Palace Hotel, San Francisco. The date marked the thirty-fifth anniversary of the *Journal of Electricity*, which has been one of the McGraw-Hill publications since September, 1919. Robert Sibley will continue as editor of the enlarged paper.

The *Journal of Electricity and Western Industry* will be devoted to the upbuilding of the West as an industrial section, and it will interpret Western progress through the application of electric power, light and heat in industries and homes. In its enlarged scope the publication will record the progress of the far West not only of the electrical industry as such but also of all industry dependent upon electrical energy. The fullest editorial support will be given to financing the huge building programs of the Western electrical utilities in the development of hydro-electric power, as this is held to be the greatest single asset of the West.

"American Machinist" Index for Volume 53 Ready

Those of our readers who save their copies from week to week will no doubt be interested in the news that the cross-index for Volume 53 is ready for distribution. This index has been carefully compiled and includes a separate author's index. A copy may be obtained by writing to our subscription department.

Patent Office Bill Approved

The Patent Office Bill has been approved by the conferees of the Senate and of the House. As approved in conference the bill provides for the higher scale of salaries authorized by the House and includes the provision that the Federal Trade Commission administer patents taken out by government employees. Some opposition to the adoption of the conference report is anticipated because of this latter provision. It is fully expected, however, that the bill will become a law as approved by the conferees.

The increase in the salary scale at the Pension Office was regarded as an urgent necessity. The efficiency of the whole service is menaced by the fact that properly qualified examiners cannot be attracted by the present salary scale. At present out of the ninety-four examiners in the Patent Office fifty-six are temporary employees due to the fact that the Civil Service Commission cannot obtain an eligible list. The provision with regard to the handling of patents taken out by government employees, as approved by the conferees, is as follows:

That the Federal Trade Commission be, and hereby is, authorized and empowered to accept assignment of, on behalf of the United States, under such regulations and in such manner as the President shall prescribe, inventions, patents and patent rights which said commission deems it to the advantage of the public to be so accepted, as these may from time to time be tendered it by employees of the various departments or other establishments of the Government except employees of the Patent Office, and to co-operate, as necessity may arise, with scientific or other agencies of the Government in the discharge of the duties herein set out, and the Federal Trade Commission is hereby authorized and empowered to license and collect fees and royalties for licensing said inventions, patents and patent rights in such amounts and in such manner as the President shall direct, and shall deposit the same with the Treasurer of the United States; and of the total amount of such fees and royalties so deposited a certain per centum, to be determined by the President, shall be reserved, set aside, and appropriated as a special fund to be disbursed as directed by the President to remunerate inventors for such of their inventions, patents and patent rights contemplated by this section as may prove meritorious and of public benefit. Provided, That nothing herein shall be construed to give to said commission or any other government agency any authority to engage in the manufacture of any such invention or patented article.

The Commissioner of Patents is hereby directed to grant all patents and record all assignments and licenses contemplated by this section without the payment of any fee.

Eastern Time Zone Daylight Saving Association Organized to Push Edge Bill

At a meeting held in New York City on Wednesday, Feb. 9, delegates from twenty states included in the first zone, the Eastern Time Zone Daylight Saving Association was organized. The meeting was held in the rooms of the New York Merchants' Association, Woolworth Building.

The delegates gathered following a call issued by the New York Association and sponsored by various chambers of commerce and boards of trade throughout the Eastern Time Zone. A. L. Filene, of the Boston Chamber of Commerce, was elected chairman of the meeting. A general discussion took place on the present status of daylight-saving practice and ways and means which could be taken by the association to strengthen its forces and make its wishes known to Congress. Many suggestions were offered and many plans devised and the best of these were consolidated into the organization which will carry on the fight as the representative body of the people in favor of the proposed measure.

A constitution was drawn up and adopted and a committee was chosen to arrange for the selection of a board of directors, three from each state in the zone. This committee comprises C. A. Cotton, of Providence, R. I., Robert Garland, of Pittsburgh, Pa., and S. C. Mead, of New York. The object of the association will be to encourage and build up an organized resistance to the enemies of daylight saving in the Eastern Time Zone; to consider legislation on this subject; to disseminate data which shows the sentiment in favor of daylight saving, and to assist in securing such legislation as will establish the practice uniformly throughout the zone.

As an adjunct to the meeting Dr. Royal S. Copeland, Health Commissioner of New York, spoke on the benefits which daylight saving would afford to the majority of the urban population. The doctor prefaced his remarks with a comparison of the destitute condition of Europe today—and drew the conclusion that if health conditions in this country are not improved and kept up to standard we can expect the same epidemics of plague and consequent death to invade our communities.

He drew the striking inference that daylight saving was one of the best means of combating disease and death among the working class. In conclusion he said:

"We are menaced by diseases more terrible than we have ever had in this country. We are menaced by diseased conditions which are a peril and indicate impending disaster. Our people must be put in the sunlight—and I want to say to you that I am interested in this daylight saying. I am interested in this problem because I want to see the mothers and the babies and the factory workers and the clerks, and those who are indoors of necessity; I want to see them go out into the sunlight for that extra hour. Do you realize that if you could have this daylight saving continued that that hour of daylight saving through the five or six months of the summer is the equivalent of a two weeks' vacation? Count it up—it is the equivalent of a two weeks' vacation. You have actually the same number of hours of sunlight that you would have if you had two

Evolution of an "American Machinist" Article—III

The associate editor now puts the article through his "gray matter" grinding machine. The contributor who has an "idea" but who thinks he is not qualified to write it up will find our associates a friendly bunch. Our advice to him is to write his idea simply as if he were telling about it to a friend and let the editors write it up. On the other hand, the contributor who uses double and treble the space



actually required to describe an idea and expects it to be published as sent in is due for a disappointment. The cartoon pictures any editor at work upon such manuscripts—note the cheerful smile with which he goes about his job. However, it takes a lot to get an associate's goat and what one doesn't know the other does, all of which makes them a tough bunch to put one over on. P. S.—Pictures are very helpful in describing machinery and should be sent when possible.

weeks without anything to do. I say, gentlemen, that there isn't any measure that I know of which is more important to the public health and more conservative as regards good health than this very thing.

"When you go back to your homes bear in mind that there are knocking at the doors of this country diseased conditions such as we never had before, and every aid that can be given to health departments, that can be given to physicians in guarding against disease must be given now as never before. You have conditions which are frightful to contemplate. If I had not seen these things with my own eyes perhaps I would not feel as deeply as I do; but when I realize that disease might come in here that would take away five or ten millions of our people, put them in the cemetery instead of in their active work that they are engaged in now, to me it is a frightful prospect. I am not saying, of course, that one hour of daylight will relieve us of this thing, but I do say that if every citizen in this eastern district would spend that hour every day in the sunlight the death roll would be materially decreased. So, in the name of the public health, in the name of the babies and the mothers, and of the clerks and of the mechanics and of the firemen and of the engineers, of all the people who are deprived by reason of their occuption of this opportunity to go into the sunlight—I say in the name of all these people—and I am sure I speak for them—I urge upon you to make every effort to give them that extra hour in order that the public health may be conserved."

Twenty Years on the Staff

On Feb. 14 Mason Britton, manager of the *American Machinist*, was given a dinner in honor of the completion of his twentieth year on the paper. The dinner was attended by various officers of the company and by the members of both editorial and business departments.

Machine-Tool Combine to Change Its Address

The executive, sales, purchasing and accounting departments of the Reed-Prentice company, the Becker Milling Machine company and the Whitcomb-Blaisdell Machine Tool company, 53 Franklin St., Boston, will be located on and after Feb. 21, at the Reed-Prentice plant, 677 Cambridge St., Worcester, Mass.

On account of present business conditions the Becker plant at Hyde Park, Boston, is operating with reduced force, production to be increased as soon as conditions warrant.

The Becker cutter department business showed a marked increase in volume during January and it is expected to be running full capacity shortly.

The Worcester plants of the Reed-Prentice and Whitcomb-Blaisdell Machine Tool companies are completing orders on hand, also building machines for stock.

Without Let or Hindrance

A Shop Creed

America is the Land of Equal Opportunity and Freedom.

This is an American Shop.

The Free Man may here put forth his best effort and earn merited reward without let or hindrance from any man, sect, creed or organization.

Only those who can wholeheartedly subscribe to these principles are welcome in this Shop.

The New Offices and Showroom of the Vonnegut Machinery Company

One of the latest types of showrooms for selling machine tools and manufacturing equipment is that housed in the new building of the Vonnegut Machinery Co., Indianapolis, Ind., which was placed in use on Jan. 17. The building and the showroom are shown in the illustration.

The building is of reinforced-concrete construction and covers a space of 95 x 300 ft. There are two stories and a basement giving a total floor space of 82,500 sq.ft. The design and construction are such that several additional floors may later be added.



NEW BUILDING OF VONNEGUT MACHINERY COMPANY AND INTERIOR OF THE SALESROOMS

The natural lighting conditions are unusually good; the ceiling on the first floor is 18½ ft. in height and of this 15½ ft. is covered by glass. The piping for heat radiation is confined entirely to the outside walls giving a clear floor space. The outer walls of the building are equipped with a sprinkler fire curtain system.

The floors are constructed to carry a live load of 300 lb. per square foot, and a dead load of approximately 1,000 lb. per square foot. A ten-ton crane has been installed, with a runway the entire length of the building, for handling machine tools. A 40 x 60-ft. driveway has been provided at the side of the building with a 20 x 20-ft. loading platform at each end. Elevators are provided at each of these loading platforms. The shipping department has a five-ton dial scale built into the floor. A garage is located in the rear large enough to accommodate all of the company's trucks.

The front end of the main floor will be devoted to the display of machine tools. Back of these on one side is the department provided for machine-tool accessories and small tools, such as drills, cutters, chucks, grinding wheels, etc. This department has an individual office on a mezzanine floor directly over its stock.

The department devoted to power transmission has a stock of all equipment including steel and wood pulley hanger frames, couplings, clutches and belting. The leather belting is stored in a rack of special construction so arranged that each roll can be handled individually and unrolled or rolled without removing. A complete belt shop is arranged with full provision for making up new belts or repairing old.

The rear end of the main floor is occupied by the used machinery department and a machine shop for rebuilding old machine tools. The basement is employed for storage of surplus stocks and for a large electric motor department.

The executive and sales offices are located on the main floor and the general offices on a mezzanine floor. All departments are connected by a Dictograph inter-communicating system. The officers of the company are Anton Vonnegut, president; Chas. A. Rassman, vice-president and F. E. Halloran, secretary.

Government Appropriation for Machine Standardization Small

An appropriation of $15,000 for the standardization of machinery and equipment has been allowed the Bureau of Standards by the Committee on Appropriations of the House of Representatives and the item is embodied in the first deficiency bill. In explaining the need for this appropriation, Dr. S. W. Stratton, the director of the Bureau of Standards, said:

"This fund is to assist American manufacturers and the Government service in standardizing machinery and equipment along definite lines, especially to assist American manufacturers in standardizations which will meet the needs of the foreign trade.

"The British Engineering Standards Association is a large organization, partially supported by the Government, which has for its object the standardization of machinery and equipment used in Great Britain and for export. The Association has branches in all colonies and is exerting a very great influence throughout the world. American interests should be represented in this work. The standardization of machinery constitutes one of the most important problems before the manufacturing interests of the country."

The work is of more importance than is indicated by the size of the appropriation, as most of the work is done with the active co-operation of the industries concerned.

National Auto Chamber Proposes Program for Reduction in Taxes

Elimination of one billion dollar increase proposed in certain Federal departmental estimates for 1922, reduction of a military and naval program to its lowest practicable point, and a further slash of 10 per cent in the estimates, as a first step in a return to "sane, normal conditions" are the major proposals contained in a tax program approved by the directors of the National Automobile Chamber of Commerce. All told, the reductions asked amount to approximately $1,500,000,000. Other proposals include:

Funding of the cost of the war, spreading the operation over a period of 50 years, including therein the floating indebtedness.

Suspension of the program of retirement of the war debt during the periods ding out of the war, at least until 1923.

Funding of demand obligations of Allies and acceptance of funding securities for unpaid interest, which they may be unable to meet.

Repeal of the excess profits, excise, transportation, consumption and other tax burdens growing out of the war.

Provision for additional revenue from a moderate protective tariff.

If still further revenue is required, consumption tax is suggested of 1 per cent on all commodities based on the retail sales to the consumer.

Business Items

The Chicago Flexible Shaft Co., Chicago, Ill., opened a Detroit office on Feb. 1 for the sale and distribution of Stewart furnaces and to give the benefit of its service and counsel in heat-treating problems to customers in that territory.

The sale of the Pomeroy Machine Co., of Pomeroy, Ohio, to the Parkersburg Rig and Reel Co., of Parkersburg, was announced recently. The plant employs about 500 men when operating to full capacity.

The Reed & Prince Manufacturing Co., Worcester, Mass., manufacturers of screw machine products, announced a wage reduction ranging from 10 to 20 per cent. The change affects about 1,000 employees.

The Master Sheet Metal Contractors' Association, Youngstown, Ohio, recently held its sixteenth annual meeting and election of officers. W. J. Perry was elected president and James J. Dalzell, re-elected secretary.

The Adamson Manufacturing Co., East Palestine, Ohio, has added a new department for manufacturing all kinds of storage, pneumatic and pressure tanks, welded pipe, battery casings, evaporators, condensers and a large line of arc-welded products.

The Interstate Foundry Co., of Ohio, has purchased the plant of the Standard Steel Castings Co., located at Austin Ave. and 55th St., Chicago. This plant covers approximately 6¾ acres and is improved with foundry, machine shop and assembly room, all of which are comparatively new and represent an investment of $320,000.

The Edward R. Ladew Co., Inc., of New York City, tanner and leather belt manufacturer since 1835, has closed its sales office at Charlotte, N. C., and transferred its Southern headquarters to 95 South Forsyth St., Atlanta, Ga.

The Allen Manufacturing Co., Hartford, Conn., elected the following officers at its recent annual meeting. President and general manager, Horace R. Grant; vice-president and secretary, Graham H. Anthony; treasurer, Stanley K. Dimock. The officers compose the board of directors. Mr. Grant succeeds Joseph H. King, who retires from the directorate, Mr. Anthony being the new member of the board.

The Western Felt Works, Chicago, Ill., announces the completion and equipment of its new buildings and invites inspection. This is said to be the largest independent felt works in the world.

At a recent meeting the John Chuck Co., Milwaukee, Wis., elected the following officers for the year 1921: President, William N. John; vice president, A. W. Bues; secretary and treasurer, David F. Armitage. Besides chucks, this company manufactures specialized tools for production work.

In order to have its name more in accordance with the nature of its business the Hoosier Auto Parts Co., Muncie, Ind., has changed its name to the Hoosier Clutch Company.

The American Turret Tool Co., Cleveland, Ohio, has been chartered with a capital of $10,000 to manufacture and sell patented tools.

The Trumbull Bronze Co., Warren, Ohio, is now occupying its new foundry building which was completed recently. It will have five furnaces, one each for copper, aluminum, brass, bronze, and one for combination metals. The capacity of the new foundry will be from six to eight tons of castings a day.

The Adamson Machine Co., Akron, Ohio, held its annual meeting recently, re-electing the old board of directors. The following officers were elected: A. Adamson, president and general manager; W. E. Slabaugh, vice-president, and R. B. Koontz, secretary and treasurer.

One half of the sheet-mill extension of the Republic Iron and Steel Co., Niles, Ohio, has been completed and the other half can be placed in readiness for operation with a few weeks' work. In view of the uncertainty of the outlook, however, the remaining work on the extension was suspended on Feb. 1.

At the annual meeting of the Portage Iron and Wire Co., Akron, Ohio, the following officers were elected for the coming year: J. A. Bachman, president; J. Krajer, vice-president; J. J. Whitelaw, treasurer, and J. A. Bachman, Jr., secretary. It was reported that the firm had completed an unusually prosperous year with an increase of 40 per cent in business.

The Hauger Wheel Co., Toledo, Ohio, has bought the plant formerly occupied by the Consolidated Manufacturing Co. The company will manufacture automobile wheels.

The directors of the McJunkin Machine Co., Sistersville, W. Va., elected the following officers: President, George S. Bradfield; vice-presidents, George Conklin and T. C. Kingsley; treasurer, D. E. Curran; secretary, John W. Bunting. A cash dividend of 10 per cent was declared, and the board discussed plans for enlarging the plant.

Personals

EUGENE F. FAGAN, formerly general superintendent of the Federal Electric Co. and subsidiaries, Chicago, Ill., has become associated with the Lyon Metallic Manufacturing Co. of Aurora, Ill., in the capacity of purchasing agent.

C. A. BISHOP has been appointed Western sales manager for the Hart-Parr Co., Charles City, Iowa. Mr. Bishop was for the past two years divisional sales manager with supervision of sales in Kansas, Oklahoma, Colorado and Western Missouri.

L. L. HUGHES, manager of sales for the Cowan Truck Co., Holyoke, Mass., industrial truck makers, has resigned his position.

HUGH R. CORSE, formerly general sales manager of the Titunium Bronze Co., is now sales engineer of the Lumen Bearing Co., Buffalo, N. Y.

J. H. DESMOND, Canadian manager for the Hart-Parr Co. for the past three years, has been given charge of all salesmen in the field and will now have his headquarters at Charles City, Iowa.

FREDERICK R. PRATT, of the engineering department of the Whitin Machine Works, of Whitinsville, Mass., sailed from San Francisco for China on Feb. 8, where he will represent that department in China and Japan. He will have entire charge of installations of "Whitin" machinery in those countries.

JOHN F. HOLMES, of the Whitin Machine Works of Whitinsville, Mass., sailed for Shanghai, China, on Jan. 24 from San Francisco to join the Whitin organization in China and Japan. Mr. Holmes has been with the company several years.

R. S. ROWLETT is at present employed in the engineering department of the Eastern Manufacturing Co. at South Brewer, Me. He was until recently with the Hyatt Roller Bearing Co., Worcester, Mass.

C. M. EASON is now vice-president of the Samson Tractor Co., Janesville, Wis. He was formerly vice-president of the Hyatt Roller Bearing Company.

HERBERT W. YEAGER has become associated with the Sundh Engineering and Machine Co., 1105 Frankford Ave., Philadelphia, Pa., as production manager. He was formerly connected with the U. S. Ordnance Department as a production expert.

CHARLES H. RICHARDS, formerly with the Remington Arms, Inc., has been appointed general manager of the Warren F. Fraser Co., of Westboro, Mass., manufacturers of universal, plain, semi-automatic, and full automatic grinders.

Trade Catalogs

Northern Cranes. Northern Engineering Works Detroit, Mich. Catalog No. 28, pp. 32, 6 x 9 in. This catalog is profusely illustrated with halftones showing the Northern cranes in service.

Leather Belting. Edward R. Ladew Co., Inc., 428 Broadway, New York. Catalog, pp. 80, 5½ x 8½ in. This catalog describes the manufacture of Hoyt leather belting from the rough hide to the finished product. Belting rules and tables are given, with a data sheet for analysis of belt drives. Belting accessories are also included.

Precision Centerless Cylindrical Grinder. The F. C. Sanford Manufacturing Co., Bridgeport, Conn. This is a three-page circular describing and illustrating the construction of its precision centerless cylindrical grinder.

The Diamond "On the Job." Diamond Machine Co., Box 1188, Providence, R. I. Catalog, pp. 47, 8½ x 11 in. This catalog describes and illustrates a number of different jobs performed on heavy-duty face grinding machines.

Heat-Treatment Colors and Approximate Temperatres, and Decimal Equivalents. Firth-Sterling Steel Co., New York and Boston. The decimal equivalents are printed on one side of this celluloid card and the heat-treatment and their approximate temperatures given on the other.

Balancing Equipment for Grinding Wheels. Norton Co., Worcester, Mass. The Norton methods of balancing of grinding wheels are described. Balancing devices are illustrated and price lists given.

Vises. The Charles Parker Co., Meriden, Conn. Catalog No. 21-V. This catalog describes and illustrates the various types of "Parker" vises. Specifications are given.

Hercules Shears and Rod Cutters. W. W. & C. F. Tucker, 191 Franklin Ave., Hartford, Conn. Catalog No. 2, pp. 8. This catalog gives a description and illustration of its Hercules shears and rod cutters. It also gives specifications.

Broaching Tools. The Velco Manufacturing Co., Inc., Greenfield, Mass. Bulletin No. 1; it gives a brief description of Velco broaching tools.

Tool Steels. Vulcan Crucible Steel Co., Aliquippa, Pa. Catalog No. 6, pp. 94, 4½ x 7¾ in. This catalog shows the various classes and types of steels manufactured, and illustrates the company's plant and equipment.

Multiple-Spindle Index Centers. Miller & Crowingshield, Greenfield, Mass. This folder describes and illustrates its multiple-spindle index centers for production work on fluting and squaring taps, reamers, etc.

Chucks and Their Uses. The Skinner Chuck Co., New Britain, Conn. Booklet, pp. 56, 4 x 7½ in. This booklet is issued to the machinery buyer, the machinery salesman, the student, apprentice and mechanic, as a compact, easily understandable, authoritative fund of information on standard types of chucks and their uses.

New Publications

Non-Condensible Gases in Ammonia Refrigeration Systems.
The Bureau of Standards, Washington, D. C., has recently issued Technologic Paper No. 180, under the title of "Causes and Prevention of the Formation of Non-Condensible Gases in Ammonia-Absorption Refrigeration Machines." This paper states that the causes of the presence of non-condensing gases in ammonia-absorption refrigeration machines are leaks of air into the system and the attack of the metal in the plant by impure aqua ammonia. Nitrogen occurs in the system as a result of the first cause, and hydrogen of the latter. The corrosion, caused by impurities in the aqua, can be prevented by the addition of sodium or potassium dichromate to the extent of 0.2 per cent of the total weight of the aqua charge. A method is given for the quantitative estimation of carbon dioxide occurring in the ammonia. The paper may be had upon request to the Bureau.

Ammonium Persulphate for Revealing the Macrostructure of Steel.
Under the title of "The Use of Ammonium Persulphate for Revealing the Macrostructure of Iron and Steel," the Bureau of Standards, Washington, D. C., has recently issued Scientific Paper No. 402. It may be obtained by application to the Bureau. The paper was prepared by Henry S. Rawdon. It states that ammonium persulphate is a widely used etching reagent for copper alloys, but that the advantages of its use with iron and steel have been almost entirely overlooked. Ammonium persulphate decomposes upon the addition of water, so that the action of the reagent is that of a weak acid intensified by the presence of oxygen. Chemical inhomogeneity is readily shown by the reagent, but the most characteristic feature in its action is the readiness with which it reveals the crystalline condition of the material. The article describes the method of application of the reagent and gives photographs to illustrate typical results obtained.

Technologic Papers No. 173 and No. 179 of the Bureau of Standards. Department of Commerce, Washington, D. C. About seventy 7 x 10-in. pages each, soft covers.
Paper No. 173, "Tests of Bond Resistance between Concrete and Steel," embodies the results of three investigations made by the concrete-ship section, Emergency Fleet Corporation, to study the effect on bond resistance between concrete and steel of the applications of various anti-corrosive coatings of high-tensile stress, and to study the relative merits of different methods of anchoring the ends of stirrups to meet certain conditions which arise in concrete construction. All the paints tested (eighteen) reduced the bond resistance. The length of lap for effective splicing was found to be greater than is generally supposed to be necessary. For anchorage of stirrups 270-deg. loops were found to be more effective than the other types of anchorage tested.
Paper 179 is entitled "Electric-Arc Welding of Steel" and gives the properties of the arc-fused metal. Fusion welds differ from all other types in that the weld is essentially a casting. A study of the properties of the arc-fused metal is fundamental in the study of arc-welding. The mechanical properties of the arc-fused metal were determined, the very low ductility being a striking feature. The metal changes considerably in composition during fusion; the carbon and other elements being largely removed, a considerable percentage of nitrogen is acquired. The microstructure is characterised by many microscopic plates within the ferrite grains, the exact nature of which has not been determined. They are apparently related to the nitrogen-content. However, the unsoundness of the arc-fused metal is the deciding factor in determining its properties, the change in composition and structure being of relative minor importance.

Annual Report of the U. S. National Museum, 1920. Smithsonian Institute, Washington, D. C. Two hundred and ten 6 x 9-in. pages, cloth board covers, illustrated.
This book describes the present condition of the museum and the work accomplished in its various departments during the fiscal year ending June 30, 1920. Its contents include chapters on the Staff of the Museum, Inception and History, Operations of the Year, Immediate Needs, Detailed Reports on the Collections, List of Accessions and List of Publications.

New England, Old and New. Published by the Old Colony Trust Co. of Boston. Sixty-two 7 x 9-in. pages, illustrated.
This brochure has been issued in commemoration of the Tercentenary of the first Pilgrim landing in 1620. It contains a brief review of some historical and industrial incidents in the Puritan "New England Canaan," still the Land of Promise.

Mechanical World Year Book, 1921. Emmott & Co., Ltd., 65 King St., Manchester, England. Three hundred and nineteen 3 x 5-in. pages, cloth-board covers, illustrations.
Of the new features in this edition Cast-Tooth Gearing is given a prominent place. A new section on Ball and Roller Bearings includes a number of tables and notes which will be found to be of considerable service. In the section devoted to Friction and Lubrication data will be found on friction clutches, band brakes, lubricants, etc. The matter on chain gearing has been rewritten and extended. A new table is introduced on the Properties of Saturated Steam. Other revisions have been made here and there and new illustrations incorporated.

Forthcoming Meetings

The National Machine Tool Builders' Association has advanced the date for its semi-annual meeting. This meeting will be held at the Hotel Cleveland, Cleveland, Ohio, on Feb. 24, 25 and 26, instead of Atlantic City in May. The general manager is Ernest F. DuBrul, 817-818 Provident Bank Bldg., Cincinnati, Ohio.

The National Foreign Trade Council will hold its eighth annual convention in Cleveland, Ohio, on May 4, 5, 6 and 7. J. G. Hammond, care of the Council, 409 Park Bldg., Cleveland, is secretary.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

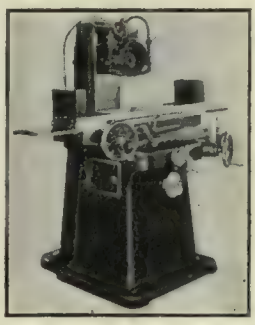
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Grinding Machine, Surface, "No. 78"

Wilmarth & Morman Co., Grand Rapids, Mich.

"American Machinist," Jan. 13, 1921

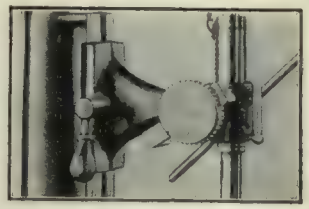


This machine is designed for precision tool and gage grinding, but is said to possess the strength and rigidity necessary for intensive production grinding. The table has a working surface of 6 x 22 in. and has three T-slots, the center one extending beyond the working surface. The longitudinal travel of the table is automatic in both directions, the reversal being controlled by simple adjustable stop dogs. Adjustable stops limit the traverse travel, which has a range of feeds from 0.015 to 0.1875 in. per stroke. A sensitive takeup for wear is provided on the wheel-head. The vertical adjustment of the wheel-head is accomplished by means of two precision elevating screws having right- and left-hand Acme threads and working in unison with one another. Weight, crated, 1,000 lb.

Drill Protector, "Martian"

F-S Machine Specialties, Inc., 171 Washington St., Newark, N. J.

"American Machinist," Jan. 13, 1921

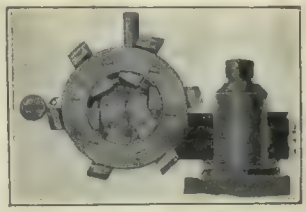


This device is intended for use on sensitive drilling machines when using drills ⅛ in. in diameter or smaller. It is stated that it prevents the breakage of small drills when they pass through the under side of the work, because it keeps the rate of feed the same as when cutting through the solid metal. The device must be set for the depth of hole to be drilled. When the drill breaks through, the operator continues to feed as before until a positive stop is reached. The action of the protector prevents the drill from advancing too rapidly, thus keeping it from seizing. When drilling holes to depth, the device will provide a positive stop, being set by means of the worm.

Threading Tool, "Multiplex"

Cruban Machine and Steel Corporation, 63 Duane St., New York

"American Machinist," Jan. 13, 1921

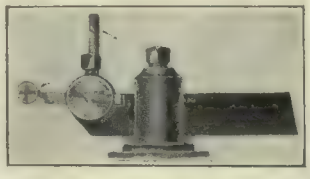


This tool is intended for the quantity production of externally threaded parts. Six cutters or knives are carried in a ring or turret capable of rotation about a horizontal shaft in a bearing at the end of the shank. The shank can be mounted in the toolpost of a lathe or on a block on the cross-slide. The cutters are ordinarily set for depth only once for a job or for a number of parts. One complete revolution of the turret should be sufficient to cut any thread up to No. 12 pitch without disturbing the position of the cross-slide. Each cutter is provided with a micrometer adjustment for depth of cut, and is held in position by locking screws. The shank is ⅝ x 1⅜ x 4⅝ in. in size and can be furnished either straight or with a left-hand offset.

Threading Tool, External, "Rapid"

Cruban Machine and Steel Corporation, 63 Duane St., New York.

"American Machinist," Jan. 13, 1921

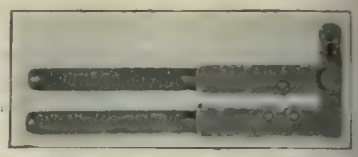


The device consists of a shank held in the toolpost of a lathe in the usual manner and carrying a small cylinder, in one end of which is inserted the tool, while a small handle is carried on the other end. The cylinder can be rotated slightly in the shank, so that the tool can be swung up out of the cutting position when desired. When starting or cutting a thread the tool is in the position shown. At the end of the cut the tool is lifted about 45 deg. by pulling back on the handle. The feed is then reversed and the toolslide fed in by hand for the next cut while the carriage is traversing. The tool can be provided with either straight or left-hand off-set shank. It is made in three sizes, taking toolbits ¼, 5/16 and ⅜ in. in size, respectively. The smallest holder is ⅜ x ⅜ x 5 in. in size, and the largest ⅝ x 1⅛ x 7 in.

Knurling Tool, Hand

A. D. Knurling Tool Co., 120 E. 128th St., New York, N. Y. (Manufactured by Lurie Machinery Corp., 432 E. 71st St., N. Y.)

"American Machinist," Jan. 13, 1921

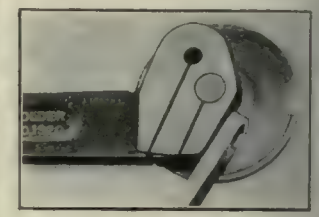


The tool is made in three sizes. The No. 2 size handles work from ⅛ to 1½ in. in diameter. It is ⅜ x 2⅛ x 6½ in. in size and weighs about one pound. The tool is intended to be held in the hand, the work being rotated between centers or in a chuck. It can be used on work held in a drilling machine spindle or turned by hand about work held in a vise. The work is held between three knurls, the distance between the jaws carrying them being adjustable. Usually the knurls are held against the rod or tube being knurled, by gripping the two handles. It is stated that non-circular work, as elliptical, hexagon or even square stock, can be knurled in this way. However, a bolt can be inserted, so as to hold the jaws in position, or a spring clamping device can be provided.

Cutting-Off Tool

R. G. Smith Tool and Manufacturing Co., 315 Market St., Newark, N. J.

"American Machinist," Jan. 13, 1921

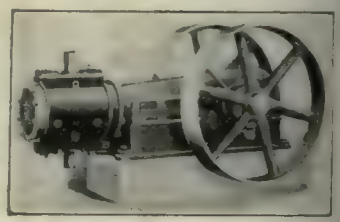


The tool is intended for use with the spring toolholder made by the same company and described in the *American Machinist* on page 694, Vol. 53. It is circular in form, being held by a shank on one side of the center. The thickness of the cutting edge gradually decreases around the circumference. To sharpen the tool, it is necessary to grind only the top of the cutting edge, the proper clearance being thus maintained. It is said that the available cutting edge occupies over 300 deg. of the circumference of the tool. The tool is said to be particularly adapted to use on automatic screw machines and turret lathes.

Compressors, Air and Pumps, Vacuum

Pennsylvania Pump and Compressor Co., Easton, Pa.

"American Machinist," Jan. 13, 1921



This company has placed on the market air compressors and vacuum pumps of similar construction, the illustration showing an air compressor. The vacuum pumps have, of course, greater cylinder diameters than the air compressors for the same length of stroke. The positions of the valves are also reversed, the discharge being at the top of the compressor and at the bottom of the pump. The mechanism is completely inclosed, so as to exclude dirt, and splash lubrication is used for the driving parts. It is claimed that the oil does not work into the air cylinder, although only one stuffing box is used, because of a baffle plate and because the crosshead, which has bored guides, nearly shuts off the oil cylinder. A float gage indicates the level of the oil in the basin.

Chuck, Breast-Drill, Three-Jaw

Consolidated Tool Works, Inc., 261 Broadway, New York.

"American Machinist," Jan. 13, 1921



This chuck is intended for use with the breast drills made by the same concern, to replace the two-jaw chuck formerly used, being shown with the drill in the accompanying illustration. The chuck is made of steel. It has no springs and is said to be simple, strong and positive in action.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

N. Y., Buffalo — The Empire Pattern Wks., 14 Perry St.—small screw machine, (used, in good condition).

N. Y., Copenhagen—J. Sargent—one 14 or 16 in. back geared engine lathe suitable for machine shop.

N. Y., Potsdam—S. Nicollette—lathe, drill press and miller suitable for machine repair work.

N. Y., Syracuse — The Greiner-Semon-Lowry Co., Everson Bldg.,—manufacturers of machines and tools. J. A. Greiner, Pres.—$75,000 to $100,000 worth of machine tools, machinery and general equipment of all kinds.

N. C., Wilmington—Carters Production Wks., 210 South Water St., manufacturers of machines, etc., O. Carter, Mgr.—band re-saw; also lathe, about 16 in. swing, 10 ft. bed.

Tenn., Knoxville—J. G. Duncan Co., 101 East Jackson St., J. G. Duncan, Purch. Agt. —boring machine for cross-arms on telegraph poles.

Tenn., Nashville—The State School for the Blind—$10,000 worth of equipment and machinery for work shop.

Va., Richmond — M. C. Thurston, 1542 East Cary St., wheelwright—portable electric d. c. drill, heavy grinder and lathe.

Mich., Detroit—The Presto Eng. Co., 31 East Woodbridge St.—miscellaneous machine shop equipment.

Mich., Grand Rapids—P. M. Hutchings, Ionia Ave., N. W.—service station equipment.

Wis., Cedarburg—J. Lanterback—reboring machine for garage.

Wis., Milwaukee — A. Jensen, 439 32d St.—tin working machinery.

Cal., Los Angeles—J. H. Reynolds, 346 Westlake St.—equipment for auto service stations.

Ont., Hamilton—The city, S. H. Kent, Clk.—2 lathes for the municipal machine shop.

Machinery Wanted

N. Y., New York (Borough of Manhattan) —The Giles Eng. Co., Grand Central Palace —wood and metal working machinery for proposed plant at Flushing.

N. Y., Rochester—F. L. Hughes & Co., 1029 Lyell Ave.—stiff leg derrick, 8 ton, 50 ft. boom (steel).

N. Y., Tupper Lake—J. A. Villnave & Son manufacturers of wood—one Lave saw mill or equal.

Fla., Tampa—J. D. Jordan Vinegar Co., 1402 Fuller St.—motor driven labeling machine, a. c. motor (used).

Ga., Cartersville—G. L. Holden—No. 0 Raymond automatic pulverizer with air separator, exhaust fan and cyclone collector, (used).

Ga., Columbus—J. E. Minter, Box 824, (woodworker) — machinery for turning trays, bowls, broom handles, etc.

Va., Denbigh—J. W. Hoopes—light brass foundry equipment, prefer coke-fired furnace.

Va., Suffolk — The Nansemond Truck Package Co., Inc., East Suffolk St., A. B. Miner, Purch. Agt.—machine for making basket tops and barrel bottoms; which will nail 2½ in. cleats about 3½ in. from end; Doig machine preferred, (used).

Va., Waynesboro—The Lambert Mfg. Co., lumber manufacturers, C. Lambert, Purch. Agt.—
One 10 in. 4 side moulder outside.
One 6 in. 4 side moulder outside.
One heavy self feed rip saw.
One table cut off saw.
One 30 in. planer L. S.
One friction drive single spindle shaper, ⅞ or 1 in. spindle.
One 20 in. circle head joiner.
One 16 in. circle head joiner.
One scroll band saw with re-saw attachment.
One jig saw.
One three drum sander, 42 in.
One combination saw and dado machine.
One hollow chisel mortiser.
One chain mortiser.
One door clamp.
One automatic knife grinder.

W. Va., Bonear — The West Virginia Eagle Coal Co., J. R. Charlton, Purch. Agt. —coal mining machinery.

Ill., Chicago—The Illinois Malleable Iron Co., 1801 Diversey Blvd.—electrically operated traveling crane, 15 ton capacity.

Mich., Detroit—D. J. Osgood, 814 Elizabeth St.—general woodworking machinery including lathes, (used).

Mich., Detroit—The Schwartz Upholstering Co., Moffat Bldg.—manufacturers of furniture—woodworking equipment, brake and double seamer.

Wis., Merton—C. Otteson—18 in. to 24 in. pony planer for woodworking shop.

Wis., Milwaukee — The Blommer Ice Cream Co., 1502 North Ave.—ice cream and refrigerating machinery.

Wis., Milwaukee—D. Rothman, 486 8th St.—new laundry machinery.

Wis., Oshkosh—The Badger Lumber & Mfg. Co., Wisconsin Ave., P. Steinhilber, Purch. Agt.—dripping and spraying machines for the manufacture of boxes and interior finish.

Wis., Thiensville—The Concrete Products Co., A. Meixner, Purch. Agt.—cement tile making machinery and rotary screen.

Wis., Wausau—H. L. Munn, manufacturer of paper plugs, etc.—automatic saws, variety lathes and bolter.

Wis., Valmy (Sturgeon Bay P. O.)—The H. White Co., H. H. White, Purch. Agt.— woodworking machinery for the manufacture of toys.

Cal., Los Angeles—The Atchison, Topeka & Sante Fe R.R., Kerckhoff Bldg.—traveling cranes for machine shop at San Bernardino.

Ont., Saulte Ste Marie—The Seaman Kent Co.—saws, planers and woodworking machinery.

Que., Hawkesbury — The Hawkesbury Textiles Ltd.—looms.

Que., Montreal—The Delson Brick Co.— equipment for its plant at Delson.

Que., Montreal—F. L. Ross, 7 York Lane, Cote St. Paul—$15,000 worth of machinery for the manufacture of syrup.

Metal Working

NEW ENGLAND STATES

Conn., Hartford—A. Goldstein, 593 Windsor Ave., will soon award the contract for the construction of a 1 story, 34 x 102 ft. garage on Maple St. Estimated cost, $20,000. F. C. Walz, 407 Trumbull St., Archt.

Me., Bar Harbor—The Bureau of Yards & Docks, Navy Dept., Washington, D. C., will soon award the contract for the construction of a garage at the Naval Radio Station, here.

Mass., Springfield — T. C. Cordner, 433 Bay St., has awarded the contract for the construction of a 2 story, 110 x 170 ft. garage on Railroad St. Estimated cost, $200,000. Noted Jan. 27.

Mass., Pittsfield—G. L. Haskins, Cheshire, plans to construct a 2 story, 50 x 75 ft. garage on South St., here. Estimated cost, $35,000. Private plans.

R. I., Newport—H. Jones, Mill St., is having plans prepared for the construction of a 1 story, 60 x 115 ft. garage. Estimated cost, $25,000. Private plans.

R. I., Providence—C. E. Brissette, 685 North Main St., plans to construct a 1 story garage on North Main and Duncan Sts. Estimated cost, $40,000. Private plans.

R. I., Providence—F. Schwarz, c/o H. Marshak, Archt., 312 Strand Bldg., is having plans prepared for the construction of a 1 story, 50 x 125 ft. and 40 x 50 ft. garage, on Point and Richmond Sts. Estimated cost, $35,000.

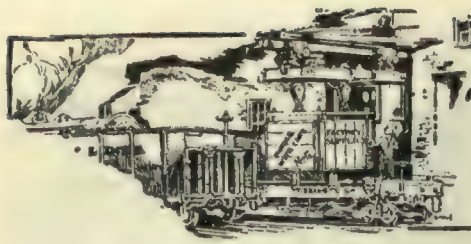
R. I., Providence—The G. Fritz Estate, 344 Wickendon St., is having plans prepared for the construction of a 1 story garage and service station. Estimated cost, $25,000. Private plans.

Vt., Windsor—The Windsor Fdry. Co. has had plans prepared for the construction of a 1 story, 115 x 252 ft. foundry. Waldron & Van Winckle, 37 Wall St., New York City, Engrs. and Archts.

MIDDLE ATLANTIC STATES

N. J., Newark—The Newark Constr. and Investment Co., c/o F. Grad, Engr. and Archt., 245 Springfield Ave., is having plans prepared for the construction of a 70 x 100 ft. garage on South Orange and Fairmont Aves. Estimated cost, $50,000.

N. J., Newark—G. Baney, 37 Bridge St., will convert present building into a garage. Estimated cost, $60,000.



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Year Ago
CINCINNATI		
No. 2 Southern	$38.50	$44.60
Northern Basic	34.50	42.80
Southern Ohio No. 2	34.00	43.80
NEW YORK—Tidewater Delivery		
2X Virginia (Silicon 2.25 to 2.75)	40.41	47.65
Southern No. 2 (Silicon 2.25 to 2.75)	44.26	47.70
BIRMINGHAM		
No. 2 Foundry	34.00	41.00
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25–2.75 sil.	36.00	45.35*
Virginia No. 2	40.00	43.25*
Basic	34.00	43.00†
Grey Forge	34.00	42.50*
CHICAGO		
No. 2 Foundry local	35.00	43.25
No. 2 Foundry, Southern	40.60	46.60
PITTSBURGH, including freight charge from Valley		
No. 2 Foundry	36.96	43.65
Basic	31.96	42.90
Bessemer	33.96	43.40

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	*Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.73	$3.80	$3.47	$3.58	$4.62	$3.58	$3.47
Soft steel bars	3.93	3.70	3.52	3.34	3.52	3.48	3.52
Soft steel bar shapes	3.93	3.70	3.52	3.48	3.82	3.48	3.52
Soft steel bands	4.33	4.65	4.22	6.25	5.25	.....	.....
Tank plates	3.93	4.00	3.67	3.78	5.00	3.78	3.67

*Add 10c for trucking charge to Jersey City and 15c. to New York and Brooklyn from warehouse.

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$2.60	$4.00
Warehouse, New York	4.75	.....
Warehouse, Cleveland	3.52	3.42
Warehouse, Chicago	4.12	3.52

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York *Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55	4.83	7.00	4.50	4.68
No. 12	3.60	4.88	7.10	4.60	4.73
No. 14	3.65	4.93	5.42	4.65	4.78
No. 16	3.75	5.03	5.52	4.75	4.88
Black					
Nos. 18 and 20	4.20	5.68	7.30	5.30	5.55
Nos. 22 and 24	4.25	5.73	7.35	5.45	5.60
No. 26	4.30	5.78	7.90	5.50	5.65
No. 28	4.35	5.88	8.00	5.60	5.75
Galvanized					
No. 10	4.70	6.23	6.90	5.95	6.10
No. 12	4.80	6.33	6.95	6.05	6.20
No. 14	4.80	6.33	7.10	6.05	6.20
Nos. 18 and 20	5.10	6.63	7.40	6.35	6.50
Nos. 22 and 24	5.25	6.78	7.80	6.50	6.65
No. 26	5.40	6.93	7.95	6.65	6.80
No. 28	5.70	7.23	9.00	7.95	7.10

AUTOMOBILE SHEETS—Patent level stock for automobile bodies and fenders. Prices in cents per pound for 100 lb. lots at warehouse, New York and Chicago—No. 16, 7.48; No. 18 20, 7.53; No. 22-24, 7.58.

*To these prices 10c. must be added for delivery in Jersey City and 15c. for New York and Brooklyn.

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.50	$5.25	$4.84
Flats, square and hexagons, per 100 lb. base	6.00	5.75	5.34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55
Special Nickel and Alloys			
Malleable nickel ingots	45		
Malleable nickel sheet bars	47		
Hot rolled rods, Grades "A" and "C" (base)	60		
Cold drawn rods, grades "A" and "C" (base)	72		
Copper nickel ingots	42		
Hot rolled copper nickel rods (base)	52		
Manganese nickel hot rolled (base) rods, "D"—low manganese	64		
Manganese nickel hot rolled (base) rods "D"—high manganese	67		

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb lots sells as follows, f.o.b. New York: 5/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	6.50	8.00	9.00
Spring steel (light)	10.00	7.00	12.00
Coppered bessemer rods	9.00	8.00	7.00
Hoop steel	4.58	4.04	4.18
Cold-rolled strip steel	9.00	8.25	9.25
Floor plates	5.75	4.00	6.03

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD					
Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
¼ to 3	54–57½%	41½–44%	⅜	15½–25½%	+1½–11½%
			½	19½–29½%	1½–11½%
			¾ to 1¼	24½–34½%	8 –18½%
LAP WELD					
2	47 –50½%	34½–38%	1½	.....	.....
2½ to 6	50 –53½%	37½–41%	1¾	.....	.....
7 to 12	47 –50½%	33½–37%	2	20½–28½%	6½–14½%
13 to 14	37½–41 %	.....	2½ to 6	22½–30½%	9½–17½%
15	35 –38½%	.....	7 to 12	19½–27½%	6½–14½%
			2½ to 4	22½–30½%	9½–17½%
BUTT WELD, EXTRA STRONG PLAIN ENDS					
¼ to 1¼	52 –55½%	39½–43%	⅜ to 1½	24½–34½%	9½–19½%
2 to 3	53 –56½%	40½–44%			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	45 –48½%	33½–37%	1½	.....	.....
2½ to 4	48 –51½%	36½–40%	1¾	.....	.....
4½ to 6	47 –50½%	35½–39%	2	21½–29½%	8½–16½%
7 to 8	43 –46½%	29½–33%	2½ to 4	23½–31½%	11½–19½%
9 to 12	38 –41½%	24½–28%	4½ to 6	22½–30½%	10½–18½%
			7 to 8	14½–22½%	2½–10½%
			9 to 12	9½–17½%	5½–+2½%

Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
⅜ to 3 in. steel butt welded	44%	28%	42½%	33½%	57½%	44%
2½ to 6 in. steel lap welded	39%	24%	44½%	29½%	53½%	41%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 6%. Cast iron, standard sizes, 15% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	13.75@14.00	15.00	19.25
Tin in 5-ton lots	33.00	34.25	60.00
Lead	5.37½	5.37½	9.00
Zinc	5.45	7.00	9.50
ST. LOUIS (In carload lots)			
Lead	4.97½	5.25	8.375
Zinc	5.05	6.75	9.225

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

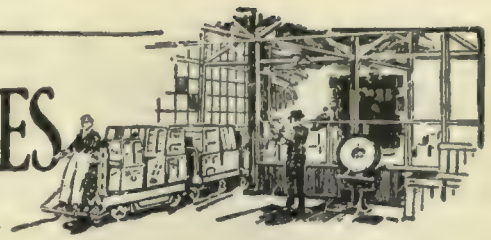
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	21.00	21.50	29.50	23.00	31.00	24.25	36.00
Copper wire (carload lots)	16.00	17.00	29.25	19.00	29.50	24.00	27.00
Brass sheets	18.75	20.25	26.50	24.00	29.00	26.50	27.00
Brass pipe	23.50	25.00	32.00	25.00	34.00	21.75	35.00
Solder (half and half) (case lots)	22.50	27.75	39.00	26.00	40.50	21.00	38.00

Copper sheets quoted above hot rolled 24 oz., cold rolled 14 oz. and heavier add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill. 1,000 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	18.25	23.75
New York	16.75	23.75
Cleveland	20.00	29.00
Chicago	21.25	26.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f.o.b. mill + less 8% for carload lots..... 11.50

	Warehouse			
	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	13.70	15.00	14.30	15.50
New York	13.00	14.00	14.50	14.50
Chicago	14.50	15.00	14.95	15.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	6.00	10.25
Chicago	6.50	10.50
Cleveland	7.50	11.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	*New York			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	11.50	17.00	10.00	10.50
Copper, heavy, and wire	11.00	16.50	9.50	9.00
Copper, light, and bottoms	9.00	15.50	9.00	8.00
Lead, heavy	4.00	7.00	4.00	3.75
Lead, tea	3.00	6.25	3.00	3.00
Brass, heavy	7.00	12.00	7.00	10.00
Brass, light	5.50	9.50	5.00	5.50
No. 1 yellow brass turnings	6.00	10.00	5.50	6.00
Zinc	4.00	6.25	3.00	3.50

* These prices nominal because of dull market.

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.30@28.50	24.50	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	28.00	35.00
Chicago	24.50	29.00
Cleveland	22.00	32.00

BABBITT METAL—Warehouse price per pound:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	70.00	90.00	46.50	70.00	35.00	70.00
Commercial	30.00	50.00	15.50	20.00	9.00	15.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at from 16.00 to 20.00.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	List	+$2.00	$1.00	$1.00	+ 1.15	1.25
Hot pressed hexagon	List	+ 2.00	1.00	1.00	+ 1.15	1.25
Cold punched hexagon	List	+ 2.00	1.00	1.00	+ 1.15	.90
Cold punched square	List	+ 2.00	1.00	1.00	+ 1.15	.90

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	60%	60%
Chicago	70%	50%
Cleveland	70%	60–10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	45%	60%	50%
1¼ and 1½ in. by 3 in. up to 12 in	25%	50%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York....$4.50 Cleveland....$3.50 Chicago....$2.50

For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:

New York....$6.00 Cleveland....$4.00 Chicago....$4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅜ by 6 in. and smaller	+40%	50%	40%
Larger and longer up to 1 in. by 30 in.	+40%	40%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	30%	20%	10%	30%
Chicago	net	10%	net	10%
New York	50%	10%	25%	10%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	45%	50%	45%
Tinned	45%	50%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York...$5.20 Cleveland..$5.25 Chicago....$5.08 Pittsburgh..$3.90

Boiler, same sizes:

New York...$5.30 Cleveland..$5.35 Chicago....$5.18 Pittsburgh..$4.00

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	24.50	27.00	29.00
Brass	23.50	24.00	28.00

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in. inclusive in rounds, and ⅛-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.50 per 100 lb.

In Cleveland—$8.50 per 100 lb.; New York price is 8@8½c.

COTTON WASTE—The following prices are in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
White	7.50@13.00	13.00	13.00	14.25
Colored mixed	7.00@11.00	9.00–12.00	10.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13¼x13½	13¼x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.00	$2.00	$2.25
Philadelphia	2.75	2.75	2.00
Cleveland	3.25	3.00	2.50
Chicago	2.50	2.75	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.70	$3.50	$3.40
Philadelphia	3.65	3.65	4.25
Chicago	4.50	4.00	5.00

COKE—The following are prices per net ton at ovens, Connellsville:

	Current	One Month Ago	One Year Ago
Prompt furnace	$5.00@$5.50	$5.00@$5.50	$6.00
Prompt foundry	6.50@7.00	6.25@7.00	7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels, (5 bbl. lots)	$0.80	$1.80	$0.90	$2.00	$0.81	$1.98
5-gal. cans	1.03	2.00	1.15	2.25	1.06	2.23
1-gal. cans (2 to case)	1.03	....	....	....	....	....

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	15.00	16.50	13.00	15.00
25 and 50-lb. kegs	13.25	14.75	15.25	16.75	13.25	15.25
12½-lb. keg	13.50	15.00	15.50	17.00	13.50	15.50
5-lb. cans	16.00	17.50	17.00	18.50	16.00	17.00
1-lb. cans	18.00	19.50	18.00	19.50	18.00	18.00

500 lb. lots less 10% discount. 2,000 lb. lots less 10-4% discount. 10,000 lb. lots less 10-7½% discount.

N. J., Orange—R. Bloom & Co., 18th Ave., Newark, will build a 1 story, 58 x 225 ft. garage at 102 Main St., here. Estimated cost, $50,000. Kruger & Siegler, 207 Market St., Newark, Engrs. and Archts.

N. Y., New York (Borough of Manhattan) —The city will soon award the contract for the construction of a garage at the Sheepfold in Central Park.

N. Y., Buffalo—A. D. Cutting Corp., 1170 Jefferson Ave., is having plans prepared for the construction of a 5 story, 125 x 137 ft. warehouse and plant for the manufacture of auto bodies. Estimated cost, $100,000.

N. Y., New York (Borough of Manhattan) —J. Ruthbard, c/o Maynicke & Frank, Archts. and Engrs., 251 East 26th St., will build a 2 story garage on 49th St. and 5th Ave. Estimated cost, $100,000.

N. Y., New York (Borough of Manhattan) —G. R. and J. T. Smith c/o N. J. Convery, Archt. and Engr., 790 Broad St., Newark, N. J., are having plans prepared for the construction of a 4 story, 107 x 176 ft. garage on 12th St. and University Pl. Estimated cost, $225,000.

N. Y., Syracuse — The Greiner-Semon-Lowry Co., Everson Bldg., will soon award the contract for the construction of a 1 story, 24 x 52 ft. and 40 x 126 ft. machine shop on West Taylor St. Estimated cost, $20,000. J. Mehan, Everson Bldg., Engr. and Archt.

N. Y., Flushing — The Giles Eng. Co., Grand Central Palace, New York City, is having plans prepared for the construction of a 4 story, 60 x 135 ft. factory, here.

N. Y., New York (Borough of Brooklyn) —The Burley Welding Wks., 22 Kosciusko St., will build a 3 story addition to its factory. Estimated cost, $50,000. E. M. Adelsohn, 1778 Pitken Ave., Archt. and Engr.

N. Y., New York (Borough of Brooklyn) —P. Cooperman, c/o S. Millman, Archt. and Engr., 26 Court St., will build a 1 story 90 x 100 ft. garage on Quincy St. and Nostrand Ave. Estimated cost, $40,000.

N. Y., New York (Borough of Brooklyn) —The Flatbush Duryea Stores Corp., 201 Montague St., will build a 1 story, 100 x 250 ft. garage on East 22d St. and Duryea Pl. Estimated cost, $80,000. F. E. Kelly, 16 Court St., Archt. and Engr.

N. Y., New York (Borough of Bronx)— Kupperman & Levy, c/o Dunnigan & Crumley, Archts. and Engrs., 394 East 150th St., will build a 1 story 50 x 120 ft. garage on Morris Ave. and 183d St. Estimated cost, $25,000.

Pa., Philadelphia—The Alfred Box Co., 1813 North Front St., will soon award the contract for the construction of a 2 story, 34 x 60 ft. and 28 x 87 ft. pattern shop, on Ontario and Janney Sts. Private plans.

Pa., Pittsburgh—H. D. Shawkey Motor Co., 5925 Baum Blvd., has awarded the contract for the construction of a 2 story, 80 x 100 ft. sales and service building on Penn Ave. and Stratford St. Estimated cost, $100,000.

MIDDLE WEST STATES

Mich., Ecorse—F. J. Fisher, Oakland and Piquette Aves., plans to build a 1 story, 100 x 200 ft. factory for the manufacture of auto parts. Estimated cost, $100,000. Architect not selected.

Mich., Grand Rapids—P. M. Hutchings, Ionia Ave., N. W., is having plans prepared for the construction of a 4 story, 100 x 125 ft. garage. Estimated cost, $200,000. Robinson & Campau, Houseman Bldg., Archts.

O., Lakewood—E. A. and C. S. MacIntyre, Madison, have awarded the contract for the construction of a 1 story, 30 x 100 ft. garage at 1415 Hopkins Ave., here. Estimated cost, $15,000.

O., Cleveland—J. Laronge Co., Williamson Bldg., plans to construct a 2 story garage on East 102d St. near Euclid Ave. Estimated cost, $50,000. Private plans.

O., Dayton—The Dayton Malleable Iron Co., West 3d St., plans to build a 2 story, 80 x 160 ft. warehouse and shop on 3d St. along the tracks of the Pennsylvania R.R., to replace the one which was recently destroyed by fire. Estimated cost, $30,000. Architect not selected.

Wis., Fond du Lac—C. A. Rossey, 430 Western Ave., is having plans prepared for the construction of a 1½ story, 44 x 80 ft. garage on Forest Ave. Estimated cost, $75,000. Private plans.

WEST OF THE MISSISSIPPI

Minn., Mankato—G. Austin plans to convert a 2 story building on 2d St. near Hickory St., into a garage. Estimated cost, $45,000. H. C. Gerlach, Mankato, Engr.

Mo., St. Louis—The St. Louis Screw Co., 6900 Prescott St., has awarded the contract for the construction of a 1 story, 163 x 185 ft. screw factory, at 6908 Prescott St. Estimated cost, $40,000.

Mo., St. Louis—The Chester Iron and Fdry. Co., 7000 Vulcan St., will soon award the contract for the construction of a 1 story, 50 x 100 ft. foundry. Estimated cost, $30,000. E. A. Linnis, Secy. L. Haeger, 3844 Utah Pl., Archt.

Mo., St. Louis—The St. Louis Wire and Iron Co., 920 Choteau Ave., will soon receive bids for the construction of a 2 story, 50 x 150 ft. wire factory, at 926 Choteau Ave. Estimated cost, $35,000. T. R. Tiesler, Pres. Private plans.

WESTERN STATES

Cal., Los Angeles—J. H. Reynolds, 346 Westlake St., is having plans prepared for the construction of four 1 story frame auto service stations on 16th St. and Western Ave. Estimated cost, $10,000. J. M. Cooper, Marsh-Strong Bldg., Archt.

Cal., San Bernardino—The Atchison, Topeka & Santa Fe R.R., Kerckoff Bldg., Los Angeles, plans to build a 70 x 510 ft. addition to its machine shop and an 80 x 300 ft. blacksmith shop, here. Estimated cost, $500,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Hartford — Bds. of Health and Charities are having plans prepared for the construction of a 2 story, 43 x 63 ft. laundry, two 68 x 204 ft. tunnels, and a 25 x 65 ft. coal bunker, on Vine St. Estimated cost, $80,000. K. D. Kimball Co., 6 Beacon St., Boston, Engrs. Whiton & McMahon, 36 Pearl St., Archts.

Conn., Hartford — The Fuller Brushes, Inc., Spruce St., is having plans prepared for the construction of a 3 story addition to its factory, for the manufacture of brushes. Estimated cost, $50,000. H. A. Wolcott, Elmwood, Archt.

Me., Brunswick—The Brunswick Textile Co. is having plans prepared for the construction of a 2 story, 80 x 160 ft. cotton mill. Estimated cost, $75,000. D. Seabury, 12 East Ave., Pawtucket, R. I., Engr. and Archt.

R. I., Newport — The Newport Bakery Co., 96 Thames St., will soon award the contract for the construction of a 2 story, 40 x 80 ft. bakery on Bway. Estimated cost, $30,000. Private plans.

R. I., Woonsocket—The Lafayette Worsted Co., Hamlet Ave., will soon award the contract for the construction of a 3 story, 100 x 133 ft. worsted weaving shed, on Manville Rd. Estimated cost, $150,000. Private plans.

MIDDLE ATLANTIC STATES

N. Y., Buffalo—F. L. Hall, 2381 Filmore Ave., is having revised plans prepared for the construction of a bakery. Estimated cost, $150,000. L. P. Beardsley, 116 West 39th St., New York City, Archt. and Engr.

Pa., Philadelphia — Supplee-Willis-Jones, 33d and Market Sts., have awarded the contract for the construction of a 3 story, 25 x 50 ft. addition to their ice cream plant. Estimated cost, $25,000. Private plans.

Pa., Pittsburgh—The Crane Co., South Michigan Ave., Chicago, is having plans prepared for the construction of a 6 story, 72 x 92 ft. warehouse and a 2 and 3 story, 192 x 290 ft. pipe shop on 24th St., here. Estimated cost, between $500,000 and $600,000. Hunting-Davis Co., Century Bldg., Pittsburgh, Archts.

MIDDLE WEST STATES

O., Cleveland — The De Klyn Co., 614 Euclid Ave., bakers and confectioners, has awarded the contract for repairing its 2 story, 72 x 80 ft. factory at 1965 East 59th St., which was recently damaged by fire. Estimated cost, $50,000.

O., Westerville—The Culver Art & Frame Co. is having plans prepared for the construction of a 2 story factory to replace the one which was recently destroyed by fire. Estimated cost, $75,000.

Ill., Chicago—The O. C. Rixon Co., 501 South Jefferson St., hardware manufacturers, has awarded the contract for the construction of a 1 story, 100 x 330 ft. factory on 45th and Carroll Sts. Estimated cost, $100,000.

Ill., Chicago—J. B. Wiggins, 1104 South Wabash Ave., will soon award the contract for the construction of a 2 story, 116 x 118 ft. engraving factory on Fullerton and Racine Aves. Estimated cost $75,000. W. G. Uffendel, 39 South State St., Archt.

Ill., Fairfield—The Sexton Mfg. Co., manufacturers of underwear, will build a 2 story, 50 x 90 ft. addition to its plant. W. E. Felix, Archt.

Wis., Kenosha—The Blommer Ice Cream Co., 1502 North Ave., Milwaukee, plans to build a 2 story ice cream factory here. Architect not selected.

Wis., Milwaukee—D. Rothman, 486 8th St., has awarded the contract for the construction of a 2 story, 60 x 120 ft. laundry on 17th St. and North Ave. Estimated cost, $45,000.

SOUTHERN STATES

Ala., Birmingham — The Amer. Cement Tile Mfg. Co., 509 Brown-Marx Bldg., plans to construct a 60 x 200 ft. plant. L. W. Barner, Mgr.

Tenn., Memphis—The Union Biscuit Co., 1101 North 6th St., has had plans prepared for the construction of a 5 story, 60 x 120 ft. factory. Estimated cost, $150,000. Janes & Furbring, Porter Blk., Archts.

WEST OF THE MISSISSIPPI

Minn., Cloquet—H. C. Hornby and R. M. Weyerhaeuser are interested in a syndicate which plans to construct a mill for the manufacture of wallboard from sawmill waste. Estimated cost, $250,000.

Neb., Norfolk — The Graham Ice Cream Co. is having plans prepared for the construction of a 2 story refrigerating plant. Estimated cost, $85,000. R. Everett, Omaha, Archt.

CANADA

B. C., Vancouver—Shelley Bros., 601 10th St., W., are having plans prepared for the construction of a bakery. Estimated cost, $175,000. L. D. Beardsley, 116 West 39th St., New York City, Engr. and Archt.

Ont., Saulte Ste Marie—The Seaman Kent Co. will build a 1 and 2 story saw mill for the manufacture of hardwood finishes and floors. Estimated cost, $50,000. Private plans.

Que., Delson—The Delson Brick Co., Montreal, plans to extend its plant here.

Que., Hawkesbury — The Hawkesbury Textiles, Ltd. plans to extend its plant.

Que., Montreal—F. L. Ross, 7 York Lane, Cote St. Paul, plans to build a 1 story plant for the manufacture of syrup. Estimated cost, $25,000.

Que., Montreal — G. Guyot will soon award the contract for the construction of a 2 story, 25 x 42 ft. factory on St. James St., for the manufacture of shoes. Estimated cost, $15,000. Private plans.

Que., Montreal — The Wyoming Valley Knitting Mills, Plymouth, Pa., manufacturers of seamless hosiery, plans to construct a plant here. T. O. West, Mgr.

American Machinist

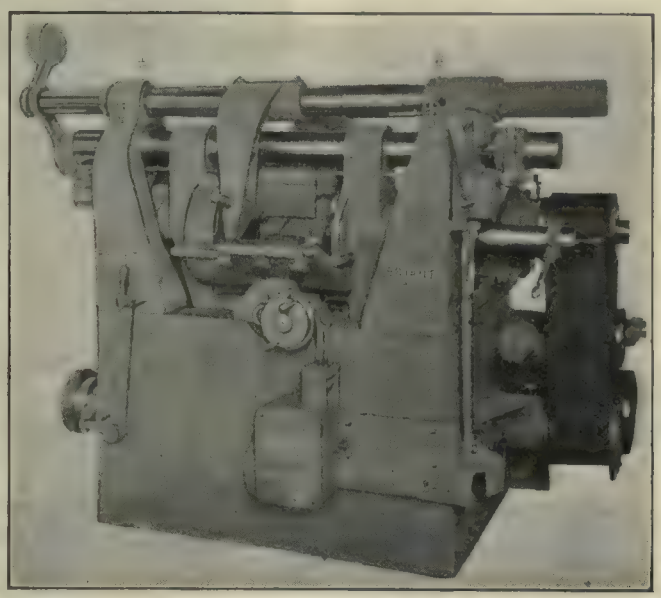
Volume 54 NEW YORK, FEBRUARY 24, 1921 Number 8

The Bryant Form-Grinding Machine

Forms Ground with One Movement—Wide-Faced Wheels Used—Machine Easily Controlled—Wheel Bearings Mounted on Rigid Base

By ELLSWORTH SHELDON
Associate Editor, *American Machinist*

THE development of the process of grinding as a means of production has been, in the past two decades, little short of marvelous. Starting about the year 1905 with the introduction of a machine for grinding crankshafts, wherewith material was removed by feeding the grinding wheel straight toward the center of the work without traversing it, and thereby accomplishing in a few minutes a job that had hitherto required in some cases hours to produce, each year has witnessed some new adaptation of the machine or some new application of the process, until the grinding machine now stands almost on a par with the lathe in the matter of versatility, and in many respects far surpasses that machine in productive capacity.



No so many years ago, mechanics looked askance upon the proposition of taking heavy cuts with a wheel 2 in. wide. Even if the work would stand the pressure, they said, and the heat generated by the wheel could be taken care of, the wheel itself would break down and continuous accurate work would be out of the question. Experience has proved, however, not only that their fears were unwarranted, but also that both work and wheel were capable of assuming the burden of much heavier cuts, distributed over much wider wheel-faces than the sponsors of the method had then dreamed of.

The latest application of this phase of the grinding process is demonstrated by the machine shown in the headpiece of this article and in the accompanying illustrations. The Bryant No. 40 form-grinding machine regularly grinds pieces 10 in. long and of any diameter up to 12 in., by feeding the wheel straight toward the center of the work with a traverse of only $\frac{1}{8}$ in.; and even this slight movement may be dispensed with if necessary. Not only are cylindrical pieces of work reduced by the ten or twelve thousandths of an inch required to remove the irregularities and make them round and smooth, but work having several diameters is produced with almost equal facility, every piece being exactly like every other piece, being finished in a matter of seconds as regards grinding time, and to limits of accuracy comparing favorably with other grinding methods.

The machine is a development of the "bar" type which has become widely known in association with the name of Bryant for internal grinding machines, but the usual principle has been reversed; the bar carries the work and the wheel is mounted upon the bed in a stationary position. Though the wheel may be adjusted with respect to its distance from the work-centers, this adjustment is not used for the feed. The wheel-head, when once set for the work in hand, has no further movement until wheel wear makes it necessary to reset it. The movement of the work toward the wheel, the feed movement, is obtained by swinging the work-carrier, which is suspended from the bar, just as in the regular Bryant machine the wheel-spindle is swung to and from the work.

With the wheel-head clamped in position the wheel-spindle has a firm support directly upon the base of the machine, thereby eliminating the vibration that might result under heavy cuts from having a free-moving slide at this point, and also a chance of error due to displacement possible with any movable member. A wheel 10 in. wide is used, having a diameter of 20 in. This wheel has a $12\frac{1}{2}$-in. hole and is supported by a cup-shaped wheel center that allows the main bearing to extend nearly to the central plane of the wheel.

The main bearing runs upon a double row of balls $1\frac{1}{4}$ in. in diameter. The outer end of the wheel-spindle is supported by a sleeve bearing of bronze having a tapered outer surface and provided with ring nuts for the purpose of taking up wear. This bearing is $3\frac{1}{2}$ in. in diameter and 7 in. long.

The belt pulley is independently mounted upon ball bearings and drives the spindle through an ingenious equalizing device that allows none of the strain of the driving belt, nor any vibration that might be caused by it, to be transmitted to the spindle. A section through the bearing and pulley is shown in Fig. 1, and photographs of the components of the equalizing device in Figs. 2 and 3. The driving pin *A*, shown in these two latter figures, passes through the larger hole in the spindle at right angles to its axis and is held loosely in place by the smaller pin *B*. The small hole in the spindle, at right angles to the larger one and through

which the smaller pin passes, is elongated to allow the driving pin to roll upon its own axis though held against endwise movement.

Flats are milled upon opposite ends of the driving pin *A* to bear against the faces *C* of the driver, which latter part is integral with the pulley shaft. These flats upon the driving pin are not exactly 180 deg. apart with respect to the axis of the pin, thus the faces *C* do not get quite a full bearing upon both of the flats at the same time. Therefore, as the pin is free to turn in the hole through which it passes, pressure of one of the faces *C* against the corresponding flat would tend to produce a turning movement of the pin about its own axis in the effort to establish a full bearing, but such a turning movement is opposed by the other face *C* tending, by reason of its slight angularity, to turn the pin in the opposite direction. Because of this condition, the pin is always in equilibrium between the two opposed forces and the driving power is thus equalized between the ends of the pin. Any shock or jar to the pulley caused by the belt is, therefore, absorbed by the device instead of being transmitted to the wheel spindle. Fig. 4 is a partial view from the rear of the machine and shows more clearly the construction of the wheel-slide.

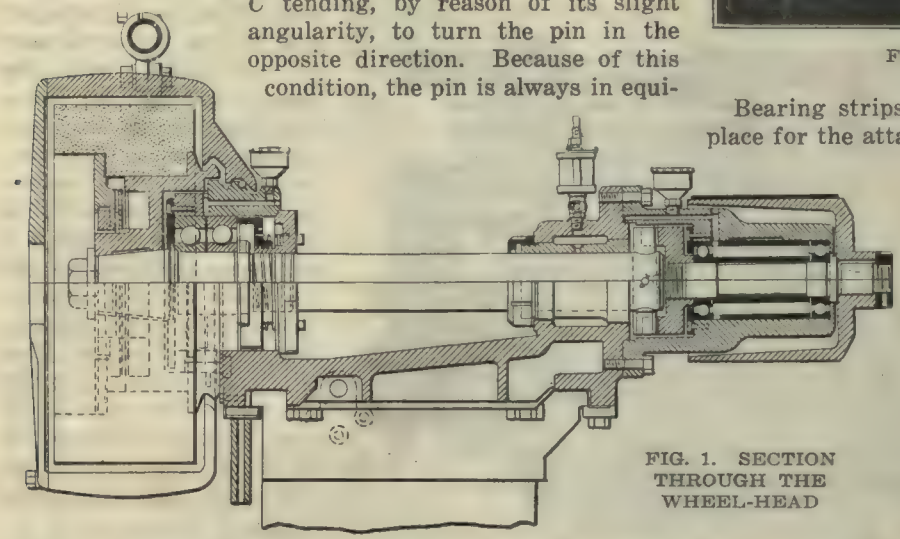


FIG. 1. SECTION THROUGH THE WHEEL-HEAD



FIG. 2. PARTS OF THE EQUALIZER DRIVE

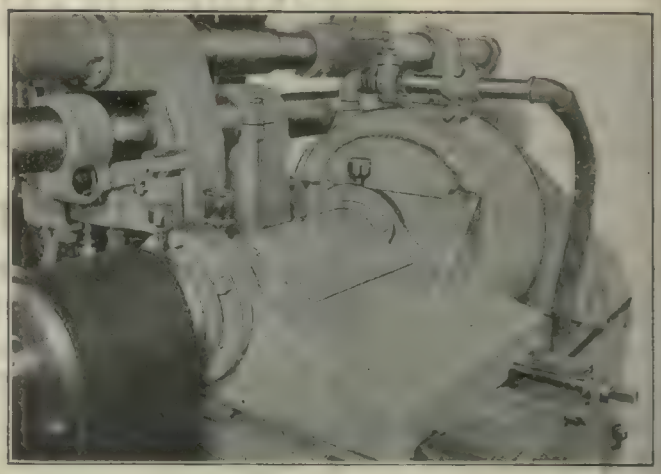


FIG. 4. THE WHEEL-HEAD

Bearing strips upon the back of the base provide a place for the attachment of the 15 hp. motor that drives the machine. An endless belt 8 in. wide passes over two idlers, shown in Fig. 5, to the pulley on the wheel-head. The lower pulley, however, is more than an idler, as it is keyed to a shaft which passes through the base of the machine and from which power for all auxiliary movements is obtained. The upper idler is weighted to maintain an even belt tension and to compensate for adjustment of the wheel-slide. Both idlers run upon ball bearings and, as neither they nor the pulley upon the spindle have outboard bearings, the belt, though endless, may be taken off or put on at will.

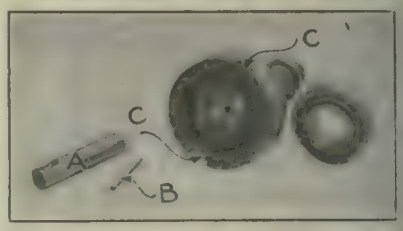


FIG. 3. PARTLY ASSEMBLED DRIVE

The drive to the work-head is first through the horizontal belt and a pair of 3-step cone pulleys seen in a Fig. 6, and then through the vertical belt to the drum pulley on the end of the spindle drive shaft. The lower belt and cones provide for changes of rotative speed. The inner horizontal belt, to be seen at the same place, drives the circulating pump. The vertical belt hangs loosely from the drum and is tightened by means of a swinging idler operated by means of a conveniently placed lever, thus furnishing the means of stopping and starting the work. The starting lever is also connected with a brake shoe bearing upon the drum, so that when the idler is drawn out of engagement the brake is simultaneously applied.

The drive shaft to which the drum is keyed is not the work spindle, but terminates at its inner end in a helical toothed pinion meshing with an internal gear upon the back of the drive plate. The helical gears minimize the tendency to produce "gear marks" upon the work, sometimes resulting from the use of parallel toothed gearing.

In Fig. 5 the various movements of the machine may be traced. The work centers are carried in the frame *AA* suspended from the main bar *B*, which latter is the

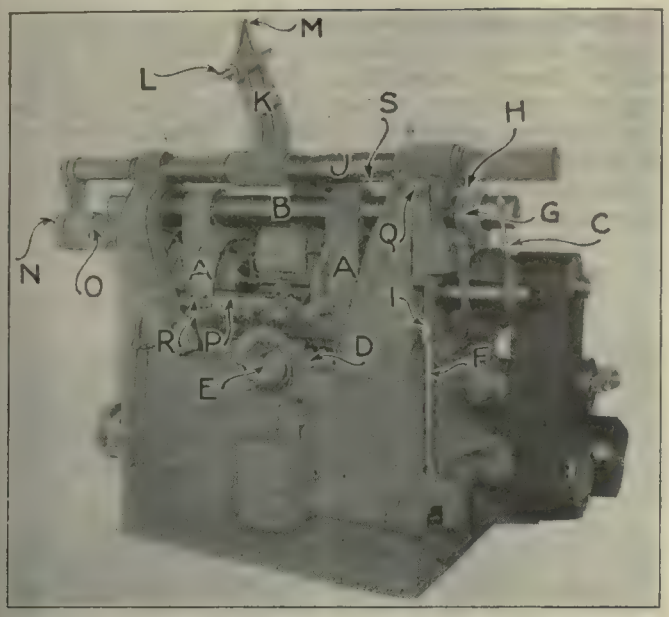


FIG. 5. FRONT OF MACHINE; OPERATOR'S POSITION

feature that gives to the Bryant type of machine its name. The center at the driving end does not revolve, nor has it any adjustment endwise, except as the whole frame is moved. The rear spindle, which is a sleeve, may be adjusted longitudinally for a distance of 12 in. to accommodate various lengths of work and, in whatever, position it may be, is firmly clamped to the lower member of the frame *AA*, the latter corresponding to the cross-slide of other types of machine.

An inner spindle, carrying the tail spindle, has a limited movement endwise for the purpose of mounting and demounting the work. This movement is controlled by the lever *C* through a spring-supported cam that holds the tail center strongly in place, while still allowing it to recede as the work expands under the influence of the heat generated by the grinding operation.

The bar *B* slides, and also turns, in adjustable bearings supported by the frame of the machine. Telescoping sleeves upon the bar protect the bearings from dirt and particles of abrasive. Endwise movement of the bar, of course, causes a traversing movement of the work across the face of the wheel, and the swinging movement provides for feeding the work to the wheel.

The bracket *D* is permanently fastened to the base of the machine and carries the cross-feed screw and sizing mechanism. The inner end of the cross-feed screw carries a hardened bearing shoe, upon which rides a bearing bar fastened to the carriage and held at all times in contact with the shoe by heavy counterweights. A pawl engaging with the ratchet *E* automatically turns the latter forward until it is disengaged by a shield that partly covers the ratchet wheel. A graduated dial enables the operator to set the shield to disengage the pawl at any predetermined point.

The machine is semi-automatic in its operation in so far as, after the work has been ground to a specified diameter, the wheel is automatically withdrawn from the cutting position. This action insures a very close duplication of size, as the grinding time of the wheel, after it has reached a positive stop, is exactly the same on every finished piece. That is to say, the length of time that the wheel is allowed to grind after reaching a positive stop for a set diameter is the same for each piece ground.

Traversing movement is transmitted to the bar *B* by means of an eccentric near the upper end of a vertical shaft, to be seen at *F*. The eccentric straps are connected to the clamping collar *G*, which may be tightened upon the bar by a movement of the operator's crank-wrench upon the head of the clamping screw *H*. The squared projection upon which the crank-wrench is shown in the picture is the end of a pinion shaft by means of which the operator may move the main bar by hand in either direction to any desired position, first loosening the clamping collar *G*. All wrench-operated parts of the machine are fitted by the one crank-wrench.

The limit of the power traverse movement is $\frac{1}{8}$ in. and can be changed only by changing the eccentric, which change is not contemplated as part of the regular adjustments. It can, however, be put out of action at any time by lifting the lever *I*, which thus disengages a clutch on the vertical shaft. If a piece of work is of a single diameter, or if it is of several diameters and each shoulder is sufficiently relieved at the corner, the power traverse is used. If all or any part of the piece to be ground is a taper or curve, traversing is, of course, out of the question.

The upper bar *J* of the machine may be rotated or moved endwise the same as the main bar. It has the same kind of bearings and is protected from abrasive in a similar manner. This bar carries a bracket *K* in which a diamond holder *L* is set, and opposite to the diamond and at the extreme end of the bracket is a hardened bearing stud *M*. Counterweights *N* and *O* on the outer end of the bar assist the operator in controlling its movements. The outer weight is keyed to the bar and balances the diamond-carrying bracket in all positions; the inner weight turns freely on the bar until the diamond is lowered nearly to position for dressing the wheel, when a lug engages and lifts it, so that further movement of the diamond toward the wheel is resisted by the weight.

Fastened to the front of the carriage at *P* and held thereto by the three large hand-operated clamping screws to be seen under the carriage is a bar about 12 in. long, the inner profile of which is an exact replica of that of the piece to be ground. This piece is called the master-bar and is produced by toolroom methods, for upon its accuracy depends the accuracy of the product. The machine has no control over *relative* diameters. Actual diameter of the work as a whole is completely under control of the operator through the cross-feed screw and sizing mechanism, but, if one diameter upon a stepped piece is too large or too small in relation to other diameters upon the same piece, the fault is in the master-bar and must be corrected there.

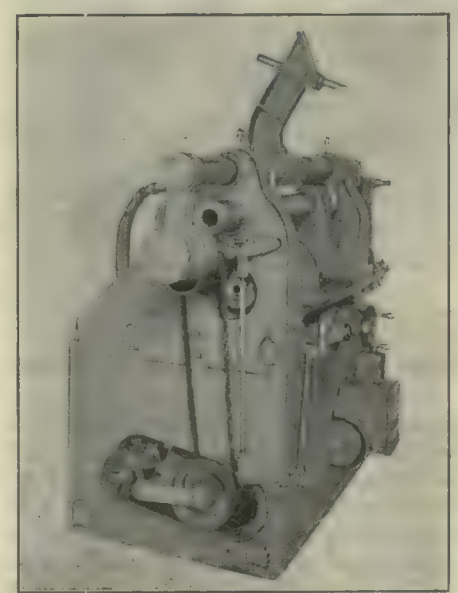


FIG. 6. END VIEW OF MACHINE

To form or to redress the grinding wheel, the carriage is locked against endwise movement by tightening the clamping screw *H*, with the power traverse clutch out of engagement. The diamond-carrying bracket is then swung down and the upper bar *J* moved endwise by means of the operator's crank-wrench placed upon the pinion shaft *Q*, until the stud *M* passes back of the

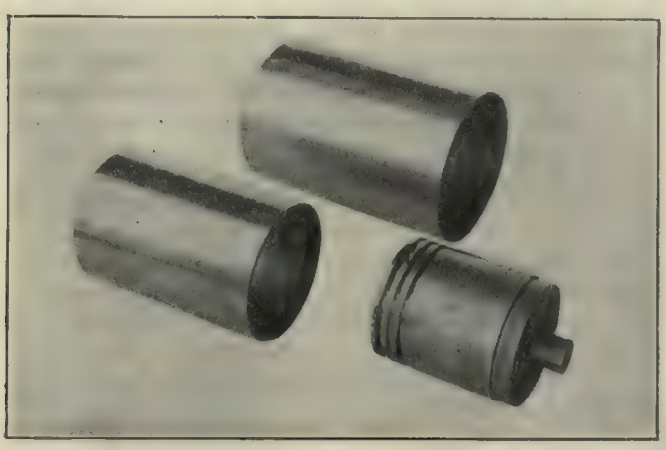


Fig. 7.

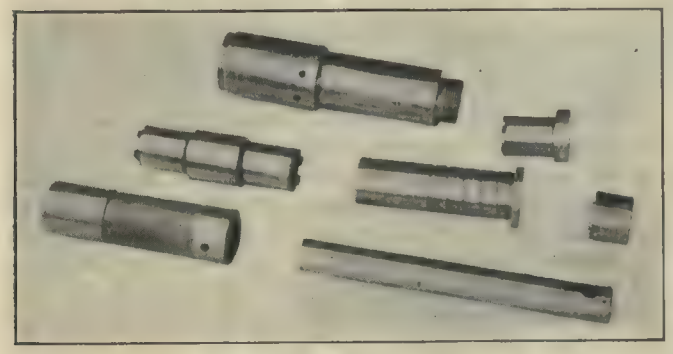


Fig. 8.

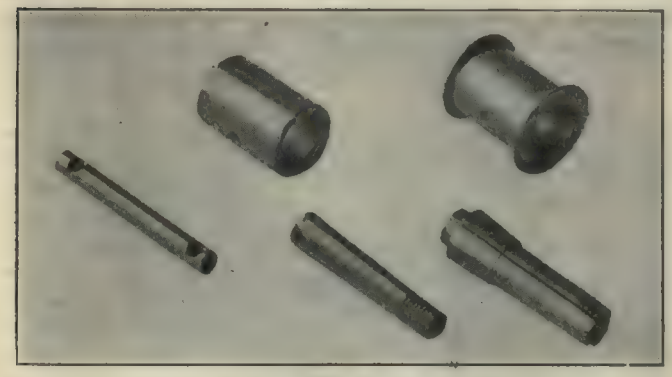


Fig. 9.
SAMPLES OF WORK GROUND ON MACHINE

master-bar and bears upon it, being held in contact therewith by the counterweight *O*.

The diamond is passed back and forth across the face of the wheel either by power or by hand, depending somewhat upon the shape of the master-bar. A double-end clutch upon the upper end of the vertical shaft *F* is controlled by the lever *S* and serves to move the bar in either direction. The stud *M* will not, of course, ride over a square shoulder on the master-bar, and if such shoulders must be produced on the work the diamond would have to be traversed by hand and the bracket lifted over the shoulders.

The standard master bar is cylindrical in shape, making it easy for the user to replace and to provide bars of special shape. Provision is made, when using the master bar for shoulder work, as the stud *M* rides against a square shoulder on the master bar, by rotating the bar slightly, to have a small pin cam lift the diamond from one plane to another. Several shoulders in this way can be operated upon by the diamond.

Because the position of the diamond is at all times dependent upon the position of the stud that bears against the master-bar, it follows that the shape of the latter will be duplicated upon the grinding wheel, and by the grinding wheel will be reproduced upon the work. As the whole carriage is swung to and from the wheel by the cross-feed screw, the latter determines the amount of material to be removed from the wheel by the diamond at each pass; therefore the diamond need never be forced beyond its cutting capacity by reason of the irregular contour of the master bar.

Samples of work ground on this machine are shown in Figs. 7, 8, and 9. Some of these pieces are parallel and of one diameter; others are of two or more diameters; and one, at least, has a tapered portion. All of the parts were ground by feeding straight on to a wheel of corresponding contour, and the grinding time was in some cases a matter of seconds.

The machine occupies a floor space of about 5 x 8 ft. and weighs 6,000 pounds.

Heavy Sugar-Machinery Operations

By Frank A. Stanley

In an article (page 441, Vol. 53) on foundry work at the plant of Dibert, Bancroft & Ross, New Orleans, La., illustrations were presented showing methods of molding big cone-shaped castings for vacuum pans. Reference was made in that article to the coring of over four hundred 3½-in. holes in the conical walls of the castings for the reception of a series of copper tubes. One of the striking jobs in the machine shops of this firm is boring out these cored holes to size, an operation illustrated in Fig. 1.

The casting to be machined in this respect is of peculiar form and of unusual size for handling under standard tools. The method of getting at the work is well shown. A big radial drilling machine is employed for the operation and is provided with a special cradle with V blocks in which the cone-shaped casting is rested for each successive boring cut. The casting is 13 ft.

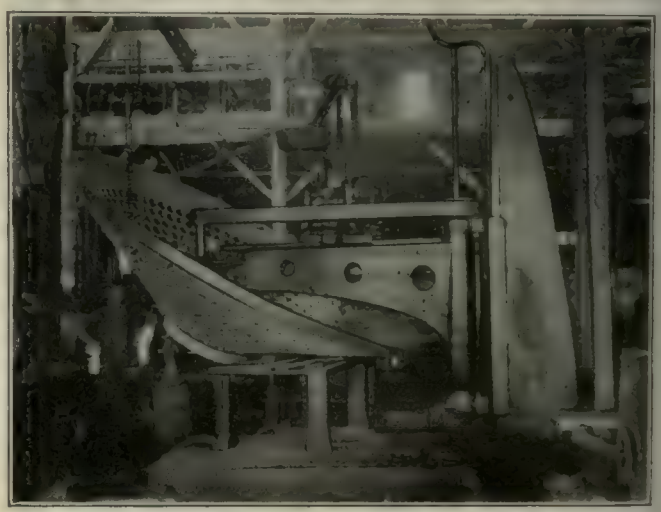


FIG. 1. BORING HOLES TO SIZE IN LARGE CONE-SHAPED CASTING

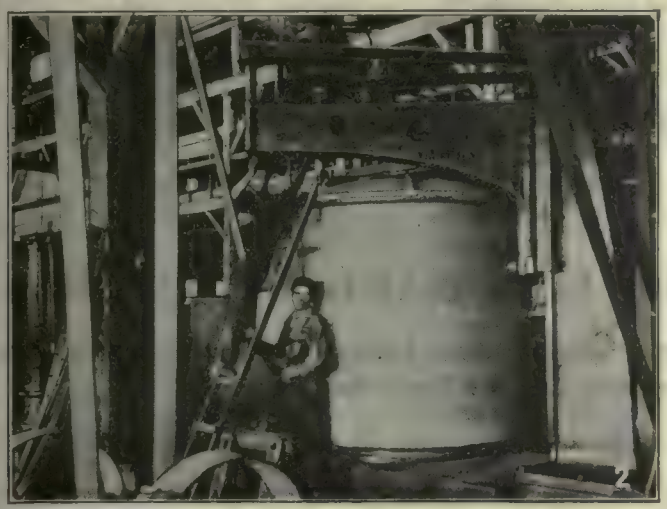
in diameter at the large end and nearly 6 ft. high. Its walls are about ½ in. thick. The holes are finished from the cored size by removing about ¼ in. of metal with the aid of a piloted boring bar and cutters. As each hole is bored out the weight of the casting is taken by the chain hoist at the outer edge and the shell rolled slightly to bring the next cored hole into position for boring. The coring of the casting is accurately done and the metal to be removed by boring is pretty evenly divided around the cut. This casting weighs 3,700 lb.

Fig. 2 illustrates drilling the flanges on big tank members. This operation is performed with the large radial drilling-machine arm run up to its highest position and with the head well out toward the end of the arm in order to clear the top of the work. As the height of the work is such as to make it impossible to swing the radial arm over the top, only one hole can be drilled in the head flange at each setting so the job is swung around to bring it into position for each hole.

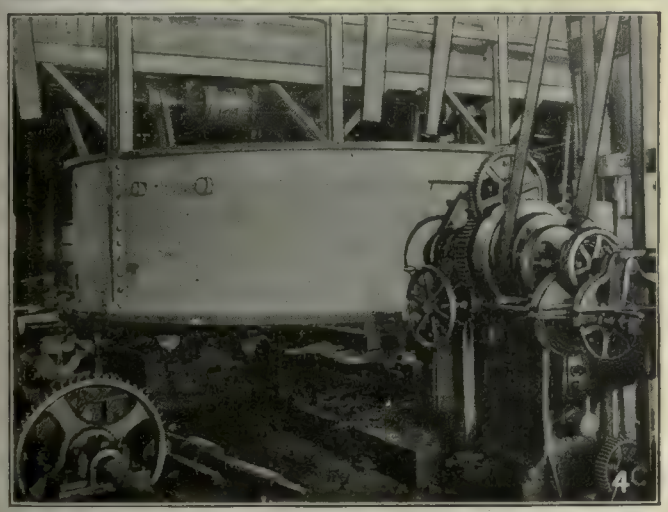
Another piece of work which requires the utmost capacity of the machine tool is shown in Fig. 3. Here a dome for a big tank is seen on the table of a vertical boring mill where the flange-joint surface is being machined. The casting is 13 ft. in diameter and 6 ft. high. The crossrail of the boring mill is elevated to the top of the uprights and with the tools run up to the highest point in the heads there is just enough clearance to permit of the facing operation.

In Fig. 4 a cylindrical piece is shown on the horizontal boring machine. The work is over 15 ft. in diameter by about 4 ft. in height. Only one point of support is therefore possible on the table of the machine; the greater part of the cylinder is carried by auxiliary supports extending across the table and resting upon jacks under the extremities. The operation shown is boring a large hole through the side wall and facing the flange around the opening. Only the head of the machine is outside of the work.

A form planing job is shown in Fig. 5. The work is a scraper bar for cleaning sugar-mill rolls and its inner face is planed out to a concave surface as indicated by means of a connecting link at the top of the planer heads. The swivel of one head is loosened and the tool point is set from the center of the swivel the exact radius required for the concave form in the work. The saddle is clamped to the crossrail and the feeding of the tool to the cut is accomplished with the tool swinging through an arc, the radius of which is established as noted. This swinging of the toolhead is due to the connecting link at the top which is attached at the outer end to the top of the opposite planer head. The crossfeed for the latter head feeds its saddle along the rail in the usual fashion and the saddle for the working head being clamped fast, the top link simply translates the side movement of the one head into a swinging movement of the planing tool carried by the other head.







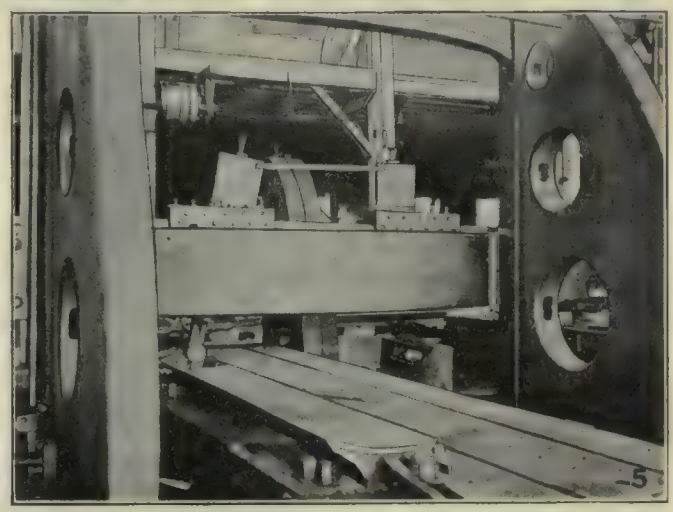


FIG. 2. DRILLING HOLES IN A TANK FLANGE. FIG. 3. A LARGE JOB ON A BORING MILL. FIG. 4. THIS CYLINDRICAL PIECE SURROUNDS ALL BUT THE HEAD OF THE HORIZONTAL BORING MACHINE. FIG. 5. A FORM PLANING JOB

Programs of Apprenticeship and Special Training In Representative Corporations

By J. V. L. Morris



X. The Bethlehem Shipbuilding Corporation, Quincy, Mass.

Apprenticeship Is Assuming Importance in the Shipbuilding Industry—Sub-Foremen Are Trained to Act as Instructors for the New Men

THE FORE RIVER shipyard was probably the first plant engaged in shipbuilding in America to introduce apprenticeship for training its craftsmen who entered the trades involved in the shipbuilding industry. This has been an established policy since 1900, but since the conclusion of the World War the well-organized department of apprenticeship has been undergoing the process of being enlarged and improved.

The outstanding characteristic of the newer apprenticeship program is the provision for special training for the sub-foremen under whom the apprentices are employed for their practical work, and who are also to provide the supplementary school instruction. Sub-foremen who were considered most adaptable to the work of apprentice training were selected from the various crafts required in the yards and put through a rigorous course of instruction for the job of teaching their respective trades. For this purpose the supervisor of apprentices got them together two nights a week after the day's work, for about six weeks, and from four until nine o'clock they studied the problems of trade teaching, one of the classes being shown in Fig. 47. With the help of the supervisor each man reviewed his trade and drew up an analysis of all the operations involved, linking up with each one the technical problems which were to be taught in the supplementary or apprentice school. At the same time these instructor-foremen were given instruction in effective methods of teaching.

They were then ready to take over their classes, which were found at the time of investigation to embrace the following fourteen trades:

1. Blacksmiths	6	8. Inside machinists	70
2. Coppersmiths	22	9. Boilermakers	0
3. Electricians	12	10. Outside machinists	18
4. Shipwrights	4	11. Shipfitters	18
5. Joiners	11	12. Mold-loftsmen	32
6. Patternmakers	14	13. Layer-outs	12
7. Sheet-metal workers	8	14. Draftsmen	16
		Total	243



FIG. 47. INSTRUCTING SUB-FOREMEN WHO ARE TO TRAIN APPRENTICES

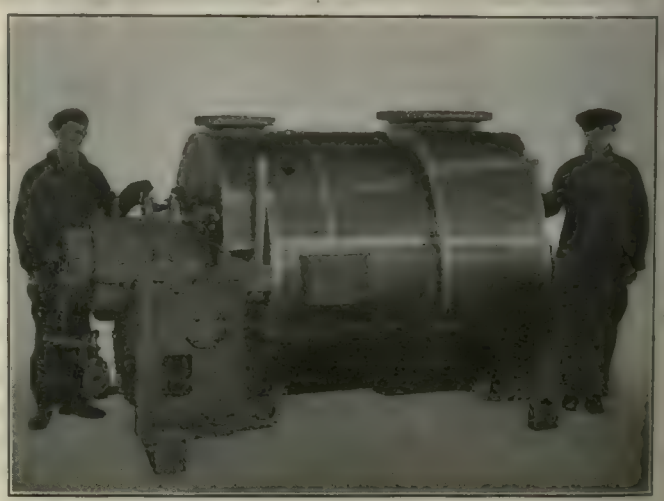


FIG. 49. TWO APPRENTICES AND A PRODUCT TURNED OUT BY THEM

The figures after each trade or craft mentioned represent the number of apprentices enrolled. It was stated that this is at an average ratio of 17½ apprentices to 100 first-class mechanics.

The Apprentice System

One half day each week the apprentices are to meet with their instructors for the supplementary instruction. At this time the apprentice files a report, shown in Fig. 48, in the supervisor's office of the work upon which he has been engaged during the week. It will be noted that the report calls for entries as to whether the apprentice worked alone or with a mechanic, independent work being considered to his credit. In Fig. 49 can be seen a

S 5029

BETHLEHEM SHIPBUILDING CORPORATION, LTD.

FORE RIVER PLANT QUINCY WORKS

APPRENTICE WORK REPORT

FOR WEEK ENDING _____ 1920

NAME _____

DEPT. _____ No. _____ YEAR _____

MONDAY _____

TUESDAY _____

WEDNESDAY _____

THURSDAY _____

FRIDAY _____

SATURDAY _____

GIVE NAME OF JOB, LOCATION, AND YOUR DUTIES.
MARK IN COLUMN AT RIGHT A LETTER FOR EACH DAY AS FOLLOWS:--

A- IF YOU WORKED ALONE.
B- IF YOU HELPED A FIRST CLASS MECHANIC.
C- IF YOU HELPED A SECOND CLASS MECHANIC.
D- IF YOU HELPED ANOTHER APPRENTICE.
E- IF YOU HELPED ANY OTHER PERSON.

SIGN HERE _____

FIG. 48. CARD ON WHICH APPRENTICE REPORTS WORK DONE

couple of apprentices with the product which they have assembled. When the plan is perfected, the report is to be entered on the individual cumulative record sheet of the apprentice, which sheet will show the progress in covering all the operations entering into the analysis of his trade. As this record is to show the quality of the work, as well as the operations involved, the supervisor will be able to obtain a constant rating on a man's progress.

It is planned to consider the record in determining the length of apprenticeship, so that by superior workmanship the apprentice will be able to shorten his period of service. The supplementary training is to consist of instruction in trade nomenclature, sketching, drafting, and the mathematics of the trade involved. The classes are in every case to be small, with never more than twelve assigned to each.

Apprenticeship in the plant conforms to the standard practice of admitting only boys over sixteen years of age and, while grammar-school graduation is desired, the completion of the sixth grade is required, together with the usual stipulations of sound health, average height, and good moral character. There is also a plan under consideration to shorten the period of apprenticeship as recognition either of graduation from an approved high school or of previous experience on the part of the apprentice.

The pay was stated to be at present at the following rates:

	Cents per Hour
First year	28
Second year	34
Third year	40
Fourth year	46

There is, however, a tentative plan under consideration to establish the pay of apprentices as proportional to that of the journeymen. Under this provision the rates would be determined upon the following basis:

First six months	35% of the first-class mechanics' wages
Second six months	40% of the first-class mechanics' wages
Second year	45% of the first-class mechanics' wages
Third year	50% of the first-class mechanics' wages

The latter system of payment, with an added item to provide for a fourth year, seems the more reasonable, as the earning power of an apprentice at any period of his contract is evidently to be determined equitably by the amount paid to journeymen for performing the same work. How much this journeyman's rate will be can not be known four years in advance. Because of dissatisfaction with the fixed rate, undoubtedly many apprentices failed to complete their periods of service during the frequent wage increases of the late war; and it is to be expected that there will be many readjustments because of the unsettled labor conditions apt to exist for the next few years before normal conditions of production are recovered.

School for Draftsmen

It should be stated that the sixteen drafting apprentices mentioned in the summary of apprentices were promising individuals selected from the other crafts and given a four-month intensive training course previous to their transfer to another plant of the corporation. It is now planned to develop a regular drafting school under the direction of a skilled naval architect. The plan is to make a careful selection of apprentices, graduates of high schools being preferred, give them at least one year of practical experience in the shipbuilding crafts, and then two years of naval drafting under intensive training. Mathematics, mechanics, strength of materials and the various phases of ship design are to be given in classes held twice daily, one in the forenoon and the other in the afternoon. This action is now planned as an emergency measure to meet the present very serious shortage of draftsmen of all kinds, the shortage being particularly acute in the field of naval design on account of the sudden impetus given to shipbuilding in the United States.

Later, when the need has become less acute, it is planned to make the course somewhat more extended and to introduce a plan whereby the drafting students will be formed into pairs, alternating one week in the drafting room under the course outlined above and the following week at work at the various crafts about the plant so that the prospective draftsmen may become conversant with all phases of shipbuilding. This plan is a highly interesting development of the co-operative idea for training technical workers, in that the plant's

management will supply both the school and the shop practice, and it seems to promise nearly ideal conditions for learning this highly technical vocation.

Although the complete development of some phases of the apprentice training here outlined awaits the construction, now in progress, of the building necessary to satisfactorily house the supplementary schools, the programs have been described as fully as possible when in only partial operation. Other phases of special training have been projected and were in partial operation during the past winter. Among them should be mentioned foreman training and the teaching of English, with a comprehensive course in civic training for the alien employees.

Handling Tools in Railroad Shops

Toolrooms and Tool Cribs—Care and Repair of Tools—System of Inspection—Storing and Issuing—Grinding—Standardization of Shapes and Sizes

By J. V. HUNTER
Western Editor, *American Machinist*

MANY of our railroad shops no longer have the hit-or-miss sort of toolrooms that unfortunately still afflict some industrial plants. The toolrooms in the cases under observation are highly organized affairs, giving efficient and economical service. Tools are kept properly, regularly inspected for damage, put in good condition before reissuing and carefully checked in and out, and all haphazard handling has been eliminated. This condition contrasts strongly with another shop recently visited where at least one drilling-machine operator told the writer he needed more tool space, although it was observed that he had a table of three shelves and an extra cabinet full of drills, reamers and similar tools. That man was only one out of hundreds of machine operators in the shop, so the amount of money tied up in dead tools distributed throughout the establishment can only be guessed at.



FIG. 1. MILLING CUTTER AND REAMER RACK IN A RAILROAD-SHOP TOOLROOM

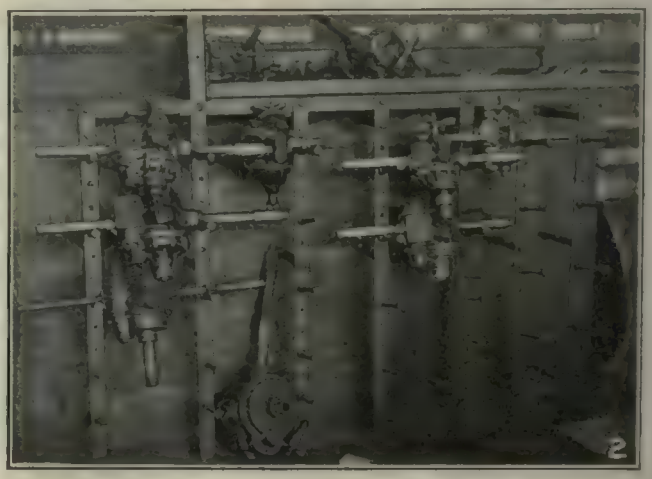


FIG. 2. STORAGE RACK FOR OVERHAULED AIR-MOTORS

At the shops of the Wabash Railway Co., Decatur, Ill., there are three tool cribs provided to serve the needs of the shop, and they are under the direction of the toolroom foreman. Two of the cribs are located so as to best serve the machine shops and erecting floor, the third serves the boiler shop.

Tool-storage method is the leading feature to be noted in these cribs as all tools are handled with great care, inspected and repaired or sharpened and then laid away in racks properly arranged so that they may be quickly found when wanted. The rack for special milling cutters and reamers, Fig. 1, is a model as all the tools are so placed that they are always readily accessible and cannot come into contact with one another to do damage to their cutting edges.

When air motors are brought to the toolroom for overhauling they are laid as received, on the shelf over the rack shown in Fig. 2. So soon as they are repaired they are laid on the pegs on the front of the rack. Each air motor has a number and a letter designating the tool crib to which it belongs and the attendant can call for these as they are made ready.

In the boiler shop, where a large number of air motors are employed, the tool crib is provided with the double rack shown in Fig. 3. The rack also provides for other parts, as will be noted, with the air hose connections below and shelves for chisels and punches above. The workman's check rack shows in the background.

Another section of steel shelving built into compartments, Fig. 4, is provided for the minor tools and wrenches. Its checkboard is located on the near end.

The proper attention is given to air hammers, and the special tank shown in Fig. 5 is provided for immersing them in oil as they are returned to the tool crib from the shop. After having been dipped in oil they are turned up to drain in the manner shown in the illustration. This insures that they are thoroughly lubricated and in a clean condition ready for re-use. The hammer shown in the background at *A* is one which has been provided with a supporting bracket made from a piece of pipe and is used for boiler-flue beading. When this hammer is in use the pipe bracket can be inserted in a flue adjacent to the

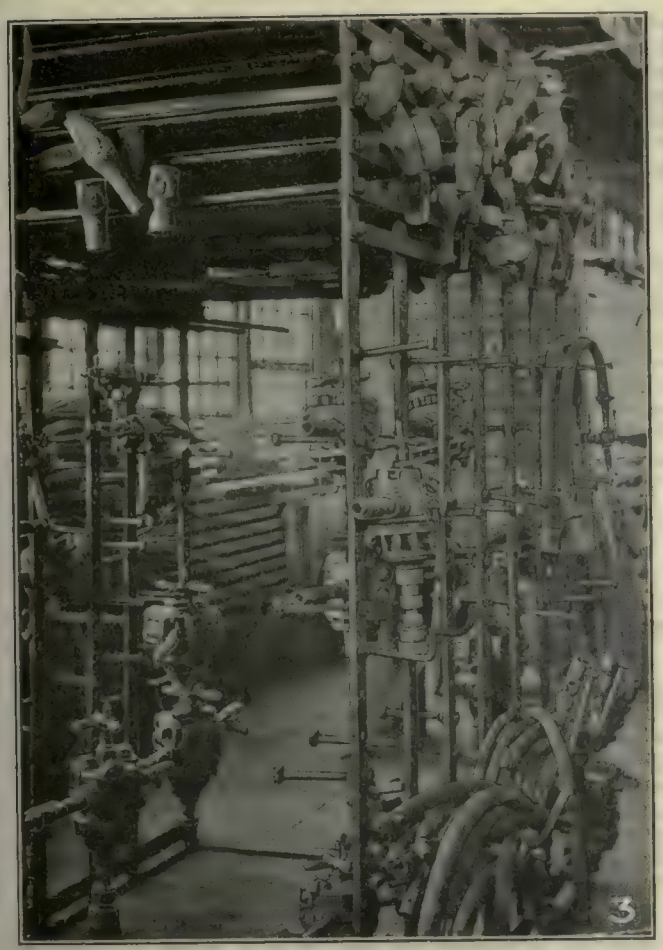


FIG. 3. RACK IN BOILER-SHOP TOOL CRIB FOR AIR MOTORS AND PARTS

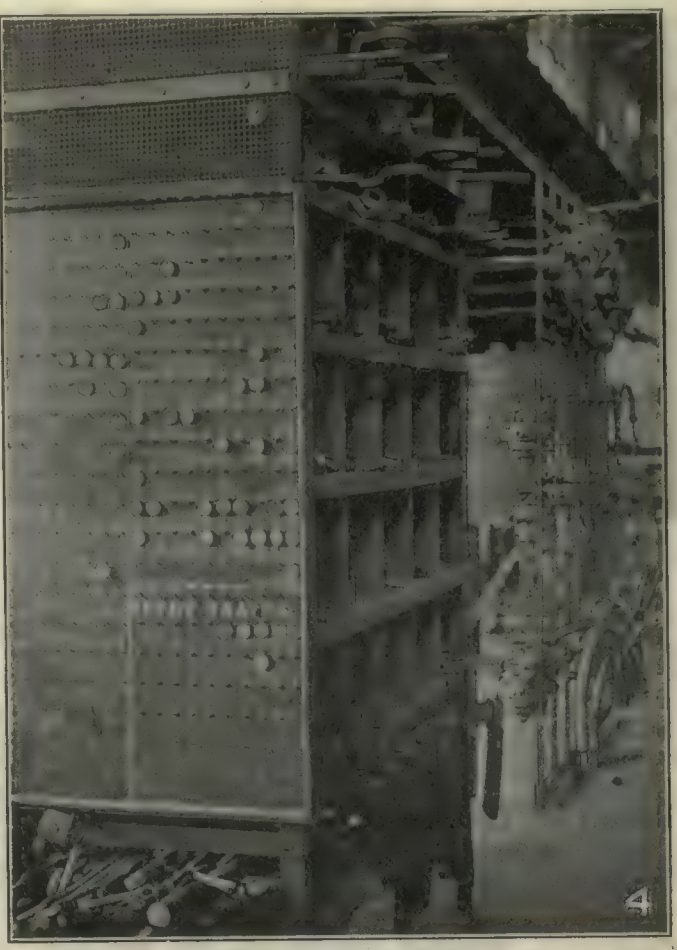


FIG. 4. STEEL SHELVING AND CHECK-BOARD IN BOILER-SHOP TOOL CRIB

one being beaded and takes a part of the weight of the tool off of the arm of the operator.

The Chicago and Alton Toolroom

The mechanical department of the Chicago & Alton R.R. has made a decided showing for standardization of the lathe, planer and kindred tools in its Bloomington, Ill., locomotive shops. Tools are no longer ground in a haphazard fashion by the workman in the shop, but when dulled are returned to the toolroom, Fig. 6, for regrinding. Some of the grinding equipment is shown in the illustration.

The tool crib for issuing the tools to the shop is handled in a systematic manner and every size and variety of tool is properly stored away in compartments provided for the purpose, Fig. 7. The uprights of the toolrack are of T-section with angle-iron shelf brackets riveted to the inside leg. The shelves are straight sheets of ⅜-in. black steel plate, and while the shelving has not been built to attain lightness it certainly is substantial and compact.

Dulled tools returned to the crib are laid aside by the attendant and in his spare time the accumulations are ground and returned to stock.

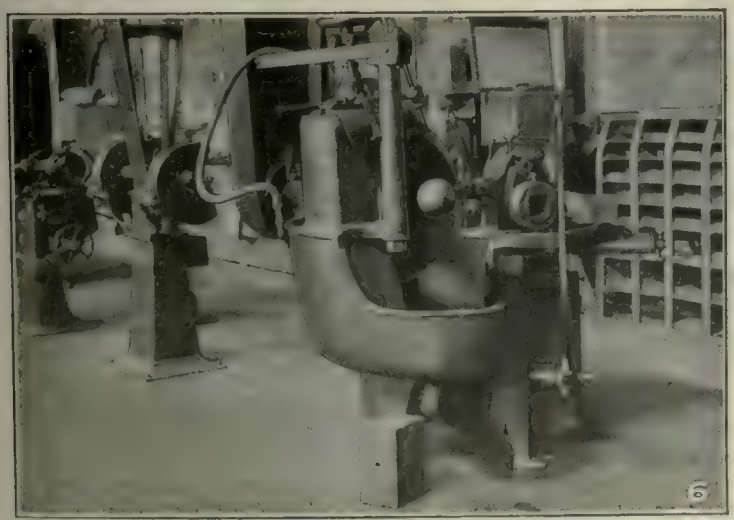


FIG. 6. TOOL GRINDING EQUIPMENT IN THE BLOOMINGTON SHOP

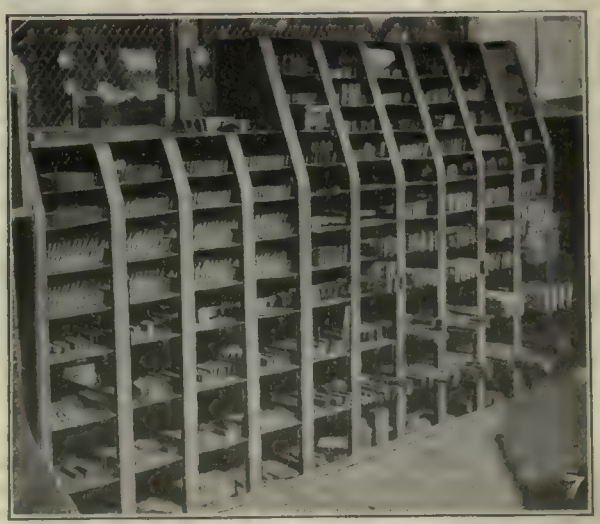


FIG. 7. TOOL CRIB FOR STANDARD MACHINE TOOLS



FIG. 5. OIL TANK FOR LUBRICATING AND DRAINING AIR HAMMERS

The stock of standard lathe, slotter and boring mill tools is well covered by a chart, which is framed and posted in a conspicuous position where it is always ready for reference. The chart gives an almost complete list of the majority of standard tools required in locomotive-shop practice.

Report of Committee on Standardization of Petroleum Specifications

The methods of testing and the specifications for petroleum products adopted by the Committee on Standardization of Petroleum Specifications has been published in the report given in Bulletin No. 5, issued by the Department of the Interior, Bureau of Mines, Washington, D. C., and the specifications contained in it are effective from Dec. 29 last.

This bulletin supersedes Bulletins 1, 2, 3 and 4 of the Committee. All the specifications contained in these bulletins have been carefully studied and, where necessary, revised and co-ordinated. To these revised specifications have been added several which have not been previously published. Bulletin 5, therefore, gives a practically complete list of petroleum products used by the Government and its agencies, together with complete specifications for each product and full descriptions of the methods of testing employed in the Goverment laboratories. In general, the committee has adopted the methods recommended by the American Society for Testing Materials, as these methods agree with those used by Government agencies and also have the sanction of a number of petroleum trade associations. It is recognized, however, that the petroleum industry continually faces changes in the quality of crude oils available, and the committee therefore will welcome suggestions and criticisms.

The following specifications are given herewith because of their more immediate interest to our readers. It is stated in the report that all tests of these specifications shall be made according to the methods for testing lubricants adopted by the Committee on Standardization of Petroleum Specifications.

Cup Grease

For the lubrication of such parts of motor equipment and other machinery as are lubricated by means of compression cups; Nos. ½ and 1 to be used in spindle cups or transmissions—The grease shall be a well-manufactured product, composed of a calcium soap made from high-grade animal or vegetable oils or fatty acids, and a highly refined mineral oil. The mineral oil used in reducing the soaps shall be a straight, well-refined mineral oil with a viscosity at 100 deg. F. of not less than 100 seconds.

No. ½ cup grease shall contain approximately 13 per cent of calcium soap.

No. 1 cup grease shall contain approximately 14 per of calcium soap.

No. 3 cup grease shall contain approximately 18 per cent cent of calcium soap.

No. 5 cup grease shall contain approximately 24 per cent of calcium soap.

These greases shall be similar in consistency to the approved trade standards for Nos. ½, 1, 3 and 5 greases. The grease shall be a boiled grease, containing not less than one or more than three per cent of water when finished. A clean copper plate shall not be discolored when submerged in the grease for 24 hours at room temperature.

No. ½ grease. Ash shall not be greater than 1.7 per cent.

No. 1 grease. Ash shall not be greater than 1.8 per cent.

No. 3 grease. Ash shall not be greater than 2.3 per cent.

No. 5 grease. Ash shall not be greater than 3.5 per cent.

The grease shall contain no fillers such as resin, resinous oils, soapstone, wax, talc, powdered mica or graphite, sulphur, clay, asbestos, or any filler.

Transmission Lubricant

For the lubrication of transmission gears and bearings, differential gears, worm drives, winch drives, and roller and ball bearings used in connection with such parts of the equipment of motor vehicles—The lubricant shall be a refined petroleum product, without the addition of any vegetable or animal oils or products derived from them, and must be entirely free from fillers. The flash point shall not be lower than 460 deg. F. The viscosity at 210 deg. F. shall be within the following limits: 175 to 220 seconds.

Marine-Engine Oil

For the lubrication of reciprocating steam engines in marine service where a compounded engine oil is required—This oil must not be used in circulating or forced feed systems. The oil shall be a compounded oil made from refined petroleum oil and 10 to 20 per cent of blown refined rapeseed or blown refined peanut oil, so compounded that it will not separate or break down in any way either before or while in service. The viscosity shall be: 65 to 75 seconds at 210 deg. F., not over 700 seconds at 100 deg. F. The pour test shall not be above 32 deg. F. The oil shall not contain more than 1.50 per cent of acid, calculated as oleic acid (equivalent to 3.0 mg. K. O. H. per gram of oil). A clean copper plate shall not be discolored when submerged in the oil for 24 hours at room temperature. The oil shall remain completely emulsified for an hour from an emulsion with (1) distilled water, (2) 1 per cent salt solution. The oil shall show a flow at the end of 14 days of at least 30 per cent of its flow at the end of the first 24-hour period.

Mineral Steam Cylinder Oil for Non-Condensing Engines

For non-condensing steam-engine cylinder lubrication where a mineral oil is required; also as a stock oil for compounding—The oil shall be a well-refined petroleum oil without compounding of any nature. The flash point shall not be lower than 475 deg. F. The viscosity at 210 deg. F. shall be within the following: 135 to 165 seconds. The cold test shall not be above 45 deg. F. When 5 c.c. of the oil is mixed with 95 c.c. of petroleum ether and allowed to stand 24 hours, it shall not show a precipitate or sediment of more than 0.25 c.c. (5 per cent by volume of the original oil).

Compound Steam Cylinder Oil for Non-Condensing Engines

For the lubrication of steam cylinders of non-condensing engines and pumps where a compounded oil is required. The oil shall be a well-refined petroleum oil, compounded with not less than 5, nor more than 7, per cent of acidless tallow oil or lard oil. The flash point shall not be lower than 475 deg. F. The viscocity at 210 deg. F. shall be

within the following: 120 to 150 seconds. The cold test shall not be above 45 deg. F. When 5 c.c. of the oil is mixed with 95 c.c. of petroleum ether and allowed to stand 24 hours, it shall not show a precipitate or sediment of more than 0.25 c.c. (5 per cent by volume of the original oil). The oil shall not contain more than 0.40 per cent of acid, calculated as oleic acid (equivalent to 0.80 mg. K. O. H. per gram of oil).

GEAR-CHAIN AND WIRE-ROPE LUBRICANT

For the lubrication and protection of chains, wire ropes and gears of cranes, dredges, steam shovels and all other heavy equipment; for the lubrication and protection of the gears and ropes of balloon hoists; and for swabbing the wires and cables of aircraft—the oil shall be a petroleum product only, free from vegetable or animal oils or products derived from them. It shall be entirely free from fillers, such as talc, resin, and all materials of every nature not related to the original product. The viscosity at 210 deg. F. shall be within the following limits: 900 to 1,100 seconds. When applied to a plate of polished steel the lubricant shall protect the steel for a period of thirty days when immersed in a 10 per cent salt solution.

LIBERTY, AERO AND MOTORCYCLE OIL

For the lubrication of stationary cylinder aircraft engines and motorcycles—The oil shall be made from pure, highly refined petroleum products and must be suitable in every way for the entire lubrication of stationary cylinder aircraft engines and motorcycle engines operating under all conditions. The oil shall not contain moisture, sulphonates, soap, resin, or tarry constituents which should indicate adulteration or lack of proper refining. These oils shall be supplied in two grades, to be known as Grade 1 and Grade 2. The flash point of the two grades shall not be lower than the following: Grade 1, 400 deg. F.; grade 2, 500 deg. F. The viscosity of the two grades at 210 deg. F. shall be within the following limits: Grade 1, summer, 90-100 seconds; grade 1, winter, 75-85 seconds; grade 2, 125-135 seconds. The pour test of grade 1 shall not be above the following limits: Summer, 45 deg. F.; winter, 15 deg. F. The cold test of grade 2 shall not be above 35 deg. F. Not more than 0.10 mg. of potassium hydroxide shall be required to neutralize one gram of grade 1 oil. The oil shall separate completely in one hour from an emulsion with distilled water at a temperature of 180 deg. F. The carbon residue on grade 1 shall not be over 1.5 per cent; on grade 2, not over 2.0 per cent. When 5 c.c. of the oil is mixed with 95 c.c. of petroleum ether, and allowed to stand 24 hours, it shall not show a precipitate or sediment of more than 0.25 c.c. (5 per cent by volume of the original oil).

TRANSFORMER OIL

For oil switches, oil circuit-breakers and transformers—The oil shall be made from pure, highly refined petroleum products, free from animal or vegetable oils or fats of any kind, and shall be suitable in every way for the purposes listed. The flash point shall not be lower than 290 deg. F. The viscosity at 100 deg. F. shall be within the following limits: 95-110 seconds. The pour test shall not be above 20 deg. F. Not more than 0.03 mg. of potassium hydroxide shall be required to neutralize one gram of the oil. The oil shall not show a deposit or any change other than a darkening of color when heated to 450 deg. F. A clean copper plate shall not be discolored when emerged in the oil for 24 hours at room temperature. The break down value shall not be less than 23,000 volts. The oil shall not contain more than 4.0 per cent of hydrocarbons soluble in concentrated sulphuric acid.

CAR OIL

As a lubricant on journals of all cars, passenger coaches, steam and electric locomotives—Only refined petroleum oils, without the admixture of fatty oils or other compounds not derived from crude petroleum, will be considered. The flash point of this oil shall not be lower than 300 deg. F. The viscosity at 210 deg. F. shall be within thc following limits: 65 to 75 seconds. The cold test shall not be above 32 deg. F. When 5 c.c. of the oil is mixed with 95 c.c. of petroleum ether and allowed to stand 24 hours, it shall not show a precipitate or sediment of more than 0.25 c.c. (5 per cent by volume of the original oil).

LOCOMOTIVE-ENGINE OIL

As a lubricant (by the Panama Canal) for all locomotives, running gears of all locomotive cranes, deck machinery of dredges (except engines) and for cold-saws in machine shops—Only refined petroleum oils, without the admixture of fatty oils or other compounds not derived from crude petroleum, will be considered. These specifications are identical with those of car oil (Panama Canal). The flash point of this oil shall not be lower than 300 deg. F. The viscosity at 210 deg. F. shall be within the following limits: 65 to 75 seconds. The cold test shall not be above 32 deg. F. When 5 c.c. of the oil is mixed with 95 c.c. of petroleum ether and allowed to stand 24 hours, it shall not show a precipitate or sediment of more than 0.25 c.c. (5 per cent by volume of the original oil).

CRANKPIN GREASE, DRIVING JOURNAL COMPOUND, ROD CUP GREASE

For the lubrication of driving journal on locomotives (provided with grease cellars) and for the lubrication of cranks and rods on locomotives (provided with grease cups)—The grease must be a well-manufactured product, suitable in every way for the purpose listed. It shall be composed of a soda soap (made from tallow) combined with a well-refined cylinder stock of petroleum oil. It shall be smooth, uniform and must not crumble under pressure. Driving journal compound shall be green or greenish in color. Rod cup grease and crankpin grease shall be slightly yellowish in color. The soap content shall not be less than the following: Driving journal compound 45 per cent, rod cup grease 40 per cent. Neither grade shall contain less than 0.50 per cent nor more than 2.5 per cent of free alkali, calculated as N.O.H. The total water, glycerine and impurities present shall not exceed one third the total dry soap content.

Should Jigs and Fixtures Be "Designed"?

BY J. J. SIEFEN

Should jigs and fixtures be designed in the drafting room? The writer would answer in the affirmative. It reduces errors to a minimum and betters the product.

Minor parts can be made standard in quantities and used again when the jigs or fixtures become obsolete or partly worn out, as a record is available, and a low-priced man can look it up. A good many readers, no doubt, have been in contact with both systems as explained on page 26, Vol. 54, of the *American Machinist*, but a comparison of cost and efficiency which I made is very much in favor of designing in the drafting room. There is more teamwork, resulting in a better and cheaper product, since it is generally the combined ideas of several mechanical executives. Also less interference is caused as the drawings are checked and approved by different men. It requires less supervision, for even the best toolmakers and machinists will need advice when not working to blueprints, and the writer always found they expected and required it. We are slowly outgrowing the old-fashioned systems and are trying for standardization and specialization to reduce manufacturing costs.

It requires very little addition to the drafting force to design jigs or fixtures for quite a number of toolmakers or machinists. Standardization of machining operations and routing cannot be planned or executed efficiently when the shop does the designing, as each man wants to use his own system, feeling his way step by step. Where there is teamwork between the shop, drafting room and mechanical executives the shop always gets what it wants in jigs or fixtures, which are generally the very best obtainable.

Metal Cutting Tools—IV*

By A. L. DeLEEUW

(Continued from last week.)

Uncertain as the beginning of a drilled hole is the end is still more so. If we imagine a drill of great length but of a material strong enough to transmit torsion from a spindle to the drill point, then this drill might be very flexible. If the drill point should strike a spot in the material which is somewhat harder or softer than the average material it would be deflected, in other words the axis of the hole will take a new direction. The flexibility of the drill will permit it to follow this new direction and even if that flexibility were not sufficient we still have to reckon with the looseness between the drill and the spindle, between the spindle and its bearing, with the flexibility of the spindle itself, and so forth. It has often been observed that in trying to drill a long hole, say through a spindle forging, the hole would not come out at the center of the far end, but somewhere away from that center, and sometimes even through the side of the forging. This latter case does not often happen, but neither is it an uncommon occurrence.

Locating the center of the far end of the hole is quite a difficult matter. Where bolt holes have to be drilled in flanges or castings, and where these holes have to match with holes in a flange of another casting, it is customary to start them at the surfaces where the castings must join. (See Fig. 66 where this matter is represented in exaggerated form.) Even if the material were entirely homogeneous and if the drill were ground entirely correct, there would be no assurance that the drilled hole would come out at the far end where it is wanted for the direction of the feed would not be exactly the desired direction of the axis of the hole. Little as this difference may be it becomes quite an important item when the hole is of considerable depth, say 5 ft. If for instance the drill spindle made an angle of 3 min. with the desired direction of the axis of the hole, and if the hole were 5 ft. deep, the center of the hole would be 1/20 in. away from its proper location at the far end. Such accuracy—only 3 min. variation—is not easily obtainable with a drill press. For that reason it is customary to revolve the work instead of the drill when drilling deep holes. This at least insures that the drill will have a tendency to follow in the proper direction if nothing interferes. The interfering items are: lack of homogeneity of the metal, incorrect grinding of the drill, looseness in the spindle, etc. Though this method is much better than revolving the drill and holding the work stationary it gives no absolute assurance of good results. In order to minimize the effect of heterogeneity of the metal, it is customary to drill with a very fine feed so as not to exert much pressure against the metal at any point, thereby reducing the amount of deflection of the drill point if it should strike a hard or soft spot. Of course this fine feed slows down the operation.

A much better method is to revolve both work and drill. If proper precautions are taken a hole will be produced which will come out at the proper point at the far end and which will be straight throughout its entire length. The only variation from a perfect hole will be that the far end of the hole may be of somewhat greater diameter than the size of the drill. For very deep hole drilling the piece to be drilled should be laid in a cradle supported from a fixture on the faceplate of a lathe at one end and in a steadyrest at the other end. The hole should be drilled half way through and then the piece with its cradle should be reversed in the lathe and the hole drilled from the other end. In this manner the axes of the two half holes will meet exactly but the holes themselves may be of somewhat different diameters where they meet. This is not objectionable if the hole has to be reamed out later on.

The reason why a straight axis of the hole is obtained when both work and drill revolve will be taken up more in detail under boring tools.

One precaution which should be taken when deep holes must be drilled with a twist drill is to make sure that the two lips of the drill cut equally. This may be done in the following manner: The drill should be held in the socket which can be centered on the spindle in the lathe. A small bar of soft metal should be held in the

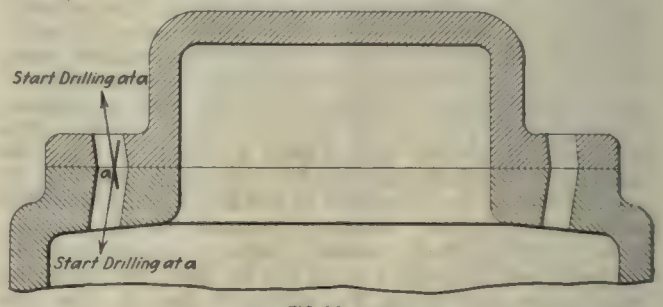


FIG. 66. DRILLED HOLES IN MATING PARTS

toolpost of the lathe, and should be placed in such relation to the drill that a small chip is taken by one lip of the drill when the drill is turned through half a revolution. If the other lip of the drill is correct or if it is too short the second lip will take no chip if the drill is turned through another half revolution, but if the second lip is too long it would take a chip. If we find that no chip is taken we know that the lip is either correct or too short as compared with the first lip. To find out which of these two is the case we advance the toolpost a very small amount, say 0.001 in., enough to let the second lip take a small chip. We now turn the drill through another half revolution and if the first lip takes no chip the drill is correct because we have already found that the second lip is not longer than the first one, and now we find that the first lip is not longer than the second one. When the two lips of the drill cut evenly and are ground to the same angles there will be very little tendency for the drill to deflect.

A coolant is often used to assist in drilling. A later chapter deals with the general features of the using of coolant but in drilling operations the coolant has often a function to perform of an entirely different nature. Although as a rule coolants are commonly used under low pressure, drilling operations often require the coolant to be used under heavy pressure. As was mentioned before there is danger in automatic machines of the chip wrapping itself so tightly around the drill as to cause trouble, and therefore the drills are often modified in shape for the purpose of breaking up the chip, but even then the finely broken-up chips are apt to remain in the

*For the author's forthcoming book. All rights reserved.

grooves of the drills unless some means is provided to eject them. This ejecting of the fine chips is generally done by means of the coolant, whether this be oil, water, or some cutting compound. In some shops where considerable deep hole drilling has to be done, one will find permanent installations of hydraulic pumps, piping, drain tanks or cellars and filters. In other shops, for instance in rifle shops, the deep hole drilling machines are provided with their own little hydraulic installations consisting of a geared pump capable of delivering oil at a high pressure and the necessary piping, etc. We are not concerned here with these installations but rather with the means by which the fluid can be brought to the point of the drill. In some cases grooves are milled on the outside of the drill body and small copper pipes are laid in these grooves and fastened by means of soldering or some other method. Sometimes these pipes terminate below the shank and are provided with unions to connect them to the flexible pipe line. In other cases the holes terminate at the end of the drill shank so that the oil can be brought to the drill through the spindle or chuck holding it. These methods are quite satisfactory for relatively small holes when the chip is properly broken

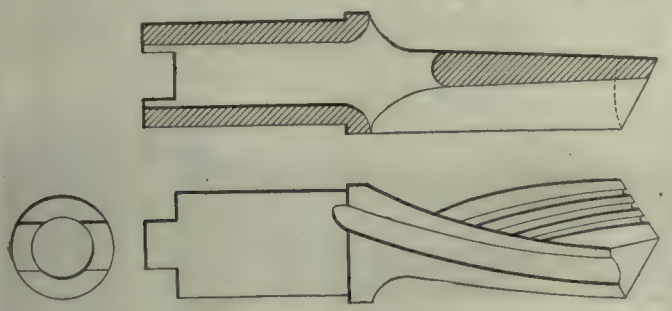


FIG. 67. AN OIL DRILL

up into small pieces and when it is not objectionable to have the oil and chips flow out through the grooves of the drill. Drills of this kind are quite frequently used in automatic machinery such as screw machines or on chucking lathes. However, they do not lend themselves to very high pressures or to large amounts of liquid. Where very deep holes have to be drilled it is better to use the oil drill shown in Fig. 67. This drill has a hollow shank and the grooves of the drill terminate in this shank. The oil is introduced around that portion of the outside of the drill which is milled to a smaller diameter than the land permitting a large volume of oil to flow toward the point. The chips are forced by the oil through the groove and into the center of the shank. The drill itself is connected to a hollow bar which is held in a device—a carriage or moving tailstock of a lathe—so that the oil and chips can flow out through the rear end of the bar. When the chips are formed they will gradually crowd into the grooves of the drill and finally choke up the openings leading to the pipe, or if they are already in the pipe they will collect there and choke the pipe itself. However, the oil is forced in under a sufficient pressure to eject these balls of chips. When drilling of this nature is done there is a continuous flow of oil coming out of the rear end of the pipe but without any chips, then suddenly a large mass of chips will be ejected and the flow will be free once more.

All that has been said about the construction and grinding of twist drills can also be said about the straight fluted drills, the only difference being that the flutes are not made in a spiral but in an axial direction. As a result straight fluted drills have no rake and are therefore particularly adapted for work in softer metals. A twist drill taking a fairly heavy chip is liable to pull itself into the work as it may be harder work to bend the chip than to penetrate further into the metal. If this happens the drill is apt to penetrate so far into the work that it will be twisted off. Of course this may be overcome by a special grinding of the twist drill so as to reduce the rake, but where a great deal of drilling in soft bross or copper or similar materials has to be done it is better to use a straight fluted drill. Special grinding of the lips of a twist drill must be done by hand, and as a result there is much danger that one lip would extend beyond the other which would cause it to take a much heavier chip. Straight fluted drills on the other hand can be properly ground by machine. It should be remarked, however, that a straight fluted drill requires much more power to remove the same amount of metal than a twist drill so that there is more danger of breaking. Large establishments which have to do much drilling in the softer metals should provide themselves with twist drills of greater lead. In that way they will have the advantage of as much rake as it is possible to use and consequently there will be much less danger of breakage of drills.

The requirements of gun barrel drilling are in a class by themselves. The barrel to be drilled has a length many times the diameter; very little metal is left for finishing on the outside, and the subsequent operations will remove very little metal from the bore, so that the hole must be practically correct after the first operation, drilling. It is not possible to drill from both ends because the two half holes would probably be out of line much more than the amount of finish left for reaming, so that it will be necessary to drill the entire length of the barrel in one setting.

The barrel is rotated and the drill held stationary. The drill is cylindrical in shape with a groove which removes about one-third of the metal of the cylinder. An oil tube in the drill body brings lubricant to the point and the chips are removed through the groove. The one lip goes to the center of the hole and terminates at a sharp angle, so that very little crushing of metal needs to be done. Therefore the pressure against the drill will be small. A very fine feed, only a fraction of one thousandth of an inch per revolution is taken, which still further reduces the pressure against the drill and its consequent tendency to deflect. Under those conditions the drill is guided in the hole by the fact that the body of the drill is the same diameter as the hole, in other words there is no clearance between the body of the drill and the hole.

The one lip drill serves its purpose of drilling small holes in long work very well but would be unproductive for ordinary drilling operations.

As one of the chief difficulties in deep hole drilling is the removal of chips, the most logical way to overcome it would be to have the work suspended from a vertical spindle so that the chips *fall* out. In machines of this kind the work revolves, the drill is stationary and either the drill or the work feeds. The first machines of this kind built were intended for very small work and were, to the best of the writer's knowledge, brought out by the Pratt & Whitney Co., but their manufacture has been discontinued. Recently drills of this type of much larger size have been brought out as a result of the requirements of the late war.

Some Sheet Metal Body Work

Operations Involved in Making Metal Bodies for Ford Cars — Blanking, Forming and Finishing the Sheets

SPECIAL CORRESPONDENCE

THE making of sheet-metal bodies for automobiles involves the use of large presses, not so much on account of the heavy nature of the work as of the large sizes of sheets which are necessary in the production of certain parts. In making the cowl for a Ford car, the sheet is first trimmed to the shape shown in Fig. 1; these sheets then go into the large press shown in Fig. 2, the sheet being firmly clasped between the plunger *A* and a corresponding member in the upper part of the die. These members hold the sheet firmly while it is carried down into the forming die and, before it assumes its final form, the friction ridges *B* and *C* come in contact with the outer edges of the sheet.

The sheet as it comes from the dies, is shown in Fig. 3, the central portion being largely cut away as well as the outer edges being trimmed in later operations. It will be noted that there are two depressions, *A* and *B*, made by punches in the central plunger, which help to hold the sheet firmly against all side motion during the forming operation.

The forming of the back sheet of the Ford coupelet is shown in Fig. 4, the sheet having been previously punched for the rear window. The window opening fits over the block shown in the center and the descent of the ram forms the sheet as shown in Fig. 5. This operation as will be seen, folds in the edge around the window at the back and also forms a stiffening bead along the front edge. In both Figs. 4 and 5, it will be noted that hooks are provided on the upper member and pins on the lower member, so that both parts can be held together when it is desired to do so.

A good idea of the way in which various sheets are finished is shown in Fig. 6. The sheets forming the back of the body are laid over the form shown, and any slight irregularities in the surface, such as produced by the tendency of the sheet to wrinkle, are taken out by the use of what is sometimes known as a milling file. In other words, a file with circular cut teeth instead of points as in the common file. It only requires the removal of a small amount of metal to take out most of the imperfections and by the aid of abrasive cloth on properly shaped, wooden blocks, the surface is easily restored to a good finish.

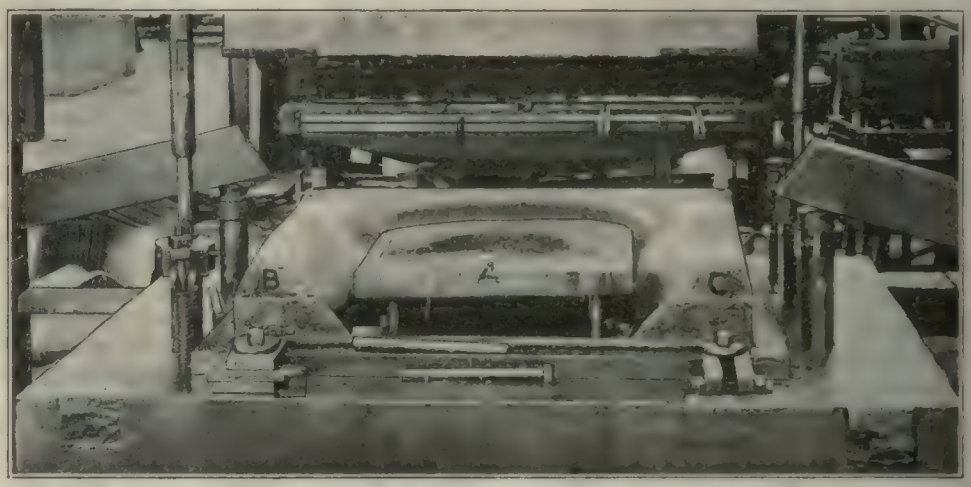


FIG. 2. THE COWL FORMING DIE

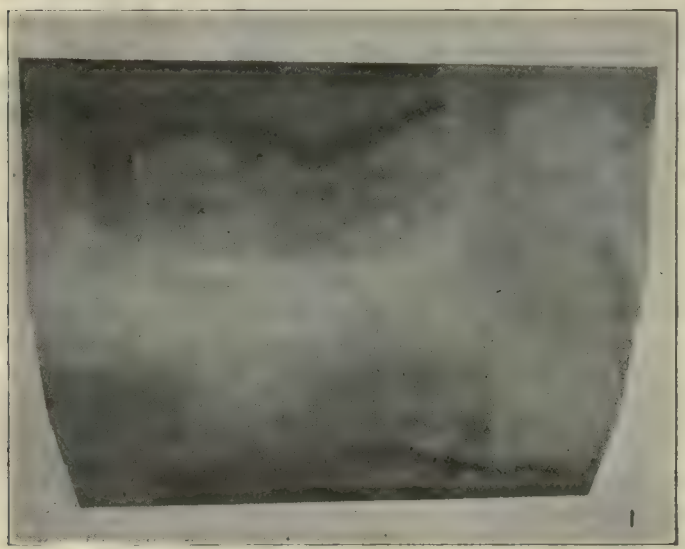


FIG. 1. BLANK FOR A FORD COWL



FIG. 3. A COWL AS IT COMES FROM THE DIE

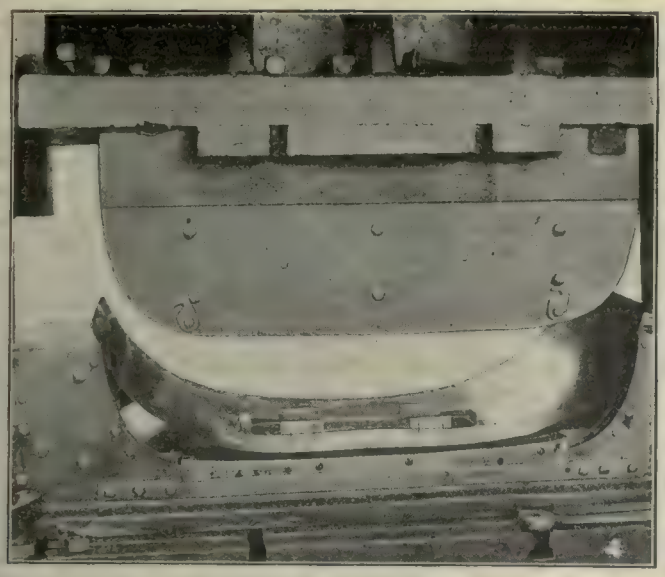


FIG. 4. FORMING THE COUPELET BACK

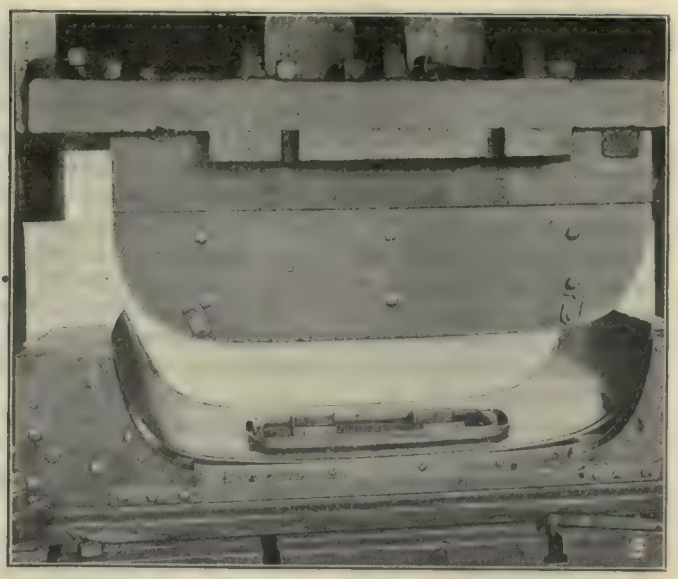


FIG. 5. AFTER THE FORMING OPERATION



FIG. 6. WHERE THE PARTS ARE FINISHED READY FOR PAINTING

This view also shows at the left how the finished cowls are handled; the fender-sides or wings, are treated in the same manner. Previous to this, the bumping hammer has been used where necessary, as shown in a previous article in connection with the making of fenders. This work depends largely upon the skill of the individual operator and men become very proficient in producing body parts with remarkably smooth surfaces so as to be readily finished in the usual manner.

Movie Records of Machinery

By Lyne S. Metcalfe

In no industry have the new moving picture processes been so valuable as in the machinery and tool industry. These new processes consist of the animated technical drawing, the phantom drawing, the slow motion process of cinematography, the microscopic attachment to the movie camera, films in natural colors, and the new X-ray process.

It is in the animated technical drawings that machinists find the greatest utility, since they will reveal the ordinary unseen parts of intricate machinery in cross section and in motion. In the instruction of workmen, the animated drawings are doing much toward the saving of time and the maintenance of efficiency. A leading manufacturer of electrical machinery has just finished production on eight reels of technical drawings to be used in the instruction of workmen and salesmen. The Burroughs Adding Machine Co. has just completed a picture showing the inside workings of the calculator which may be run off in fifteen minutes time.

It is possible to project on the screen a moving picture of a machine complete, followed by sectional views of its parts. This gives the audience a clear idea of the relationship of the part to the whole, at which point a phantom drawing appears. All but the part then slowly

fades out; this turns into a cross section drawing, revealing the interior workings in detail. Notes amplify the pictorial explanation, in connection with a pointer, calling attention to the important point. The part is then shown in motion and when fully explained the whole machine reappears on the screen and again fades out, leaving a second portion for similar visualization. Thus the entire unit may be pictured, step by step and in life-like motion, with the X-ray effect. At the end, it is possible to display a cross-section view of the whole machine at once, setting all parts in motion. The animated drawings also permit the picturization of electrical current passing over a given route, also water and air currents.

Pneumatic tools used in steel construction have lent themselves to animated drawing processes admirably. This was done for the benefit of the workmen who use them, as well as for the mechanics who make the parts.

It is possible to demonstrate complicated machinery by moving pictures for the benefit of prospective buyers, saving their time and making clear the meritorious points more effectively than can be done by word of mouth or by means of the printed page. Not long ago the twist drill was the subject of an interesting movie that was widely shown before machinists in the East.

Firms That Have Used "Movies"

One of the most valuable films ever produced in the tool industry was that circulated by the Henry Disston & Sons Co. of Philadelphia, which makes clear the manufacture of crucible steel, circular, band, cross cut and hand saws. This picture goes deeply into the process of saw manufacture under the most modern conditions. The scenes are not only of value to the mechanic, but also to the saw user.

The Russell Jennings Manufacturing Co., of Chester, Conn., has an interesting useful moving picture subject showing the manufacture of auger bits. The Sprague Canning Machinery Co., of Chicago, has filmed its canning machinery in action in a picture entitled, "Pea Canning in Wisconsin," and the United Shoe Machinery Co. has utilized the screen in three instances, having produced films which demonstrate the most intricate units in motion.

The larger toolmakers and special machinery builders are giving careful consideration to the possibilities of extending the use of the moving picture into the field of demonstration.

It is possible to "animate" drawings for new models in a manner that will give experts a more rapid understanding of the end it is sought to accomplish. Such drawings permit the showing of advance plans to prospective stockholders who perhaps could not easily grasp the ideas of the inventor in any other way. By using the moving picture, a number of investors might be assembled in one room at one sitting and witness a complete movie illustration of a piece of machinery, even before the model itself is made.

This was done in the case of an Eastern inventor who devised a new method of salvaging sunken ships in the Atlantic. He wished to get funds with which to build his boat and its necessary equipment; the idea was extremely complicated as it involved problems of marine engineering which the average man could not possibly grasp. Mere paper plans meant nothing and it was impossible to take the stockholders under the sea and show them how the idea might be expected to work out in practice. So he had made a full reel picture, showing in animated drawings the detailed operation of the boat and its equipment, with the result that in fifteen minutes every man in the room knew precisely what he was driving at and willingly made investment.

In most machine shops, each workman is called upon to perform only one function which goes to making complete a machinery unit. He seldom knows much about the complete machine itself or how it works and often does not know exactly what the man in the next aisle is doing. Foremen are coming to realize that every mechanic should have at least a general idea of the shop's product and what it does for the buyer. To this end, moving pictures are being used widely, shows being given at the noon hour, and all shop men given a chance to see them. The mechanic thus gets a broader idea of the machine he helps to produce and is more in sympathy with the labors of his neighbors.

One of the most interesting uses to which the movie screen has been put in connection with machine shop work was a production put on for the National Cash Register Co., entitled "Waste Can't Win." A large part of this picture was devoted to a moving picture "record" of the costly waste in machine tools, machines and raw materials in the big plant at Dayton. Several bushels of costly machine parts, tossed out of the window at stray dogs and cats by idle mechanics, were shown on the screen; the failure of employees to salvage waste metal and the wholesale misuse of costly tool parts, together with picture examples of the gross mistreatment of delicate machinery, was brought out clearly on the illuminated screen, in order that every employee might see himself as the foreman sees him—sooner or later.

Also in this production are pictured the results of careless machine assembly, what it costs in time, money and reputation for a careless assembly job to go through to the customer and that it must be shipped back over a slow and costly route to a high-priced assembler to be reassembled. The larger part of the NCR employees are skilled mechanics and though a good many thousands of dollars were spent on this picture, it was said after its first showing that it had paid for itself. The picture was by Jam Handy, who has found twenty-six different uses for films in business and industry and who has written similar productions for large American business organizations.

In teaching the use of costly tools—tools which require great skill to use—the moving picture undoubtedly will render the mechanic a great service. Besides teaching better, the picture teaches more quickly. Seventy per cent of the time ordinarily required was saved in teaching American soldiers by means of animated drawings of the Browning machine gun and the Springfield rifle in 1917, according to an official statement made by War Department officials who directed their use.

"Movie" Catalogs

These movie records of machinery and tools may be edited more easily, from year to year, or, from month to month, than can a catalog. The master drawings are retained and may be filmed over, as models change, with very little extra cost. Film is practically nonperishable since reprints can be made of negatives every decade and, if kept waxed, the originals will last a generation. For that reason, the bigger concerns are producing all of their pictures with a definite plan in mind, that of maintaining a permanent moving picture record of the development of their units from year to year.

What's So and What Isn't About Patents and Inventions

By EMANUEL SCHEYER

IT WAS in the summer of 1919, in the year following the signing of the armistice that I met a man who before the war had been a machinist. During the war he and some fellow machinists chipped in together and started a machine shop. They filled the technical requirements of one of the large government departments and obtained contracts which made them considerable money. He told me of some of his plans for investing his newly acquired riches, which included backing one of the men who formerly worked in his shop. This man had his head full of inventions and my acquaintance was seeing him through on some of them. One in particular he was enthusiastic about and it seemed good to me, despite the half-inch of callous I have acquired toward such things. And I still believe it is good, but not as a patent proposition, a distinction which will be clearer shortly.



HIS ROSY DREAM OF MILLIONS WITH ITS ACCOMPANIMENT OF LIMOUSINES AND SHADED LAWNS WAS FLICKERING

The invention was for a photographic means of making medallions, busts or statuettes. Instead of having made an ordinary photograph of your baby or wife it would be possible to have a bust made in stone or metal, any size being possible, or if you preferred, in the form of a cameo to wear on a ring. The reproduction would be as exact as a photograph and not very much more expensive. My friend had already spent considerable money in experiments and the construction of apparatus, besides paying the inventor a weekly salary and there was still much more work to be done. I annoyed him somewhat by asking the question, "But how do you know it is new?"

"I know it is," he answered. "I never heard of it before. Did you?"

"No," I replied. "But that doesn't prove anything. You have the whole world against you and have had for countless years; besides, while I am ready to confess that I am a very bright fellow, I don't know about anything that was done in the past. What I do know, though, is a pretty good way of finding out. Now I suppose you know that if this invention were known or patented by others or even described in any printed publication before you cannot obtain a valid patent. In such a case all this money you are spending will be for the benefit of the public at large, because anyone will be permitted to copy and compete with you. While this would be very philanthropical of you I don't believe you had it in mind when you started."

His rosy dream of millions with its accompaniment of limousines and shaded lawns was flickering a bit as he asked, "Well, what would you do about it?"

"The first thing I would do if I were you," I replied, "would be to have the patent records searched to see if it has been patented. If it should turn out that it has not it would be a good indication that the thing is new and you would be reasonably safe in proceeding further."

In due time I made a search for him and found that the same thing had been invented by a German who took out a British patent for it twenty-one years ago. Our more recent inventor, who had been perfectly honest about the whole business (he really had worked out the process himself) was sick for a week when he heard the news. Here was this man, spending much real thought and ability to say nothing of other people's money, when a small fraction of this money and effort spent in investigation would have saved everything. As a patent monopoly the invention now fell flat. It remained to look at its hopes as an open competitive business. If its backers thought they could develop special technique and produce it cheaper or better than competitors they had something equally as good as a patent. Finally if it looked as if there would be a big enough demand for the product, even if they could not best their competitors, there would be enough for all in the general scramble for business, it being remembered that the big bulk of all business not subject to a financial monopoly is done in just this way.

What has been said is perfectly general, the same line of reasoning being applicable to any invention and patent. Notice I use the words invention and patent as if they mean different things. Well, they do. The subject of patents and inventions can be com-

pared to a real estate proposition. In this comparison the invention corresponds to the house and the patent to the deed to the house. The first thing one would do before purchasing a house would be to ascertain the value of the house by having an appraisal made. Just so one should proceed with the purchase of an invention. Find out its commercial value. After one knows the value of a house and a satisfactory price has been agreed upon the next step is to have the title searched. The money is paid over upon proof that the title is clear, that is, after one has found out that when he pays his money, he is really going to own the house and nobody can bob up at some future time and claim that house.

In the case of the medallion invention already described, the search showed that it would be impossible to get a good patent for it, in other words, the deed would be defective and no matter how valuable the invention (or house) upon payment of the purchase money one would not own it.

It often happens, however, that one is asked to invest in an invention that has already been patented. It is perfectly possible to be granted a patent for a valuable invention and still have an absolutely worthless patent. In the language of our real estate analogy the deed does not cover the property, it may be for only one small and unimportant corner of it. Therefore, it is just as important to have an investigation made after a patent has been granted as before. This is especially so for a patent in a much overworked field, say the automobile field.

A Narrow Escape

A friend of mine had a narrow escape in connection with a spring wheel patent for automobiles. There have been hundreds of patents granted for spring wheels. Of course this was not known to him. As is well known, the ordinary pneumatic tire soon wears out and is subject to frequent punctures, so inventors have been trying for years to substitute a wheel that has a solid outer tire and to take up the shocks by various means in the interior of the wheel, such as by spokes, a wheel within a wheel with a pneumatic tire between them and spring hubs.

I was riding home in the subway one night when some one next to me popped up and said, "Why you're just the party I wanted to meet. A group of business men and myself intend to back up an inventor who has a great thing. There are ten of us and we are each going to put in $1,000 apiece. Of course that's only going to start the thing, because it really is a million-dollar proposition. Every automobile in the country can use it. It saves the tires. No more punctures. He has a wheel with a small leather tire about the hub. The spokes bang up against this hub tire which takes up all the shock. The rim of the wheel is in sections, one section to each spoke and each section is covered with a piece of solid rubber tire."

"Listen here, Dave," I said, "the woods are full of patents for inventions similar to that. Only the other day as I saw an automobile with resilient wheels driven down Broadway, and they were trying to sell stock from the car. Maybe your inventor has something different and better than all the rest, but the chances are against it for a good patent. Of course, it isn't fair to pass judgment offhand like this, but I'd go slow if I were you."

"Well, I'll tell you what I'd like to do," said Dave. "Next Saturday afternoon we are going to have a meeting of the people interested at a Mr. Sands' office. He's a jobber in leather goods at 7—0 Broadway. The inventor will be there, too, and if everything's all right we are going to put up the money. I want you to be there. At the beginning anyway you can pose as a friend of mine who is interested and might put up some money. Then if the thing doesn't look good to you, let loose. I get off the train soon, but before I go I want you to answer me one question. How is it that so many patents, as you said, can be issued all for the same invention? I thought if a man had a patent for an invention nobody else could have one."

Many Patents of the Same Invention

"Well you see," I said, "an invention is usually composed of a number of different parts all of which acting together make up the whole. Take for instance our wheel. There are the tire, the rim, the spokes and the hub, which fastened together make up the wheel. Now suppose you were the first man in the world who ever thought of a wheel and that you took out a patent for it. Your patent, if properly worded, would claim any round object that revolved on an axle. It would be what is known as a basic patent. Basic patents are the wheat among the chaff of patents and they are few and far between. Your patent would be so broad that it would stop anybody from using any kind of wheel, whether it was a solid disk wheel, a wire wheel, a wheel with wood spokes, a pneumatic-tired wheel or an iron-tired wheel. As soon as your invention became known to the world, people would be quick to see how good it was and begin to make improvements. Mr. Jones would invent the solid disk wheel and patent it; Mr. Smith would do likewise with a wire wheel, etc. The result would be hundreds of different patents for different kinds of wheels and for the different parts of a wheel. Your patent, covering all wheels, being good for seventeen years, all these other inventors in spite of the fact that they had patents would not be allowed to use their improvements without first paying you for your permission. As time went on and seventeen years passed, your patent would no longer be in force. Now everybody could make wheels in accordance with their patents. Hundreds and hundreds of patents would now be obtained, each differing from the other only in some small detail of the wheel and having a value equal only to the value of that detail over the others. The vast majority of all patents issued, no matter what the field, comes under this last-mentioned category. If the detail has value then so has its patent, but if the detail be unimportant, the patent is worthless because by substituting something else, the patent can be beaten."

Saturday afternoon came, and, in accordance with our appointment, I went to the meeting with Dave. Mr. Sands' office, where the meeting was to be held was on the fourth floor of a typical loft building on Broadway north of Canal St. The prospective investors were already in the room when we arrived. They were at the windows looking down at the heavy auto traffic.

"Just think of all those automobiles using our wheels," gleefully remarked Mr. Sands. "And each car would use four of them!"

The continued whir of traffic was music to their ears as they gathered about the table for further consid-

eration of their project. The report of a bursting tire from the street below threw them into an ecstasy of joy, and someone remarked, "Well that won't happen when our wheels get on the market, we have no tires on the outside to be punctured, ours are at the center around the hub where they are protected."

Near one end of the table sat the inventor. He was holding a small model of the wheel on the table before him and was pressing in the telescoping spokes as he explained how it worked. One glance was enough to show me that the thing would hammer itself to pieces in a short time under service conditions. It was hopeless.

A few specific objections on my part threw the inventor into a breathless torrent of words and abuse. He knew what he was talking about, so he said, because he had been in the garage and automobile business for years, and knew everything about a car. Besides what could an outsider know about such things? He knew all about the slipping and skidding of cars and where did I come in. His argument about being a practical automobile mechanic and therefore being in a position to know, made a good impression on his hearers and put me at a disadvantage. It was useless for me for the time being to follow this method of attack. By this time everyone knew my true capacity. I asked him if he had a copy of the patent with him. I read over the claims of the patent and as I expected they were worthless. The claims of a patent are practically its whole value. No matter what wonderful drawings and descriptions a patent may have it is worthless with poor claims. The claims are those little numbered paragraphs at the end of a patent which tell how your patent differs from all the others. The claims of the automobile wheel had as their new feature a *polygonal*-shaped tire at the hub. So if some one made the wheel with a circular tire at the hub he could beat the patent. The inventor not knowing anything about claims thought he had a patent on an automobile wheel with a tire at the center while as a matter of fact he had a patent only on a wheel which must use a *polygonal* tire at the hub. Of course a round tire was just as good, if not better, hence the patent was worthless.



READ CHIEFLY BY YOUTHS AND AMATEURS

Almost every thinking person at some time or other in his career has the invention bug. Some follow the matter through and obtain patents, while others are content to enthuse a little and dream about it and let it go at that. The amount of energy and money spent on patents is far greater than the public suspects. Every week over 700 patents are issued. In a year there are about 90,000 applications filed of which about 35,000 come to issue. Counting the time of all the people involved as well as the money spent in fees and experiments, $100,000,000 per annum is a conservative estimate of the country's expenditure. And over 90 per cent of it is wasted!

Some idea of the extent of the heartbreaks involved in this loss can be obtained from the answers to an advertisement inserted in a Sunday addition under the "Business Opportunities" columns of one of the big New York newspapers. The advertisement which was inserted in good faith by a client looking for something to manufacture read as follows:

"Retired business man will finance and develop meritorious patent or idea. Address Z144 Annex."

For ten days the newspaper kept forwarding him replies. One answer was from a tailor on his tailor-shop letterhead about a detachable rim and expanding wheel for automobiles; another from a clerk in the foreign teller's department of a big Wall St. bank in regard to a new tire. It is safe to say that he did not have his mind on foreign exchange all during banking hours. A clever letter was received from a daughter who wrote that she was the administratrix and heir to her father's estate and that as he was an inventor rather than a business man, it consisted of little else than inventions. Then followed a list and description of them, all requiring capital for their development. A little thought showed the pathos behind this letter. He had wasted his life and to a certain extent hers, and left as a heritage her desire to perpetuate his forlorn hopes. And there were dozens of other inventions submitted, from a mayonnaise mixing machine by a delicatessen man to an aircraft scheme for long distance passenger and fast freight service by an ex-naval officer and a new kind of rotary steam engine by a college professor. Irrespective of their possible merit, some of them would require nothing short of a special government department to see them through.

There are published several weekly and monthly papers, profusely illustrated, which write about mechanics and science in popular and exaggerated style. These papers are read chiefly by youths and amateurs and whet the invention appetite to white heat. And in their advertising columns are to be found big display ads of certain patent attorneys who fairly run wild in this happy hunting ground of inventors. The result is that thousands of patents are procured for half-baked ideas doomed to failure. And strange as it may seem this phenomenon is not without its good results. It follows natural laws. Nature is prolific. Thousands of seeds are produced in order that a few may survive. These magazines spread scientific knowledge where it ordinarily would not reach and now and then the germ of a great idea is to be found in a half-baked invention. Most startlingly new ideas come from the rank outsiders anyway. Those entrenched in a particular field become cautious and conservative; they know the pitfalls, whereas an outsider is often the "fool who enters where angels fear to tread," and once in a while gets away with it.

It seems a pity that so much energy and money are wasted on inventions and patents when by the application of a few simple principles most of it could be saved. This would also result in giving inventions of true merit a better chance for a hearing, instead of overwhelming them by the general ill repute of the others. The tantalizing part of it all is that there remains a tremendous field for invention as most of the arts are still in their infancy.

Magnetic Chucks—II

BY ELLSWORTH SHELDON
Associate Editor, *American Machinist*

(Continued from last week.)

DURING the month of January, 1917, another name was added to the rapidly increasing roll of aspirants for distinction in this field. George G. Pragst, of Providence, R. I., obtained a patent which he immediately assigned to the D & W Fuse Co., upon a single-magnet chuck designed to take separate work-holding plates with any desired arrangement of pole-pieces to hold work of various sizes and shapes. Several such shapes are covered by the patent which is shown in Fig. 38; though but one is illustrated, as the principle involved is the same in all.

Incorporated in the specifications and claims is a new and ingenious method of sealing the chuck against water, and though the usual precautions are taken to make the work-holding plates proof against leakage by beading and staking the non-magnetic metal, it really doesn't matter whether they leak or not for the chuck body is supposed to be water tight with the plate off.

The chuck body is a shell of cast iron with a single hollow hub projecting up from the bottom but rising not quite so high as the side walls of the shell. This hollow hub is the core of the magnet and in the finished chuck is surrounded by the energizing coil.

A steel disk of a thickness equal to the difference between the height of the hub and the height of the side walls has a brass ring of a certain width forced on its periphery "preferably by hydraulic pressure." The outer diameter of the brass ring is made to fit the inner diameter of the shell, and when the brass bound disk is forced into the shell and further held by screws (having lead washers) to the hub; and a brass bushing forced into the central hole, there is no doubt but that the chuck should be water-tight whether there is an auxiliary work-holding plate on it or not.

With such a construction of the chuck body almost any arrangement of polepieces in the work-holding plate is permissible. All that is necessary is to see that the skeleton plate does not touch the steel disk and that the inserted polepieces do. To make this condition certain each skeleton plate or grid has a raised rib around its periphery to match the edge of the shell.

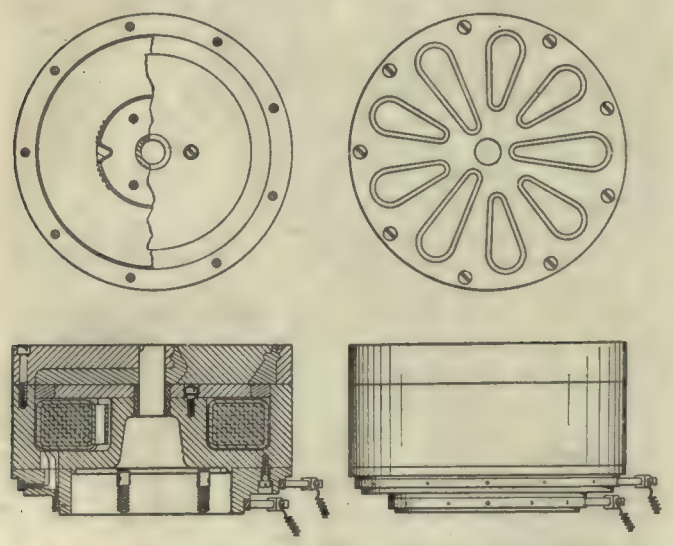


FIG. 38. A SINGLE MAGNET CHUCK BY GEORGE G. PRAGST

Fig. 39, a patent issued to O. S. Walker in April, 1917, should be carefully studied. It marks the completion of the cycle of evolution, if a cycle of evolution can be said to be complete. Though the chuck of 1873 was round and the chuck of 1917 square; though the former was the crudest conception of an electromagnet and the latter a development of years of experience; though the one was a toy and the other a practical tool; in principle the device is right back where it started from forty-four years before.

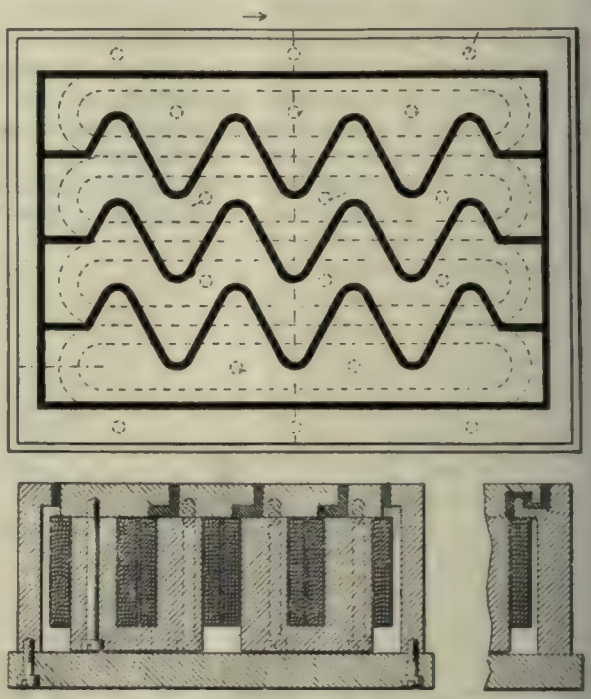


FIG. 39. A MODERN FORM OF INDEPENDENT MAGNET CHUCK

Now, as then, the top or work-holding surface is composed entirely of actively magnetic poles each with its individual coil. Now, as then, the magnet does not rely upon the casing which holds it, and the latter might as well be made of wood or brass; or, as a year or two later it was to be, of aluminum; so far as its effect upon the work-holding capacity of the chuck is concerned. The "independent-magnet" chuck is again back on the job.

The chuck shown by the patent drawings has but two pairs of magnets the cores and polepieces of which are disposed parallel to the longer dimension of the body, but this is only to illustrate the principle. It is obvious that the shorter dimension could easily become the longer one by extending the shell in that direction and putting in more magnets.

As in this form of chuck both cores and polepieces can easily be forged, thereby allowing the use for these parts of material of a much higher magnetic permeability, there is no longer need for or advantage in casting them. The shell is still of cast iron, but this shell has become merely a box in which to assemble the parts. It could be made of wood except for the requirements of accuracy and mechanical strength.

The cores and polepieces of this chuck are specified to be made of Swedish iron; the polepieces to be shaped at the ends as shown in the sectional elevation to form an interlocking joint with the shell that, when the soft metal is poured, will unite the whole in a rigid water-tight structure. For convenience in assembling, the shell is cast as a rectangular frame, open at the bottom, and this opening closed by a flat plate after the U-shaped magnet cores, with their coils in place, have been attached to the polepieces of the magnet by means of long fillister head screws.

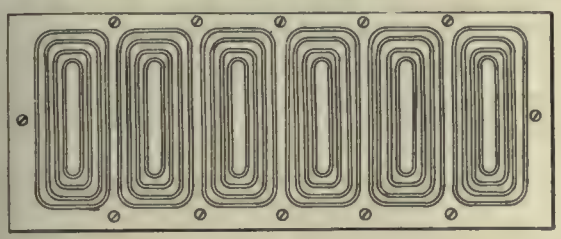


FIG. 41

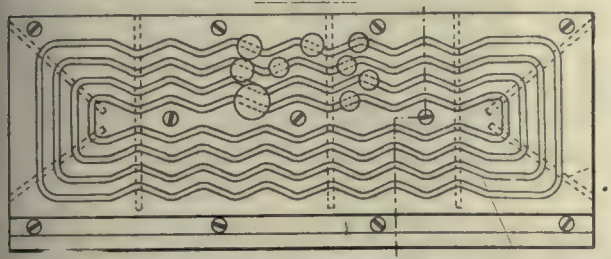




FIG. 42



FIG. 40

FIGS. 40 AND 41—TWO FORMS OF SINGLE MAGNET CHUCKS BY DOWNES & PATTON. FIG. 42—THE DOWNES & PATTON IDEA APPLIED TO ROTARY CHUCKS

The serrated edges of the polepieces are for the purpose of securing a wider distribution of holding power, and are, of course, so formed on their under surfaces that they do not make magnetic contact with more than one core.

Downes and Pattons Chucks

In July, 1917, Louis W. Downes and Ralph Clifton Patton, both of Providence, were granted a patent, which they immediately assigned to the D & W Fuse Co., upon still another form of single magnet chuck; the variation between this and preceding patents held by the same company being principally one of construction.

The shell is a box of cast iron, either rectangular or circular as the case may be, with a central hub or core of wrought iron cast in place. Two forms of construction are covered in the claim; one with a single large core and coil, the other with a number of smaller cores each with its own coil. There is no difference in principle; both are single-magnet chucks, but the arrangement of polepieces presents a markedly different appearance. One is shown in Fig. 40; one in Fig. 41, while in Fig. 42 may be seen the same arrangement adapted to a rotary chuck.

Only the outer frame of either form of top-plate is in contact with the shell of the chuck, only the inner section is in contact with the central core; consequently only these two parts are actively magnetic. The intermediary rings are left "in the air" as it were and are magnetic by induction. Such a chuck would, apparently, hold quite well if fully loaded with small pieces, and not at all well if only partly loaded.

An ingenious method of constructing the top plate is devised. If these plates with their multiplicity of sinuous frames had to be assembled it would be a discouraging job, but by simply casting each plate complete as a thick plate with deep grooves cored in it, pouring the grooves full of soft metal and staking it in, and then planing off the web from the side that had rendered the original casting continuous, the top plate is completely assembled without ever having been apart.

On the same day, July 10, 1917, that the Downes and Patton patent was issued, Mr. Griffith of Worcester took out his second patent for the Heald Co. This patent does not involve a new form of chuck but is rather to cover a detail of construction.

The original Griffith's chuck was a multiple-magnet chuck with the magnet cores cast integral with the body. The new construction would cast the shell the other side up with elongated holes in the bottom and thus the bottom of the shell as cast becomes the work-holding surface. The cores and polepieces are forged from "magnet steel" (each core and polepiece being a single forging) and are set in the holes in the bottom of the shell and babbitted to place. The upper ends are then faced off and, after the coils are set and the connections made, a flat cover put over the whole, being fastened by screws to the rim of the shell and to each core. The new chuck differed little in appearance and not at all in principle from the previous one by the same inventor.

The Independent Magnet Chuck Again

Frank L. Simmons of Millbury, Mass., has not heretofore appeared as a patentee of magnetic chucks, but that does not signify that he is a new-comer to the field. For many years Mr. Simmons had been working and experimenting along this line, and his application for the patent issued Jan. 29, 1918, had been filed nearly four years previously.

Mr. Simmins' chuck is shown in the drawing Fig. 43, and though quite different in construction from the device as now manufactured by the Taft-Pierce Co. of Woonsocket, R. I., is the same in principle and, except for size, differs little in appearance.

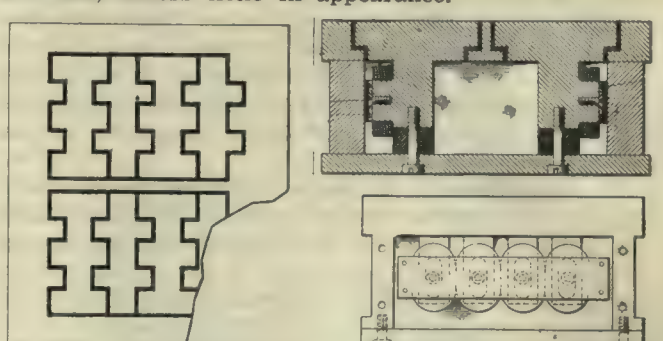


FIG. 43. THE SIMMONS "INDEPENDENT" MAGNET CHUCK

In the drawing each polepiece is shown as integral with its core, and a number of such units, with the coils in place would be connected together at each side by a steel strip which constituted the back-bar of that group of magnets. In present day construction each unit consists of four or six cores of cast steel, cast integral with their back-bar. The polepieces are separate and are machined from drop forgings.

From the nature of the independent magnet chuck it is evident that the shell has nothing to do with its holding power; it is simply a mechanical structure the sole duty of which is to hold the magnets in place.

In this original Simmons chuck the top is of cast iron, and similar in section to a channel bar. The two upturned edges of the channel form the sides of the chuck body while the ends and the bottom of the body are separate pieces held by fillister head screws. Two rectangular openings in the web of the cast-iron channel bar leave this piece but a sort of double frame in which to set the magnets and the openings in the frame are rabbetted to leave a shoulder to support the latter in position.



FIG. 44. THE ARTER SINGLE MAGNET ROTARY CHUCK

The edges of the polepieces are serrated as shown in the drawing to break up the work-holding surface into small areas of opposed polarity thus providing for the holding of small pieces.

Mr. Simmons in this design evidently seeks to encompass the feature of accessibility that some years before had seemed good to an earlier patentee. The coils being mounted upon lateral projections of the magnet cores immediately back of the removable end pieces (which become the side pieces when the in-this-case shorter dimension is extended to make a larger chuck) enables a repair man by the removal of a few screws to get at them for rewinding or replacement purposes without disturbing the permanent structure of the chuck.

If water-tightness is sought, these removable covers may be set on rubber gaskets without interfering with the accuracy or efficiency of the chuck, whereas gaskets of any kind in any horizontally disposed joint would seriously impair the accuracy of the chuck, while a rubber gasket in such position would be impossible.

The construction, however, has, like all other attempts to make the interior of the chuck accessible, been discontinued in favor of the "iron-clad" idea, wherein the endeavor has been to make repair and replacement unnecessary instead of easy.

Another Advocate of Single Magnet Idea

William Arter of Worcester, Mass., is a member of the firm of Persons-Arter of the same city, builders of

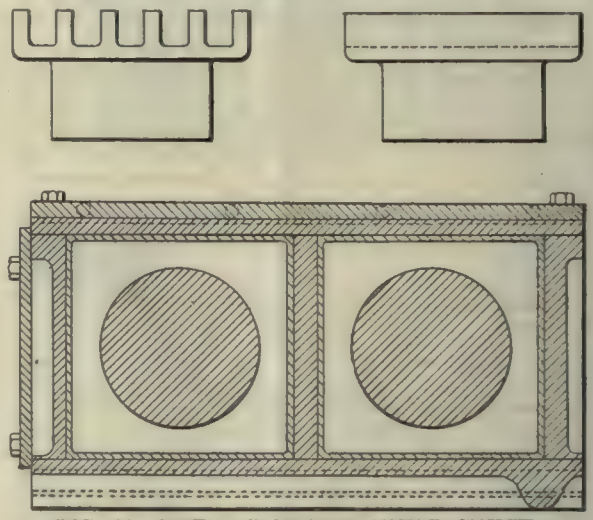


FIG. 45. DETAILS OF THE ARTER CHUCK. RECTANGULAR FORM

grinding machinery. Mr. Arter, coming in violent contact with the limitations of the magnetic chuck as it is applied to rotary grinding machines, sought to build for his machines a better chuck than he could buy on the market. Whether or not he succeeded is not for us to decide; we can only record the mechanical and magnetic details of his solution.

The patent granted Jan. 14, 1919, to Mr. Arter covers a single-magnet chuck of somewhat different construction than previously patented chucks of its type. The rotary chuck shown in Fig. 44, combines (as has been once done before) two different constructions in one chuck. The patentable feature is in the method of constructing the core and pole-pieces. The two parts are formed by a single steel casting as shown in Fig. 45, which illustrates the chuck in its rectangular form. Any number of these cores may be used to form a chuck of

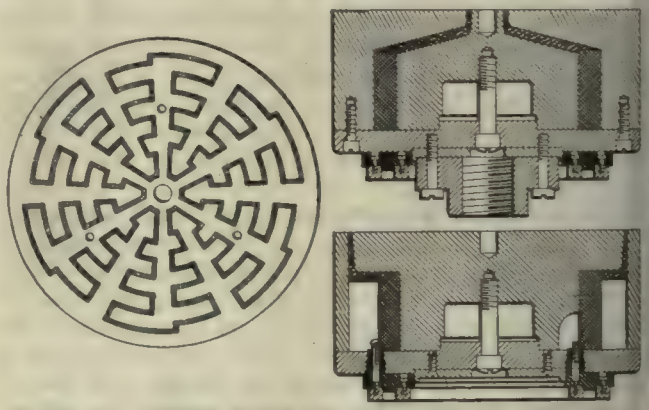


FIG. 46. OTHER FORM OF ARTER CONSTRUCTION

whatever size desired; all the coils being wound one way and all the projecting poles being of the same polarity.

The opposed poles are provided by the bars of the grid which forms the main portion of the top-plate, and the magnetic currents are conveyed from the lower ends of the cores to these bars by means of the side walls as in all forms of single magnet chucks.

In the central portion of the rotary chuck, Fig. 44, a new shape of polepiece will be noted. This shape is the subject of a separate patent granted to Mr. Arter on Aug. 5, 1919, illustrated in Figs. 46 and 47.

Insulating the Chuck from the Machine

A feature claimed in the Arter patents which had not previously been put forward relates to the insulation, magnetically, of the chuck from the table or spindle of the machine to which it is attached. On the rotary chuck this is accomplished by the interposition of a brass plate between the back of the chuck and the threaded collar which fits the spindle nose of the machine; bolting the two parts together with brass bolts. On the rectangular chuck "feet" of bronze, held to the chuck body by brass screws, are provided.

The insulation, while not entirely preventing the trouble if there is strong leakage, tends to discourage the passage of stray lines of force through the machine and its tools on the way from one pole to the other of the cores.

Such leakage is seldom serious so far as loss of holding power is concerned; the principal objectionable feature is the eventual magnetizing of cutters or other tools of hardened steel that may be used in conjunction with the job.

The Latest Walker Patent

Fig. 48 shows a new chuck by Mr. Walker, patented Feb. 3, 1920, which is a return in part to the independent magnet class. Though the drawing shows only the rotary chuck the patent claims, like practically all the others, cover the principle of construction as applied to chucks of any shape. In this chuck the magnet cores are arranged in a ring or in a straight line as the case may be and are of alternate polarity. The entire top surface inside the outer ring or frame of non-magnetic metal is made up of active polepieces so interlocked that no two adjacent sections are of the same polarity.

The segmental polepieces are all alike (as would be the parallel ones in a rectangular chuck) so that but

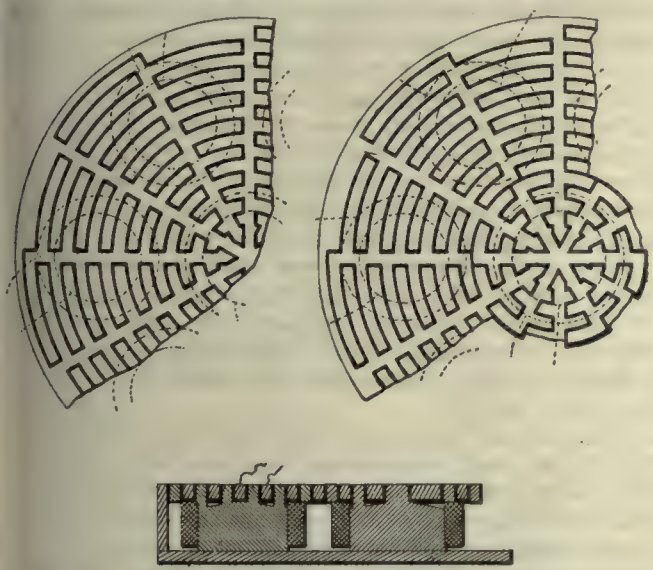


FIG. 47. ANOTHER FORM OF ARTER CONSTRUCTION

one pattern is needed to make up the entire surface; the shape lends itself to the drop-forging process, so that they may be made of the material best adapted to magnetic devices; and the interlocking feature allows adjacent segments to overlap without touching, thus securing the diffusion, so-to-speak, of magnetic flux that best adapts such chucks to the holding of small pieces. A single segment is shown at *A*; two segments interlocked at *B*; and a section of the joint at *C*.

Modification of the Multiple Magnet Chuck

The latest chuck patent up to the date of writing (June, 1920) was granted on May 11, 1920, to Leon W. Dunbar of Worcester, Mass. Mr. Dunbar's chuck is of

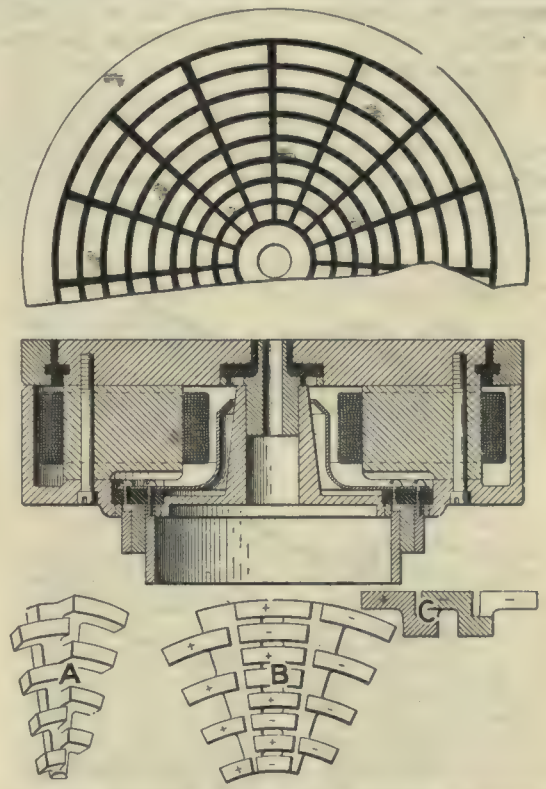


FIG. 48. MR. WALKER MAKES A ROTARY INDEPENDENT MAGNET CHUCK

the multiple magnet type, differing practically not at all in principle from foregoing chucks of the same type, but of a somewhat different construction. While the top plate is a grid, the bars, or dividers are very narrow and do not appear on the surface at all.

Magnetic Cores Are Each in Two Parts

The magnetic cores are each in two parts (not a pair) and are round. The magnetizing coils are also round, and it is claimed that by reason of each core being in two parts, each part provided with a separate coil, one or more coils may burn out or otherwise become inoperative without putting any part of the chuck out of business.

The polepieces are provided with flanges which project over the dividers of the grids so that there are no neutral spaces upon the surface of the chuck, and each pole rests upon two of the round cores. The coils of these two cores obviously must be similarly wound else a magnetic circuit would be provided within each polepiece and corresponding parts that would nullify any magnetic activity that it would otherwise display, but the two coils are parts of two different electric circuits.

The cores are cast integral with the bottom plate and there may be as many of them as may be desirable to make up the requisite length of chuck. The patent drawings are shown in Fig. 49.

The development of the magnetic chuck has by no means reached its final stage. Powerful as they now are in comparison with the earlier forms, the next few years will, without doubt, bring forth chucks much stronger in gripping power, much wider in range of adaptability, until some day the erstwhile ubiquitous bolt that is much too long or a little too short, and the strap that never has a hole in the right place or is just too thick to allow the tools to clear, will be relegated to their proper resting place on the scrap pile, and the workman will instantaneously clamp his work to lathe, planer, milling or grinding machine by the pressure of his thumb on a button.

The Alternating Current Chuck

There is no such thing as a magnetic chuck using alternating current. The makers of present day chucks are unanimous and positive in asserting that there

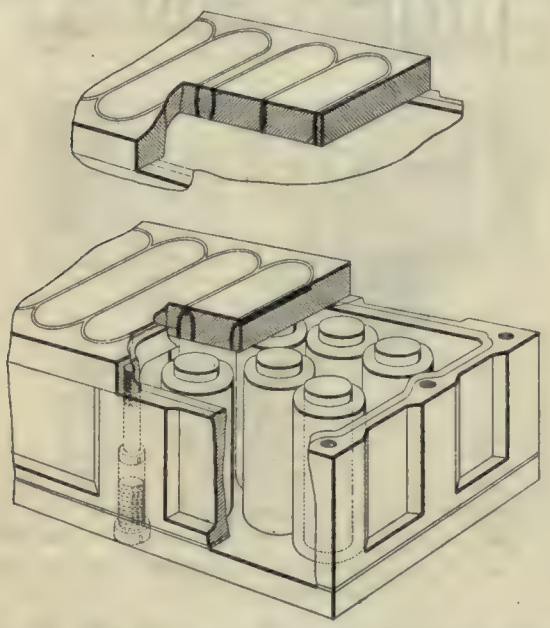


FIG. 49. THE DUNBAR MULTIPLE MAGNET CHUCK.
MAY 11, 1920

never will be; but not so many years ago makers of direct current electric machinery were equally positive that the alternating current could never be adapted to industrial power transmission, yet today it is almost impossible to get beyond ear-shot of the contented hum of the induction motor. An inventor (a successful one, too) once told me that the reason why inventors as a class were such erratic people was that "only a man who was such a fool as not to know that a thing couldn't be done had the nerve to go ahead and do it."

Some day some such chap is going to tackle the alternating current chuck proposition and get away with it.

Shop Methods of Construction

There has been prepared, or is in process of preparation, a series of articles dealing with actual shop methods employed by the various manufacturers of magnetic chucks, to be illustrated with photographs secured in the shops, showing the details of construction of each chuck now on the market. These articles will be followed by others giving a practical description of the way in which irregular shapes must be mounted upon the various chucks in order to obtain the maximum holding power.

Reminiscences of an Old-Time Machinist

By R. Thomas Huntington

Because of my proficiency in scraping and polishing, acquired during my eight months' experience at Baldwin's upon handrail parts for locomotives (of which kind of work I had become very tired), the first job handed me in my next place of employment was the scraping and polishing of a lot of change gears for lathes. This was in the shop of Bement & Dougherty, builders of heavy machine tools, located on Callowhill St. in Philadelphia.

The gears were what are called "web" gears; that is, they had no spokes, even in the largest diameters. The blanks had been bored and rough turned before coming to me and I had to scrape and polish both sides of the web and rim to a very smooth finish; so they would "wipe easily," the foreman told me.

The lathe on which the polishing was done was located in a dark corner of the shop so that I was obliged to light the gas (a welcome improvement over the old whale-oil lamps I had known) in order to see what I was doing; and this act brought about my first clash with the foreman, whom I considered to be the fussiest individual I had ever met. There was a stop cock in the gas supply pipe under the foreman's desk so that he could shut off the gas with his foot without the effort being apparent to anyone in the shop. One day while I was at work as usual on my polishing job, which, by the way was becoming decidedly monotonous, my gas light suddenly went out. After using up several matches in a vain endeavor to relight it I noticed that my immediate neighbors were surreptitiously laughing at me, whereupon I suspected the cause of my trouble and went over to Mr. Brown and told him I could not see to get the gears smooth (he had already censured me for leaving scratches in them) unless he turned on the gas.

He was quite indignant at my insinuation that he had purposely put out my light and angrily retorted that the gas was all right. I did not believe it and tried to explain how it had gone out and would not light, but he was insistent, so I finally went back to my lathe and found that the gas lighted readily when the match was applied. I have often wondered since whether I was right in my surmise or whether some joker on a nearby machine had blown air in the gas pipes.

Bement & Dougherty were at that time building a large boring mill for the Charlestown Navy Yard to turn bearing rings for the turrets of the monitors. The mill would swing 24 ft. in diameter and was built very much like a planer except that the table was round, and revolved, instead of moving back and forth like a planer table. The main shaft for this machine was 6 in. in diameter and was supported by four bearings, each over a foot long. The bearings were not bored out; instead, the shaft was levelled up in place and the boxes filled with babbitt.

This was my first experience in babbitting bearings. Before the shaft was swung into place plates of sheet iron, each having a hole to fit the shaft, were put on, so that when the shaft rested in the boxes there would be a sheet-iron plate on each side of each box. When the lining up and levelling was complete the plates were clamped to the respective boxes and the babbitt poured between them. After the metal had cooled the surfaces of the babbitt each side of the shaft were smoothed off, thin shims placed to separate the lower half of the box from the cap, the caps bolted to place and poured. When

cold the bearings were opened and scraped to a running fit for the shaft.

The work at Bement & Dougherty's was very heavy and as I was not a very husky lad I soon made up my mind to seek a job that was not quite so strenuous. This I quickly found was not so easy as at nearly every place they inquired where I had been working and upon being told would say that they did not want me; they wanted a man who was used to light work.

However, I eventually secured employment with the Lockwood Manufacturing Co., manufacturers of paper collars and cuffs. Not a promising place for a young machinist, you will say; but the mechanical interest was supplied by two brothers named Packer, who had patented and were building a machine for making envelopes; for which the Lockwood Co. had a government contract. This machine I helped to finish and put into successful operation, as well as four succeeding machines that not only cut, pasted and folded the envelopes but stacked them in packets of 25 each, put a paper band around each packet and put the packets in a box ready for shipment.

The superintendent of the Lockwood plant, one of the most efficient superintendents I ever saw, was a woman. She had all the details of the business well in hand and managed the several departments so well and so unobtrusively that there was never any friction or misunderstanding. She did not remain long after I went there, however; she resigned to get married, and her place was taken by a man, who, though professing to know it all, was far from being as capable as she.

This man was the cause of the brothers Packer closing up their machine shop at the Lockwood plant and moving elsewhere. It was nearly a year before they again became established and in the meantime I had to have a job, which I soon found at the plant of Samuel Merrick & Son, known at that time as the Southwark Foundry.

Here I was put to work on a large planer, planing the valve seats of some engines they were building for sugar refineries.

The Southwark Foundry had one very large pit planer; its capacity being, if I remember rightly, 10 or 12 ft. wide, 20 ft. deep, and 40 ft. long. The work to be done was lowered into the pit and shored up like a boat in drydock. The cross-rail moved over the work, travelling on ways located on each side of the pit and driven by two large screws. The cross-rail cleared the top of the work by six inches or so, and carried two saddles arranged in the customary manner, so that work could be planed down the sides a short distance at 90 deg. or at other angle. They also had a large boring mill, the table of which was even with the floor, the driving mechanism being in a bricked-up space beneath the floor. With this they could bore out a marine engine cylinder 60 in. in diameter to a depth, or length, of 6 feet.

Again finding the handling of heavy pieces telling upon me I sought employment where my labor would be lighter. I worked for a time in a shop doing general jobbing and repair work. Here one job that fell to my lot was to cut a keyway through the hub of a large gear. The bore was 6 in., the length of the hub 10 in., and the keyway 1 in. wide by ½ in. deep. In a modern shop, equipped with electric cranes and keyseating machines, this would be a simple job, but handling the job with block and fall and doing the work with hammer, cold-chisel and file, is quite another matter.

A machine for making bricks by the extrusion process, taking the clay in a hopper and extruding a section 2 x 4 in. in size and automatically cutting off every 8 in., was one of the products of this shop. Another was an automatic machine for folding paper as it came from the printing press. Both these machines are common enough now but were unusual and experimental at that time.

At another small shop, located in a cellar, when I stopped in to ask for a job, the proprietor was boring the cylinder of a small steam engine with a portable rig clamped to the cylinder by bolts in the stud-bolt holes. The whole job was mounted upon two wooden horses and the boring bar was turned by hand. The boss, who seemed glad to be relieved, gave me a job at once and turned the boring over to me to finish. The second job in this shop was the fitting of a setscrew to a pulley hub, the tapped hole in which was a sixteenth too small for it. The boss gave me a saw file and explained to me how to file around and around this screw with the three-cornered file until I had reduced it sufficiently to fit the tapped hole.

Right there I quit.

Know What You Are Doing and Why You Are Doing It

By Martin H. Ball

The following explanation is offered as a reason why John A. Grill was able to avoid chatter on the job, referred to on page 1196, Vol. 53, of the *American Machinist*, by using the cutting tool in an inverted position while running the lathe backward.

To produce chatter when a cutting tool is in operation there must be an unsteady movement of the work or the cutting tool. Frequently the cause of such trouble is due to a weakness in some of the various members or poorly fitting surfaces between two or more of the working parts which make up the equipment.

From Mr. Grill's description of this particular case it would seem that the trouble was most likely to have been on the work side of the equipment, because of the fact that trouble in the headstock of a lathe due to a poorly fitted or light spindle or any part of the driving device not being rigid becomes most prominent when the lathe is running in the forward or regular direction, as under these conditions the pressure of the cut lifts these moving parts from their seat, given them by the force of gravity, unless the cut being taken is so light that the weight of these parts is sufficient to hold down against the cut without material disturbance, which is not usually the case.

Running in this way is the most favorable condition for the cutting tool, and the various parts that make up its support, extending back to the foundation upon which the lathe rests, whereas running the lathe in the opposite or backward turning direction reverses all of the conditions which obtain in the above-mentioned actions.

While there are other factors that may enter into such a problem I thing it reasonable to assume that when running a lathe backward stops chatter that occurs when running forward the principal trouble is in the work, or work driving mechanism. And if it chattered when running backward and did not when running forward the trouble would usually be found in the cutting tool or its supporting or driving parts.

Solution of a Trigonometric Problem

By A. J. Pruszynski

Given: a, b, A, B, C. Required: x, Y, Fig. 1.

The lever L moves through a given angle A. A pin P mounted in this lever, operating in the slot of a bell crank M, moves it through a given angle B. Required to find the distance of the pin from the pivot of the lever and angle Y, which the lever makes with the horizontal.

Referring to the diagram, Fig. 2, let $OK = c$ and $OL = d$.

In the triangles ORM and ORN we have

$c = a \sin C - b$ and $d = a \sin (C - B) - b$

Let angle $OPK = E$ and angle $OP_1L = F$. Also let $B - A = G$.

$$Y = C - E;\ Y - A = C - B - F$$

or $$Y = C - B - F + A;$$

Substituting $C - E$ for Y and clearing

$$B - A = E - F = G \qquad (1)$$

In the triangles OPK and OP_1L, $OP = OP_1 = x$,

$$x = \frac{c}{\sin E} = \frac{d}{\sin F}$$

$$d \sin E = c \sin F \qquad (2)$$

From (1) we have $E - G = F$; substituting this value of F in (2),

$$d \sin E = c \sin (E - G) = c \sin E \cos G - c \cos E \sin G \qquad (3)$$

$$\sin E\ (c \cos G - d) = c \cos E \sin G \qquad (4)$$

Squaring both members of (4) we have

$$\sin^2 E\ (c \cos G - d)^2 = c^2 \cos^2 E \sin^2 G \qquad (5)$$

Substituting $1 - \sin^2 E$ for $\cos^2 E$ in (5) we have

$$\sin^2 E\ (c \cos G - d)^2 = c^2 \sin^2 G - c^2 \sin^2 G \sin^2 E, \qquad (6)$$

from which $$\sin^2 E\ [(c \cos G - d)^2 + c^2 \sin^2 G] = c^2 \sin^2 G, \qquad (7)$$

and $$\sin^2 E = \frac{c^2 \sin^2 G}{(c \cos G - d)^2 + c^2 \sin^2 G} \qquad (8)$$

Extracting square root,

$$\sin E = \frac{c \sin G}{\sqrt{(c \cos G - d)^2 + c^2 \sin^2 G}} \qquad (9)$$

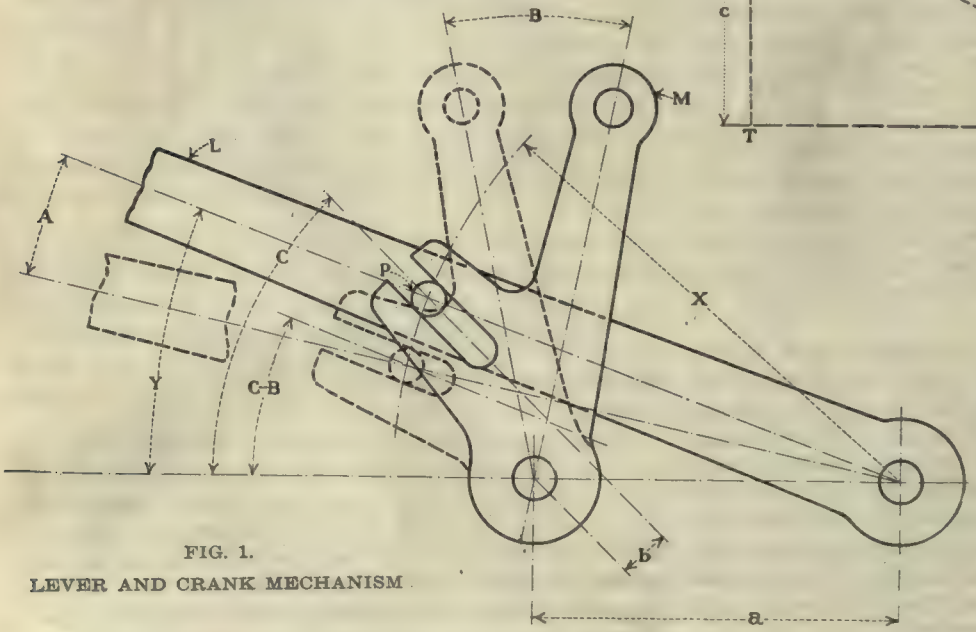


FIG. 1.
LEVER AND CRANK MECHANISM

Expanding denominator of the second member of (9), substituting $1 - \sin^2 G$ for $\cos^2 G$ and simplifying, equation (9) becomes

$$\sin E = \frac{c \sin G}{\sqrt{c^2 + d^2 - 2cd \cos G}} \qquad (10)$$

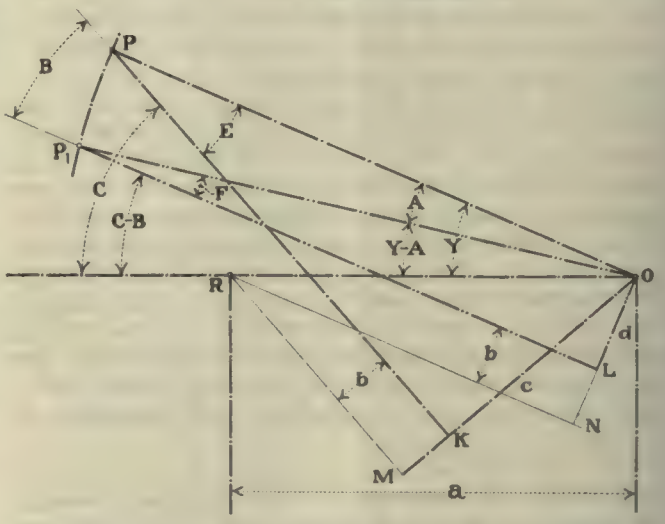


FIG. 2. DIAGRAM FOR DERIVATION OF FORMULAS FOR x AND Y

Substituting for angle G its value in known dimensions $(B - A)$,

$$\sin E = \frac{c \sin (B - A)}{\sqrt{c^2 + d^2 - 2cd \cos (B - A)}} \qquad (11)$$

$$x = \frac{c \sqrt{c^2 + d^2 - 2cd \cos (B - A)}}{\sin E \sin (B - A)} \qquad (12)$$

$$Y = C - E. \qquad (13)$$

Equations (12) and (13), while not expressed altogether in known values, are expressed in terms which represent combinations of known values and are therefore easily determined.

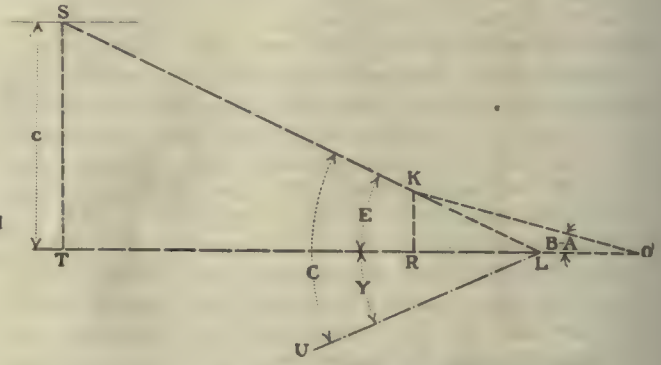


FIG. 3. DIAGRAM FOR GRAPHIC SOLUTION

The problem can also be solved graphically as follows: Referring to the diagram, Fig. 3, let $OK = c$, $OL = d$, and angle $KOL = B - A$.

In triangle OKR we have $KR = OK \sin KOL = c \sin (B - A)$.

In triangle OKL we have

$$KL = \sqrt{\overline{OK}^2 + \overline{OL}^2 - 2\,\overline{OK}\,\overline{OL}\cos KOL}$$
$$= \sqrt{c^2 + d^2 - 2cd\cos(B - A)}.$$

In the triangle KLR we have

$$\sin KLR = \frac{KR}{KL} = \frac{c\sin(B - A)}{\sqrt{c^2 + d^2 - 2cd\cos(B - A)}}.$$

Referring to the trigonometric solution of the problem, equation (11) we find that sine of angle E is expressed by the same formula as sine of angle KLR, from which we conclude that angle $KLR = E$. Let $ST = c$ and angle $KLU = C$.

In triangle STL we have: $SL = \frac{ST}{\sin SLT} = \frac{c}{\sin E} = x$.

We find angle Y by subtracting E from C, or $Y = C - E$.

The Works Manager's Problems

By W. D. Forbes

Mr. Martin sat at his desk thinking; he was not just musing. His brain was working at its best and what he was thinking about was not only of moment to him but to all those whose money was invested in the works which he managed.

He drew a sheet of paper to him and wrote as follows:

"After four years of work on certain lines which I had hoped would show satisfactory results, I am forced by the figures before me to say that the output of all the mechanics working for this company has declined in quantity each year; the cost of all articles which we are making has increased in shop cost; the quality of the work has not altered. There has been no advance in good feeling between the management and the workmen, in fact the contrary has been the case.

"What we have done has been, in part, to give the men shorter working hours and this was done with the hope that the shop costs would not be increased. In this hope we were, to some extent, influenced by our own ideas, but more so by the assertions of the men's representatives who promised that the shorter hours would not reduce the product but would, beyond doubt, increase it as the men would then work with greater will.

"The sanitary conditions in our works have always been good but we added shower baths for the molders; made our toilets more comfortable and increased their number. We provided a separate room in which the men could eat their dinner in greater comfort, and we also provided a heating apparatus for the men's coffee.

"We put in metal lockers for the men's clothes and threw the eating room open to all who wanted to come there evenings to read or write and we furnished paper and envelopes for all. We also provided a number of publications for the reading room.

"We gave dances and concerts, furnishing something to eat and drink at each; we offered to provide teachers for any who wished to take up mechanical drawing or other studies, but only a few applicants appeared so that idea was given up. Our pay roll has been advanced on an average of 15 per cent. It is evident that all this has cost us money though we had hoped that it would be money well expended.

"I find now that while the shower baths were at first used by nearly all the molders they are now seldom used. The toilets have become a place for loafing, more than ever before. The eating room is used by some but most of the men have given up its use, evidently preferring to eat in the shop. The entertainments have been less and less attended.

"Taking it all around I feel that all that we have done has not in any way bettered either the men or the company. I strongly recommend that we close the eating room and discontinue the publications we have been taking for the men; that we return to the 9-hour day leaving the wages as they are and close about one-quarter of the toilets. I would have each man put up a sum to cover the cost of the key of his locker, as keys are often lost. I also recommend that we return to our old piece-work system.

"All this can not be accomplished without friction, but we are having that now and losing by it daily, so we might as well have the friction gain us something.

"I have talked with many of our men and a great number of them are quite willing to go back to the piece-work system. Some oppose it, but I am much inclined to think that this is because of instructions from others and not of their own wills. Those who object to the piece work are always the poor workmen.

"All the men willing to return to piece work are also willing to return to the 9-hour day; in fact they want it when doing piece work. There is no use disguising the fact that the return to the 9-hour day will cause the most trouble, but I think it can be done as I find many men who prefer the shorter day.

"They say in winter the time hangs heavy on their hands and that they spend more money to pass away the time. I do not find 1 per cent of the men taking advantage of the time gained by shorter hours for study. The men say that in summer if they have gardens the shorter day does give them more time to work in them, but few have gardens as is evident. Work is very slack now and it will be some time before new orders may be looked for, and as we can by a little care get all our present orders out in three weeks, it would be well to close the works for a month. We could repair our tools, make the few changes we have been considering and then start up with as many of our old hands as are willing to come to work.

"Piece work is the only way by which we can earn our regular dividends and the question is, shall we continue to run as we are now doing, not making legal interest on our capital, or shall we take the bull by the horns and take what many will call a reactionary step? I know that we cannot grant other changes asked for by the men and gain anything; it is foolish for them to think that we can. It will be hard to get new men but I believe we can get them by making our piece work prices attractive."

Here is something for readers of the *American Machinist* to think about. I know that many managers of shops are thinking along the lines that Mr. Martin has set down, and today I believe it is about the line of thought of most investors in industrial stocks. With increased wages we shall always be forced to do one of three things: take less profits, pass the increased cost on to the consumer, or get the men to produce more for the increased pay. With shorter hours the latter will be difficult as there is little willingness on the part of most men to help in this direction. Passing it on to the consumer is not as easy as it was and to take less profits will result in no money being available for carrying on the works or building new ones. I think Mr. Martin's suggestion could be carried out today. What do others think?

Grinding in Valves in Motor Heads

Machining Methods Used on Holt Tractor Valves — Details of Grinding Machine Mechanism

By FRANK A. STANLEY

THE accompanying illustrations show the method of grinding in valves in motor cylinder heads at the Holt Caterpillar plant at Stockton, California. The special apparatus combines in one group, capacity for six heads to be operated upon simultaneously as illustrated by Figs. 1, 2 and 3. The last two of these views show the complete arrangement of equipment as installed over the grinding bench. Fig. 4 shows the grinding machine proper; that is, the machine by which the combination of movements is imparted to the valve being ground in. Figs. 5 and 6 are assembly drawings of the grinding machine. This machine has some novel principles and its operation will be seen upon inspection of Fig. 4, and the line drawings referred to.

Referring to Fig. 5, crank disk *A* is turned in the direction of the arrow, turning the large gear *D* through the medium of the pinion *B* which is kept in mesh by a connecting rod *C*; gear *D* with its shaft *K* being mounted on a pendulum *E* and shaft *K* being keyed also to gear *F* which, as it swings on the pendulum, keeps in mesh with gear *G*. The latter gear which is carried on a shaft at the top of the machine frame



FIG. 1. ROW OF HEADS WITH VALVES BEING GROUND IN

drives in turn the gear *H* and the main shaft *I* to which *H* is keyed.

Now, when crankpin *A1* turns in the direction of the arrow and the large gear *D* in the direction of the second arrow, the small gear *F* cannot drive gear *G* as fast as would be indicated by their relative numbers of teeth because the throw of crank *A1* moves gear *G* in the opposite direction as indicated by the arrow over the top of that gear. But when crank *A1* passes

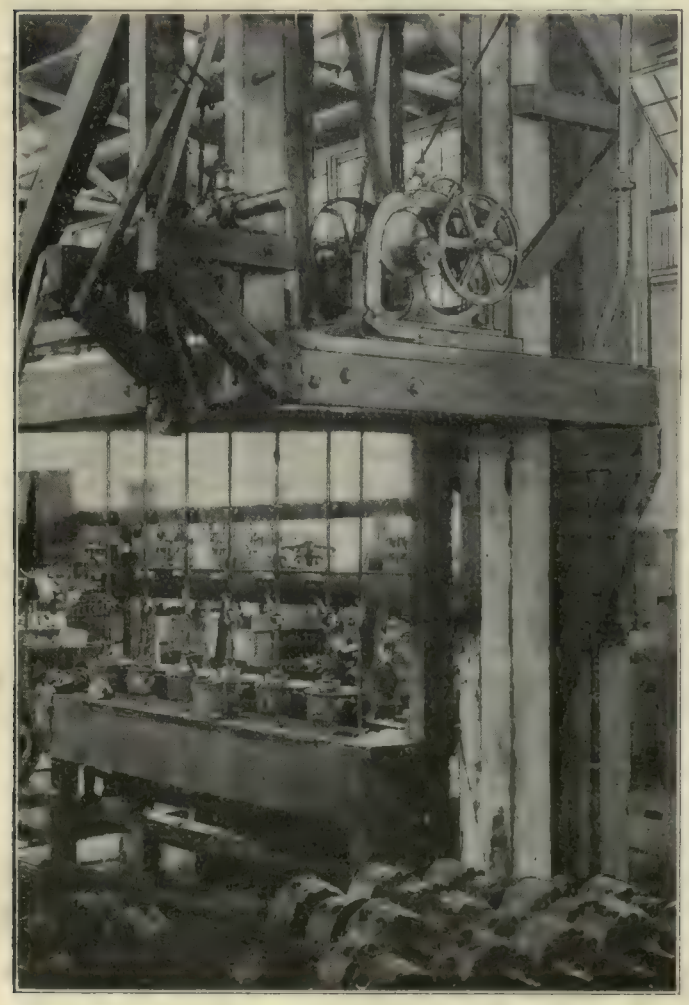


FIG. 2. GRINDING MACHINE COMPLETE AND IN OPERATION

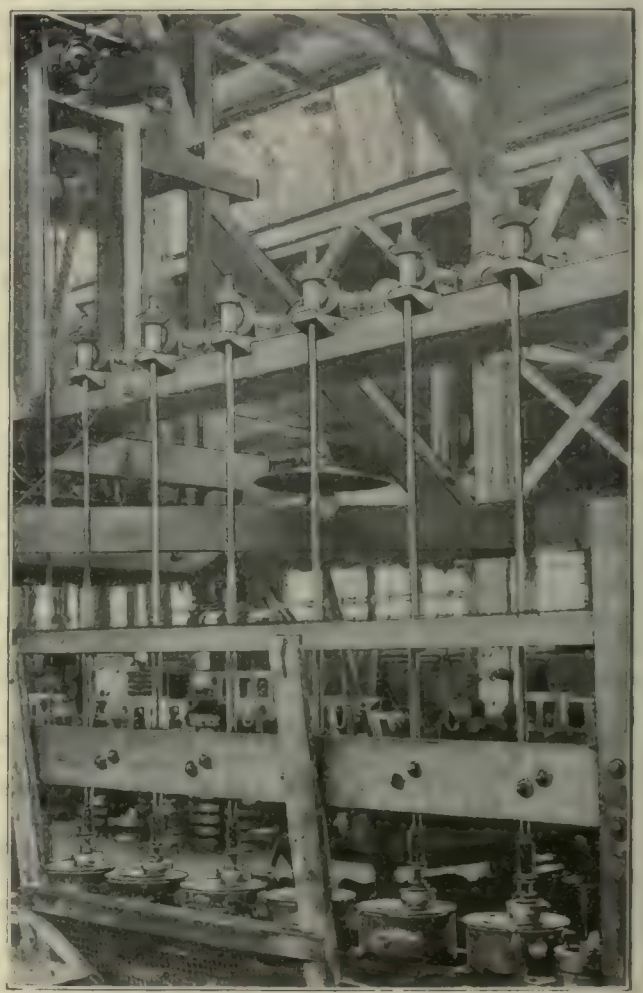


FIG. 3. CAM MECHANISM FOR LIFTING SPINDLES AND DRIVERS

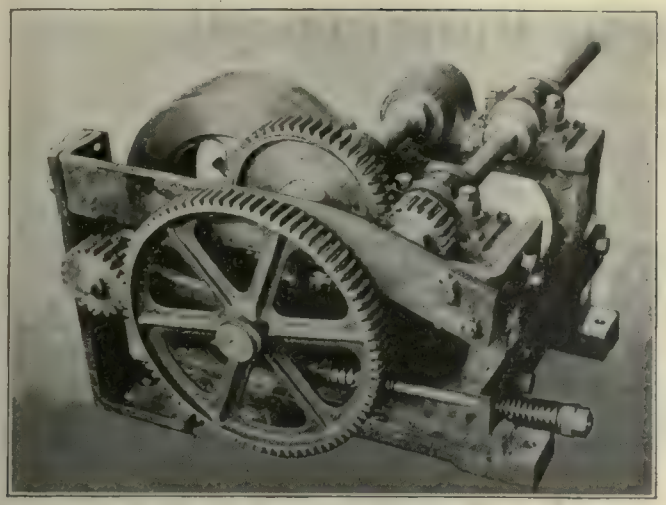


FIG. 4. VIEW OF GRINDING MACHINE MECHANISM

the center *B1* the gear *G* turns in the other direction and not only is being rotated by gear *F* but is doubled in speed by the throw of the crank *A1* and the pendulum *E*, making shaft *I* turn about two-thirds back and six-fifths forward, thus always gaining. On the main assembly drawing, Fig. 6, long shaft *I* is shown driving bevel gears *M* and *N* and on the other side miter gear *O* drives gear *O1* and through this the vertical spindle *P*. This spindle in turn drives a tool-steel blade *U* which is held by a setscrew in the head *S* which slides up and down in a sleeve *P1* and slot *Y*, tension being derived from spring *S1*.

A lever *T* is provided to lift the spindle *P*, disengaging gear *O1* from *O* when changing heads *R*. A lever arrangement is provided to lift valve *Q* about every 3¼ turns to allow the grinding material to flow between the valve and seat. This is operated by the rod *X* and cam *X1* which is driven from the main driving shaft *J*. It will be seen that when lever *T* is swung down the blade *U* will engage in valve *Q* before gears *O* and *O1* are in mesh due to the action of the spring *S1*. This spring also gives a

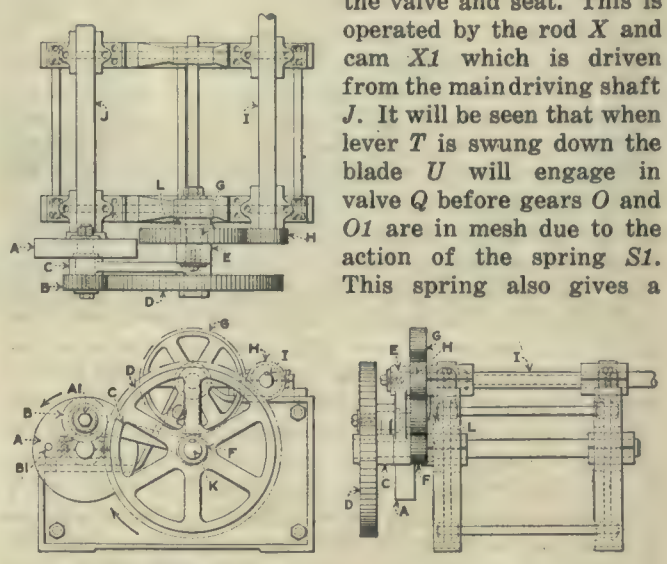
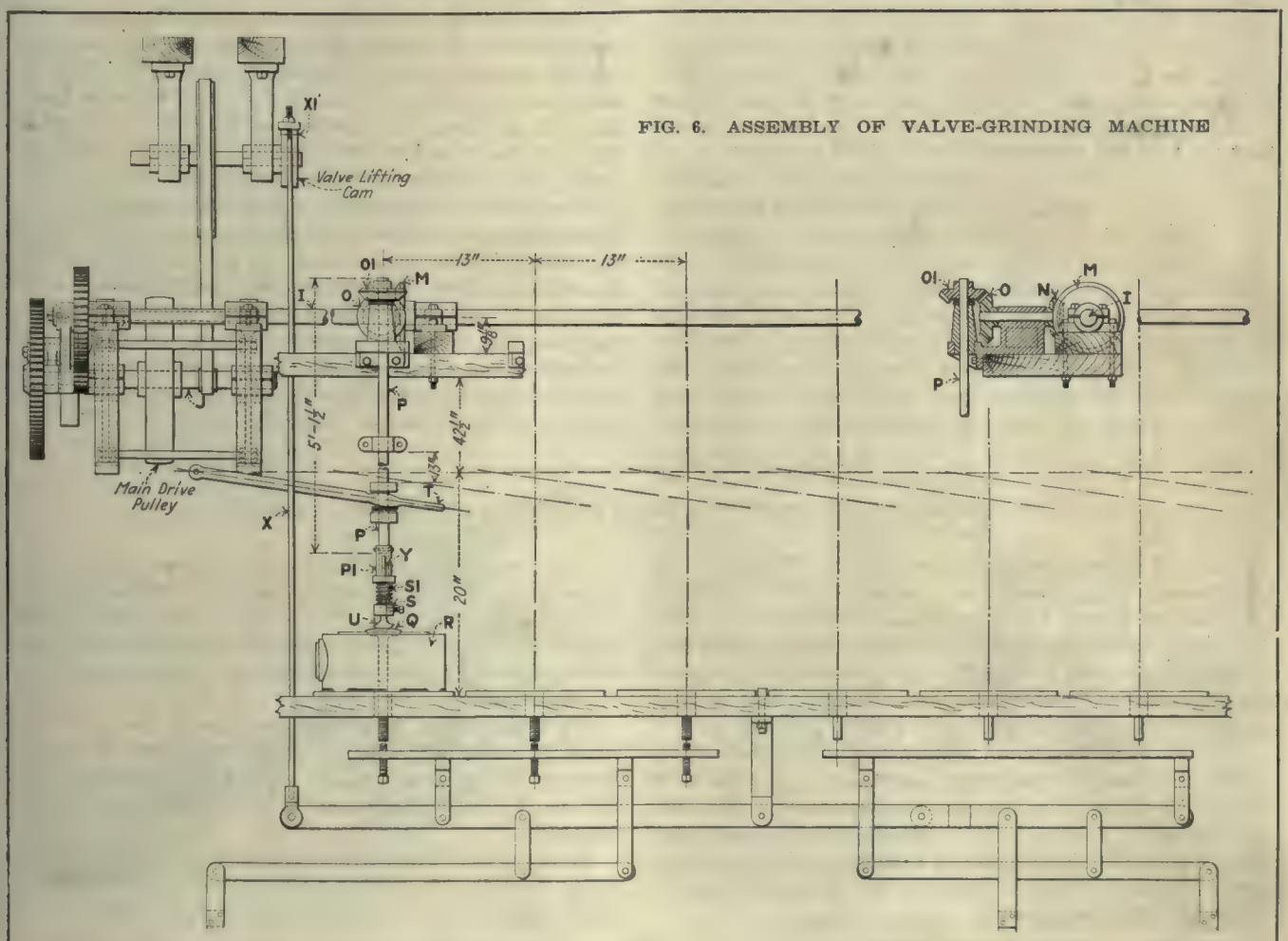


FIG. 5. DETAILS OF VALVE-GRINDING MACHINE

uniform degree of pressure of the valves against the seat. The vertical spindles, the driving blades *U* and the controlling levers and cam mechanisms are all seen clearly in the different photographs, Figs. 1 to 3. The machine shown is the design of P. A. Udall.

FIG. 6. ASSEMBLY OF VALVE-GRINDING MACHINE



Meeting the Present Emergency

By Another General Manager

THERE is not much to write. We find almost no business coming in. It is much worse than ever before at any time since we started in business; 1907 and 1914 were not nearly as dull years at any period as the present. We have cut our productive force from around 600 to 150 or a little less, and the non-productive, of course, not so much, as that is always an impossibility. We are running about 35 hours a week, both shop and offices.

In the spring we were behind on our orders and in April we had orders for as many machines as we ever did in any one month and were pushing things to the limit. Therefore when the slump came in the fall we had a large stock of machines on hand and for that reason could not keep on building, as we would be willing to do if we had not such a large stock on hand. In previous years we have kept building right along through the dull times so as to have a stock against the revival of business, but with something like 250 machines in stock at the present time we do not feel that this can be done now as the financial load would be too great.

Developing New Machines

We realized last August that the wise thing to do would be to develop some new machines if we could and that a less expensive tool for the repair man would be a desirable tool to have. We went to work on this and we are sure it will bring us some business just as soon as the repair shops get enough work in the shape of overhauling cars to lead them back to their present equipment. Furthermore, there are new firms starting up all the time in this work so that we expect that we will get some business on this machine.

So far as prices are concerned, we have made no reductions yet. We do not believe in making reductions just to line up with the prevailing trend of thought. We believe the correct way is for a company to go over their costs carefully and if they find some of their machines are actually overpriced, to make a change in their prices in conformity with that information and then announce just that amount of change. We think it puts the manufacturer in a great deal stronger position to say that he has found he can do just this than it does to simply send out the statement that he will make no changes in prices. It looks, then, as though the matter had received actual consideration and that the prices were based on real figures rather than modified to suit the popular demand, or kept where they were simply on the principle of standing pat.

The writer feels that the machine-tool builders are due for quite a long period of quiet, much longer than the manufacturers of merchandise. The man who builds washing machines or carpet sweepers, victrolas, motors and automobiles can get going again in fine shape, and in fact be very busy indeed before he is going to need much additional equipment. This is further accentuated by the belief that labor will produce more per man in the next six months than a year ago, so that the need of additional equipment will be still further delayed. In the meantime the factory expenses are going along, and further reductions in prices will not help much in paying these bills.

Believes in Guaranteeing Prices

Considerable discussion has come up with regard to the guaranteeing of prices, which seems to us to be a perfectly natural, straight-forward and proper thing to do. We know that a great many manufacturers think this unwise. But it seems to us as though if they were buying instead of selling they would be pretty anxious to have perfect assurance that the prices would not drop on them shortly after they had made a purchase. It almost seems as though some of the people that argue against guaranteeing prices wanted to reserve to themselves the privilege of making a cut whenever they found it necessary on account of a little stiff competition on some order and the guaranteeing of prices would get in the way of doing this easily.

"Confidence" seems to us to be the corner stone of good business and if every manufacturer could agree, and stand by that agreement, to maintain prices for six months or a year the chances of doing business would be greatly improved. A customer is oftentimes urged to place his order to protect himself against a raise in prices, and should he not receive assurance against a drop in prices when he comes across with his "John Henry" at the bottom of the order blank?

By the General Manager of a Large Eastern Machine Tool Company

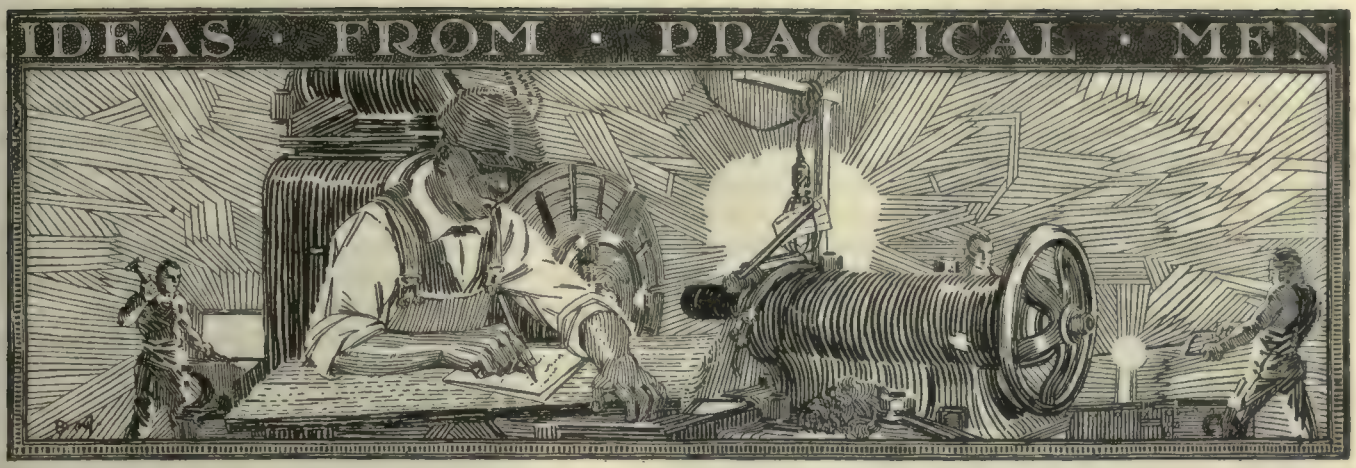
I HAVE carefully read the article "Meeting the Present Emergency" on page 104 of *American Machinist*, and am almost convinced that it might have been written by a member of our own organization, so accurately does it describe our present and proposed future practice, and our ideas regarding the development of the near future.

We have not reduced wages and shall not do so unless it becomes absolutely necessary. We have reduced our force first by the elimination of the least desirable, but followed by the laying off of a good many men whom we shall be most anxious to have with us again when conditions permit. We are working four days of eight hours each.

Our program is to have a few of every type of machine in stock for immediate delivery but not to stock very heavily, because of the fear that selling prices will have to drop below present manufacturing costs. We are developing our new ideas and getting them ready for the market.

We believe that improved business is coming in the near future—not with a rush, but with a gradual growth along sound lines. The excess profits tax is the most troublesome factor with which we have to contend.

It seems that this statement adds nothing but a hearty amen to your original article on Meeting the Present Emergency.



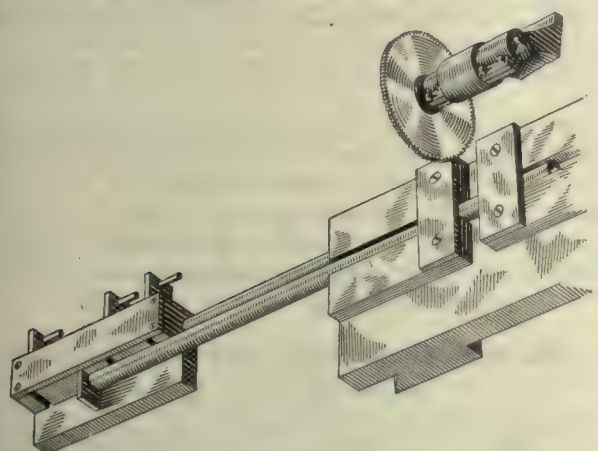
A Device To Reduce Wastage in Cutting Random Lengths of Brass Tubing

By Donald A. Hampson

We had a lot of several hundred thousand brass tubes of different lengths, to cut. The tubing was received in 14-ft. boxes weighing three hundred pounds each and filled with random lengths just as cut at the mill, these lengths being from 2 to 14 ft. It would have been possible to order the tubes in multiples of the finished lengths but the mill extra for this was considered more than the loss from wastage in the factory.

It may not be generally known, but one of the quickest ways to cut brass tubing (and thin sheet brass) is by means of a "buzz saw," using a fine tooth saw, which is in reality a milling cutter of large diameter and very narrow face. The ordinary saw bench of the carpenter shop may be used for the work if there is no other, while saw tables made for printers' uses are admirably adapted to soft metal cutting. In the case now being discussed there was an unused special machine in the shop having an overhead mandrel and a sliding table moved by a hand lever. This is shown in the illustration, which also shows the strips that were fastened to the face of the table to act as guides for the tubes on both sides of the saw as they were cut.

The stock lengths were so long that it took as much time to put the tubes in the machine as to cut them up. To expedite matters a boy opened the boxes and piled the tubes on a table within easy reach of the man doing the sawing, who then had only to move each piece a few inches, slide it in the guides, and cut. Obviously hand feeding was the quickest way of bringing the tube up against the stop each time. After a dozen boxes of tubes had been cut up the man doing the work proposed a scheme that reduced the waste 75 per cent., without retarding production.



MULTIPLE GAGE FOR ELIMINATING WASTE

The ⅜-in. rod, which hitherto had carried an adjustable stop, carries a multiple stop made of cast iron with four sliding pieces corresponding to the four lengths to be cut. These pieces are a close sliding fit as to stock length but may be pushed in and out with a touch of the finger and are kept from jarring out by a light spring on each.

Besides having all four lengths instantly available there is the stock saving feature, which is employed as follows. Suppose that 24-in. tubes are being cut and that the 24-in. slide is out, as shown. There is a board to the right of the workman on which he rests each tube as he picks it from the stock pile and on this board, about 4 ft. from the saw, are several notches which he learns to know. When a number of pieces have been sawed off from the tube the free end approaches these notches, which point the workman is watching, and he knows from its position about how many pieces of certain length are still in the tube. If, for instance, there is a scant 44 in. left in the piece, it would make one 24-in. length and the entire remainder would be waste because even the thickness of the saw cut would make it too short for a 20-in. piece.

Instead the workman shoves out the 23-in. slide, cuts off one piece, pushes back the 23- and out the 20-in. slide and cuts a second piece with only ½ in. waste. When the next tube is put in the machine he goes back to the 24-in. length. Working all day on 24's, he has a dozen kegs of them by night and one keg each of the three other lengths. Though seemingly complicated, this process is so simple in practice that an ordinary man "catches on" at once—and the saving is a considerable item.

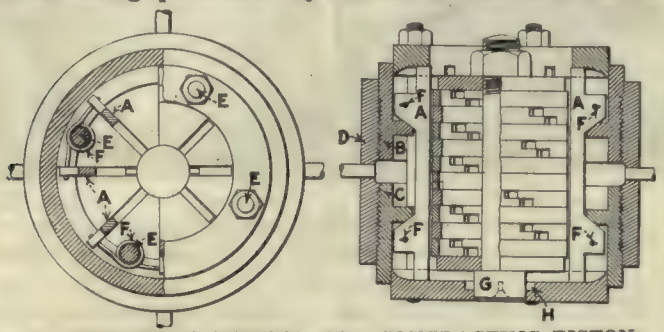
Gas Engine Piston-Ring Contracting Device

By C. D. Simpson

The drawing shows a jig for contracting gas-engine piston rings preparatory to grinding them.

The jig consists of eight slides *A*, which are constrained to move in a radial direction by slots cut in the two end plates, and these slides are given a radial movement by means of the two rings *B* and *C*, which bear at an angle on the rear of the slides. The rings *B* and *C*, threaded right- and left-hand, are caused to

approach or recede from each other by the rotation of the threaded ring *D*. The jig is held together by four distance bolts *E*, around which at top and bottom are placed the springs *F*, whose function it is to return the blades to their original position. The rings *B* and *C* are cut out where the distance bolts *E* pass through them, thus constraining the rings to recede or approach them. In use the jig is opened to its fullest extent, and the arbor *G* with its bottom plate is placed in the jig, the arbor being positioned by means of the hole in the



CONSTRUCTION OF TOOL FOR CONTRACTING PISTON RINGS

end plate. The piston rings to be ground are then placed in the jig, together with the arbor top plate, and the ring *D* is rotated. This rotation of *D*, by means of the rings *B* and *C*, as above explained, causes the blades *A* to move toward the center and contract the piston rings. The arbor nut is then screwed up, rotation between it and the arbor being prevented by the pin *H*. The ring *D* is then rotated in an opposite direction and the piston rings on the arbor lifted out, ready for grinding the external surfaces.

This device is in service at the shops of the Boise Machine and Welding Works, Boise, Idaho.

Spacing Jig for Slot Holes

BY HARRY MOORE

The sketch shows a novel idea for drilling two holes, close to each other, through one bushing. The work shown in Fig. 1 is a valve stem with a keyway and a slot. The length of the slot is twice the diameter of the holes, necessitating the holes being drilled close to each other, the remaining metal to be punched out.



FIG. 1

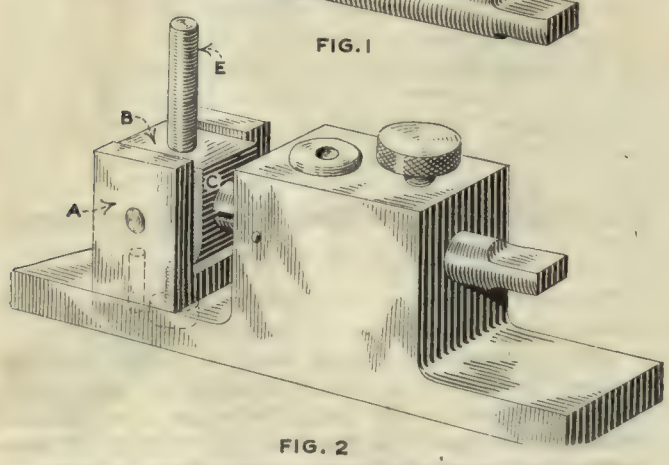


FIG. 2

FIG. 1. VALVE STEM WITH KEYWAY AND SLOT
FIG. 2. JIG WITH WORK INSERTED IN POSITION TO DRILL FIRST HOLE

The jig, Fig. 2, is of simple design, being bored to take the work. It has a drill bushing and a thumbscrew to hold the work in place, a pin at the side engaging in the keyway. Part *A* is screwed and dowelled to the jig base, and is slotted to take part *B*, which swivels on a pin through *A*. Part *B* is of such dimensions on the working faces *C* and *D* that after the first hole is drilled face *C* and on the face opposite the one carrying the handle *E*, that after the first hole is drilled the face opposite *E* is brought into contact with the work, locating it in the proper place for the second hole.

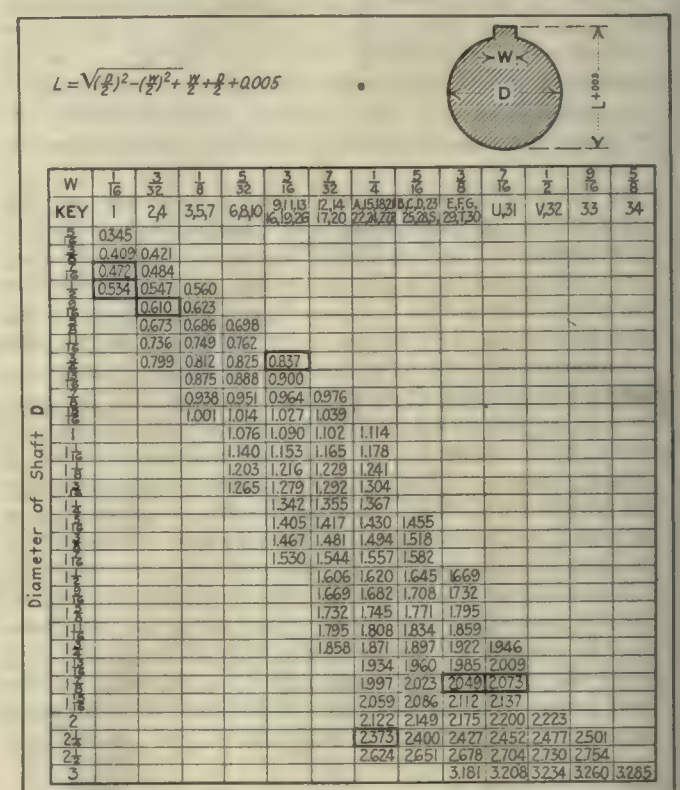
The jig is quick in action. After the thumbscrew is loosened, the locating forces are brought into contact by means of the handle *E*.

Dimensioning of Keyways

BY A. B. WELLS

On page 82 of the *American Machinist* there was published an article under the above title by Hans Ernst. In copying the table accompanying the article several mistakes were found.

As the height of a key above the shaft is one-half its



W	1/16	3/32	1/8	5/32	3/16	7/32	1/4	5/16	3/8	7/16	1/2	9/16	5/8
KEY	1	2,4	3,5,7	6,8,10	9,11,13,16,19,26	12,14,17,20	A,15,18,21,22,24,27,28	B,C,D,23,25,28S,	E,F,G,29,T,30	U,31	V,32	33	34
5/16	0.345												
3/8	0.409	0.421											
7/16	0.472	0.484											
1/2	0.534	0.547	0.560										
9/16		0.610	0.623										
5/8		0.673	0.686	0.698									
11/16		0.736	0.749	0.762									
3/4		0.799	0.812	0.825	0.837								
13/16			0.875	0.888	0.900								
7/8			0.938	0.951	0.964	0.976							
15/16			1.001	1.014	1.027	1.039							
1				1.076	1.090	1.102	1.114						
1 1/16				1.140	1.153	1.165	1.178						
1 1/8				1.203	1.216	1.229	1.241						
1 3/16				1.265	1.279	1.292	1.304						
1 1/4					1.342	1.355	1.367						
1 5/16					1.405	1.417	1.430	1.455					
1 3/8					1.467	1.481	1.494	1.518					
1 7/16					1.530	1.544	1.557	1.582					
1 1/2						1.606	1.620	1.645	1.669				
1 9/16						1.669	1.682	1.708	1.732				
1 5/8						1.732	1.745	1.771	1.795				
1 11/16						1.795	1.808	1.834	1.859				
1 3/4						1.858	1.871	1.897	1.922	1.946			
1 13/16							1.934	1.960	1.985	2.009			
1 7/8							1.997	2.023	2.049	2.073			
1 15/16							2.059	2.086	2.112	2.137			
2							2.122	2.149	2.175	2.200	2.223		
2 1/4							2.373	2.400	2.427	2.452	2.477	2.501	
2 1/2							2.624	2.651	2.678	2.704	2.730	2.754	
3									3.181	3.208	3.234	3.260	3.285

Diameter of Shaft D

CORRECTED TABLE OF INTERNAL KEYWAY DIMENSIONS

width, the difference between the dimension *L* for a 1-in. shaft with a 1/8-in. key and the same size shaft with a 1/32-in. key can not be greater than 0.0156 in. In Mr. Ernst's table the difference given is 0.032 in.

I am sending you a copy I made from Mr. Ernst's table in which the mistakes found have been corrected and are inclosed in the squares with heavy lines.

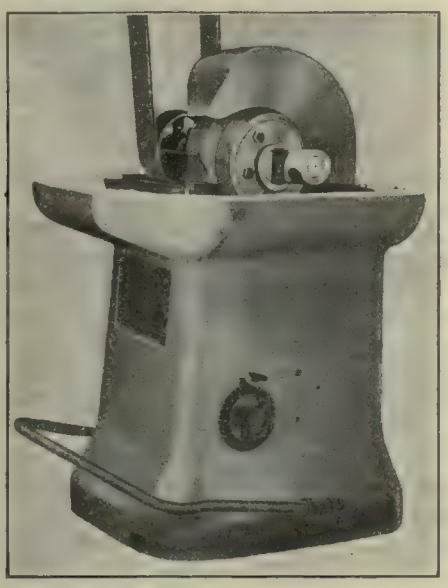
Machine Beds Made of Ferro-Concrete

SPECIAL CORRESPONDENCE

The development of the cement gun process, by means of which layers of concrete can be applied in any desired shape, level or curved, without molds, has in-

spired a German engineering firm with the idea of using beds for machine tools and other machines, such beds made of ferro-concrete as a substitute for those made of cast iron.

The illustration shows the base of a tool grinding machine made of ferro-concrete, which is the first sample of this work. This machine was built for the



TOOL GRINDING-MACHINE WITH FERRO-CONCRETE BASE

Minimax Fire Extinguisher Co. and has been in continuous use for three years with satisfactory results. The ferro-concrete shows no cracks or fissures, which is believed to be proof of its being fully qualified for this purpose.

The process of making machine bases of ferro-concrete is simple. A wire skeleton is first erected, shaped to design, and the hollow part within is shuttered off by wooden boards. Concrete is then applied in two or three layers by means of a cement gun. Machine parts like bearings, bushes, etc., are inserted in the proper places and fixed to the wire skeleton before applying the concrete.

The field of application of this process is, of course, limited. A machine built in this way cannot be moved, which is a considerable disadvantage. For heavy planers with long beds this process seems, however, to be quite suitable. The practical use of the process has so far been very limited as it is only a side line of the extensive application of the cement gun in engineering construction.

The matter has, however, now been taken in hand by a combine of several leading engineering firms and it is intended to propagate the use of ferro-concrete in machine building as far as possible, on account of the high price and shortage of iron.

Cut-Off Tools for Brown & Sharpe Automatics

BY FRANK E. WILDER

The draftsman is frequently called upon to design circular cutting-off tools for Brown & Sharpe automatics and in most cases he knows but mighty little about the subject. How thick and how long should he make the blade, and what should be the cutting angle of the point? How can he know these things when there is so very little reliable information to be found?

Regarding the cutting angle of the point, the Brown & Sharpe practice can be found in some of the handbooks and for special tools made for one specific purposes it is best to follow that and use a cutting angle varying from 10 deg. for drill rod to 23 deg. for brass, but for all general purposes an angle of 15 to 18 deg. will answer.

The best thickness of the blade is not so easily determined. For economy of stock, it should be as thin as possible consistent with sufficient strength, but on the other hand there must be thickness and body enough to resist deformation in the hardening process and to carry away the heat generated by the cut.

Usually the matter is decided empirically with the result that the work of different draftsmen will vary considerably according to the experience and ideas (or lack of them) of the individual.

The only formula that has been floating around within the writer's knowledge is one that has a stern and haughty look to it, and besides, it gives results that are unnecessarily large, especially for the smaller diameters of work. Referring to the notation below, in its original form it looks like this: $t = \sqrt{\frac{d \cot \alpha}{3}} \times 0.14$. This is discouraging at the outset, but it can be reduced to a little better shape like this: $t = 0.081 \sqrt{d \cot \alpha}$, but even in this form it involves an amount of work for which the average draftsman has but little stomach, and it is a good deal easier to make a guess at it than to wade through that square root.

The accompanying formulas and table represent the regular practice of a concern operating a large number of Brown & Sharpe automatics. The whole thing is so simple and easily applied that it might well find a place in the note book of every screw machine man, especially as it gives results that are thin enough and thick enough and theoretically all right.

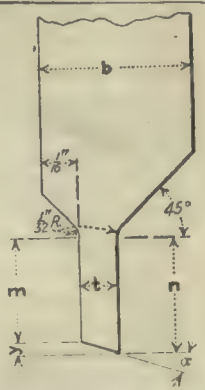
FORMULAS AND TABLE FOR CIRCULAR CUT-OFF TOOLS FOR BROWN & SHARPE AUTOMATICS

NOTATION:

d = Diameter of work
b = Thickness of cutter
t = Thickness of cut-off blade
m = Back length of blade
n = Whole length of blade
α = Cutting angle
y = Angular rise

FORMULAS

$t = 0.16d$
$m = 0.7d$
$n = m + y$
$\alpha = 18$ deg. for average work
$y = T \tan \alpha$



NOTE.—The value of t can be expressed in this way: Make the blade 0.010 thick for every one-sixteenth of work diameter. The value of y is taken for α equals 18°. The tabulated sizes are sufficient for all practical purposes and the Remarks column gives the range of stock sizes for which each cutter is well adapted.

Machine Size	d	t	y	m	n	Remarks
No. 00	1/32	0.035	0.011	0.153	0.164	Brass up to 1/4 diam.
	1/4	0.040	0.013	0.175	0.188	Brass 1/4 to 5/16 diam.
						Screw stock up to 1/4 diam.
	5/16	0.050	0.016	0.219	0.235	Screw stock 1/32 to 5/16 diam.
No. 0	3/8	0.060	0.020	0.263	0.283	Brass up to 3/8 diam.
						Screw stock up to 3/8 diam.
	1/2	0.080	0.026	0.350	0.376	Screw stock 7/16 to 1/2 diam.
No. 2	1/2	0.080	0.026	0.350	0.376	Brass up to 11/16 diam.
	5/8	0.100	0.032	0.438	0.470	Brass up to 5/8 diam.
						Screw stock 1/2 to 11/16 diam.
	3/4	0.120	0.039	0.525	0.564	Screw stock 3/4 to 7/8 diam.

IN THIS ISSUE

THE Bryant No. 40 form-grinding machine furnishes the subject matter for our leading article this week. The machine referred to uses wide-faced wheels, grinding "pieces 10 in. long and of any diameter up to 12 in. by feeding the wheel straight toward the center of the work with a traverse of only ⅛ in." Sheldon has written a complete description from which the quotation was taken, a description few, of course, will pass by.

The second article, page 308, deals with operations on heavy sugar machinery. Examples of such operations are not so numerous that an article treating of them should be skipped. A further recommendation for this particular article is that it was written by Stanley.

In the tenth of his series about programs of apprenticeship and special training in representative corporations, J. V. L. Morris takes up the apprentice course at the plant of the Bethlehem Shipbuilding Corporation, Quincy, Mass. Shipbuilding on a considerable scale is comparatively new in the United States, so that it must be peculiarly gratifying to many to learn that even now apprenticeship and systematic apprentice instruction are assuming importance in the shipbuilding industry. Subforemen at the Bethlehem plant are acting as instructors for the apprentices, not in a haphazard way, but after being themselves instructed. Says Morris: "The outstanding feature of the newer apprenticeship program is the provision for special training for the sub-foremen under whom the apprentices are employed for their practical work, and who are also to provide the supplementary school instruction. Sub-foremen who were considered most adaptable to the work of apprentice training were selected from the various crafts required in the yards and put through a rigorous course of instruction for the job of teaching their respective trades." That is going at it in the right way, it would seem. The article begins on page 310.

Another of Hunter's railroad articles begins on page 312. Once upon a time railroad shops were sadly lacking in efficient and economical systems of handling their small tools. A progressive spirit has caused them to realize the disadvantages of such deficiency and, as Hunter says, "Many of our railroad shops no longer have the hit or miss sort of toolrooms." If all of them were strictly up-to-date of course there would be no need for an article such as we are writing about. But for those that still have the hit or miss toolrooms, and for industrial plants that are always going to get at the business of working up a system for handling tools, but never do, the article will furnish a good reminder and a good starting point.

Specifications for some of the petroleum products of immediate interest to our readers are given on page 314. These specifications were adopted by the committee on standardization of petroleum specifications of the Department of the Interior, Bureau of Mines.

Coming Features

The first issue in March will contain an article by Associate Editor Hand who once in a great while manages to take time from his manifold editing duties to write something. The coming article deals with tools used in making phonograph tone arms, and Mr. Hand assures us that there are some very clever tools among those he describes.

"Industrial Research in the Art of Man Management" is the title of an article by Erwin H. Schell that we shall run next week. A high-sounding title, but don't misjudge the article because of that. There is a deal of good in it and there are other related articles to follow.

Of series articles there will be two — part IV of "The Foreman and His Job" and part V of "Metal Cutting Tools."

Hunter will furnish a railroad article on repairing air brake hose connections for railroad cars, there will be an automotive article by Colvin on the Ford frame, differential spider and differential gear case, and the liability for lack of ventilation will be discussed by Chesla Sherlock.

We think that we said, last week, quite enough about the fourth article by DeLeeuw on metal-cutting tools to get the average reader started. Having gotten him started we believe that he will finish without further urging, so that our mentioning it now is merely to call attention to the fact that the article referred to is concluded in this issue. Page 316.

It's rather difficult to exhaust the possibilities of the Ford, on the straight-away, on hills, or in a literary way. As special correspondence this week we have a short but very worthy article on sheet-metal body work, which deals with operations involved in making metal bodies for Ford cars. Page 318.

Another short article beginning on page 319, deserves mention in passing because it records some of the things that have been done and shows some of the possibilities in a field that is not generally considered as properly belonging to the realm of machinery. The title, "Movie Records of Machinery," indicates the intent of our remarks.

What a wonderful word is "patent." It has meant riches to some and poverty to others and it has no doubt at some time or other misled all of us. Its companion word, though one much less misunderstood, is invention. Emanuel Scheyer attempts to set all of us straight once again by telling us what's so and what isn't about patents and inventions; page 321.

Sheldon's second article on magnetic chucks is concluded this week, beginning on page 324. Another article by Stanley appears on page 332. It tells how the valves in motor heads of the Holt tractor are ground i

EDITORIALS

Sane Retrenchment

THE pendulum is swinging back. After five years of increasing expenditures and extravagance we are struggling to economize at every possible point and, as usual, are overdoing it.

Inflation is easy and can be accomplished on the spur of the moment without any great amount of mature deliberation, but deflation is quite another matter. It would be quite possible to lop ten or twenty or forty per cent from all appropriations but it would be a most unwise thing to do. At this time the activities of each administrative department and branch should be carefully scrutinized to determine their value to the economic life of the country. Those that contribute little or nothing to our advancement should suffer at the expense of the useful ones.

According to statisticians something over ninety cents of our tax dollar goes to the maintenance of our military and naval establishments. Obviously a relatively small proportional reduction in this direction would save far more than a much larger proportional one in all the other departments put together. In making these reductions it goes without saying that nothing should be done to weaken our defenses against possible aggression. It is claimed by many that we cannot cut down military and naval appropriations without weakening the two services seriously, but those of us who were in the service or had war-time contracts have had sad experience to prove that many retrenchments could be effected that would help efficiency rather than hinder it.

Among naval experts a controversy is raging over the efficacy of the dreadnaught and yet we seem to be committed to a very expensive building program consisting mostly of such craft. There can be little doubt that the next war will see far greater development of aerial, submarine and chemical warfare than has yet been dreamed of, in which case the nation that centers its defense in first-line battleships without adequate preparation in other directions will fare badly. Yet Congress has seen fit to strike out the appropriation for the air mail service which is really our experimental laboratory for aeronautic development.

Two divisions of the military establishment appeal to us as worthy of the heartiest support and encouragement, the engineering and research stations such as Aberdeen and McCook Field, and the arsenals such as Watertown and Edgewood and the Naval Gun Factory. They should be equipped with the finest up-to-date machinery and their personnel should be the best the service can assign. In the second division we would include the government nitrate plant partly because of its vital necessity in time of war, but also because it can pay its way in peace times by producing commercially useful products. First cost is high but a return on the investment is sure, while the investment in capital ships must be written off in a few years because of obsolescence.

We believe implicitly in preparedness and particularly in industrial preparedness, but there is much that is unnecessary in our present military and naval estimates. Sane retrenchment should be our aim.

Getting Men and Jobs Together

THE shortage of labor during the war caused the establishment of the United States Employment Service, to regulate and conserve the labor supply. Although handicapped by bureaucratic methods and both personal and political jealousies, it performed a signal service in distributing labor to much better advantage than ever before.

In spite of the strenuous efforts of its friends, political and business enemies succeeded in having the service discontinued at a time when it was becoming increasingly necessary. It would be particularly valuable at a time like this when there is much unemployment which might be avoided if the work and the men could be brought together.

An agency that can bring unemployed men to jobs which they can fill is certainly to be desired. We have talked much about square pegs in round holes, but even this is better than no holes at all, in times of depression. For unemployment is not only the most disheartening, it is the most dangerous thing that can happen either to individuals or to a country.

The unemployed man with a family dependent on him, is in no condition to weigh fine points of ethics or of economics. No question is of greater importance than that of steady employment, of sorting men and jobs into a fairly satisfactory relationship. A clearing house which will help to do this, as did the Employment Service, is a necessity at all times. It is not an expense but an asset.

Good Outlook for Oil-Well Tools

ONE of the great advantages which the United States has over most other countries is the great diversity of resources and industries within its own borders. This has a good effect in steadying fluctuations of trade and in helping to smooth out the present low spots in general business.

Perhaps one of the busiest industries at present is that of oil. Old wells are being kept at work and new ones are constantly being drilled. The demand for drilling heads or bits is great enough to cause the makers of such tools to greatly enlarge their facilities as indicated by the following extract from a letter recently received from a well known builder of oil-well tools.

"I am glad to be able to say that everything is going well with us, the last year having been a particularly good one; and we look forward to 1921 as our Banner Year. We have had wonderful success in California, and believe that our business for 1921 will be about double that of 1920."

These shops use machine tools in larger quantities than we have imagined, although the equipment is small as compared with builders of motors and similar machinery. But oil-well equipment is still in demand and some of it is going to be built on new machinery. If you have been thinking of oil-well tools as being made in a country blacksmith shop it may pay to investigate the possibilities of selling machinery to the makers of these interesting contrivances.

Industrial Waste*

Weaknesses in Our Production System — National Progress Depends Upon Continuous Improvement in Production—Causes of Industrial Waste

By Herbert Hoover
President, American Engineering Council

THE Federation of Engineering Societies has been brought about solely that we might secure for public service the collective thought and influence of 100,000 to 200,000 of our professional engineers. This great body of men in administrative and technical service penetrates every industrial avenue and thus possesses a unique understanding of many of our intricate economic problems and an influence in their solution not equalled by any other part of the community. Wanting nothing from the public either individually or as a group, they are indeed in a position of disinterested service. This Federation has initiated services to the public in many directions.

I propose to deal with only one measure of this service today. Your Council has organized a preliminary survey of some of the weaknesses in our production system. This survey will attempt to visualize the nation as a single industrial organism and to examine its efficiency toward its only real objective—the maximum production. In a general way this inquiry will bear upon the whole question of deficiency in production—industrial waste in a broad sense.

Causes of Under-Production

The waste in our production is measured by the unemployment, the lost time due to labor conflict, the losses in labor turnover, the failure to secure maximum production of the individual due either to misfit or lack of interest. Beyond this again is a wide area of waste in the poor co-ordination of great industries, the failures in transportation, coal and power supplies which re-echo daily to interrupt the steady operation of industry. There are again such other wastes due to lack of standardization, to speculation, to mismanagement, to inefficient national equipment and a hundred other causes. There is a certain proof of deficient production by comparisons of our intense results in 1918, when, with 20 per cent of our man-power withdrawn into the army, we yet produced 20 per cent more commodities than we are doing today. We are probably not producing more than 60 or 70 per cent of our capacity; that is, if we could synchronize all national effort to maximum production, we could produce 30 or 40 per cent more commodities and service. Our national machine is today doing worse than usual, as witness the 3,000,000 idle men walking our streets. One part of the human measure of this shortage in production is the lack of necessities or comforts to them and their families, and their anxieties as to the future.

No one will ever suppose that it is ever possible to bring national productivity up to the full 100 per cent, but the whole basis of national progress, of an increased standard of living, of better human relations, indeed of the advancement of civilization, depends upon the continuous improvement in productivity. While we currently assume that great advances in living standards are brought about by new and basic invention, ye in fact even a greater field of increasing standards lie in the steady elimination of these wastes. The primar duty of organized society is to enlarge the lives and in crease the standards of living of all the people—not o any special class whatever. We are therefore propos ing to make a preliminary examination of the volum of waste in certain industries, the proportions that li in each field of fault. And no engineering report i worth the paper it is written upon without constructiv suggestions in remedy.

Production and Over-Supply

There is oftimes a superficial dismissal of this sub ject of maximum production on the assumption tha there are positive limits in production due to over supply. Such assumption has no proper foundation i the broad view of industry as a whole. Too much eco nomic thought on production has delimited its bounda ries by the immediate volume of demand of a given com modity. There is no such thing as the nation over producing, if it produces the right commodities. Th commodities or services produced by the whole natio are capable of absorption by the whole nation if the are of the right character. In other words, if w could attune the whole industrial machine to the highes pitch, agriculture as well as manufacture, an increasin production would mean a directly increasing standar of living. When ten men or one hundred million me divide their united output, they can by doubling thei output have twice the amount to divide. The probler in doubling output is to direct it to commodities o services that they can use. There is no limit to the in crease of living standards except the limitations o human strain, scientific discovery, mechanical inventio and natural resources.

It is true enough that any particular commodity o service can be over-produced, for each will reach saturation point in demand when all the members o the community have been supplied. The absorption o increased productivity lies in the conversion of luxurie of today into necessities of to-morrow, and to sprea those through the whole population by stimulation o habit and education. Wheat bread, railways, goo roads, electricity, telephones, telegraphs, automobile and movies were once luxuries. They are still luxu ies to some parts of the population.

It is but a corollary that certain commodities ca better be produced for exchange for commodities fro outside our boundaries of more appropriate character our needs. To-day we have capacity for production some commodities not only in excess of our home nee but even beyond export demand under present financi conditions. As a matter of practical remedy, we mu either reorganize these financial relations or alternate abandon some part of this kind of production and tu our idle men to making things of which we are not y fully supplied.

To put the matter in another way, there is no lin

*Address delivered before American Engineering Council's Executive Board and Convention of Engineers at Syracuse, N. Y., Feb. 14, 1921.

to consumption except the total capacity to produce, provided the surplus of productive power is constantly shifted to new articles from those that have reached the saturation point of demand. For instance, we have the productive capacity wasted today that would improve the housing conditions of our entire people to the level that perhaps only 50 per cent of them enjoy—and at the same time not entrench upon our established necessities. I am not suggesting that the forces of production can be shifted by imperial direction. The practical thing that can be done is to eliminate some of the wastes and misfits in our production, and depend upon the normal processes of business and human desires to absorb them.

Stabilized Production

The largest area of waste lies in the large periods of slack production and unemployment, due to the ebb and flow of economic tides between booms and slumps. The ideal would be steadily increasing production—an ideal of no likelihood of exact realization because of inability to ever gage the advance in growth consumption or the approach of saturation. On the other hand, there are certain possibilities of stabilization worth consideration. For instance, we can classify labor into that engaged in production and service from this equipment. Our studies of industries as a whole show that we usually expand our equipment just at the periods of maximum demand for their products instead of doing our plant expansion during periods of slack consumption. We thus make double demands on labor and we doubly increase unemployment in periods of reduced consumption. That is indeed one of the factors in our great unemployment today. Everyone knows that for our normal productivity, our transportation facilities are today inadequate. We know that we are insufficiently housed, insufficiently equipped in our public roads and our public utilities; that we need an entire revision of our power supply, that we need expansion of our water ways, and yet armies of idle men are walking the streets. The reasons why this occurs are not far to seek, in that it is at times of high productivity that capital is most easily obtained. It is then that the necessity of increased equipment most impresses men's minds and it is the high hopes of these periods that lead them into the adventure of expansion. Nor is it possible to expect that all industry could be so stabilized as to do its capital construction in periods of depression in commodity demand. Nevertheless, there are some industries that could, by co-operation of the government and co-operation amongst themselves, be led in this direction. More particularly does this apply to railways, telephones, telegraphs, power supplies and other public utilities, and to the expenditure upon our state, municipal and national public works.

Another variety of intermittent employment, and thus great waste, lies in certain industries now operating upon an unnecessarily wide seasonal fluctuation, as for instance the bituminous coal industry. This is today one of our worst functioning industries. These mines operate seasonally and erractically. They proceed from gluts to famines, from profiteering to bankruptcy. As already determined by our engineering bodies, the men who mine our coal find work only 70 per cent of their time. In other words, there are 30 per cent more equipment, 30 per cent more men, attached to this industry than are necessary if it were stabilized to continuous operation. The mining engineers have already pointed out the directions in which remedy lies, through storage, through railway rate differentials and other remedies. Through constructive action, an army of men could be released from this industry of necessity to convert some luxury into a necessity of tomorrow. This is no plan to control prices or profits, although through it both the producer and consumer in coal could be placed upon a sounder basis than today. The interest of the consumer and producer, is, however, even less important than relief from the intermittent employment and unemployment within this industry that today bring a train of indefinite human misery and some of our lowest standards of living.

The second largest area of waste in productivity is the eternal amount of labor friction, strikes and lockouts. The varied social and economic forces involved in this problem need no repetition here. Fundamentally this is not alone a struggle for division of the results of production between capital and labor, but there is also a loss greater from strikes and lockouts in the element of purely human friction and loss outside the area of dispute on wages and hours. The growth of industry into large units has destroyed the old mutuality of interest between employee and employer. Our repetitive processes have tended to destroy the creative instinct and interest in employees; at times their efforts sink to low levels indeed. We will yet have to reorganize the whole employment relationship to find its solution. There is great promise in this field during the past two years, and the progress in this matter is one of the subjects under our inquiry.

Yet another variety of loss lies in the unnecessarily faulty distribution of our labor supply due to seasonal and to shifting demands. An adequate national employment service is indeed the first need to reduction of those wastes.

Need of Standardization

Probably the next largest fraction of waste in productivity lies in a too high degree of individualism in certain basic products and tools. In other words, a standardization of certain national utensils makes for economy in distribution, in operation and in repairs. The necessity of maximum production during the war opened a great vista of possibilities in this direction. Such standardization as car couplings, or wheels, and cars generally, represents real progress in this direction. These possibilities lie in a hundred directions. There are all sorts of cases from sizes of chains to the size of automobile wheels. Today dozens of different sizes are placed in the market by manufacturers and entail not only special equipment and skill to produce those many varieties, but also great stocks are required in distribution and losses are entailed due to lack of interchangeability. It is certain that there are a great many articles of every day use in which the manufacturer would indeed be glad to undertake some co-operation in standardization, from which the saving in national effort would be interpreted not into millions but into billions of dollars. This does not mean that we stamp the individuality out of manufacture or invention or decoration; it means basic sizes to common and everyday things.

Another type of waste lies in our failure to advance

our industrial equipment. The Super-Power Board will demonstrate the saving of 25,000,000 to 50,000,000 tons of coal annually by the electrification of our eastern power supply. The St. Lawrence Waterway Commission will demonstrate the saving of five to ten cents a bushel to the farmers of fifteen states by unlocking the lakes to ocean going vessels.

Nor will this added efficiency to our national transport injure our present systems of canals and waterways, for we have ever found that the prosperity of an industry blesses them all.

Co-operation Solves Many Things

Nor do we believe it is necessary to effect these things by the government. The spirit of co-operation that has been growing in our country during the last thirty years has already solved many things; it has standardized some things and is ripe for initiative toward co-operation of a wide-spread character. The leadership of our Federal government in bringing together the forces is needed. No greater field of service exists than the stimulation of such co-operation. The first step is sane analysis of weakness and sober proposal of remedy. If the facts can be established to an intelligent people such as ours, action is certain even if it be slow. Our engineers are in unique position for this service, and it is your obligation to carry it forward.

How To Get Back to Normal

By C. E. Knoeppel

Do you want to get back to normal quickly?

This is the year of liquidation and readjustment in business.

The present condition can be best expressed as follows:

No selling, no buying;
No buying, no making;
No making, *then what?*

Falling sales, unemployment, idle plants, decreased production, high costs, and heavy losses, are elements in the present situation, and can only result in one thing—*depression and business stagnation*—unless constructive steps are taken to get back to normal *quickly.*

There should be plenty of business ahead. Our children need schools; our families need homes to live in; our cities require new public buildings; our automobiles, trucks and farmers need roads; our railroads need repairs and new tracks, roadbeds and equipment; our public utilities need betterments and replacements; our furnaces and stoves require fuel; our people need shoes and clothing. In addition to all of this, *the world needs food.*

A Constructive Program

Here is a constructive program based on years of experience in industry, which will mean results to you:

(1) Determine normal capacity of machines, working places, departments and plants, in hours. This may be 75 to 85 per cent of your possible capacity.

(2) Standardize overheads according to departments, with due consideration to reductions in same, determining what these overhead rates would be for your normal capacity.

(3) Determine from estimates, records of past performances, by conferences or by observations, what would be fair and attainable production standards per hour for your various operations, using your normal capacity as a basis. *Do this for the reason that productivity* (relative amount produced per hour) *is the gage of economy and efficiency in manufacturing.*

(4) This will enable you to determine various combinations of the standard quantities of the various products you can make.

(5) Using current prices for labor and material, and your standardized overhead rates, the cost of these products, at normal capacity can be determined.

(6) A fair and reasonable profit added to costs—or using costs for a time, if you have to—will mean prices which will bring business, *because greatest volume of work goes to that concern whose prices reflect normal operating conditions.*

(7) Now call in some of your best workers as representatives of their fellow workmen, and outline to them what your present conditions are and what you want to do, explaining the above points, especially number (3), as they relate to unemployment, reduction in wages or hours, and company losses.

(8) Place these plans before your banks, as a basis for credits and financial help.

(9) At the same time, get your sales and advertising campaigns tuned up with the above, giving due consideration to time payments, discounts and the like.

(10) Charge the differences between actual and standard overhead costs into an adjustment account for the time being, which will decrease as you approach normal capacity, and which will cease when you reach normal. *This loss will be much less for the coming year than it would otherwise be as plants are now operating.* As you go above normal and reach possible productions, this loss would be offset in whole or in part by credits to the adjustment account.

The balance, loss or gain, at the end of the year, would be carried into profit and loss.

Not Mere Theory

The above is not mere theory. The steps have been tried and proven out and *are practical and workable.* They have been used by plants before the war and since the war.

Anticipating normal conditions will mean normal conditions more quickly.

High-Speed Tapping

By F. C. Mason

As I have never seen any production records of tapping operations I thought the following record would be of interest.

The work was tractor transmission cases, which weighed approximately 225 lb. There were twenty-four $\frac{5}{8}$-in. holes through metal $\frac{3}{4}$ in. thick, nineteen $\frac{1}{2}$-in. holes through metal $\frac{5}{8}$ in. thick, one $\frac{3}{4}$-in. iron pipe size and one other size I do not remember, making a total of forty-five holes to be tapped.

The case was held in a rotating jig under a radial drill and one operator with one helper, who assisted in handling the casting and oiled the taps, did the work. They finished fifty cases per eight-hour day, or 2,250 holes, an average of 281$\frac{1}{4}$ holes per hour.

The spindle speed used was 400 r.p.m., a peripheral speed of nearly 80 ft. per minute for a $\frac{3}{4}$-in. tap. The work had to be turned four times and the different sizes of taps used.

SHOP EQUIPMENT NEWS

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and equipment

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs and equipment

Boston 12-Inch Rotary Surface-Grinding Machine

The Boston Scale & Machine Co., 100 Ruggles St., Boston 20, Mass., has recently placed on the market a 12-in. rotary-table surface-grinding machine, shown in Fig. 1. The maker states that the tool is adapted to production work, being intended to produce work both quickly and cheaply, and to give continuous service with but little liability of breakdown.

The means employed to impart reciprocating motion

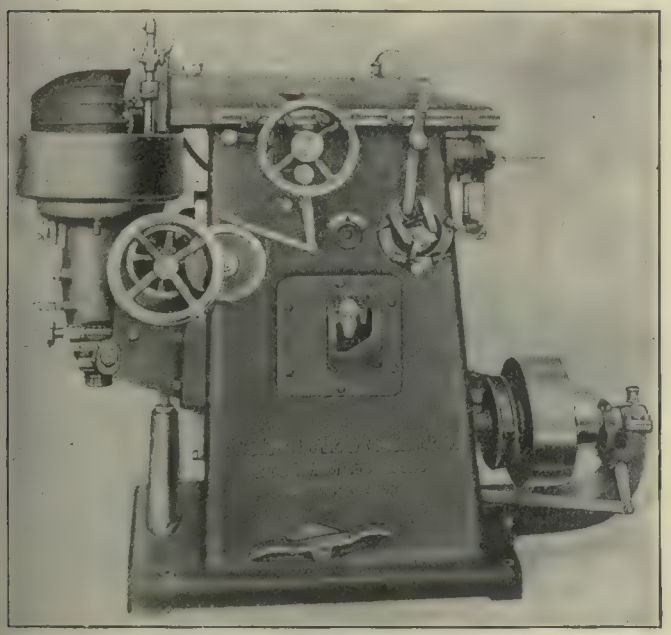


FIG. 1. BOSTON 12-INCH ROTARY-TABLE SURFACE-GRINDING MACHINE

to the head which carries the grinding-wheel spindle is worthy of notice. The motion is obtained by the use of oil flowing under pressure, the direction of flow being controlled by a balanced reversing mechanism. The motion is said to be smooth and even, being convertible instantly from the slowest to the fastest speed, and vice versa, or to any intermediate speed. There is no gearing or multiplicity of small parts to wear or to become deranged. It is stated that the machine may be used at a short stroke on a great number of similar pieces without producing unevenly worn parts, as in the case of a gear or worm-and-rack-driven reciprocating head.

A wide range of speed is provided for the reciprocating head, the minimum speed being one full stroke forward and return, or 17 in. in 10 minutes. This



FIG. 2. GRINDING-WHEEL SPINDLE, SHOWING TAPER BEARINGS

speed can be converted instantly to the fastest speed of ten full strokes per minute or to any intermediate speed, the speed and the range being indicated on a sector mounted on the column.

The reversing mechanism is primarily a cylindrical rotary type of balanced valve. The pump which supplies power for operating the sliding head is also of rotary type and is capable of giving a pressure of 100 lb. per square inch. About 40 lb. per square inch is the working pressure, a relief valve set for 60 lb. being supplied. The oil used is designated as "white compressor oil" and is practically foamless.

The grinding spindle is provided with taper bearings of liberal dimensions at each end, as shown in Fig. 2. Readjustment for alignment and for wear of either bearing is made at the rear bearing, which is arranged to permit the making of close adjustments quickly. A hardened thrust bearing is provided to take the pressure of the backward stroke.

The machine is driven by a 4-in. belt on a 14-in. clutch pulley. The pedal for operating the clutch is placed conveniently for the operator. The driving shaft bearings are bronze bushed and made separate from the frame castings, for convenience in rebushing or for removing the driving shaft.

The four-speed cone change gears, shown in Fig. 3, and controlling the speed of the vertical spindle which carries the magnetic chuck, are inclosed in a gear box and so arranged that the gearing and shaft bearings are splash oiled, insuring constant lubrication and

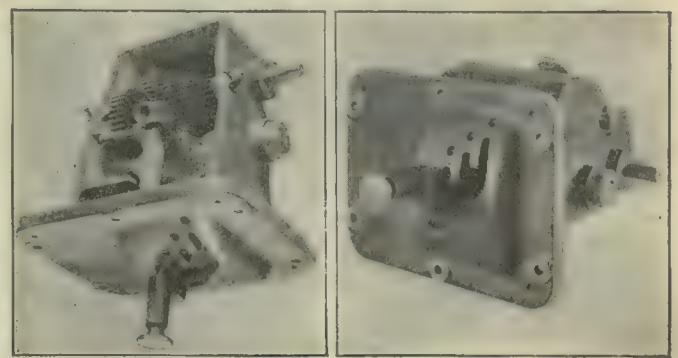


FIG. 3. CHANGE-GEAR BOX SHOWN OPEN AND CLOSED

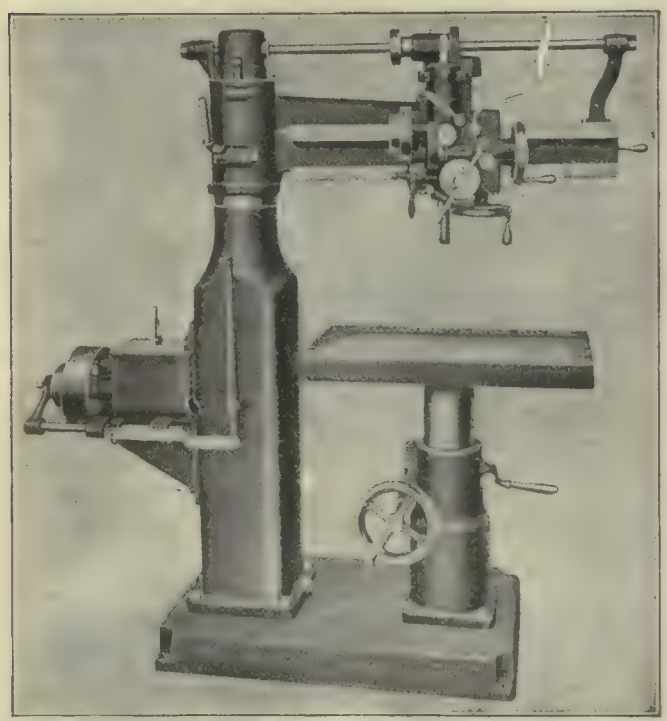
smooth running. This whole arrangement of gearing and gear box forms a unit, as shown at the right of the illustration, which unit can be readily removed as one piece. The automatic feed to the vertical spindle is positive, and ranges from 0.0025 to 0.005 in. by one-quarter thousandths. Means are provided to automatically throw out the feed at any desired point.

The chuck spindle has a wide-angle taper bearing at its upper end, to receive the thrust due to grinding and to assure a free-running bearing. The bottom bearing of the spindle is provided with an adjustment for wear. This spindle can be tilted 10 in. in either direction. The grinding and chuck spindles are each one-piece forgings and they, as well as the change gearing, are of heat-treated chrome-nickel steel.

The machine is arranged to carry a wheel 12 in. in diameter and having a face 1¼ in. or narrower, and it is furnished with a 12-in. circular magnetic chuck. It will grind the whole of a 13-in. disk. The sliding head can be set back, so as to grind a 6½-in. face on any disk up to 16 in. in diameter, provided that it can be held on the chuck supplied. A diameter of 17 in. can be swung inside the water pan. The machine weighs 2,800 lb. and takes up a floor space of 6 x 3 ft.

Crescent 2½-Ft. Sensitive Radial Drilling Machine

The Crescent Tool Co., Second and Elm Sts., Cincinnati, Ohio, recently placed on the market a 2½-ft. sensitive radial drilling machine, a view of which is shown in the illustration. The machine, intended for high-speed, heavy-duty work, is entirely gear driven and can be furnished in two styles, one being equipped with hand feed only. The other, in addition to the hand feed, has two changes of power feed and also a quick return motion.



CRESCENT 2½-FT. SENSITIVE RADIAL DRILLING MACHINE

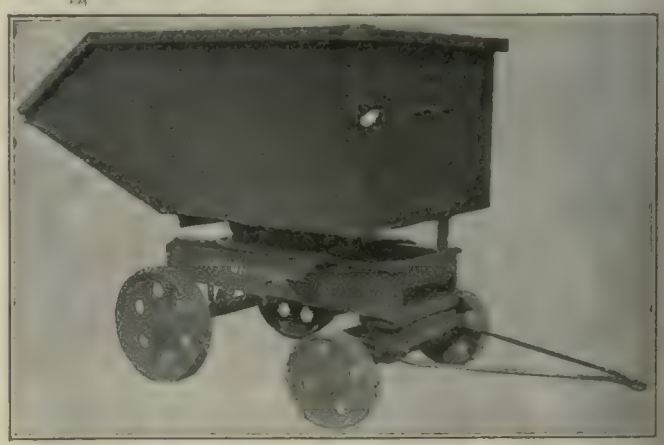
Specifications: Drills to center of 60-in. circle. Length from center of column to end of arm, 44 in. Minimum distance center of column to face of column, 3 in. Maximum distance end of spindle to base, 42 in. Minimum distance end of spindle to base, 35⅝ in. Maximum distance end of spindle to table, 20 in. Vertical traverse of spindle, 6¾ in. Drilling capacity, 1⅛ in. in diameter on steel. Size of table, 18x30 in. Vertical adjustment of table, 18 in. Size of base, 24x38x4 in. Driving pulley: size, 10x3 in.; speed, 550 r.p.m. Spindle speeds, 132 to 1,100 r.p.m. Spindle feeds, 0.0055 and 0.017 in. per revolution. Floor space, 26x72 in. Approximate weight: net, 1,200 lb.; crated, 1,300 lb.; boxed for export, 1,400 lb.

The machine is driven by a belt on a clutch pulley. It can be started or stopped instantly by a lever located at the front side of the column within easy reach of the operator. The variable-speed gear box provides six speeds in geometrical progression for the spindle, which makes from 130 to 1,100 revolutions per minute. The column and arm are of rectangular section. The arm is supported on steel balls and can be swung around the center of the column by a slight pressure. The head is rapidly moved on the arm by means of a rack and pinion, and a clamping device handy for the operator secures it tightly. The table is adjusted vertically by means of a handwheel, acting through a worm and wormwheel and a rack and pinion. It can be rigidly locked by a hand lever. All gears are made of steel with generated teeth, the gears in the speed box running partly in oil.

Easton Scoop-Body Trailer Car

The Easton Car and Construction Co., 50 Church St., New York, N. Y., whose factory is at Easton, Pa., has recently put on the market a scoop-body trailer car. The capacity of the car is 27 cu.ft. The body is mounted on a structural-steel turntable which can be turned around in any direction and may be dumped from any one of the four sides. The wheels are equipped with roller-bearings. The front axle is of a swivel type and has a machined cast-iron ball-bearing around the kingbolt, permitting the car to be turned in practically its own length.

The low height of the car makes it convenient for hand loading. The car can be used for handling such materials as sand, coal, castings, cinders and metal-chips. It is equipped with "flat-tread" instead of narrow-gage-track wheels, not being confined to the limits of a track system. It can be handled by one man, where single cars, either hand pushed or pulled, can be employed.



EASTON SCOOP-BODY TRAILER CAR

Hill Adjustable Size Block

A block of adjustable size and intended for use in setting cutting tools to height above a given surface is shown in the illustration. It is made by M. B. Hill, 10 Eden St., Worcester, Mass. The block is made of carbon steel, hardened and ground all over, and the sliding surfaces are lapped.

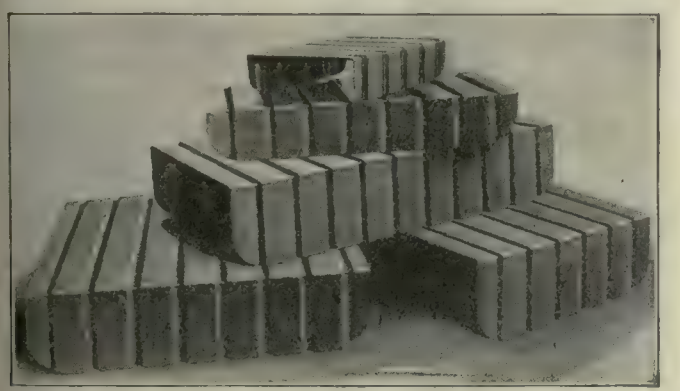


HILL ADJUSTABLE SIZE BLOCK

In the inclined surface of the larger piece is a T-slot, in which slides a small T-head stud that extends up into the hollow sliding block. A tapered hole in the upper end of this stud receives the correspondingly pointed end of the knurled-head screw in the block, a turn of which screw serves to clamp the latter in any position. The setting is, of course, measured by means of a micrometer over both blocks.

Powell Pressed-Steel Lift-Truck Platforms

The Powell Pressed Steel Co., Hubbard, Ohio, has recently placed on the market pressed steel lift truck platforms, such as shown in the illustration. The platform is made of one piece of sheet steel and is formed by a cold process, which sets the material when pressed to the form required. This process is stated to give the platform more rigidity than if it were formed hot. The height, or inside clearance, of the platform is generally from 6½ to 12 in. The corrguations used to strengthen the platform are 1½ in. wide x ¾ in. deep and spaced at 6-in. centers. The size of platform that can be furnished is governed only by the size of the

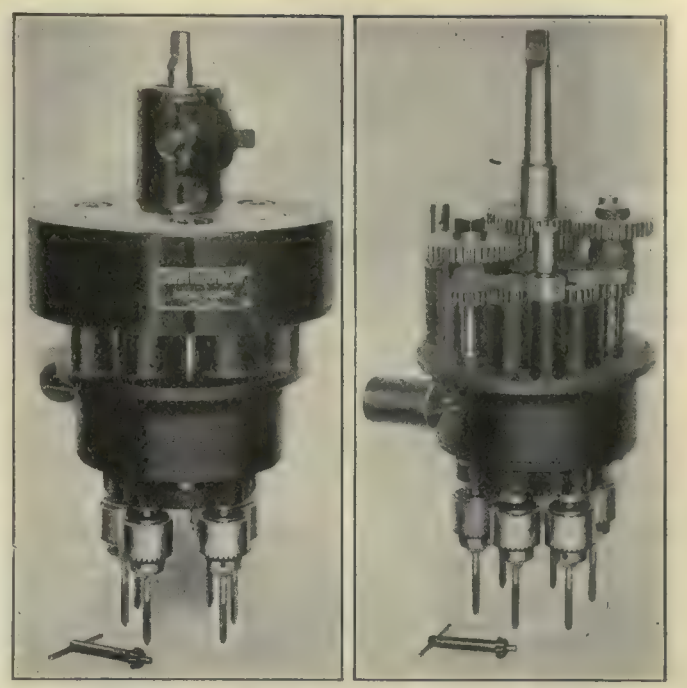


POWELL PRESSED-STEEL LIFT-TRUCK PLATFORMS

sheet or plate that can be purchased, and No. 7, 9, 10 or 12 gage material is generally used. It is stated that a platform made of No. 9 gage steel will easily carry from 15,000 to 20,000 lb., and may be overloaded considerably, that the life of a platform is practically endless, and that no repairs are required. Racks or boxes may be built onto the platform, and to provide a large flat top a sheet metal plate is spot-welded to the top of the platform.

Dorman Multiple-Spindle Tapping Head

John H. Dorman & Son, 5148-52 Hudson Blvd. West, West New York, N. J., have recently brought out a tapping head of the sort shown in the illustration. It is intended for tapping simultaneously six holes grouped closely together, the holes not lying on the circumference of the same circle. The head at the left is com-



DORMAN MULTIPLE-SPINDLE TAPPING HEAD

pletedly assembled, while the housing has been removed from the head in the view on the right. The housing and body of the head are made of aluminum, the lower plate of cast iron, and the plate providing the upper bearings for the spindles is of bronze.

Some of the holes to be tapped are grouped rather closely together. For this reason, the knurling on the Jacobs chucks which hold the taps is ground off, so that the operator's fingers are not liable to be pinched between the chucks. The clamp at the top of the head is secured to the spindle of the drilling machine and helps to drive the main spindle. The lug on the side of the body prevents the head from rotating, by pressing against the column of the drill press.

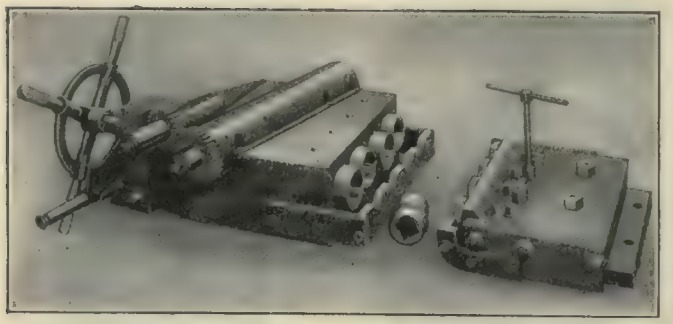
The gears driving the tapping spindles are compounded, the driving spindle carrying two gears of different sizes. In this way, the taps can be given the same speed of rotation, although they are placed at different distances from the center line of the driving spindle. It is possible, also, to vary the speeds of the different spindles by means of the gearing, so that taps of different pitch can be used at the same time, the rate of feed of each being kept the same.

The regular form of reversing mechanism made by the concern is provided for each tapping spindle. The direction of rotation reverses automatically when the head is raised or the work withdrawn. Heads can be furnished to fulfill the special requirements of individual jobs.

Miller & Crowningshield No. 2½ Multiple-Spindle Fluting Centers

Miller & Crowningshield, Greenfield, Mass., have recently placed upon the market the No. 2½ multiple-spindle fluting centers shown in the illustration. The device is intended for use on the table of a milling machine when fluting taps or reamers, and it consists of an indexing head and a tailstock. It can be furnished with either three or four spindles, the same range of work being handled in each case.

The spindles can be turned simultaneously in the



MILLER & CROWNINGSHIELD NO. 2½ MULTIPLE-SPINDLE FLUTING CENTERS

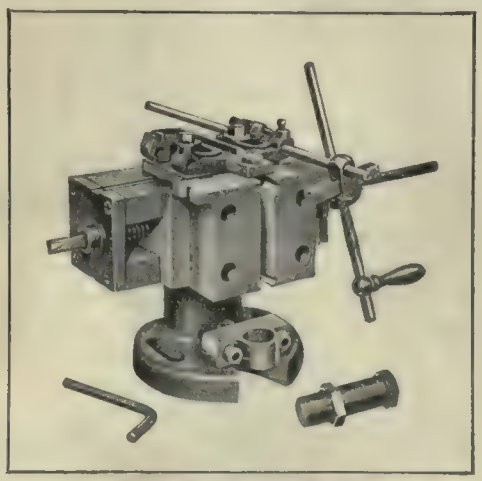
Specifications: No. of spindles, 3 or 4. Swing, 2⅜ in. Capacity: to flute reamers from ⅛ to 2¾ in. in diameter; to flute reamers from ⅜ to 2½ in. in diameter. Width of head block: 3 spindles, 9½ in.; 4 spindles, 12½ in. Combined length of head and tailstocks: 3 spindles, 27 in.; 4 spindles, 28 in. Net weight: 3 spindles, 260 lb.; 4 spindles, 295 lb.

same direction by means of the crank, acting through hardened worms on the driving shaft. The indexing for pieces having any number of flutes up to 20 can be done by means of a single full turn of the indexing handle, change gears being provided so that the ratio can be varied to suit the number of flutes necessary. The spindles are clamped simultaneously by means of one handle. They are connected by equalizing levers, so as to allow of a variation in length of ⅛ in. on the work being milled. They are provided with taper holes in the ends, so that the centers are removable. Centers to hold either round or square pieces can be furnished.

The tailstock is separate from the head, two styles being made. One style is solid and the other has separate vertical adjustment for each center. Either round or square stock can be held.

John Universal Chuck

The John Chuck Co., Milwaukee, Wis., has added to its line a universal drilling machine chuck, shown in the illustration. The device is intended to be used for



JOHN UNIVERSAL CHUCK

holding work while performing such operations as drilling, reaming, spot-facing, milling, centering, grinding and tapping, being employed chiefly on the tables of drilling machines. False jaws are made to conform to the work and if hardened will last indefinitely. An adjustable arm is furnished to hold the stop. A male or female center may be used in place of the stop. Guide bushings may also be used when necessary. The jaws are operated by means of a right- and left-hand screw, thus being self-centering. The screw is of high-grade steel and provision is made for taking up end thrust. A handle is provided, by which the screw can be operated from either end of the chuck.

The body and crossheads of the chuck are made of cast iron. Provision is made for taking up the wear on the crossheads. The screw and crosshead ways are housed in the body, protecting them from chips, grit and foreign substance. Extension bases can be furnished for long work.

The work can easily be placed in the chuck and quickly removed from the front when the operation is completed. The cutting tool is always in close proximity to the work but does not interfere with handling.

Acme Automatic Charger for Electric Industrial Vehicles

The Acme Electric and Manufacturing Co., Cleveland, Ohio, has recently introduced a charger for the batteries of industrial trucks. The charger, known as the "Acme" and shown in the illustration, is intended to charge the battery at the rate recommended by the battery manufacturer. This feature is said to eliminate much of the trouble incident to the use of too high a charging rate, which will overheat and ruin a battery, or too low a rate, which will "starve" it.



ACME AUTOMATIC CHARGER FOR ELECTRIC INDUSTRIAL VEHICLES

The following points are brought out by the manufacturer: The chargers automatically take care of the charging rate without the use of rheostats; they give a tapering charge, which prolongs the life of lead batteries; they maintain a constant ampere-charging rate; and a safety control on the switchboard insures protection to the operator. All high-voltage parts are inclosed.

To operate the charger the ampere-hour meter is set to correspond to the truck meter and the charger is started by means of the automatic-switch handle. When the battery becomes fully charged the ampere-hour meter actuates a trip in the switch and the motor is shut down, the battery being disconnected simultaneously.

The charger takes up a little more than a square foot of floor space. Its motor is of liberal capacity and built for heavy service; and the generator is constructed to suit the battery. The shaft is one solid piece, rotating on ball bearings, the dynamically balanced armature and rotor both being mounted on it. The commutator has a large radiating surface and maintains a low operating temperature. Cool operation is afforded by

a Sirocco-type fan, which ventilates the machine by drawing air through the windings.

An automatically operating panel accompanies the charger. It is made of rubber-finished electrical slate mounted on an angle-iron frame and contains the following equipment: Volt-ammeter for indicating the battery charging rate and voltage, field rheostat for regulating the generator voltage, fuse for protecting the generator, ampere-hour meter for automatically controlling the charger, this meter also containing a dial which indicates the progress of the charge, and an automatic oil switch for controlling the motor and for disconnecting the battery on completion of charge.

Diamond Type-C High-Duty Surface Grinding Machine

The Diamond Machine Co., 9 Codding St., Providence, R. I., has just placed on the market the Type-C, high-duty, surface-grinding machine. The machine is intended to do small work, although it can handle pieces up to 10 in. wide, 24 in. long and 8 in. high. It is made much heavier than the usual small surface-grinding machine, so that rigidity and freedom of vibration might be obtained. The maker claims that the type of construction and the distribution of the weight enable the machine to give both speed of production and accuracy and finish to the work.

The machine is intended for use where heavy cuts, as well as light finishing operations, must be made, provisions for wet grinding being incorporated. Guards are provided to prevent the cutting lubricant from splashing off the table. The coolant flows from the table through channels into a separate compartment within the base of the machine where the grit settles, allowing the clear liquid to be pumped back to the "spreader," or special form of nozzle which directs the stream to the point of grinding.

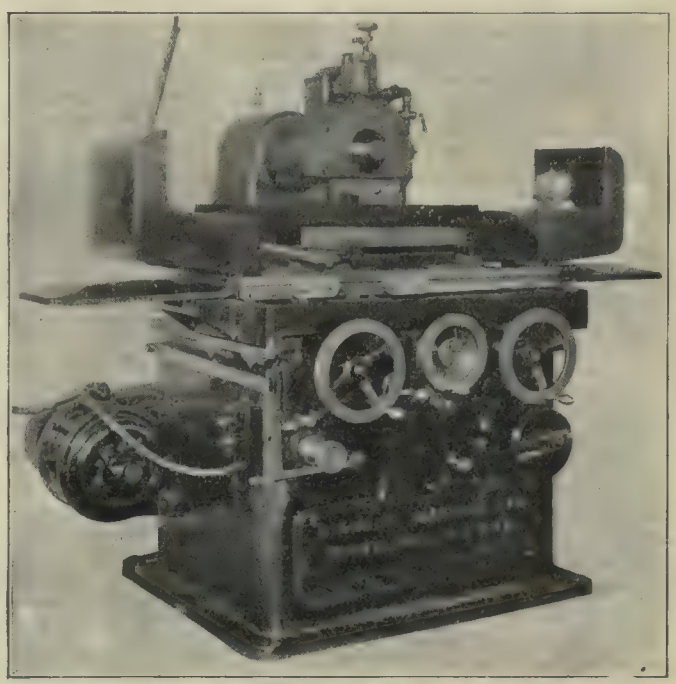
The machine has individual motor drive, the motor being a component part of the machine, and standard in all respects. Provision is made, however, to drive from a countershaft, in case that this be desired.

The wheel-head is cast integral with the vertical column. The combined column and head, rather than the head alone, can be adjusted vertically to suit the thickness of the work. The mass of the column added to that of the head is said to give stability to the wheel. Also, the construction makes possible a large area of surface for the ways of the vertical slide. The joint contains a long narrow tongue, which is said to hold the head firmly without excessive tightening of the gib.

The main spindle bearing is placed close to the grinding wheel. It is a composite ball and plain bearing, the plain bearing consisting of a floating bushing adjacent to the ball races. It is stated that chatter is thus practically eliminated, and that since the ball bearing takes care of almost the entire radial pressure there is no appreciable wear on the floating bushing. The rear end of the spindle is also ball bearing. The driving pulley is between the two spindle bearings and nearer the rear bearing, so that vibration of the driving belt is not apt to affect the wheel. The spindle is 2¼ in. in diameter between the bearings, so that flexure may be avoided.

The handwheels for the adjustments are arranged side by side at the top and front of the base, and are placed symmetrically with reference to the center line of the machine. The left-hand wheel controls the longitudinal travel and moves the table about 2 in. per revolution; the center wheel moves the table transversely 0.500 in. per revolution; and the right-hand wheel moves the wheel-head with the column vertically 0.100 in. per revolution. The outer edges of the rims of the two latter wheels have graduations for each thousandth of an inch, so widely spaced that the operator can split the thousandths into tenths. Ball thrust bearings are used on both the horizontal and vertical adjusting screws.

The ways providing for motion in the three directions of travel are completely covered by metal guards to prevent injury from abrasive dust or gritty water. Longitudinal travel of the table is accomplished by a train of belt-driven gears and reversal is effected by a single shifting belt. A device insures a complete shifting of the belt at each end of the stroke. A "stop trigger" is provided, a momentary pressure of the finger upon this trigger stopping the table at the completion of any stroke already begun. By means of a clutch connected with the left-hand wheel the table travel can be stopped at intermediate points.



DIAMOND TYPE-C, HIGH-DUTY SURFACE-GRINDING MACHINE

The traverse or "in and out" table feed is automatic, and adjustable from 0.001 in. to 0.020 in. per stroke. The feed takes place at both ends of the table travel and can be in either direction. There is an automatic stop which prevents overtravel and which can be set to disengage the feed at any desired point.

It is stated that the machine can take a cut 0.234 in. deep and ⅛ in. wide, or a total cross-section of 0.015 sq.in., one reason for the large size of the cut being that the usual sliding toothed clutch for reversing has been eliminated. Also, a pound of metal can be removed per minute, although it is not recommended that stock be removed that fast, because the grinding wheel would wear away too rapidly. However it is stated, since the capacity of the machine surpasses the capabilities of the wheel, the machine will not be strained in service and will have a long life.



NEWS SECTION

Situation of the Austrian Iron and Machine Industry

The rather acute iron shortage existing during the past months shows a considerable improvement of late. This improvement is due, in a measure, to the large shipments from Germany and Czecho-Slovakia, where a slump in business has freed considerable stocks for export. Apart from this, however, the inland production has made some headway lately. The cut in iron prices, of which we hear so much in the papers and which has taken place in other countries, has not made itself felt in Austria so far; on the contrary, cost prices are showing an upward tendency as is reflected by the recent increase of prices for Donawitz bar iron. Output of Styrian pig-iron during 1920 is estimated at 150,000 tons compared with 60,000 tons in 1919 and 600,000 tons in 1913. The output of crude ores shows an increase of 70 per cent only, owing to labor shortage. The Alpinische Montangesellschaft reports an increase in the output of finished rolled products of 20 per cent, against the preceding year.

Steel production shows an improvement which was chiefly brought about by the extensive use of scrap and old material, the reserves of which, however, are now stated to be rapidly diminishing. A distinct revival is noticeable in the special steel industry, particularly in the export business, which, of course, is due to a large extent to the lowered value of the krone. Supply of the special steel works with iron is more satisfactory now that the Alpinische Montangesellschaft and the Boehler works have blown in one more charcoal blast furnace each. The coal famine is still affecting the entire industry. The malleable iron foundries and openhearth furnaces are the chief sufferers. Foundries are commenting upon the reticent attitude of consumers owing to high prices which, they declare, had to be advanced by the recent wage concessions.

The aspects of the tool industry are more hopeful than they were a couple of months ago and the machine industry likewise reports, broadly speaking, satisfactory business, most of the works being well stocked with orders. The locomotive works turned out 211 engines and 73 tenders during 1920, which would represent about half their normal productive capacity. Old government orders having been completed, the federal department for traffic and transportation has recently placed another order for 76 engines and 700 cars.

Conditions in the railroad-car industry—which is busy on export orders—as well as the mining machinery, hoisting gear, pump and water power plant machinery, are decidedly better. Production of steam engines, however, is slowing down in the face of steadily decreasing demands, preference being given to motors of all kinds. Trade in the fittings industry is slumping.

Apart from the raw material question, it is the fuel supply problem that commands most of the attention in industrial circles. The total supply of inland and imported fuel amounted to 6,469,110 tons in 1920 compared with 4,824,123 tons in 1919. While the coal shortage is still being severely felt, a comparison of the supplies of January, 1919, and December, 1920, would show that an improvement is gradually taking place, 27.2 per cent of the total quantity required being supplied in the former and 41.9 per cent in the latter. Inland coal output has increased from 2,000,000 tons in 1919 to 2,500,000 tons in 1920 and the government is confi dent that the next few years will wit ness a doubling of the present output.

New magnesite and gypsum deposits have been discovered in the Styrian forests and it is hoped that it will be possible to start mining operations on a large scale at the end of the year. Several inland and foreign concerns, among others Krupp's at Essen, have already evinced a keen interest in the newly discovered magnesite deposits as the magnesite is stated to be excellently suited for industrial purposes.

United Engineering Society Elects Officers

At the annual meeting of tne board of trustees of United Engineering Society held on Jan. 27, the following persons were elected officers of the society for the ensuing year: President, J. Vipond Davies; 1st vice-president, Calvert Townley; 2nd vice-president, W. L. Saunders; secretary, Alfred D. Flinn; treasurer, Joseph Struthers; assistant treasurer, George H. Pegram.

S. A. E. Summer Meeting Dates and Place Set

The Society of Automotive Engineers has just announced the completion of arrangements for its 1921 Semi-Annual Meeting. The West Baden Springs Hotel at West Baden, Indiana, has been selected as the place for this year and May 24 to 28 are the dates set.

The program for the technical meetings has been outlined but it can only be stated that indications point toward the presentation of papers that will be classed among the most noteworthy presented at meetings in the past. There will be sessions devoted to fuel, research, aeronautics, farm power, highways and transport, and engineering relation to sales. The latter subject is particularly pertinent at this time and should arouse unusual interest.

The members and their guests can arrange to attend the annual 500-Mile Race at Indianapolis on Decoration Day as part of their vacation. West Baden is 120 miles south of Indianapolis and it will be noted that the S. A. E. meeting closes on Saturday and Decoration Day falls on the Monday following.

The officers of the Society and the Meetings Committee are extremely enthusiastic over the selection of West Baden and look forward to the greatest Summer Meeting ever held by the S. A. E.

Georgian Business Men To Tour That State in Better-Business Campaign

About 150 prominent business men of Georgia, leaders in the state's industrial and commercial life, will make a tour of the state during the week of April 4 to 9 under the auspices of the Georgia School of Technology, of Atlanta, with the end in view of starting a business and industrial revival in Georgia that will result ultimately in the expansion and further development of the state's resources.

One of the principal objects of the tour, which will cover thirty-seven towns and cities, will be to bring about the development of Georgia's facilities as an iron-ore production center through the establishment of mines and furnaces in those sections where ore abounds.

Business Conditions as the Big Banks of the Country See Them

Peoples National Bank of Pittsburgh Thinks Stock Market Over-Discounted Situation—Steel Trade Outlook Something Like that of 1908

The favorable developments thus far in 1921 have been largely of a negative character. That is to say, none of the seriously disturbing things anticipated in December happened in January. The decline in the stock market during the closing weeks of 1920 apparently over-discounted the situation, and last month witnessed a substantial recovery in all kinds of securities, the demand for and advance in bonds, however, being more genuine than the movement in stocks.

It is possible that the financial preparations of corporations during the last quarter of 1920 to tide over an uncertain situation at the opening of the new year were also overdone, although affairs have not as yet progressed far enough to be positive on this point. At the opening of the second month of 1921, a somewhat more cheerful feeling prevails, particularly in those industries which were most depressed, and a partial resumption of operation has taken place.

Steel Trade Outlook

The steel trade outlook is not much, if any, clearer today than it was a month ago. This is likewise true of the fuel industry. The principal things that have happened have been the establishment of a parity of quoted prices on steel products which enter most largely into tonnage, and the placing of some fair sized orders for steel rails. In a few instances smaller manufacturers are reported to have quoted concessions on the March, 1919, prices on certain products, but this was apparently for the purpose of testing market sentiment. The results were not satisfactory in the way of stimulating new business. There is no evidence of any concerted policy being agreed upon, but by common consent the trade, after the early announcement of readjustment of prices to the 1919 level, seems to have adopted the attitude of watchful waiting. Consumers also appear to have adopted a similar policy.

In this respect the situation somewhat resembles that which developed in the spring of 1908 following the severe financial disturbances of the last quarter of 1907. It will be recalled that during the first quarter of 1908 the mental state of the public was such that steel manufacturers reached the conclusion that considerations of price would not stimulate buying; that time would be required for a healing of the financial sores and commercial bruises of 1907 before confidence was recovered. The consequence was that the pig iron output fell from 25,781,000 tons in 1907 to 15,936,000 tons in 1908. There was a moderate shrinkage in Germany's output from 13,045,000 tons in 1907 to 11,813,000 tons in 1908, but in Great Britain, France and Russia the decrease was insignificant.

In other respects there was contraction in industrial activities in that year. Thus the number of miles of railroads built in the United States decreased from 5,212 in 1907 to 3,214 in 1908; the number of freight cars built from 284,188 in 1907 to only 76,555 in 1908, and the number of locomotives from 7,362 in 1907 to only 2,342 in 1908. There were 24 railroad receiverships representing 8,009 miles of track and $596,359,000 stocks and bonds in 1908 against only seven receiverships, 317 miles and $13,585,000 stocks and bonds in 1907. The index number of commodity prices fell from 9.0409 (Bradstreet's) in July 1907 to 7.7227 by the middle of 1908. It was not until June 1908 that a turn for the better occurred and bank clearings began to expand, and it was not until the beginning of the last quarter of that year that commodity prices began to recover.

Analogies and Contrasts

In quoting these figures it is not intended to suggest an analogy between 1908 and 1921. That there is some analogy between the reckless speculation of 1906-7 and the industrial boom of that period and what happened in 1919-20, none will deny. That there was some similarity between the monetary stringency of the two periods is recognized. What is warrantably to be deduced, however, is that there is some likeness between price conditions and the attitude of consumers at the opening of 1908 and now. Whether the policy of 1908 of waiting for a change instead of trying to force a change will be adopted in 1921, is something that remains to be seen.

From the attitude of steel manufacturers last month the inference is permissible that the trade is inclined to await developments, on the theory that some months may elapse before there is a change of sentiment concerning prices. The fact is pointed out that in the textile trade some five or six months elapsed between the slash in wholesale prices and the beginning of buying by retail distributors, and that the "strike" on the part of consumers of clothing, shoes, etc., has not yet been entirely broken. In the automobile industry the recovery is still scarcely perceptible.

True, there is one basic difference between the steel trade and its affiliated industries and the others just mentioned, namely: there is at present no over-production and there is virtually no accumulation of surplus stocks. The reaction in steel and fuel was so sudden and overwhelming, and production costs were on such a high plane, that the brakes were applied with celerity, thus preventing congestion. However, as frequently pointed out in these reviews, the potential producing capacity of existing plants today is in excess of domestic needs, and for the future the industry faces competition not alone from Germany—the second largest potential producer and for the past five years excluded from outside markets—but it faces world competition. Furthermore, it faces a credit situation which, while arising out of causes differing from those which produced the 1908 situation, are fully as strained.

Whether well founded or not, the impression seems to be that steel prices will be lower before they are higher, and that the costs of construction—including the cost of capital as well as of material and labor—must be considerably reduced before there is a revival of activity.

Guaranty Trust Co. of New York Says Price Drop Is More Gradual—Foreign Trade Largest on Record—Course of Foreign Exchange

Improvement in the business situation as a whole continues slowly, but more or less steadily. While the textile industries of New England are resuming operations, and farm products are moving more quickly, there are evidences of slackening activity in the steel and iron centers, and idle railroad rolling stock is increasing. Wholesale dealers and jobbers complain that while their prices have been reduced to costs, retailers continue to place orders on the day-to-day basis. The retailers declare that their prices are at rock bottom, and that offers of big reductions from the sale prices of a few months ago obtain no response from the ultimate consumer, who expects prices which would represent too big a loss to the stores, despite the apparent opportunity to replace at lower levels.

The consumer, on the other hand, has failed to be convinced by the fact that the price drop in this country is the most precipitate on record, and that he should not wait for a greater fall, if each element in the country is to do its share toward the maintenance of an orderly, conservative and safe readjustment. This attitude is due in part, of course, to the consumer's loss in buying power resulting from reduced wages,

part time work, and unemployment. The effect is seen in the decrease in railroad traffic, in the diminished bank clearings, in the falling off of mail orders, in the effort which producers are making to contract their cost expenditures. This last involves further wage reductions and a whole train of attendant circumstances which no one can predict.

Constructive Factors

Holding the controlling lever and giving promise of approaching stability, however, are those factors in the situation which lie on the constructive side of the problem. Arrangements are being made to dispose of a large part of the country's copper surplus through private financing. The War Finance Corporation has made a survey of the markets and this country's ability to supply them. The Foreign Trade Financing Corporation is being organized to furnish credits to cover exportation of American products. There is a disposition on the part of industrial enterprises to avoid complete disintegration of their working forces or scrapping of their plants. In a dozen directions efforts are being made to extend business or at least to hold fast. Many look to see the traditional dullness of February give way to an Easter revival of old-time proportions. It is a period where constructive planning and optimism as to the future prevail over the mere surface conditions. Hence the perceptible feeling everywhere that the trend inclines toward improvement.

The Price Movement

During the third week of January the decline in wholesale prices continued, but more slowly than during the first two weeks of the year. In the following week the rate of decline was accelerated, while during the first week of February the number of advances in the wholesale prices of household commodities as compared with the declines swung upward. Last week the declines were again in the majority. By the end of the month a comparison will probably show a net decline, but, as was the case for the month of January, at a slower pace than during the preceding month. In the opinion of business men who perceive the difficulties in the way of recovering from a severe setback, a normal condition would in the end have been reached more quickly had the sweep of price reductions inaugurated last year not been so intense and so wide.

Foreign Trade in 1920

With exports valued at $8,288,759,000 and imports valued at $5,279,398,000, the foreign trade of the United States during 1920 exceeded all previous records. The figures show that exports were one-third greater than those in 1913 and our imports were nearly three times those of that year. As compared with 1919 our exports increased from $7,920,425,000 to $8,228,759,000, or by $308,334,000. Imports, on the other hand, increased from $3,904,364,000 to $5,279,398,000, or by $2,275,034,000. Our favorable balance of trade, as a result of these shifts in the course of trading, was reduced from $4,016,061,000 in 1919 to $2,949,361,000 in 1920.

During 1920 there were increases in United States exports to Germany, Spain, Canada, Central America, Mexico, Cuba, Argentina, Brazil, Chili, Uruguay, China, British India, Dutch East Indies, Japan, Australia, Philippine Islands, British South Africa, and Egypt. The most notable increase was, of course, in the case of Germany, which took merchandise to the value of $311,437,000 as compared with $92,761,000 in 1919. As for our imports they were increased from every country except Greece, Spain, Brazil, Uruguay, Australia, and British South Africa. Imports from Belgium increased from $7,700,000 to $47,443,000; from France, from $123,819,000 to $165,654,000; from Germany, from $10,608,000 to $88,836,000; from the United Kingdom, from $309,189,000 to $513,846,000; from Cuba, from $418,610,000 to $721,695,000; from Egypt, from $39,628,000 to $97,015,000.

Foreign Exchange

The report of the Department of Commerce on the foreign trade of the United States during 1920, coming at a time when the European statesmen were gathered to discuss the amount of reparations money to be paid by Germany, has directed attention to the matter of foreign exchange, and the question of its course in the immediate future is being eagerly discussed. A sudden showing of strength by Sterling during the last week of January, which was accompanied by a rise in Continental exchange, was interpreted as reflecting the prospect of an early and definite settlement of the amount which Germany would be compelled to pay. Sterling exchange went to $3.89, the highest point touched since July of last year. The percentage of gain was even higher in the case of some Continental exchanges. There was also read into the rise the fact that general economic conditions are improving rapidly in the leading countries of Europe. In the case of Great Britain, while detailed figures are not available, it is probable that the current balance of trade is in her favor, not considering that much of her renewed foreign business is being done on long term credits. Demand bills on London sold from $3.79 to $3.85½ last week. During the same week a year ago the rates ranged from $3.19 to $3.49½. The low rate for the present year is $3.53¼.

The decision of the Entente Allied statesmen as to the sum Germany must pay, together with the provisions for a tax upon her exports for many years to come, was followed by a decline in European exchange.

National City Bank of Chicago Sees Further Decline in Living Costs—World Hungry for American Capital

Continued liquidation in various branches of industry with a sufficient readjustment of commodity prices to depress quotations to an average level virtually 40 per cent below the high record of the inflation period, has benefited the general situation and brought about a more hopeful feeling concerning the future. The credit strain is less acute and within the past month there has been an encouraging movement by retail merchants throughout the country to lower prices to a level which should attract public buying on a large scale. This has led to the distribution of a large quantity of valuable merchandise and while the movement has been by no means completed, it has assisted in the thawing out of a portion of the frozen credits. This movement, together with the greater contraction of credits growing out of heavy selling by wholesale interests, is bringing the sort of relief that the country most needed in its campaign for lower prices. The government figures show that during December the retail cost of more than 20 food commodities declined 8 per cent while a recent analysis of average import prices showed that 71 articles were now obtainable at recessions. This is deflation of the right sort and shows how effective the nation-wide buyers' strike has been in relieving the markets of the more serious abuses which developed during the period when the seller and not the buyer was in absolute control of the market.

The country's spending power has been greatly reduced by the growing unemployment, the sharp decline in farm products, the reduction or omission of dividends by numerous corporations, and the various vicissitudes which are encountered in every community in a season of declining wages. Partial compensation for the wage reductions will come from the decline in living costs which are bound to become more pronounced as the season advances. It must be remembered also that statistics show that from 60 to 75 per cent of the original purchasers of Liberty Bonds still retain those securities. This represents a reserve purchasing power of great potential influence, since the war issues are largely in the hands of small investors who conceivably may be induced to make considerable purchases of merchandise when the price decline has gone as far as they think it should go. In this connection it is interesting to note that within recent months the public as well as the banks have been heavy purchasers of Treasury certificates of indebtedness. Out of $2,350,000,000 of such certificates outstanding only about $131,000,000, or less than 6 per cent, are held by the Federal Reserve banks as collateral for loans. This represents an important change and means that member banks which previously were heavy borrowers at

the Federal Reserve banks have found it more profitable to pass these investments on to their customers. It is easy to see that this movement would not have taken place at all had not rediscount rates been maintained at a level high enough to make it profitable for the banks to pay off heavy loans thus secured and pass on the underlying securities to the investing public where they belonged.

Money rates have reflected the temporary ease which usually follows the turn of the year when the return flow of dividend money to the great financial centers sets in. It is also true that the credit strain has been appreciably relaxed by the selling of merchandise and various collateral pledged for long standing loans. It takes much less credit to finance day to day business at the prevailing price level, and with production costs somewhat lower and household expenses reduced the pressure upon the money market must be relieved to some extent. There is nothing in these conditions, however, to indicate that a long period of easy money is in sight, or that the banks have abundant funds with which to finance a great volume of speculative undertakings. All the world is still applying for American capital, and it is evident that the new Belgium Government $30,000,000 loan will be followed by many others, these offerings being restricted only by the willingness of the American investing public to supply the funds required. The sharp rise in French exchange has been attributed to plans under way for a later loan for the French Government. It has been reported also that Great Britain later in the year may place a loan in the United States. Virtually all the South American countries would be glad enough to borrow here if the accommodation was forthcoming at acceptable terms. Inasmuch as such advances to the hardpressed European nations must be classed as highly essential financing and of a character contributing not alone to the restoration of crippled industries abroad, but also to the upbuilding of American industry which possesses the only productive machinery capable of providing the material required, it is easy to see that it is our duty to take care of these borrowers and make the advances required at terms consistent with the almost world-wide demand for such accommodation. The total demand for essential borrowings, therefore, is so great as to suggest the folly of expecting an accumulation of free credit soon.

American Engineering Council Meets in Syracuse

The two-day conclave of engineers and technologists from all sections of the country began in Syracuse, N. Y., on Feb. 14 with the announcement by Herbert Hoover, president of the American Engineering Council of the Federated American Engineering Societies, of the appointment of a committee on Elimination of Waste in Industry.

The appointment of this committee, according to Mr. Hoover, marks the beginning of a great national assay of waste, in which from 100,000 to 200,000 engineers functioning through the council will attempt, by studying the nation as a single industrial organism, to locate the weaknesses in the country's production system.

A preliminary survey has already been organized and the different elements making for production waste, such as labor conflict, decrease in individual productivity, lack of co-ordination, and many other sources of industrial failure will be brought under the close scrutiny of the organized engineers of the nation with the aim of solving pressing economic problems.

The personnel of this committee follows:

J. Parke Channing, mining engineer of New York City, vice-president of the F. A. E. S., and member of the American Institute of Mining and Metallurgical Engineers, chairman.

Dr. Ira N. Hollis, president of the Worcester Polytechnic Institute, Worcester, Mass., and past president of the A. S. M. E.

L. W. Wallace of Baltimore, member of the A. S. M. E., member and president of the Society of Industrial Engineers, and treasurer of the F. A. E. S.

H. R. V. Scheel, assistant treasurer, Brighton Mills, Passaic, N. J., and member of the A. S. M. E.

L. P. Alford, editor of *Management Engineering*, New York, vice-president of the A. S. M. E., and director of the Society of Industrial Engineers.

George D. Babcock, manufacturing executive of Peoria, Ill., and author of "Taylor System in Franklin Management."

F. G. Coburn, Bethlehem Shipbuilding Co., former commander in the Construction Corps, U. S. Navy.

Morris L. Cooke, consulting engineer in management, Philadelphia, member of A. S. M. E., Taylor Society and Society of Industrial Engineers.

Harington Emerson, consulting engineer of New York, member of the A. S. M. E., and Society of Industrial Engineers.

E. E. Hunt, New York, formerly labor investigator for Clothing Manufacturers' Association, New York City, member of the Taylor Society.

C. E. Knoeppel, industrial engineer of New York City, member of the A. S. M. E., and the Society of Industrial Engineers.

Robert Linton, Montana mining engineer and member of the American Institute of Mining and Metallurgical Engineers.

Fred J. Miller, past president of the A. S. M. E.

J. H. Williams, engineer of New York City and member of the Taylor Society.

Robert B. Wolf, New York engineer, vice-president of the A. S. M. E., and a pioneer in the three-shift system of industry.

Mr. Hoover, who is president of the American Engineering Council, is also a member of the committee of which he is one of the principal sponsors. He will take a leading part in the assay of waste which the committee will conduct for the council. Mr. Hoover is a member of the American Society of Civil Engineers, president of the American Institute of Mining and Metallurgical Engineers and a member of the American Society of Mechanical Engineers.

The committee, it was announced, has already started work and a nation-wide plan will be put in operation from the New York and Washington headquarters of the council at once. The scope of the undertaking was outlined by Mr. Hoover in an address which he made following the dinner given by the council and which was attended by prominent engineers from every industrial center, including special delegations from the engineering centers of New York State.

Other Problems

Morning and afternoon sessions of the council dealt with numerous social, industrial, political and technical problems. Betterment of Patent Office conditions in Washington through bringing about the passage of the Nolan Bill, was recommended.

The council gave formal approval to the action of the committee on Procedure requesting that President Harding put an engineer on the Interstate Commerce Commission. The Procedure Committee was authorized to name six qualified engineers.

Activity in behalf of a National Department of Public Works will be continued by the council through the Public Affairs Committee. It was recommended that engineering efforts be extended to the whole question of government reorganization planned under a special congressional committee.

The plan for the registration of engineers as presented in the council's report was endorsed and the appointment of another committee was authorized. The Russian Affairs Committee was made a new committee on International Relations, the personnel of the old committee being retained.

An invitation from Philadelphia engineers to hold the April meeting in that city was accepted. The June meeting will be held in St. Louis.

The council decided to recommend to President Harding that an engineer be appointed assistant secretary of war. No action was taken relative to the National Civic Federation, Fuel Conservation, or Merchant Marine Committee appointments. The Committee on Public Affairs was authorized to recommend the congressional appropriation to investigate deeper waterways—particularly those pertaining to the St. Lawrence project.

Mr. Hoover presided over the meeting of the executive board which represented universities, engineering societies and industries in many states. The vice-presidents of the council are Calvert Townley of New York, W. E. Rolfe of St. Louis, Dean D. S. Kimball of Cornell and J. Parke Channing of New York.

Idle Freight Cars Increase

There were 323,376 idle freight cars on the railroad lines of the United States in the week ended Jan. 31, according to semi-official sources. This was a gain of more than 22,000 cars over the preceding week. Car loadings for the week ended with Jan. 29 were 699,936, a decline of 103,396 from the corresponding period a year ago and 18,361 less than in the corresponding week in 1919. The number of idle cars reported is the greatest in more than ten years.

Lawrence Wilkerson Wallace, Secretary of American Engineering Council

Lawrence Wilkerson Wallace was elected secretary of the American Engineering Council at the meeting of the executive board in Syracuse, N. Y., on Feb. 14, succeeding L. P. Alford of New York who has been acting secretary since the formation of the council in Washington on Nov. 19, 1920. Mr. Wallace has been one of the most active figures in the council and from the time it was organized had been its treasurer. As vice-chairman of the council Mr. Wallace has been directing the work of the committee on Elimination of Waste in Industry, one of the principal committees of the council whose scope, following the Syracuse meeting, will be greatly broadened.

Mr. Wallace was born in Austin, Tex., Aug. 5, 1881. He was graduated from the Agricultural and Mechanical College of Texas in 1903 with the degree of B. S. in Mechanical Engineering. In 1912 he received the degree of M. E. from Purdue University. From 1903 to 1906 he served a special apprenticeship with the Santa Fe Railway Co. and was a member of the Purdue faculty during 1906-07 becoming head of the department of railway and industrial management. During this period Mr. Wallace conducted researches and did consulting work in railway mechanical engineering and factory management. For several years he investigated fire losses from locomotive sparks and gave expert testimony in many fire cases.

Mr. Wallace is well-known as an author of technical works. His volume on "Car Design" is used as a textbook as well as generally by designers. He also has written special instruction books for railway educational departments and papers on engineering and management topics before railway and management societies.

Mr. Wallace brings to the secretaryship of the council the experience of a manufacturing executive. He was formerly assistant general manager in charge of Production of the Diamond Chain and Manufacturing Co. of Indianapolis. More recently he has been director of the Red Cross Institute for the Blind in Baltimore, which provided vocational training to the blinded men of the military forces.

Mr. Wallace is a member of the American Society of Mechanical Engineers and the vice-chairman of the society's management section. He is now serving his third term as president of the Society of Industrial Engineers and is a past president of the Indiana Engineering Society. Mr. Wallace is a member of the International Railway Fuel Association, Western Railway Club, Master Car Builders' Association, Academy of Political and Social Science, and Western Efficiency Societies. Mr. Wallace is prominent in masonry, and is a past grand lecturer of the Grand Lodge of Indiana.

Mr. Wallace's social and commercial activities embrace a wide range. His work in New York as vice-chairman of the committee on Elimination of waste in Industry has been instrumental in bringing national attention to the purposes of the council.

Mr. Wallace, now at the temporary headquarters of the council in the Engineering Societies Building, New York City, will soon transfer his activities to Washington, where the council has established permanent national headquarters in the McLachlen Building. The Employment Service Bureau will be continued in New York where Walter V. Brown is in charge.



LAWRENCE WILKERSON WALLACE

Automotive Engineers Hold One-Day Meeting at Columbus Tractor Show

The annual tractor session of the Society of Automotive Engineers was held at the New Southern Hotel, Columbus, Ohio, on Feb. 10. E. A. Johnston of the International Harvester Co. was in the chair at both morning and afternoon sessions and made an address on the trend of tractor design.

At the morning session D. L. Arnold, also of the Harvester Co., presented a report on an investigation of plowing speeds; John Mainland of the Advance Rumely Works reported for the committee on pulley widths and speeds; and O. B. Zimmerman read a paper on anti-freezing solutions for tractor cooling systems.

In the afternoon Professor O. W. Sjogren told of the Nebraska State University tests on sixty-nine different tractors and commented on some of the results obtained. A. W. Scarratt of the Minneapolis Steel and Machinery Co., in a paper describing a successful alcohol fuel equipment for tractor use, characterized alcohol as the coming motor fuel, particularly for foreign use, and called attention to the fact that even now alcohol is the cheapest fuel obtainable in some parts of the world. The discussion brought out a statement from Professor C. A. Norman of Ohio State University to prove that for a good many years to come gasoline would be cheaper than alcohol in this country because of recent developments in shale oil extraction processes and the wide extent of oil-bearing shale deposits.

The Tractor Banquet was held at the Hotel Deschler in the evening and was the occasion of three excellent addresses and a very clever moving picture. The "movie" was prepared by the Timken Roller Bearing Co. and was in the form of animated cartoons taking off the better known tractors and their designers. Colonel Fred Glover as toastmaster introduced Professor J. B. Davidson of Iowa State College, who spoke on the field in agricultural machinery development for the automotive engineer. He was followed by L. J. Taber, Master of the Ohio State Grange. Mr. Taber mentioned the rumored farmers' strike and gave it as his opinion that it was as unlikely as the conversion of the farmer to bolshevism. He told of conditions on the farm where all sorts of labor-saving agricultural machinery had been installed and the farmer's wife carried water a hundred feet to her kitchen door, and pointed out the opportunity for the household machinery manufacturer to educate and sell the farmer the inside equipment he ought to have to make life more livable for his family.

The last speaker was W. H. Stackhouse, President of the National Implement and Vehicle Association. Mr. Stackhouse discussed business conditions and prices of farm implements and called attention to the fact that the implement manufacturers had not been guilty of profiteering and that consequently there could be little reduction in their selling prices until material and labor costs were greatly reduced.

The Machine Tools Trades Association and German Tools

FROM OUR EUROPEAN EDITION

The annual meeting of the Machine Tool Trades Association, held in the Hotel Victoria, London, S. W.—about sixty members being present—was chiefly remarkable for the discussion on trading in German machine tools. The chairman said that among machine tools were included small tools and wood-working machinery.

A fortnight ago we demonstrated in these columns that the proposal to exclude German tools, for that is what it amounted to, was quite impracticable, given complete unanimity in the association. The discussion showed pretty clearly that even the council, on whose account the resolution was put forward originally, was not unanimous. Sir Alfred Herbert however, perhaps rather quixotically, took personal responsibility for the resolution when moving it. And although the council is, we believe, composed both of manufacturers and merchants, he took this course partly at least because he is

both an importer and a manufacturer, so that, he said, if the resolution were carried he himself would suffer pecuniarily. The logic is a little doubtful perhaps.

While some members of the association who are merchants only might presumably stand to lose, those members who may be described as merchant-manufacturers could surely expect to pick up on the swings what they lost on the roundabouts. The suggestion that, being dealt with only by persons who were not members of the association, German tools would thereby further be discredited was possibly not put forward seriously: few people inquire on such a subject. The resolution was supported by arguments which combined personal sentiment and business.

The objection to trading in German goods most often in evidence, and it is undeniably cogent, lies in the present rates of exchange. The debate was, however, lifted to a higher plane by J. H. Barker, of Greenwood and Batley, and Mr. Massey, of the Openshaw firm. The former, in order that the whole position should be clearly understood, proposed as an amendment that American tools should also be excluded, and the gravity of the position was clearly shown by Mr. Massey, who recalled the duty the machine-tool trade and industry owe to the British engineering industry, that the latter shall have the best available tools with which to carry on work. After these two speeches little doubt remained as to the opinion of the meeting.

While certain speakers referred to the effect of such a resolution on opinion abroad, no one noted what was likely to happen in Germany. The fact is often overlooked that Germany was one of the best customers of Great Britain. Now the world will not return completely to peace conditions until trading between countries is general. The idea of an absolutely self-contained nation is in effect a proposal to return to a lower state of civilization. One can well imagine the delight with which such a resolution, if passed, would have been received by those who, for convenience, may be described as the industrial jingos of Germany. The probable result of such pinpricks is retaliation by way of the boycotting of British goods, as to which the worsted people of the Bradford district and, to come closer home, the high-speed steelmakers of Sheffield, would feel the effects pretty directly.

Contributions to the discussion on one side or other—mostly on one side—were made by C. Wicksteed, F. Pollard, E. Parkinson, H. Selson, J. E. Cohen, W. Hatch, R. Stirk, and others, and the suggestion of W. Deakin that the matter should be deferred a year being rejected by the chairman and the meeting generally, the resolution was defeated by 35 to 11. Any danger of a split in the association was therefore avoided.

The members are free to deal in German goods, not furtively as the chairman had suggested, but openly and frankly, and the question is immediately raised as to the value of the recommendation that members should not advertise in journals publishing advertisements of German goods. For if a merchant is entitled to buy and sell German goods, he is, we presume, equally entitled to advertise the fact. The discussion showed that machine-tool people see that the war is ended, and that British people at least still hold that Hymns of Hate are merely matters for laughter. The association may be congratulated on taking a broad national view in circumstances which might well have excused a narrow outlook. It was decided by 38 or 39 (there being two different countings) to 15 to hold the next exhibition in 1924.

Business Conditions To Improve From Now On

Business conditions will improve from now on, says Archer Wall Douglas, chairman of the Committee of Statistics and Standards of the Chamber of Commerce of the United States, in his monthly review of business issued on Feb. 21.

"The most convincing evidence that we are on the high road to recovery," Mr. Douglas says, "is found in the universal report brought by traveling salesmen from every section of the country, of steadily growing sentiment that 'business will be better in the spring'—not a sudden return to prosperity, which is neither likely nor desirable, but a slow and natural working out of those processes of liquidation which are now in full operation.

There are few who are more respon sible than these same traveling salesmen for the growth of this healthy sentiment, which in effect is the recognition of the inherent soundness of the situation, and that the remedies for it lie largely in constructive action. Not only is sentiment improved, but there is definite increase in the volume of business done. It is not a very great increase, but as Mercutio says, ' 'Twill do,' for it forecasts the beginning of better days. Farmers are gradually bringing their produce to market. Bankers are slowly 'loosening up' and extending to farmers and dealers money and credit, the two vital factors needed to restore the situation. In the tobacco districts of Kentucky, where the deadlock between sellers and buyers seemed unbreakable, there are increasing reports of agreements made and sales consummated.

"Despite the general story of farmers withholding their products, there is daily a steady stream of grain and livestock coming to market, not in full volume, but enough to assist in alleviating the situation. Shipments of early fruits and vegetables from California and the South are running heavily, some 10,000 cars per week, thus distributing much-needed cash among the growers. Caution and conservatism are still universal among merchants in buying, and most orders are restricted to immediate wants for keeping up assortments.

"Out in the world of cold, hard facts, few take much stock in the current prophesies of the coming of a new prosperity at any specified date. Nor yet in those mystic charts which foretell when declines will cease, and business resume its upward march. For it is perfectly obvious that prices have not reached bottom in all lines, and even a Wall Street lamb does not buy heavily on a falling market. The general thought inclines to early spring, March or April, as the date when distinctly definite improvement will set in, though in many parts of the Cotton Belt the belief is that June is early enough to expect a decided change. Yet scarcely any believe that present conditions will prevail throughout the year.

"All are agreed that the only way to hasten matters is by the general exercise of the homely virtues of hard work and economy.

"The South intends to illustrate this theory in a very practical fashion this year by raising the cheapest cotton crop in years; a crop grown on a "corn meal and syrup" diet system of expense. Also farm labor everywhere will be cheaper this year and improved farm machinery is decreasing the cost of production and increasing efficiency per man.

"The present distressful situation brings into vivid relief the inherent and fatal weakness of one-crop countries—cotton and tobacco as salient examples—and how they fail their growers in time of tribulation. The saving grace of the situation today consists in the revenue producing capacity of the numerous factors in the diversified farming sections where livestock (especially hogs and poultry) and dairy products are furnishing ready cash to the farmer and helping him liquidate his obligations. Fortunately the South has progressed a long way toward diversification since the last era of low-priced cotton.

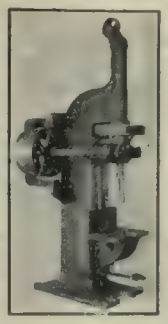
"The tremendous importance of the dairy industry may be gathered from the story of its annual productions. Ten billion gallons of milk, 1,500,000,000 pounds of butter, and 800,000,000 pounds of cheese. To these must be added its hundreds of millions of dollars invested in dairy cows, buildings, land and general supplies. Production is now, and will continue to be, the dominant factor in the business situation. Yet it must be accompanied by intelligent forethought as to adequate distribution of the thing produced. Last summer a large proportion of the garden truck crop in a section of the Rio Grande valley was a dead loss to growers because of lack of cars. Somewhere there has been lack of co-ordination between production and transportation.

"A recent expression of opinion by a number of representative business men throughout the country brought out the significant fact that they were not so much concerned about the problems of labor, material, prices, transportation, and collection on the whole, as they

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Press, Power, "Flexible"
General Manufacturing Co., Detroit, Mich.
"American Machinist," Jan. 20, 1921



The machine is called "flexible" because the amount of pressure applied by the ram can be varied by the operator from a few pounds to 20 tons, depending upon the pressure applied to the pedal. It is stated that a wide range of work can thus be handled, the machine being adaptable to such work as push broaching, straightening, and pressing in bushings. The ram has a stroke of 18 in. with a speed when not resisted of 100 to 140 in. per minute, and the position of the knee is adjustable, a maximum distance of 28 in. between the table and the ram being obtainable. The knee is adjusted for height by means of a rack and pinion, and it is held in position by clamping gibs tightened by six nuts, and by a spring plunger engaging teeth cast in the front of the column. Power is applied to the ram through a worm and worm gear of 10 to 1 ratio.

Ladle, Crane, Geared, "Helical-Worm"
Whiting Foundry Equipment Co., Harvey, Ill.
"American Machinist," Jan. 20, 1921



The device consists of a pair of forged-steel helical gears actuated from the handwheel, and a worm engaging a gear mounted and keyed on the trunnion of the ladle. The use of the worm-gear makes the device self-locking. The worm shaft is placed at an angle, so that the forged-steel worm meshes properly with the straight teeth of the large cast-steel gear. All gears have machine-cut teeth. They are inclosed in a dustproof cover, are readily accessible and can be oiled through small oil holes with spring caps. The gearing is mounted on the trunnion instead of on the ball, so that distortion of the ladle, or ball, or wearing of the trunnion journals, will not interfere with the alignment of the gears.

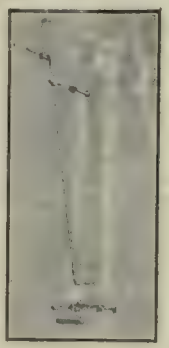
Chucks, Drill-Press, and Pilot-Bar, Air-Operated.
Frontier Chuck and Tool Co., 30 Letchworth St., Buffalo, N. Y.
"American Machinist," Jan. 20, 1921





The chucks are made with either two or three jaws, in either the manufacturing or the adjustable type, and in four sizes, 10, 12, 15 and 18 in. The chuck shown at the top is intended for use when the tools employed are equipped with pilot bars. The pilot bushing is screwed into the chuck and does not slide on its seat. A chuck intended for holding work on the table of a drilling machine is shown below. The bushing extending through the center of it allows chips to fall through. The base rests on four legs, thus raising the bottom of the air cylinder about 1 in. above the table.

Shifter Belt, "Spurgin"
R. G. Haskins Co., 27 S. Desplaines St., Chicago, Ill.
"American Machinist," Jan. 20, 1921



This device consists chiefly of two strikers or guides, one at the top and the other at the bottom of the belt and operated by a single lever, so as to enable the shifting of the belt on the cone pulleys. The belt guides are fitted with rollers running on oilless bearings, both on the edges and on the faces of the belt, so that it is not damaged by the guides. They are automatically locked in position, so that the belt stays on the steps to which it is shifted.

Threading Tool, Internal, "Rapid"
Cruban Machine and Steel Corporation, 63 Duane St., New York
"American Machinist," Jan. 20, 1921



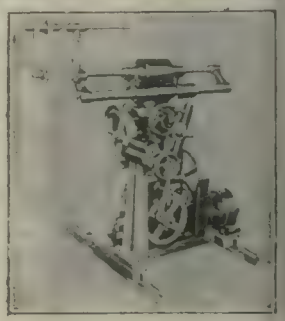
The cutting tool is mounted on a bar carried in a bracket hinged on the shank of the holder. The tool can thus be moved through a small arc by means of the lever. When the cut is started, the lever is turned down. When the end of the cut is reached, the lever is raised, thus dropping the cutter back out of contact with the work. The feed is then reversed so as to bring the cutter to the starting position, the cross-slide being fed in to the proper depth for the next cut. By means of a screw, the amount of swing of the tool can be limited, so that the back of the tool does not strike the threads. Three sizes are made, the shanks being $\frac{3}{8}$ x $\frac{3}{4}$, $\frac{1}{2}$ x $1\frac{1}{4}$ and $\frac{5}{8}$ x $1\frac{5}{8}$ in. in size. The smallest diameter of the hole that can be threaded is $\frac{7}{16}$ in.

Cement, Steel, "Cinch"
Deeds & Chapin, 2130 Montcalm St., Indianapolis, Ind.
"American Machinist," Jan. 20, 1921



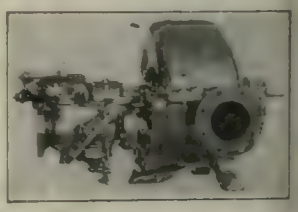
The cement is in the form of a powder and is intended for fastening high-speed steel or stellite to low-carbon steel in making cutting tools, punches, dies and shear blades. When tipping the cutting edge of a lathe tool, such as shown in the illustration, it is stated that only 3 per cent of the tool need be made of high-speed steel. The cement melts at approximately the hardening temperature of high-speed steel, or 2,200 deg. F. Thus the cementing and the hardening of the tool can be done at one heating. It is stated that the cement fastens the steel parts securely and solidly supports the cutting edge and that one pound of it is sufficient to cement in place 250 pieces each 1-in. square.

Buffing Machine, Contour
Contour Buffing Machine Co., Inc., 410 Bird Ave., Buffalo, N. Y.
"American Machinist," Jan. 20, 1921



This machine is intended for feeding against the wheels of standard buffing or polishing lathes, articles of circular, oval, triangular or rectangular form. It is driven by an electric motor attached to the bed plate, which rests on rails that permit a travel of 8 in. to or from the polishing wheel or buff. The work-carrying spindle is slowly rotated and is supported on a sliding frame that has a mechanical reciprocating motion adjustable up to 16 in. in length. The column is supported on trunnions at the bed plate and is free to oscillate through about 10 deg. When polishing the periphery of an article of irregular contour, the oscillating movement is controlled by a cam suited to the shape of the piece. Weight crated, 1,000 lb.

Turbine, Steam, Curtis Type
General Electric Co., Schenectady, N. Y.
"American Machinist," Jan. 20, 1921



This turbine is suitable for driving such apparatus as centrifugal pumps and blowers. It is made in either one, two, or three stages, and operates at steam pressures of from 50 to 300 lb., either with or without superheat, and either condensing or non-condensing. The illustration shows a two-stage, type-*L* unit. The turbine is heavily and rigidly constructed. The casing is divided horizontally into halves, the upper of which can be easily raised. The steam connections are so arranged that they need not be disturbed when it is desired to remove the top of the casing. The steam passes through the first-stage nozzle from the steam chest, the nozzles being opened or closed by hand valves placed in the steam chest. The governors control the flow of steam.

Clip, paste on 3 x 5-in. cards and file as desired

were with the question of sales. In other words, when demand starts up, the whole tangled economic skein will begin to unwind like the nursery rhyme, when the butcher began to kill the ox, and the ox began to drink the water, then the pig, at the other end of the rhyme, began to get over the fence, and the woman got home that night.

"While unemployment is still larger, there is more work and less idleness on the whole in industrial sections. The lessened production in manufacturing has naturally resulted in decreased output of coal. Also in the oil fields there are falling prices.

"While building is practically at a standstill throughout the country, save in Los Angeles and around Palm Beach and Miami, there exists the general expectation in nearly all sections, of a revival in the early spring, somewhere around the first of April, provided certain contingencies obtain; namely, lower costs of labor and the assurance of steady, efficient work, lower costs of building material, and greater ease and certainty of obtaining loans from banks on construction work. The nature and extent of building during this year will depend almost entirely upon the extent to which these factors prevail.

"There will probably be more building in the cities than in the towns and less in the country than in either of the former two."

A. England Succeeds S. W. Dudley as Chief Engineer of Westinghouse Air Brake Co.

The Westinghouse Air Brake Co. has announced the appointment of Alexander England as chief engineer to succeed S. W. Dudley who resigned on Feb. 1 to join the faculty of Yale University as a professor of mechanical engineering.

Mr. England has been a member of the Air Brake organization for the past 22 years and had occupied the position of assistant chief engineer since shortly after the appointment of Mr. Dudley as chief engineer in 1914. He is regarded as a man of sound judgment and discernment in the treatment of engineering problems and is the author of a number of important mechanical improvements in connection with the company's products, especially as concerns the development of the Westinghouse steam and motor-driven air compressors for railroad and traction service.

Other changes occurring as a result of Mr. Dudley's resignation and the promotion of Mr. England have been announced as follows: R. E. Miller, engineer of Tests and Inspection, promoted to superintendent of Tests and Inspection; W. E. Dean, assistant engineer of Tests, promoted to engineer of Tests; and A. A. Mackert, chief inspector, promoted to engineer of Inspection. Mr. England will report to C. C. Farmer, director of engineering of the Westinghouse Air Brake Co., and will maintain his headquarters at the Wilmerding plant.

Business Items

The Scovill Manufacturing Company, of Waterbury, Conn., manufacturers of brass goods, etc., has petitioned the Connecticut State Legislature for authority to increase its capital stock from $5,000,000 to $25,000,000.

The Jewell Belting Company, of Hartford, Conn., manufacturer of factory leather belting, etc., plans to increase its capital stock from $1,000,000 to $2,000,000.

At a meeting of the Chas. Miller & Son Co., Utica, N. Y., Charles Miller was elected president; D. S. Howard, first vice president; R. U. Sherman, second vice-president; A. H. Dobson, treasurer.

N. B. Payne & Co., 25 Church St., New York, dealer in electric cranes and hoists, has extended its lines of material handling machinery to include the portable conveyors of A. C. Warner Co., Philadelphia and Chicago; automatic coal elevators, and McKinney-Harrington package pilers and car loaders.

The Oxford Brass Foundry, Inc., Philadelphia, has been incorporated under Pennsylvania laws to manufacture brass, bronze and other metal castings.

The Hansel-Mulranen Co., Inc., was organized at Syracuse, N. Y., to make metal products of various kinds. The company is capitalized for $10,000, of which amount half has been paid in.

Personals

WALTER B. LASHAR, president of the American Chain Co., of Bridgeport, Conn., was elected a vice-president of the First National Bank of Bridgeport, at the annual meeting held recently.

CHARLES L. ALLEN, president and general manager of the Norton Co., of Worcester, Mass., manufacturer of grinding machinery, etc., has recently been elected a vice-president of the Eastern States Agricultural and Industrial League.

HARRY W. OSGOOD has recently been appointed plant engineer at the Fore River yards plant at Quincy, Mass., of the Bethlehem Shipbuilding Corp., Ltd. Mr. Osgood has been with the Bethlehem Co. at Bethlehem, Pa., for the past two years.

EDMUND OTTO, for several years secretary of the Hardware and Supply Co., and prior to that associated with Manning, Maxwell & Moore, Inc., New York, is now associated with N. B. Payne & Co.

DONALD S. MICHELSON, who became general manager of the Globe Machine and Stamping Co., Cleveland, Ohio, in September, 1920, was elected president of that company.

P. D. WAGONER, of New York City, has been elected president and general manager of the Elliott-Fisher Co., Harrisburg, Pa., manufacturers of bookkeeping machines. C. S. Duncan was appointed secretary-treasurer of the same company, and E. R. Baines, general auditor.

Obituary

After an illness of about six months, caused by heart trouble, W. THOMAS STARR, president of the B. F. Starr Co., manufacturer of mill machinery, etc., died on Feb. 1 at his home in Baltimore. He was sixty-three years old.

WILLIAM PENN SNYDER, head of the Shenango Furnace Co., died recently at his home in Pittsburgh. Mr. Snyder was also president of W. P. Snyder & Co., Shenango Steamship and Transportation Co. and an ore company, besides being connected with other companies.

GEORGE R. RANDOLPH, age 26, Pittsburgh sales representative of the Warner & Swasey Co., Cleveland, Ohio, working under the jurisdiction of the Buffalo office, died on Feb. 3.

Forthcoming Meetings

The Taylor Society will hold its winter meeting in Springfield, Mass., on Feb. 24 to 26.

The National Machine Tool Builders' Association has advanced the date for its semi-annual meeting. This meeting will be held at the Hotel Cleveland, Cleveland, Ohio, on Feb. 24, 25 and 26, instead of Atlantic City in May. The general manager is Ernest F. DuBrul, 817-818 Provident Bank Bldg., Cincinnati, Ohio.

The National Metal Trades Association will hold its annual convention at the Hotel Astor, New York, on April 18, 19, 20, 21. Homer D. Sayre, Peoples Gas Building, Chicago, Ill., is secretary.

The Engineering Section of the National Safety Council will hold its annual meeting in Philadelphia on Feb. 28. This meeting will be held jointly with the Philadelphia section of the A. S. M. E.

The annual meeting of the American Welding Society will be held in the Engineering Societies Building, 29 West 39th St., New York, on April 22.

The Society of Industrial Engineers will hold its national convention in Milwaukee, Wis., on April 27, 28 and 29. Geo. C. Dent, 327 So. La Salle St., is business manager.

The National Foreign Trade Council will hold its eighth annual convention in Cleveland, Ohio, on May 4, 5, 6 and 7. J. G. Hammond, care of the Council, 409 Park Bldg., Cleveland, is secretary.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The American Society of Mechanical Engineers, 29 W. 39th St., New York, will hold its spring meeting in Chicago, May 23 to 26 inclusive, at the Congress Hotel.

The Society of Automotive Engineers, 29 West 39th St., New York announces that its summer meeting will be held at West Baden, Ind., on May 24 to 28 inclusive.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Hammer, Forging, Power

Brett's Patent Lifter Co., Ltd., Coventry, England

"American Machinist" (European Edition), Sept. 18, 1920



This machine is suitable for general forging and for tool work, taking round or square stock up to 3 in. thick. The weight of the ram exclusive of the top die is 200 lb. The stroke is usually 7 in., but it can be extended to 10 in. by the fling of the hammer when working at the top speed of 250 strokes per minute. The drive is by a slipping belt which is put into operation by means of a tightening pulley operated by a pedal. Springs are provided in the driving mechanism to prevent undue shock from the blows. The anvil block is a separate casting from the frame. The weight of the machine is 4,370 lb.

Chucks, Four-Jaw, Lathe

Vickers, Ltd., Broadway, London, S. W. I.

"American Machinist" (European Edition), Sept. 18, 1920



This chuck is available in nine sizes, the range being from 8 to 24 in. outside diameter. The parts are shown in the illustration. The body is a steel casting, while the screw and nut are also of case-hardened steel. The jaws are steel stampings, case-hardened and ground to suit the form of the slot. They are reversible and will also interchange with a group of bodies comprising three different sizes. The screw always has a full bearing in the nut and, the parts being interchangeable, the nut and screw can easily be replaced when worn.

Tapping Machine, Nut

J. Holroyd & Co., Ltd., Milnrow, England

"American Machinist" (European Edition), Sept. 18, 1920



This machine threads nuts up to 4-in. in diameter by ¾ in. pitch by 6 in. long. The work spindle is 4½ in. in diameter and is driven by belt. At its front end the spindle carries the chuck or jig plate to secure the work. Interchangeable lead-screws of various pitches are supplied, the screw used running in a gunmetal nut fastened in the head and split to adjust for backlash. The traverse of the spindle is 9 in., the three forward speeds being 15, 30 and 45 r.p.m., with a constant quick return at 50 r.p.m. The saddle carries a turret toolpost, so that roughing and finishing tools may be employed. The height of centers is 9 in., the center being 3 ft. 3 in. from the floor level. The floor space is 2 ft. 6 in. by 8 ft. The weight is about 35 cwt.

Fluting and Backing-Off Machine, Twist-Drill

J. Holroyd & Co., Ltd., Milnrow, England

"American Machinist" (European Edition), Sept. 18, 1920



This semi-automatic machine is intended for fluting and also backing-off two-lip twist drills. Fluting and backing-off take place simultaneously, the machine having two spindles for each purpose, that is, four milling cutters set at the required angles. Drills with constant or increased twist and with parallel or taper core can be produced, and the relief can be varied. A ⅝-in. high-speed-steel drill, 3 in. long on the flutes can be grooved and backed off in 2 min. The machine shown, the No. 3 size, will flute lengths of 4½ in. The machine is made in a number of sizes to suit drills up to 1¼ in. All movements are graduated, and the machine can easily be set for change from one size to another.

Slotting Machine, Sprue

Clifton & Baird, Ltd., Johnstone, England

"American Machinist" (European Edition), Sept. 18, 1920

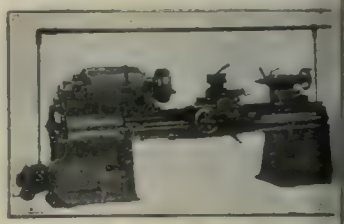


This machine has a stroke variable up to 18 in. With a maximum depth of cut of 8 in., turning over the work will allow risers 18 x 16 in. to be removed from steel castings. The machine is really a double slotter with two tools, one operating on each stroke. One tool has a V-nose, and the other is square so as to remove the corners of the cut. The tools are reciprocated by a vertical screw of quick lead, driven by a belt through bevel gears and reversing clutches placed in an oil-tight box at the top of the column. The machine also has a facing at the back so that it can be driven by a reversing electric motor, used in place of the mechanically operated reverse.

Lathe, Toolroom

Smith, Barker & Willson, Ltd., Halifax, England.

"American Machinist" (European Edition), Sept. 18, 1920



The lathe swings work 17½ in. over the bed and 10¾ in. over the saddle, admitting 38½ in. between centers. The drive is through a hardened-steel worm and a phosphor-bronze wheel, and then through a friction clutch to a gear box placed in the leg under the headstock. In the head itself are three friction speeds, one direct and the others through double back gearing. With the four speeds obtained in the swinging gear box, twelve spindle speeds are available. Screws can be cu without reversing the lathe, only the lead screw being reverse (The spindle is bored 2⅜ in. and has a front bearing 3½ x 5½ in the back bearing being 3 x 3¼ in.) Weight, about 3,400 lb.

Grinding Machine, Bar, 2½-In.

J. Holroyd & Co., Ltd., Milnrow, England

"American Machinist" (European Edition), Sept. 18, 1920



This machine is intended for grinding bars 1 to 2½ in. in diameter and 7 to 18 ft. long. The bars are gripped by rotating disks and run through steadyrests. They do not have to be centered. It is said that 2-in. bars, say, 0.003 in. above size and, within limits, eccentric in form, can be ground to within plus or minus 0.0002 in. as to size and roundness. The bars are required to pass through the machine twice, the surface speeds being, su 60 ft. per minute and the feed forward 1 in. per revolution. Th surface speeds available range from 30 to 80 ft. Two wheel each 20 in. in diameter by 1½ in. wide, are employed side by sid The peripheral speed of the wheel is about 6,500 ft. per minut Weight, about 4½ tons.

Distance-Pieces, Combination

Burton Griffiths & Co., Ltd., Ludgate Square, London, E. C., England.

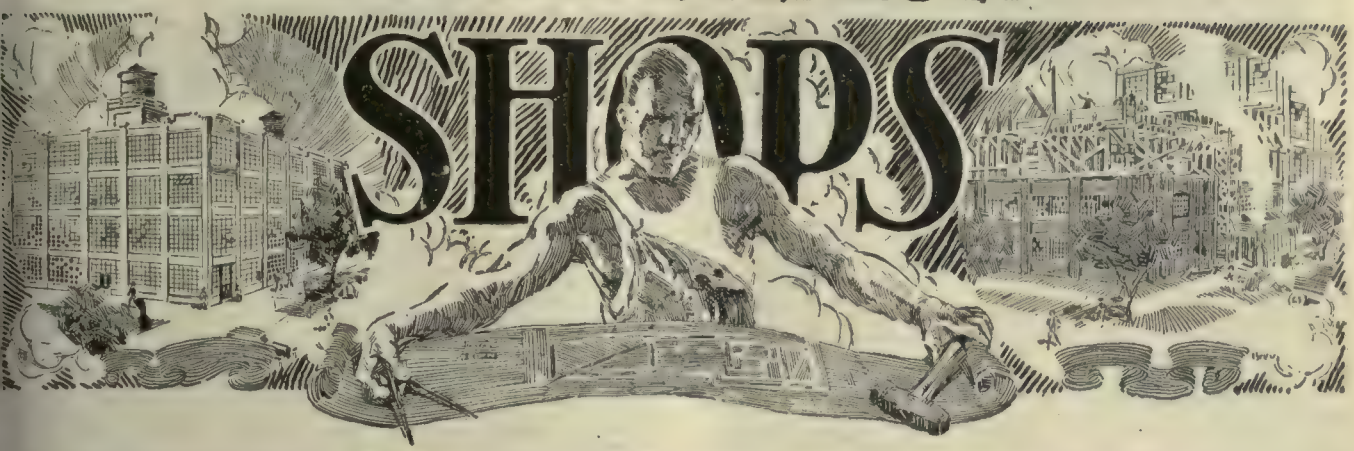
"American Machinist" (European Edition), Sept. 18, 1920



These pieces are intended for such purposes as the accurate spacing of milling cutters on an arbor. They are manufactured in ring form, a set containing 56 pieces. An instruction chart is included for determining the combination required. The distance pieces vary in thickness from 0.05 to 1.0015 in., arranged to give graduations from 0.15 to 2.1 in. With a maximum of three pieces in combination, any of 3,900 dimensions between these limits can be obtained. The pieces themselves are accurate between plus and minus 0.0001 in. Blocks are also available in solid cube form to be used as parallels or packing blocks, and are manufactured to the same limits.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Fla., New Port Richey—The Palm Prodcts Co., furniture manufacturers, D. L. ush, Purch Agt.—
One 36 in. band saw.
One Universal woodworker, saw table ith boring attachment, dado head, etc.
One drum and disk sander.
Sand-blast equipment for roughing polhed surfaces.
One split weaving loom.

La., New Orleans—Estate R. G. Holzer, 17-29 Burgundy St., architectural and heet metal work, contractors and jobbers, c., J. E. V. Holzer, Purch. Agt.—
One small bench lathe with screw cutting djustment, 8 or 10 in. swing.
One power shaper for cutting 14 and 20 material.
One power planer to plane material 12 x in. wide up to 10 ft. long or 24 x 24 in. de up to 11 ft. long.
One power hack saw to cut material 8 8 and smaller.
One small power bench drill.
One power angle cutter to cut angles 3 3 and smaller, thickness ⅝ in.
One power squaring shear to cut material or ⅜ and lighter to cut 10 ft. soft sheet eel.
One ring and circle shear to cut ⅛ soft eet steel.
One 10 ft. power press or brake for bendg material ⅛ or ⅝ and lighter.
One power gang slitting shear with extenn table and gang to cut material 36 in. de and narrow gauge ranging from 20 uge and lighter. Also extra pair of cutg rollers.
One power or hand squaring 36 in. wide, ate gauge of material machine will cut.
One power wood swing saw used for cutg off wood strips with and without motor ttached to ceiling.
State condition, age, style, number, make, d shipping weight, (used).

Ky., Louisville—The Mercury-Body Corp., 3 Marion E. Taylor Bldg., C. E. McCorck, Mgr.—Bids until March 1 on machine ols.

Tenn., Johnson City—The Automobile Reewal Co., Inc., B. A. Mathes, Pres. and r.—
One 14-24 in. gap bed lathe.
One 20 in. B. A. drill.
One cylinder grinder.
One 10 in. sensitive drill.
One Universal burning-in and testing chine.
Battery charger and tools.
Welding outfit.
One small heat treating furnace.
Small tools, etc.

Va., Richmond—The Armstrong Motor 1813 West Broad St., (auto rapir work)
One lathe.
One drill press.
Auto repair machinery.

Va., Richmond—F. E. Carson, 719-21 orth 21st., F. E. Carson, Purch. Agt.—hanical outfit for new auto repair shop.

Va., Richmond—W. C. Jackson, 1643 st Broad St.,—lathe, drill press, univerl boring bar and vulcanizer for auto repr shop.

Va., Richmond—McMullen & Benton, 1649 West Broad St.—6 in. vise and small lathe for their auto repair shop.

Va., Richmond—C. P. Parish, 1647 West Broad St.—power drill press, bench drill press, grinding wheels, gear press and small lathe for auto repair shop.

Va., Richmond—A. Plageman, 1639 West Broad St.—mechanical out-fit for auto repair shop.

Va., Richmond—Sherbridge & Hare, 100 North Meadow St., (auto repair shop)—small lathe and drill press.

Va., Richmond—City Repair Dept., 2100 West Broad St., F. Baptist, Purch. Agt.—
One tire bender.
One tire upsetter.
One woodworker's vise.
One set dies and stock 1 in. to ½ in.

Mich., Detroit—The Dept. of Purchases and Supplies, 710 Marquette Bldg., G. J. Finn, Purch. Agt.—
Three reciprocating grinders.
Four gasoline driven arc welding generators with all welding accessories.

Mich., Detroit—The Wheel Truing Brake Shoe Co., 219 Tuxedo Ave.—miscellaneous equipment for making brake shoes.

O., St. Bernard (Cincinnati P. O.)—The Jarecki Chemical Co., manufacturer of fertilizers, J. P. Allen, Purch. Agt.—one lathe 36 in. swing and 10 ft. bed, (second-hand).

Wis., Beaver Dam—H. Krueger—modern garage repair machinery.

Wis., Luxembourg—Spitzer & Diestelhorst, A. Spitzer, Purch. Agt.—machinery for garage repair department.

Wis., West Allis—J. Barnekow & Son, 87th and Greenfield Aves., J. Barnekow, Purch. Agt.—small drill press and lathe, suitable for garage repair work.

Kan., Mulberry—The Mulberry Fdry. and Machine Shop, G. Brickney, Supt.—foundry and machine shop equipment.

Tex., San Antonio—The Stroud Motor Manufacturing Assn., Ltd., 423-31 Gunter Bldg., R. B. Shoop, Ch. Engr.—small tool equipment and supplies for the manufacture of tractors.

Cal., San Francisco—S. Ward & Son, 170 1st St., (machine tools supplies)—1,500 lb. bore drop hammer.

Ont., Toronto—The Canadian-Libbey-Owens Sheet Glass Co., 241 Spadina Ave.—
One electric crane.
Box shop machines.
Machine shop tools, conveyors, etc. Full particulars furnished by the De Vore Eng. Co., Nicholas Bldg., Toledo, O.

Machinery Wanted

Md., Oakland—The Oakland Laundry Co., A. S. Teats, Pres.—laundry machinery.

N. Y., Buffalo—E. R. Maltby Co. 938 Ellicott Sq., Bldg.—$50,000 worth of roofing paper machinery.

N. C., Lexington—The United Furniture Furniture Co., B. C. Philpot, Purch. Agt.—machinery for veneer and glue room.

N. C., Wilmington—Carters Production Wks., 210 South Water St., manufacturer of machinery, O. Carter, Purch. Agt.—20-24 ft. sawmill carriage and husk.

Tenn., Mooresburg—G. W. Bolinger—broom handle lathe for turning birch handles, machinery for the manufacture of brooms, plow handles and beams, (new or used).

Va., Richmond—W. M. Reynold, 1839 West Broad St.—machinery for electrical repair work, (used).

Va., Roanoke—The Roanoke Lumber & Mfg. Corp.—B. B. Irby, Pres. and Mgr.—general planing milling machinery.

Wis., Wausau—The Marathon Electric Mfg. Co., Plummer Island—machinery for the manufacture of electric fans, etc.

Wis., Eau Claire—C. H. Hopson, 463 Summit Ave., manufacturer of tires—rubber working machinery and vulcanizing equipment.

Wis., Peshtigo—The Peshtigo Pulp & Paper Co.—10 ton crane.

Wis., Amherst—The Amherst Jersey Creamery and Dairy Co., F. Shanklin, Pres.—machinery for creamery and dairy.

Ia., Des Moines—M. L. Patzig, 206 11th St.—Universal testing machine, capacity 400,000 lb., for testing tensile compressive and transverse stresses, (new or used).

Ont., Port Arthur—The News Chronicle Co.—$10,000 worth of printing machinery.

Ont., Toronto—J. Inglis Co., Ltd., Strachan Ave., manufacturers of machinery—traveling cranes, jib cranes, etc.

Metal Working

NEW ENGLAND STATES

Conn., Bridgeport—G. T. McCarthy, 929 Ivanston Ave., has awarded the contract for the construction of a 1 story, 50 x 100 ft. garage. Estimated cost, $20,000.

Conn., Hartford—The Elm Garage, 93 Main St., will soon award the contract for the construction of a 1 story, 55 x 85 ft. garage on Park St. Estimated cost, $20,000. Private plans.

Mass., Cohasset—S. E. Ruiter plans to build a 1 story, 40 x 80 ft. addition to his garage on South Main St. G. F. Newton, 6 Beacon St., Boston, Archt.

Mass., Roxbury, (Boston, P.O.)—T. H. Connolly, 110 Bower St., will soon award the contract for the construction of a 1 story, 120 x 145 ft. garage on Washington St. Estimated cost, $75,000. Tuck & Gilman, 34 School St., Boston, Archts. and Engrs. Noted Feb. 3.

Mass., Malden (Boston P. O.)—The Terminal Garage, 339 Main St., plans to build a 1 story garage, containing 10,000 sq.ft. floor space on Eastern and Main Sts. Estimated cost, $40,000. Probably private plans.

Mass., New Bedford—F. W. Greene, Jr., 252 Union St., will soon award the contract for the construction of a 1 story garage containing 8,500 sq.ft. floor space, on Ash St. Estimated cost, $35,000. La Brode & Bullard, 251 Union St., Archts., Noted Dec. 2.

Mass., Worcester—E. R. Bostwick, 25 Kingsbury St., is having plans prepared for the construction of a 1 story, 50 x 90 ft. garage. Estimated cost, $20,000. J. A. Jollette, 58 Front St., Archt.

Vt., Springfield—Gilman & Son, Inc., River St., are having plans prepared for the construction of a 2 or 3 story, 50 x 150 ft. machine shop. Brainerd, Leeds & Kellogg, 89 Franklin S., Boston, Archts. Noted Dec. 23.



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Year Ago
CINCINNATI		
No. 2 Southern	$38.50	$44.60
Northern Basic	34.50	42.80
Southern Ohio No. 2	34.00	43.80
NEW YORK—Tidewater Delivery		
2X Virginia (Silicon 2.25 to 2.75)	40.41	47.65
Southern No. 2 (Silicon 2.25 to 2.75)	44.26	47.70
BIRMINGHAM		
No. 2 Foundry	34.00	41.00
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25–2.75 sil.	36.00	45.35*
Virginia No. 2	40.00	43.25*
Basic	34.00	43.00†
Grey Forge	34.00	42.50*
CHICAGO		
No. 2 Foundry local	35.00	43.25
No. 2 Foundry, Southern	40.60	46.60
PITTSBURGH, including freight charge from Valley		
No. 2 Foundry	36.96	43.65
Basic	31.96	42.90
Bessemer	33.96	43.40

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	*Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.58	$3.58	$3.97	$3.58	$4.62	$3.58	$3.47
Soft steel bars	3.48	3.45	4.12	3.34	3.52	3.48	3.52
Soft steel bar shapes	3.48	3.45	4.12	3.48	3.82	3.48	3.52
Soft steel bands	4.18	4.18	4.82	6.25	5.25	....	....
Tank plates	3.78	3.78	4.17	3.78	5.00	3.78	3.67

*Add 10c. for trucking charge to Jersey City and 15c. to New York and Brooklyn from warehouse.

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$2.25	$4.00
Warehouse, New York	3.53	3.52
Warehouse, Cleveland	3.52	3.42
Warehouse, Chicago	4.12	3.52

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York *Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55	4.68	7.00	4.50	4.68
No. 12	3.60	4.73	7.10	4.60	4.73
No. 14	3.65	4.78	5.42	4.65	4.78
No. 16	3.75	4.88	5.52	4.75	4.88
Black					
Nos. 18 and 20	4.20	5.58	7.30	5.30	5.55
Nos. 22 and 24	4.25	5.63	7.35	5.45	5.60
No. 26	4.30	5.68	7.90	5.50	5.65
No. 28	4.35	5.78	8.00	5.60	5.75
Galvanized					
No. 10	4.70	6.13	6.90	5.95	6.10
No. 12	4.80	6.23	6.95	6.05	6.20
No. 14	4.80	6.23	7.10	6.05	6.20
Nos. 18 and 20	5.10	6.63	7.40	6.35	6.50
Nos. 22 and 24	5.25	6.78	7.80	6.50	6.65
No. 26	5.40	6.93	7.95	6.65	6.80
No. 28	5.70	7.13	9.00	7.95	7.10

AUTOMOBILE SHEETS—Patent level stock for automobile bodies and fenders. Prices in cents per pound for 100 lb. lots at warehouse, New York and Chicago—No. 16, 7.48; No. 18 20, 7.53; No. 22-24, 7.58.

*To these prices 10c. must be added for delivery in Jersey City and 15c. for New York and Brooklyn.

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.50	$5.25	$4.84
Flats, square and hexagons, per 100 lb. base	6.00	5.75	5.34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55
Special Nickel and Alloys			
Malleable nickel ingots	45		
Malleable nickel sheet bars	47		
Hot rolled rods, Grades "A" and "C" (base)	60		
Cold drawn rods, grades "A" and "C" (base)	72		
Copper nickel ingots	42		
Hot rolled copper nickel rods (base)	52		
Manganese nickel hot rolled (base) rods, "D"—low manganese	64		
Manganese nickel hot rolled (base) rods "D"—high manganese	67		

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb lots sells as follows, f.o.b. New York: 3/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	6.50	8.00	9.00
Spring steel (light)	10.00	7.00	12.00
Coppered bessemer rods	9.00	8.00	7.00
Hoop steel	4.58	4.04	4.18
Cold-rolled strip steel	9.00	8.25	9.25
Floor plates	5.75	4.00	6.03

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
¼ to 3	57½%	44%	⅜	15½–16½%	+10½–11½%
			½	19½–20½%	1½– 2½%
			¾ to 1½	24½–25½%	8½– 9½%

LAP WELD

2	50½%	38%	2	20½–21%	6½– 7%
2½ to 6	53½%	41%	2½ to 6	22½–23%	9½–10%
7 to 12	50½%	37%	7 to 12	19½–20%	6½– 7%
13 to 14	41%	....			
15	38½%	....			

BUTT WELD, EXTRA STRONG PLAIN ENDS

¼ to 1¼	55½%	43%	¾ to 1½	24½–25½%	9½–10½%
2 to 3	56½%	44%			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	48½%	37%	2	21½–22½%	8½– 9%
2½ to 4	51½%	40%	2½ to 4	23½–24%	11½–12%
4½ to 6	50½%	39%	4½ to 6	22½–23%	10½–11%
7 to 8	46½%	33%	7 to 8	14½–15%	2½– 3%
9 to 12	41½%	28%	9 to 12	9½–10%	+2 –2½%

Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅜ to 3 in. steel butt welded	44%	28%	42½%	33½%	57½%	44%
2½ to 6 in. steel lap welded	39%	24%	44½%	29½%	53½%	41%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 6%. Cast iron, standard sizes, 15% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	13.75 a 14.00	15.00	19.00
Tin in 5-ton lots	32.00	34.25	60.00
Lead	5.25	5.37½	9.00
Zinc	5.87½	7.00	9.50
ST. LOUIS (In carload lots)			
Lead	4.85	5.25	8.375
Zinc	4.47½	6.75	9.225

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

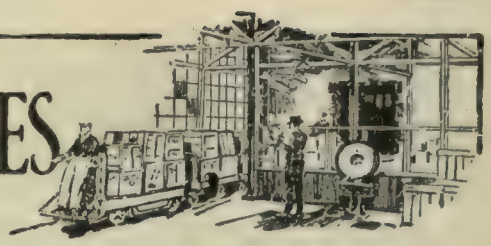
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	21.00	22.50	29.50	23.00	31.00	24.25	36.00
Copper wire (carload lots)	16.00	17.00	29.25	19.00	29.50	24.00	27.00
Brass sheets	18.75	20.25	26.50	24.00	29.00	26.50	27.00
Brass pipe	23.50	25.00	32.00	25.00	34.00	21.50	35.00
Solder (half and half) (case lots)	22.50	27.75	39.00	26.00	40.50	21.00	38.00

Copper sheets quoted above hot rolled 24 oz., cold rolled 14 oz. and heavier add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill, 1,000 lb. and over, warehouse; net extra:

	Current	One Year Ago
New York	16.75	23.75
Cleveland	20.00	29.00
Chicago	21.25	26.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f.o.b. mill + less 8% for carload lots..... 11.50

	Warehouse			
	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	13.70	15.00	14.30	15.50
New York	12.50	14.00	13.50	14.50
Chicago	14.50	15.00	14.95	15.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	6.00	11.25
Chicago	6.50	12.50
Cleveland	7.50	13.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	*New York			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	11.50	17.00	10.00	10.50
Copper, heavy, and wire	11.00	16.50	9.50	9.00
Copper, light, and bottoms	9.00	15.50	9.00	8.00
Lead, heavy	4.00	7.00	4.00	3.75
Lead, tea	3.00	6.25	3.00	3.00
Brass, heavy	7.00	12.00	7.00	10.00
Brass, light	5.50	9.50	5.00	5.50
No. 1 yellow brass turnings	6.00	10.00	5.50	6.00
Zinc	4.00	6.25	3.00	3.50

* These prices nominal because of dull market.

ALUMINUM—The following prices are spot from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb.	28.2@28.1	24.50	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	23.50	33.00
Chicago	24.50	29.00
Cleveland	22.00	32.00

BABBITT METAL—Warehouse price per pound:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	70.00	70.00	46.00	70.00	35.00	70.00
Commercial	30.00	30.00	16.50	20.00	9.00	15.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	List	+$2.00	$1.00	$1.00	+1.15	1.25
Hot pressed hexagon	List	+2.00	1.00	1.00	+1.15	1.25
Cold punched hexagon	List	+2.00	1.00	1.00	+1.15	.90
Cold punched square	List	+2.00	1.00	1.00	+1.15	.90

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	60%	60%
Chicago	70%	50%
Cleveland	70%	60–10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in.	45%	60%	50%
1½ and 1¼ in. by 3 in. up to 12 in.	25%	50%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:
For wrought-iron washers:
New York....$4.50 Cleveland....$3.50 Chicago....$2.50
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York....$6.00 Cleveland....$4.00 Chicago....$4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅜ by 6 in. and smaller	+40%	50%	40%
Larger and longer up to 1 in. by 30 in.	+40%	40%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	35%	20%	10%	30%
Chicago	net	10%	net	10%
New York	50%	10%	25%	10%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	45%	50%	45%
Tinned	45%	50%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$5.20 Cleveland...$5.00 Chicago....$5.08 Pittsburgh...$3.90
Boiler, same sizes:
New York...$5.30 Cleveland...$5.10 Chicago....$5.18 Pittsburgh...$4.00

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	24.50	27.00	29.00
Brass	23.50	24.00	28.00

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in. inclusive in rounds, and ⅛-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.50 per 100 lb.
In Cleveland—$8.50 per 100 lb.; New York price is 8@8½c.

COTTON WASTE—The following prices are in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
White	7.50@13.00	13.00	13.00	14.25
Colored mixed	7.00@11.00	9.00–12.00	10.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.25	$2.00	$2.25
Philadelphia	2.00	2.75	2.00
Cleveland	3.25	4.00	2.50
Chicago	2.50	2.75	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.

	Current	One Month Ago	One Year Ago
New York	$2.70	$3.50	$3.40
Philadelphia	3.65	3.65	4.25
Chicago	4.50	4.00	5.00

COKE—The following are prices per net ton at ovens, Connellsville:

	Current	One Month Ago	One Year Ago
Prompt furnace	$5.00@$5.50	$5.00@$5.50	$6.00
Prompt foundry	6.00@6.50	6.25@7.00	7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels, (5 bbl. lots)	$0.77	$1.80	$0.90	$2.00	$0.84	$1.98
5-gal. cans	1.00	2.00	1.15	2.25	1.09	2.23
1-gal. cans (2 to case)	1.00	....	....	....	....	....

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	15.00	16.50	13.00	15.00
25 and 50-lb. kegs	13.25	14.75	15.25	16.75	13.25	15.25
12½-lb. keg	13.50	15.00	15.50	17.00	13.50	15.50
5-lb. cans	16.00	17.50	17.00	18.50	16.00	17.00
1-lb. cans	18.00	19.50	18.00	19.50	18.00	18.00

500 lb. lots less 10% discount. 2,000 lb. lots less 10-4% discount. 10,000 lb. lots less 10-7½% discount.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Carter Type Machine Co., Industrial Bldg., plans to build a 75 x 150 ft. plant for the manufacture of type casting machines. N. Keen, Pres.

N. Y., Dunkirk—The Commercial Machine Co. 35 West Front St., will build a 1 story, 47 x 157 ft. factory. Estimated cost, $20,000.

N. Y., Hudson—The Holbrook Co., 67th St. and West End Ave., New York City, has awarded the contract for the construction of a 1 story, 100 x 260 ft. factory, here, for the manufacture of auto bodies.

N. Y., New York (Borough of Brooklyn)—J. E. Albright, 282 Stuyvesant Ave., has awarded the contract for the construction of a 1 story, 99 x 100 ft. garage on Atlantic Ave. Estimated cost, $13,000.

N. Y., New York (Borough of Brooklyn)—W. M. Currie, 70-4 Adams St., Machinist has awarded the contract for altering and extending his plant. Estimated cost, $10,000.

N. Y., New York (Borough of Brooklyn)—The Liberty Wyona Co., Inc., 1199 Eastern Parkway, is having plans prepared for the construction of a 1 story, 128 x 167 ft. garage on Flatbush Ave. Estimated cost, $40,000. C. Goodman, 375 Fulton St., Archt.

N. Y., New York (Borough of Brooklyn)—E. L. Megill, 60 Devore St., is having plans prepared for the construction of a 2 story, 40 x 40 ft. factory on Atlantic Ave. and Adelphi St., for the manufacture of metal novelties. Gilbert & Ashfield, 350 Fulton St., Archts. and Engrs.

N. Y., New York (Borough of Brooklyn)—The Parkside Improvement Corp., care of B. Dreisler, Jr., Archt., 153 Remsen St., will build a 1 story, 100 x 125 ft. garage on 49th St. near 2nd Ave. Estimated cost, $50,000.

N. Y, New York (Borough of Brooklyn)—H. Proacci, 19th St. and 3rd Ave., will soon award the contract for the construction of a 1 story, 51 x 68 ft. garage on 19th St. and 3rd Ave. Estimated cost, $16,000. D. A. Lucas, 98th St. and 3rd Ave., Archt.

N. Y., New York (Borough of Brooklyn)—J. J. Sullivan, 570 Hamilton Ave., will soon award the contract for the construction of a 1 story, 85 x 200 ft. garage on Degrew St. Estimated cost, $50,000. E. K. Adolsohn, 1778 Pitkin Ave., Archt.

N. Y., Long Island City—The Interstate Land Holding Co., 44 Wall St., New York City, has awarded the contract for the construction of a 1 story, 70 x 100 ft. garage on Vernon Ave., here. Estimated cost, $40,000. J. Larkin, Pres.

Pa., Philadelphia—M. Poley, 1523 North 17th St., is having plans prepared for the construction of a 1 story, 45 x 55 ft. and 25 x 92 ft. furniture shop and garage on Livingston, Belgrade and Albert Sts. I. W. Levin, Mutual Life Bldg., Archt.

Pa., Philadelphia — J. Topp, 10 Delancy St., has awarded the contract for the construction of a 2 story, 22 x 60 ft. garage. Estimated cost, $10,000.

SOUTHERN STATES

Fla., De Land — The Buick Garage is building a 60 x 196 ft. garage.

Tenn., Memphis — The Ideal Tractor Cultivator Co., McCall Bldg., has purchased a plant and plans to remodel same for the manufacture of farm tractor. R. F. Carr, Pres.

Va., Alexandria—The Bureau of Yards & Docks, Navy Dept., Wash., D. C., plans to alter plating shop and cafeteria, here. Estimated cost, $28,000.

Va., Durmid—The United Cigarette Machine Co. has awarded the contract for the construction of a 2 story, 52 x 145 ft. addition to its plant, for the manufacture of cigarette machinery. Estimated cost, $40,000.

W. Va., Wheeling — The Twelfth Street Garage Co., c/o C. W. Bates, Archt., 77 14th St., will soon award the contract for the construction of a 5 story, 82 x 125 ft. garage on 12th and Main Sts. Estimated cost $150,000.

MIDDLE WEST STATES

O., Cleveland — The Electrical Steel & Forge Co., 6600 Grant Ave., is having plans prepared for the construction of a 1 story rolling mill. Estimated cost, $200,000. J. H. Foster, Pres. J. H. Herron & Co., 1360 West 3rd St., Engrs. and Archts.

O., Cleveland—I. Fergenbaum, 704 Ullmer Bldg., plans to build a 6 story, 80 x 175 ft. garage and display room at 3142 Prospect Ave. Estimated cost, $200,000.

O., Cleveland — The Hares Motors Ohio Co., 6545 Carnegie Ave., plans to build a 2 story garage and salesroom on Euclid Ave. Estimated cost, $75,000. R. J. Coach, Pres. Architect not selected.

O., Cleveland—The Natl. Acme Co., East 131st St. and Coit Rd., manufacturer of machinery, is having plans prepared for the construction of a 3 story factory. Estimated cost, $200,000. A. Walker, Supt. of construction. Private plans.

O., Columbus — The Packard Columbus Co., 3rd and Spring Sts., has awarded the contract for the construction of a 2 story, 60 x 180 ft. salesroom and service station, on East Broad St. stimated cost, $125,000.

Mich., Detroit—The Wheel Truing Brake Shoe Co., 219 Tuxedo Ave., will soon award the contract for the construction of a 2 story, 50 x 90 ft. factory. Estimated cost, $50,000. Kasurin Bros., 512 Empire Bldg., Archts.

Wis., Wausaw—W. R. Chellis, 407 McClellan St., plans to build a 4 story, 60 x 125 ft. factory for the manufacture of butcher block scrapers. Estimated cost, $100,000. Architect not selected.

WEST OF THE MISSISSIPPI

Kan., Mulberry—The Mulberry Fdry. and Machine Shop has had preliminary plans prepared for the construction of a 1 story, 75 x 100 ft. foundry and machine shop. Estimated cost, $75,000. C. Brickney, Supt. G. J. Munn, 307 West 7th St., Pittsburg, Archt.

Mo., St. Louis—The Power Truck & Tractor Co., c/o P. G. Craven, Agt., Central Natl. Bank Bldg., will soon award the contract for the construction of a 1 story, 50 x 300 ft. truck and tractor factory on Goodfellow Ave., along the tracks of the Wabash R.R. Estimated cost, $40,000. W. S. Frank, c/o Hunkins-Willis Lime and Cement Co., Century Bldg., Archt.

Tex., El Paso—The Hill Sutton Co. plans to build a 1 story, 85 x 150 ft. plant for the manufacture of sheet metal wares. Estimated cost, $20,000.

WESTERN STATIONS

Cal., Stockton—The Kroyer Motors Co. is building a 90 x 440 ft. plant, which is the first unit of a large plant. H. P. Cowley, Mgr.

CANADA

Ont., Toronto — The J. Inglis Co., Ltd., Strachan Ave., manufacturers of machinery, plans to build a 1 story foundry. Estimated cost, $250,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Danbury—The Beaver Brook Paper Mills, Inc., Beaver Brook Rd., will soon award the contract for the construction of a 1 story, 75 x 150 ft. addition to its plant. Estimated cost, $25,000. Sunderland & Watson, 248 Main St., Archts. Noted Jan. 13.

Conn., Hartford—The Acme Bedding Co., Inc., 94 Brown St., will soon award the contract for the construction of a 1 story, 40 x 60 ft. addition to its plant. Estimated cost, $8,000. G. Zunner, 182 High St., archt.

Conn., New Britain—E. R. Hitchcock & Co. 303 Main St. plans to build a 3 story, 45 x 100 ft. printing and binding plant. Private plans.

Me., Portland—The W. Underwood Co., 52 Fulton St., Boston, is having plans prepared for the construction of a 6 story, 60 x 120 ft. factory, here, to be used for the packing and canning of meats and fish. Estimated cost, $150,000. Monks & Johnson, 99 Chauncy St., Boston, Archt. and Engrs.

Mass., Danvers Junction (Danvers P. O.)—H. P. Gifford, c/o Salem Five Cent Savings Bank, Salem, plans to build a cold storage plant, here. Architect not selected.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Bugle Coat & Apron Co., 112 South Gay St., has purchased a site and plans to build a laundry.

Md., Oakland—The Oakland Laundry Co., recently incorporated with $10,000 capital stock plans to build a 30 x 80 ft. laundry. Estimated cost, $5,000. A. S. Teats, Pres.

N. J., Newark—Barrasso & Blasi, South St., will soon award the contract for the construction of a 2 story factory on Governor St. and Marion Pl., for the manufacture of jewelry. Estimated cost, $75,000. F. Grad, 145 Springfield Ave., Archt. and Engr.

N. Y., Buffalo—The Natl. Biscuit Co., 409 West 15th St., New York City, plans to build a bakery along the tracks of the New York Central R.R. belt line between Ferguson and Urban Sts., here. Estimated cost, $1,000,000. J. G. Zeller, Vice Pres.

N. Y., New York (Borough of Bronx)—The Keystone Tire & Rubber Co. is having plans prepared for the construction of a 2 story, 100 x 100 ft. factory on East 172nd St. Estimated cost, $100,000. F. Suton, 140 Cedar St., New York City, Engr. and Archt.

N. Y., North Tonawanda—E. R. Maltby Co., 938 Ellicott Sq., Buffalo, N. Y., will soon receive bids for the construction of a 1, story, 75 x 100 ft., 60 x 100 ft. and 40 x 100 ft. factory on Erie Ave. here, for the manufacture of roofing products. Estimated cost, $125,000.

N. Y., Buffalo—The Marine Laundry, 93 Elk St., will soon award the contract for the construction of a 1 story, 72 x 100 ft. laundry. C. E. Reynolds, 1691 Abbott Rd., Archt.

N. Y., Lockport—The Lockport Co-operative Dairy Assn. is having plans prepared for the construction of a 2 story, 40 x 80 ft. addition to its dairy. H. W. Dale, Pres. Miller & McNeil, 80 West Genessee St., Archts.

N. Y., New York (Borough of Brooklyn)—The Monsoon Cooling System, Inc., 70 West 45th St., New York City, plans to build a 2 story factory, containing 6,000 sq.ft floor space, at 71 North 6th St, here, for the manufacture of blowers. J. F. Daly, Pres.

N. Y., New York (Borough of Bronx)—The Superior Fireproofing Door and Sash Co., 1811 Carter Ave., will soon award the contract for the construction of a 1 story, 63 x 140 ft. factory. Estimated cost, $15,000. W. J. Meyer, 1861 Carter Ave., Archt.

Pa. Pittsburgh—The Methodist Episcopal Church Union of Pittsburgh, 6th and Smithfield Sts., will soon award the contract for the construction of a 47 x 100 ft. good will industrial building on 28th St. and Liberty Ave. Estimated cost, $100,000. T. B. and L. Wolf, Century Bldg., Archt. Noted Nov. 25.

SOUTHERN STATES

Fla., Campbellton — The Kelly Foshee Lumber Co., Montgomery, Ala., plans to build a saw-mill here.

Fla., Milton—C. Y. Mayo, Jr., plans to build a sawmill.

Ga., Vienna—The Barfield Lumber Co. will build a 50 x 250 ft. ft. plant.

N. C., Charlotte—The Southern Ice Machine Co. plans to build a 75 x 140 ft. plant. F. A. Owens, 205 South Poplar St., Pres. and Mgr.

MIDDLE WEST STATES

O., Canton—The Wilson Rubber Co., 1216 Garfield Ave. S. W., plans to build a 3 story, 50 x 100 ft. addition to its factory. Estimated cost, $100,000.

O., Cleveland—The Arnold Woodenware Co., 1369 West 9th St., will soon award the contract for the construction of a 2 story, 60 x 180 ft. factory on West 53rd St. and Detroit Ave. Estimated cost, $90,000. C. W. Hopkinson, 900 Rose Bldg., Archt. Noted Jan. 6.

O., Greenville—The Franklin Tractor Co. plans to build a 2 story, 50 x 120 ft. addition to its plant. Estimated cost, $50,000. Architect is not selected.

O., Columbus—The Iron Clay Brick Co., 64 Ruggery Bldg., has awarded the contract for the construction of a 1 story, 60 x 175 ft. factory on East 2nd Ave. Estimated cost, $45,000.

Wis., Amherst—The Amherst Jersey Creamery and Dairy Co., plans to build a 5 story, 50 x 110 ft. creamery and dairy on Main St. Estimated cost, $75,000. F. Shanklin, Pres. Architect not selected.

Wis., Racine—The Journal Printing Co., 328 Main St., has awarded the contract for the construction of a 2 story, 60 x 110 ft. publishing plant on 4th St. Estimated cost, $110,000.

American Machinist

Volume 54 NEW YORK, MARCH 3, 1921 Number 9

Some Tools Used in Making Phonograph Tone-Arms

By S. A. Hand
ASSOCIATE EDITOR, AMERICAN MACHINIST

Ingenious Tools for Thin Metal Work—Making Difficult Angular Parts from Tubing—Fixtures for Assembling and Holding Parts to be Soldered

A PHONOGRAPH tone arm must be accurately built and while it must swing with the slightest pressure there must be no slack in the bearings. As the movement of the tone arm is guided solely by the spiral grooves in the record, it is evident that unless the bearings are well nigh frictionless the wear on the record will be excessive.

An assembled universal tone arm and sound box, as made by the Presto Phono Parts Corporation, Brooklyn, N. Y., where the data and illustrations for this article were obtained, are shown in Fig. 1. It will be seen that the whole arm is arranged so as to swing in a horizontal plane while the sound box can be turned on its angular mounting to present a right angle to the center line of the arm. This arrangement permits the use of either a record with undulations in the bottom of the groove ("hill and dale") or one with the undulations in the side of the groove ("lateral") on the same machine.

In addition to the horizontal movement the tone arm is so pivoted as to allow a slight up and down movement in order that the needle will bear with equal weight at both the top and bottom of the undulations. It must be understood, however, that all the weight of the overhanging arm is not borne by the needle and record as the weight is partly balanced by the pull of spring *A* at the rear of the pivotal point.

The bracket supporting the tone arm revolves on a ball bearing and is in turn mounted in and supported by an outer bracket to which it is pivoted at . The top and bottom races of the bearing are formed in the lower part of the inner bracket and the upper side of the base of the outside bracket. As the machining of the two brackets is an ordinary lathe job, except for the special fixtures for holding them, no details are necessary. However, having been made, their accuracy must be tested and the gages and parts to be tested are shown in Fig. 2. *A* is the outer bracket and *B* is the gage. The bottom of the gage has a projecting ring which the lower half of the ball race in the bracket must fit. With the gage in position, the hardened pin at the top is placed in the pivot hole in the top of the bracket and pushed into the hardened bushing at the top of the gage and while so located the gage must revolve without binding.

The inner bracket *C* is tested by the gage *D* in a like manner except that the gaging pin for the pivot has a point like a lathe center and enters a conical hole in the top of the bracket. The base of the gage has an upwardly projecting ring which the upper half of the ball race in the bracket must fit. With the bracket located in the gage and the pivot pin in the conical hole the bracket is revolved instead of the gage as in the former case. The holes *E* are for the screws upon which the arm is pivoted for its up and down motion, while the holes *H* are for pins to limit that motion. One of these pins also serves for holding one end of the balancing spring.

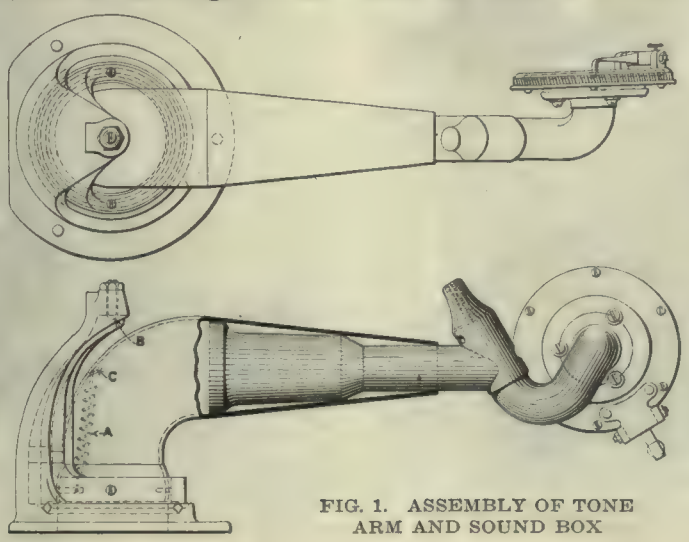


FIG. 1. ASSEMBLY OF TONE ARM AND SOUND BOX

The arm proper, as shown in Fig. 3, is made up of three pieces, the elbow *A*, the tapered tube *B* and the insert *C*. The elbow, Fig. 4, must be faced true at both outlets and for this operation is held in the box jig shown in Fig. 5. The facing tools at the right are made with bodies that fit the bushings in the jig and are provided with collars so located in relation to

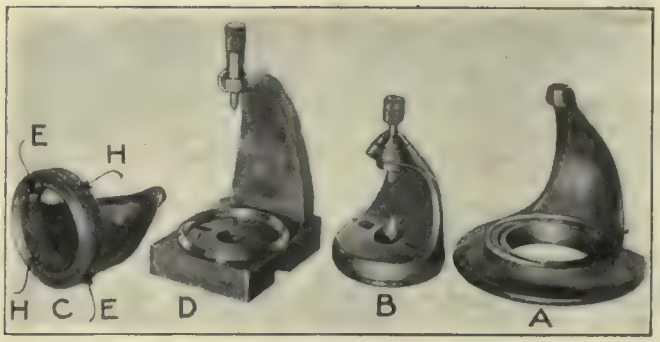


FIG. 2. GAGES FOR TESTING BRACKETS

the cutters that when they contact with the bushings the outlets will be faced to the proper dimensions. After one outlet has been faced the jig is rolled over 90 deg. to present the other outlet to the facing tool. The gage to be seen with the elbow on top of the jig shows whether or not the operation has been correctly done.

The holes for the pivot screws and the slots for limiting the vertical movement of the arm are both punched with press tools of similar construction so that only one set will be described. The tools for punching the limiting slots are shown in Fig. 6. The lower

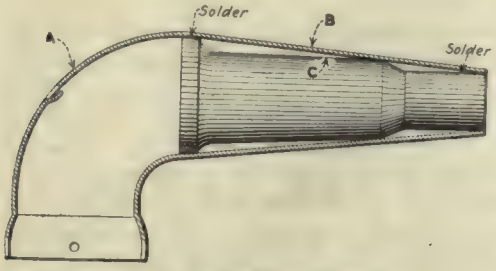


FIG. 3. THE TONE ARM

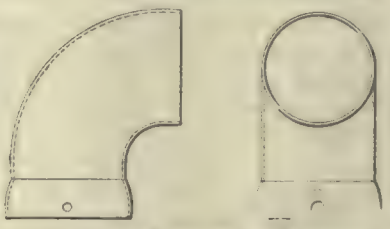


FIG. 4. THE TONE-ARM ELBOW

outlet of the elbow is placed on a stud containing the dies in its sides and located by the pivot holes which have previously been punched. The punches slide horizontally and are forced inwardly by the wedges *A* on

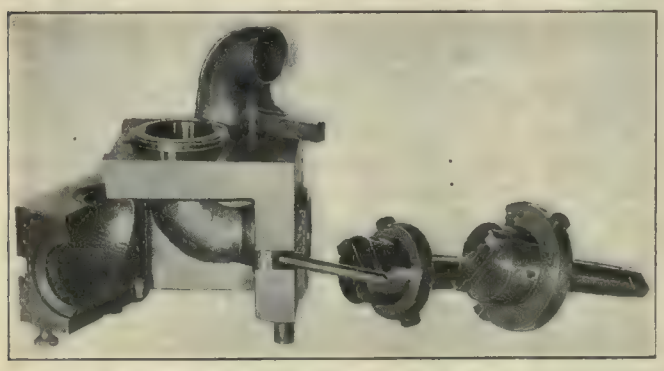


FIG. 5. JIG AND TOOLS FOR FACING TONE ARM ELBOW

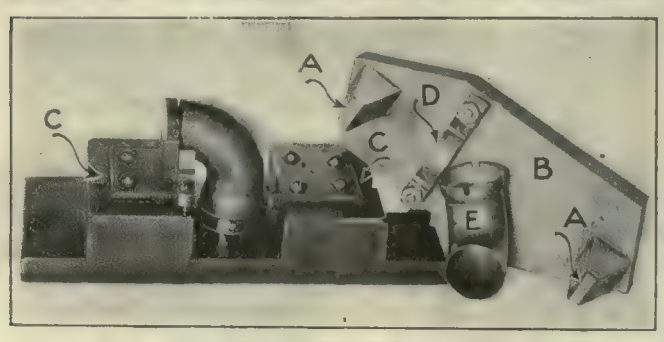


FIG. 6. TOOLS FOR PUNCHING SLOTS IN TONE-ARM ELBOW

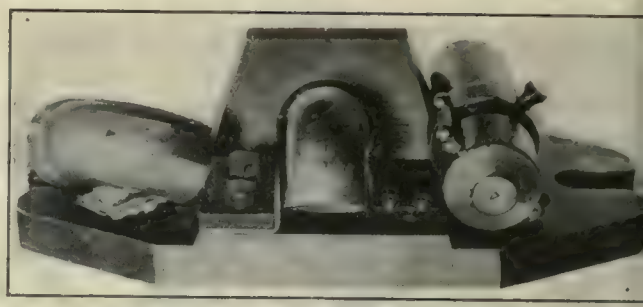


FIG. 7. TOOLS FOR FORMING THE SPRING HOOK

the plate *B* attached to the ram of the press, the punc slides being bevelled at *C* to correspond with the wedge The punches are normally held in their outward pos tions by springs which return them to that positio when the press ram ascends. Before the punches rea the work, the spring pressure-pad *D* contacts with t upper part of the elbow and holds it firmly while t punches do their work. An elbow with both slo punched is shown at *E*.

One other operation, forming the hook for the cou terbalancing spring, completes the elbow. This ho can be seen at *C*, Fig. 1, with the upper end of t spring looped over it. The tools for forming the ho are shown in Fig. 7 and as can be seen, the punch



FIG. 8. BARREL-JOINT ASSEMB

provided with a spring pressure-pad to hold the elb in position during the operation. The punch is tri gular in shape and shears the metal at its apex a on the two sides down to the base only and at t same time bends inwardly the sheared metal thus for ing the hook.

The barrel joint upon which the sound box swings made up from two parts and is shown assembled

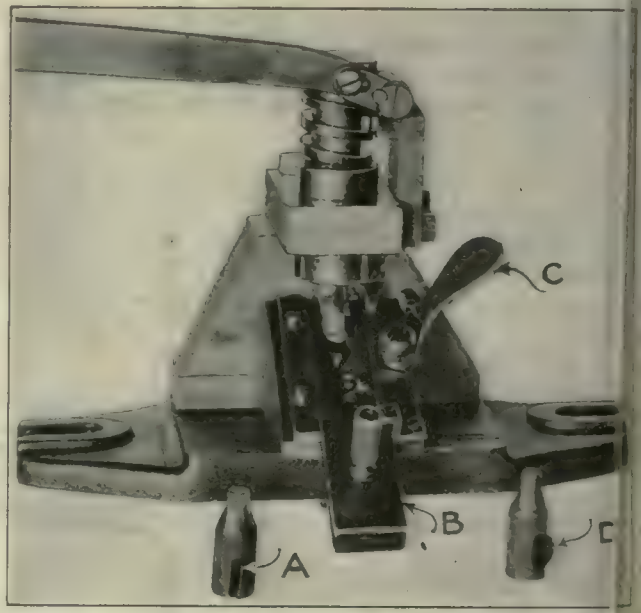


FIG. 9. TOOLS FOR FORMING PROTRUSION ON PAR OF BARREL JOINT

Fig. 8. The part *B* fits over a protrusion on part *A*, the two parts forming an included angle of 60 deg. when assembled. The method of forming the protrusion on part *A* is quite ingenious. The first operation consists in punching a slot as shown at *A*, Fig. 9. The piece is then placed in the hand press shown in the illustration, part of the punch being cut away to clear the piece when it enters the die and assumes the angle to which the die is made. With the piece located in the die, the slide *B* is pushed in and locked by the eccentric lever *C*, holding the piece firmly while the punch is brought down by the hand lever at the top, forcing out the protrusion as shown at *D*.

The other part of the joint must fit tightly over the protrusion thus made and the edges make a close fit around the body. In order to accomplish this a tube of twice the required length is placed in the inclined recess of the jig shown in Fig. 10. The step-pointed end mill *B* is then run down through the wall of the tube, completely severing it and producing two parts, *C* and *D*, both of which will fit properly.

Before assembly of the barrel joint, the part *A*, Fig. 8, has a plain slot punched at *C* which must afterward have notches *D* at each end. These notches are not cut until after the joint has been assembled as their location must have a certain reference both to the location and direction of the straight tube *B*. The tools for punching the notches are illustrated in Fig. 11. The assembled joint is placed on the stud *A* which also contains the dies. The punches are mounted on slides placed at an included angle of 90 deg. and are operated by the descending ram of the press through the inclined wings *B* on the plate *C*. The lever at the right operates the ejector for removing the work. As the ram of the press ascends, springs return the punches to the normal position.

The sound-box elbow is rather a crooked piece of

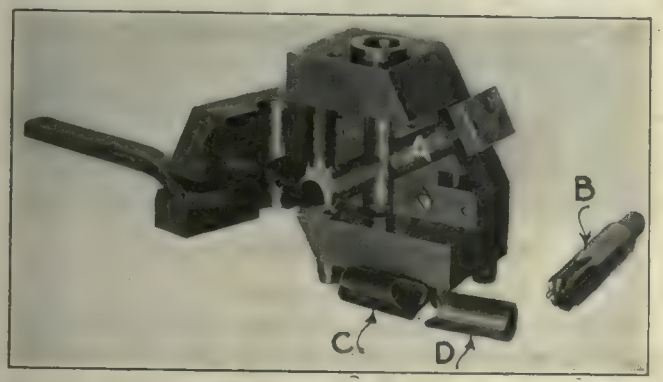


FIG. 10. TOOLS FOR CUTTING TUBES FOR BARREL JOINT

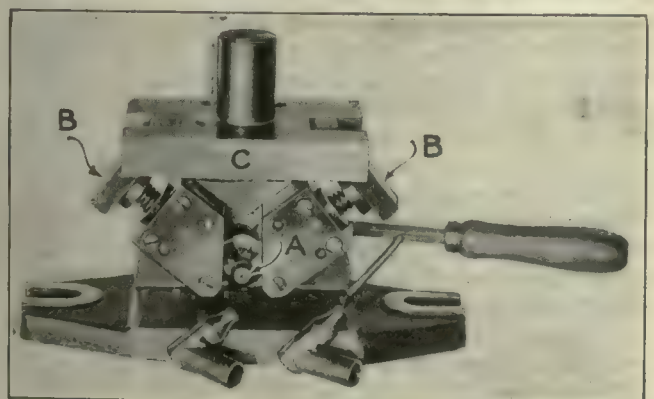


FIG. 11. NOTCHING TOOLS FOR BARREL JOINT

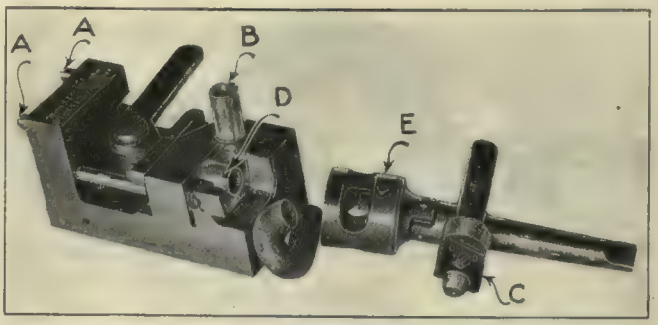


FIG. 12. FACING AND SIZING TOOLS FOR SOUND-BOX ELBOW

tubing and it is necessary to face both outlets and to size the outside diameter of the short end so as to make a tight fit in the flange to which it is afterward to be assembled. Both operations are performed in the fixture and by the tools shown in Fig. 12. As the two ends are not at a right angle with each other, the feet of the fixture (two of which can be seen at *A*) are not of equal length so that when the fixture is stood upon them the end *D* of the work will be presented to the cutter at the proper angle. The end *B* is faced and the inside chamfered by the tool *C*. The end *D* in addition to being faced has the outside sized by the tool *E*. This tool has a floating member, as can be seen from the illustration, and carries a hardened bushing which is slightly bell mouthed. With the tool revolving in a drilling machine spindle it is brought down over the work and the bushing spins the metal at the end to the proper size. After being assembled to the flange, a peculiarly shaped hole covering more than half the circumference of the tube is punched near one end. An elbow showing this hole at *A* may

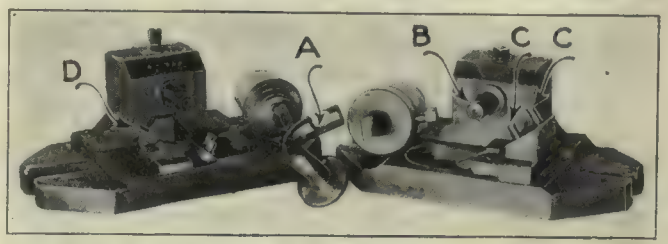


FIG. 13. TOOLS FOR PUNCHING HOLE IN SOUND-BOX ELBOW

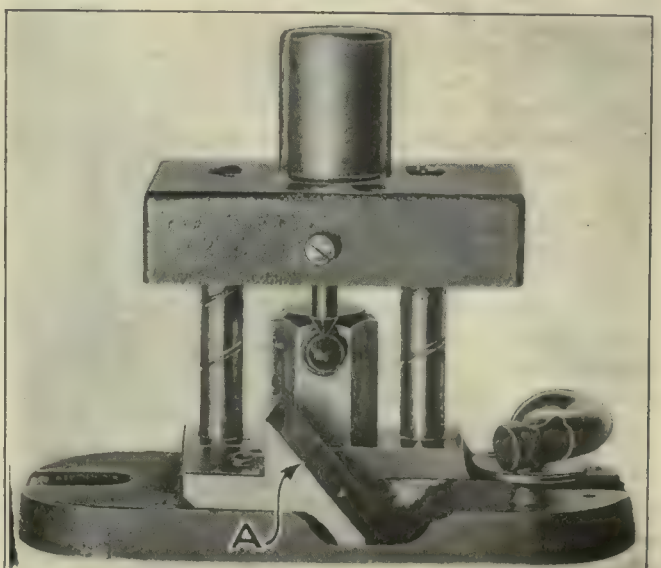


FIG. 14. TOOLS FOR PIERCING A BURRED HOLE

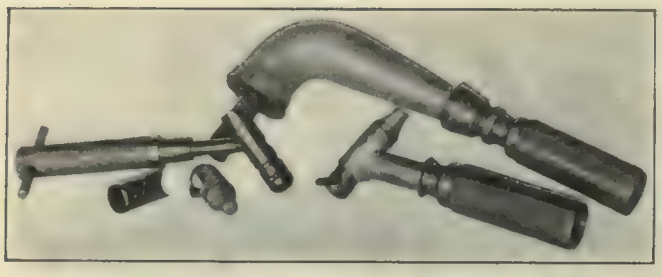


FIG. 15. ASSEMBLY FIXTURES

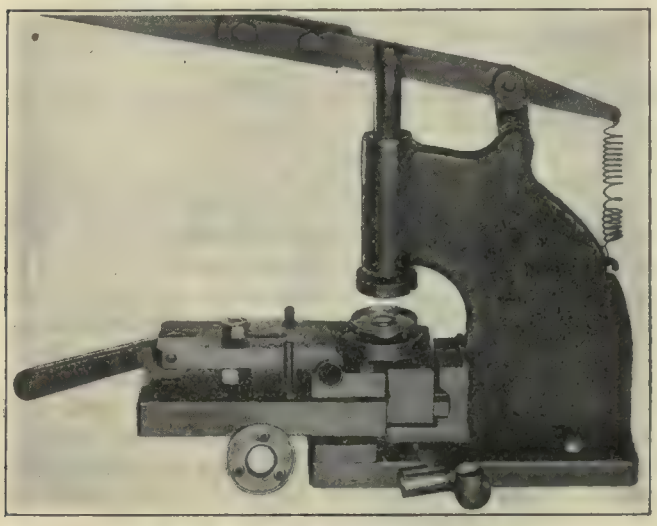


FIG. 16. AN ASSEMBLY PRESS

be seen in Fig. 13, while on each side are the tools for doing the work. Since the hole covers more than half of the circumference of the tube the work must necessarily be done in two operations. The tube is placed over the horn *B* of the fixture at the right with the flange in contact with pins *C* and one-half of the opening punched. It is then placed over the horn in the fixture at the left with the flange resting on pin *D* and the other half of the opening punched, the position of the completed opening bearing a certain angular relation to that of the flange. A small hole near the extreme end has to be tapped but the metal is too thin to allow the forming of a satisfactory thread. The tube is placed over the horn of the pillar tools shown in Fig. 14, and located by bringing the flange in contact with the angular block *A*. The punch has a point similar to that of a lathe center and simply forces its way through the metal leaving quite a burr on the inside. In tapping, the inside edges of this burr take the thread and answer the purpose of a thicker wall in the tube. In assembling parts that are soldered together fixtures are used to hold them in proper relative positions while the solder is being applied. Two such fixtures with the work in place are illustrated in Fig. 15, the upper one being for the tone arm while the lower one is for the barrel joint. An empty fixture for the latter is shown at the left and the parts it is to hold are directly beneath it.



FIG. 17. GAGE FOR TESTING CORRECTNESS OF ASSEMBLY

The sound-box elbow and flange are assembled in a hand press, as may be seen in Fig. 16. Here the elbow is held in a matrix with the end to receive the flange pointing upward. The flange is put in place by hand and forced on by the press. As soon as the solder is applied the ram of the press is again brought down holding the parts firmly in position until the solder sets. In the finished assembly the position of the flange must bear a certain relation to the small hole to be tapped and previously referred to. The gage for determining the correctness of the assembly is shown in Fig. 17. Here one end of the elbow is held within the sleeve *A* with the pin *B* in the small hole. If the assembly is correct the flange will bear evenly on the angular block *C*.

Marking Tools by Etching

By A. T. Smith

On page 1047, Vol. 53, of *American Machinist*, a very clear description of a method of marking steel tools by etching is given. However, I suggest the following simple, harmless and effective method for accomplishing the same result:

Make a saturated solution of approximately equal parts of copper sulphate and ordinary table salt, in water. The article to be marked is coated evenly with toilet soap, simply by rubbing with a cake of soap. The desired marking is then drawn through the soap coating with a scriber or other sharp point. The marking is covered with a few drops of the solution, no dam being required. The solution will pile up on the soap, an effect caused by the chemical re-action. Let it stand two or three minutes until the markings show quite red and then rub off with oily waste. The writer marked several tools by this method twenty years ago, and the marking is now as clear and sharp as when made.

Substitute for Thumbtacks

By F. L. Sylvester

We have almost discontinued the use of thumbtacks in our shop. Our method is first to cover the drawing board with heavy Manila drawing paper stretched on by wetting it and then gluing it on by the edges all around, keeping the middle moist by laying a dampened cloth on it until the glue has had time to set. When this has dried out, it gives a smooth surface which will not pucker or wrinkle under varying weather conditions. Onto this we stick our drawing paper, whether large or small, with white library or photo paste, applying it in spots 8 to 10 in. apart along the edges.

This holds the paper well enough for doing the drawing but not so that it cannot be removed without tearing after the work is done. This method might not be feasible with tracing cloth which, of course, would be used if much blueprinting were done, but our work is mostly done either on light brown paper or thin white sketching paper. For the few blueprints we do require we make the drawing on the paper direct.

Details of Large Airplane Work

Fixtures Used in Wing Construction—Increasing Application of Metal Framing—Installing Motors in Planes—Methods of Assembling Fuselages

SPECIAL CORRESPONDENCE

SOME idea of the progress which has been made in the commercial construction of airplanes is shown in the accompanying illustrations. Those who recall the early heavier-than-air machines, cannot fail to notice a marked difference in the details of construction of the various members and the more workmanlike manner in which they are put together. Fig. 1 shows the latest fixture for building up wing ribs, it being an improvement over some of the fixtures previously illustrated. This fixture is largely of metal, the outside edge *A* showing the construction of the complete boundary around the outer surfaces of the ribs. The strip forming the boundary projects sufficiently above the space on which the rib members are laid, to hold the upper and lower strips in their proper positions while the intermediate braces and cross members are being put in place. The outer strips are put in place and the inner members assembled as shown.

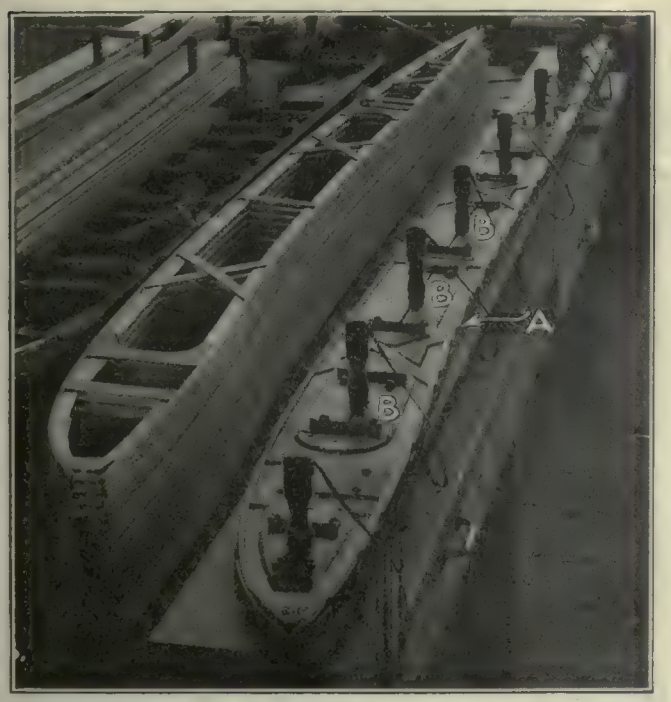


FIG. 1. A MODERN RIB FIXTURE

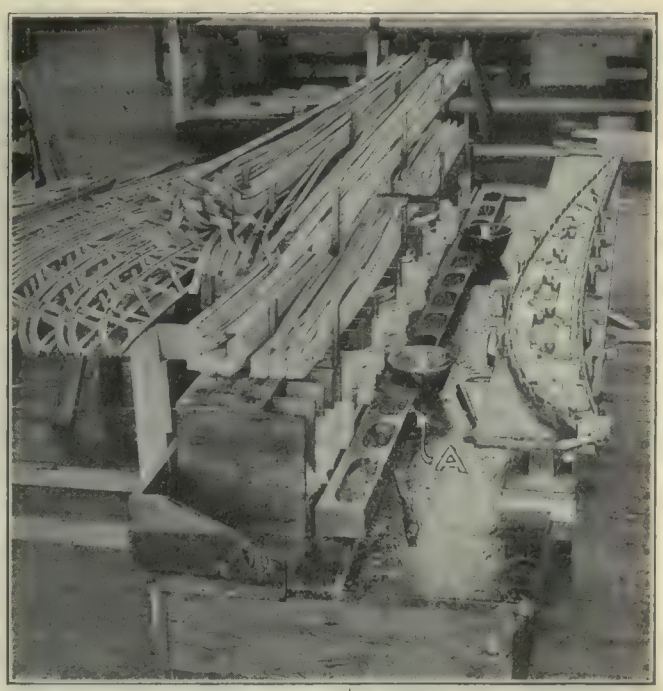


FIG. 2. ANOTHER TYPE OF RIB FIXTURE

Nine Pairs of Wedging Blocks

There are nine pairs of wedging blocks *B*, each pair being forced into its extreme or outer position by means of the taper pins shown. A light strap is attached to each pin, in reality it is a piece of belt lacing and keeps every pin within easy reach of the operator. With the upper and lower members of the rib forced against the outer portions of the fixture, the cross-members and other pieces in their braces are placed in position and fastened firmly in place by both gluing and nailing. It will be noted that there are suitable openings or notches provided in the outer edge of the fixture to allow small nails or brads to be easily driven into position.

Another type of fixture is shown in Fig. 2, the rib in this case being of an entirely different contour, as can be seen. The outer edges of the fixture are very similar to those shown in Fig. 1, but a different method is used for forcing the upper and lower members into position against the outer frame of the fixture. In this case the wedges are controlled by cams actuated by the handles shown on the outside. This illustration also shows the convenient way in which the various sizes of small nails or brads are kept, as at *A*. Both Figs. 1 and 2 give a very good idea of the way in which the work is handled.

In Fig. 3 is shown a complete unit for wing ribs, mounted on an independent bench and shows how two men can easily work on the same rib without interference. This incidentally, gives a good idea of the size of the ribs themselves.

The growth in the use of metal framing, even where fabric is used for the wings, is shown in Fig. 4. This view shows a complete elevator frame and two rudder frames ready to be covered, the frames being entirely of metal; mostly steel tubing with the joints brazed or soldered.

Handling Liberty Motors

Figs. 5 and 6 show a convenient method of handling the Liberty motors, lifting them from the floor and placing them on the engine bed in the plane. Fig. 5 shows how the engine is mounted on a base or subframe and also the way in which it is swung from



FIG. 3. A RIB MAKING BENCH



FIG. 4. STEEL TAIL FRAMING

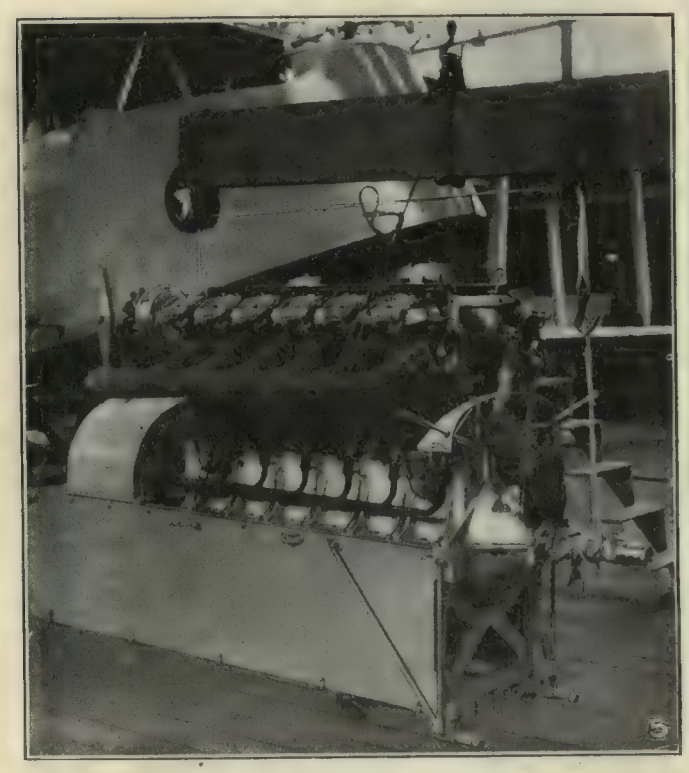


FIG. 5. SLINGING THE MOTOR



FIG. 6. SWINGING THE MOTOR INTO PLACE



FIG. 7. BUILDING UP THE FUSELAGE

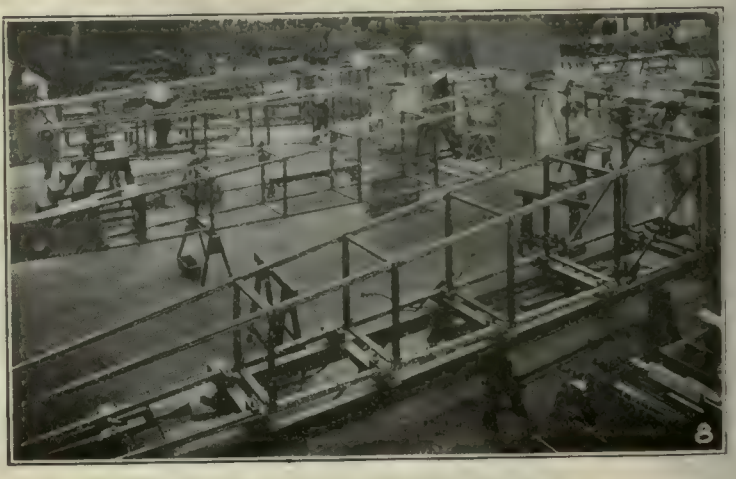


FIG. 8. FOUR STAGES OF COMPLETION

the overhead beam. The rope from the beam to the exhaust manifolds is simply to prevent any tendency of the engine to turn over.

Fig. 6 shows how the engine is lifted by the hoist at *A* and then swung into position by means of the long beam *B*, which is handled by the man on the step-ladder, assisted by the two men shown behind the engine on the lower plane. This combination has been found to work out very satisfactorily as traveling cranes are not available. It must be remembered that these engines are 400 hp., and each weighs, with its base, between 800 and 1,000 lb.

Assembling

The remaining illustrations, Figs. 7 and 8, show two views of the floor where the fuselages are erected. The assembling is done on the rails or erection platform, shown in Fig. 7 and in the foreground in Fig. 8. These platforms are composed of steel I-beams, mounted on substantial horses.

After the skeleton of the fuselage is assembled the four longerons are tied together by the vertical and horizontal braces and the cross wires. Then the assembly moves up the line as it is now only necessary to support the fuselage at two points as can be seen in the plane next to the one in the foreground.

As improved airplane construction is developed, it becomes more and more of a real machine and in consequence requires more and more machine equipment for its manufacture. For this reason, if for no other, it behooves machine builders to watch and to encourage the development of the airplane industry.

Should Jigs and Fixtures Be "Designed"?

By H. W. Armstrong

On page 26, Vol. 54, of the *American Machinist* P. A. Fredericks brings up the question for discussion as to whether it pays to design jigs and fixtures in the drafting room, or to have the toolmaker design these to fit the job on hand.

The writer, whose experience has been gained with about fifteen concerns in various parts of the country [some of these being small jobbing and manufacturing plants, while others were of national importance], would like to take part in this discussion. My experience covering such positions as machinist, toolmaker, draftsman, chief tool designer, master mechanic and superintendent should qualify me to express a fair opinion.

As Mr. Fredericks states, it may be largely a question of personnel. Undoubtedly any shop which has been using either of these methods would flounder around for awhile if the method in use was suddenly changed. However, it has been my experience that the shops in which the tools were designed in the drafting room were the ones which were most up to date and profitable. It is quite true that there are still a number of shops which do not use this method but I feel sure they are in the minority.

Advantage of a Designing Department

The advantages which a shop with a designing department has are many. First, it must be remembered that good all-around mechanics are scarce. That is, it is easier to find lathe hands, milling machine hands, etc., than good all-around toolmakers. If a fixture is designed the work can be laid out so that each specialist does his work, leaving the assembling and final work for the good toolmaker. Again, in a shop where the toolmaker starts and finishes the job himself it is not always possible to obtain a machine when he wants it, so that some of his time may not be spent profitably as the bench work cannot always be depended on to keep him busy unless he has a number of jobs at the same time, which causes the work to get more or less mixed up.

Another advantage is that the stock can be cut off to the blueprints by a cheaper man and the parts are all ready to go ahead on schedule when required. This results in very little lost time after the job is once started. Also it allows the work to be routed so that each tool or fixture is ready when needed.

The System Demonstrated

The best demonstration of this system that I know of is the plant of the Pratt & Whitney Co. at Hartford, Conn.

The jigs and fixtures are designed by the drafting department. The stock is then cut off in the stock department and each job in a separate pan is sent to the tool department. There it is turned over to the bench foreman, who has the work laid out and the lathe work, shaper work, milling work, etc., is taken care of by the straw boss or foreman in charge of each section. When all machining has been done the finished parts are returned to the bench foreman for assembling.

Everything considered, this method, in the writer's opinion, is the better. It can be used to advantage in a smaller way by the small shop. Of course it is absolutely nesessary that the shop foreman should have some say in the design of the tools and he should O. K. everything before allowing the work to go through into the shop. This gives the draftsman, who has not always had the benefit of shop experience, the advantage of the foreman's practical knowledge. Also it eliminates antagonizing the foreman, who is not always in sympathy with the designs thrust upon him, without his consent, by the drafting department. This insures the co-operation of the shop and drafting room, which is a matter of vital importance.

It must be remembered also that when drawings are made there is always a permanent record of the job for reference when such a job comes up again. When the toolmaker works to his own design without drawings or with incomplete sketches the whole job has to be done all over again next time.

Drawings May Not Pay in Jobbing Shop

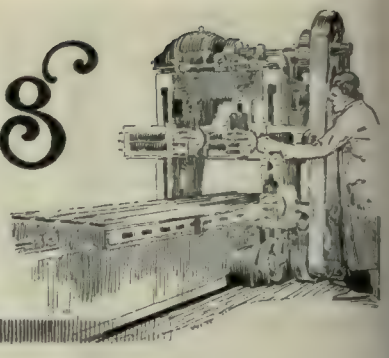
It may be that in the jobbing shop, where almost every job is different, it would not pay to make drawings, but these shops generally have only all-around toolmakers and machinists in their employ and these men can generally be trusted to do the proper thing. The larger shops cannot always get all the good mechanics they require, especially in rush times, so that it is usually necessary to specialize, thus requiring a drafting department. Also these specialists usually do the machine work much faster than the average toolmaker, as they have all necessary tools at hand and usually have a better knowledge of machine work, which is proper, as they do nothing else.

Therefore, in the opinion of the writer, it is better to have the tools designed, except perhaps in some few special cases.



Metal Cutting Tools.

By A. L. DeLeeuw



V. Boring Tools in General

The Three Operations Included in the General Term Boring—Various Arrangements of Tools and Work—Types of Boring Tools

BORING, in its narrower meaning, is the enlarging of a hole by means of a cutting tool and includes reaming as well as what is ordinarily called boring. There are, therefore, three meanings of the word boring. One is the making of a hole, which may require drilling as well as other operations. The second meaning is the enlarging of a hole, and may include reaming. The third and narrower meaning does not include reaming. The essential difference between boring and reaming lies in the difference in the tool used, and not in the nature of the operation.

We will first confine ourselves to boring in the narrower sense of the word. In that sense boring may be called inside turning. In fact it is often called just that, when, for instance, a large flywheel has to be turned at the inside of its rim. Such an operation is in no way different from the boring of a small hole, except in regard to some details. The most important fact to be kept in mind about boring or inside turning is that the tool is presented to the inside of a cylinder

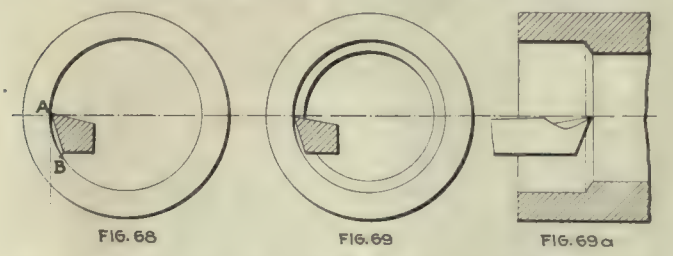


FIG. 68. POSITION OF BORING TOOL IN SMALL WORK
FIG. 69. VIEW SHOWING ANALOGY TO TURNING CUT
FIG. 69a. SIDE VIEW SHOWING FRONT CLEARANCE

instead of to the outside, and that, as a consequence, there are new relations between the angles of the tool and the surface to be finished. In Fig. 68 a tool is shown in position boring out a hole in a relatively small piece. The first thing that strikes our eye is the necessity of having a large clearance angle. If the clearance angle had been made smaller the corner *B* of the tool would have struck the finished work. In Fig. 69 this same tool is shown in the same piece, and a section of the piece, Fig. 69a, shows that the cutting takes place in practically the same way in which the turning cut proceeds; that is, a large percentage of the cut is in the direction of the feed. Just as with turning this is true for most roughing cuts, and again, as with turning, the greater part of the cut takes place by the rotation of the work if a finishing cut is taken. There is, however, one great difference. In turning, the tool was presented to the work at right angles to the axis; in boring, it is presented parallel to the axis, or nearly so. As a result the front clearance of a boring tool corresponds to the side clearance of a turning tool, and the side clearance of a boring tool corresponds to the front clearance of a turning tool. It has been remarked that the side clearance of a turning tool should be greater than the front clearance, as the tool has to do both cutting and penetrating. For the same reason, then, the front clearance of a boring tool must be somewhat greater than the front clearance of a turning tool. We might expect that the side clearance of a boring tool would be the same as the front clearance of a turning tool, but this is not so for the reason shown in Fig. 68.

All the above considerations show that a boring tool is of necessity weaker at its cutting points than a corresponding turning tool, and this weakness becomes more emphasized as the hole to be bored is smaller.

We have noticed the effects of setting a tool above or below the center when turning. There is a similar effect when boring except that in this case the rake is diminished by setting it above the center while the clearance is diminished by setting it below the center.

In a great many cases it is not practicable to support the boring tool except at one end, so that the effects of overhang are much more serious than with turning tools. There is both twisting and bending present. The bending has the tendency to reduce clearance and to increase the rake and as an excessive rake may cause the tool to pull itself into the work, it is necessary to make long overhanging boring tools with a very small amount of rake. This increases the power required to take certain cuts, and this in its turn increases the amount of bending, so that altogether it would not be practical to take heavy boring cuts with a long overhanging tool. The effect of twisting is not so serious except in so far that it increases the vibrations. Where heavy cuts must be taken the overhanging tool should not be used, but in its place should be used a tool which can be supported at both ends. All modern boring practice depends on this principle.

Boring is done by either revolving the piece or revolving the tool, and no distinctive names are given to these two operations. When the tool is overhung and the work revolves while the work feeds, we have poor conditions for taking heavy cuts. On the other

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hand the strains in the boring tool remain always the same so long as the cut remains the same, and consequently we will obtain a uniform hole. If the work revolves we will get an axis of the hole coinciding with the axis of the spindle. If the direction of the feed is parallel with the direction of the axis of the spindle we will get a straight hole. If it is not we will get a taper hole. But in any case we will get a hole in the proper direction, and round.

If the tool is overhung and revolving while it also feeds, we will get a hole in the direction of the feed but not in the direction of the axis of the spindle. We will, however, get a true hole so long as the cut is uniform. It may be remarked here that it is highly improbable that we would have a uniform cut and for this reason it is customary to take a number of cuts in order to get the last cut practically uniform. If, for instance, the first cut would be such that we have to remove $\frac{1}{8}$ in. more on one side of the hole than on the other, then the tool will spring, let us say, 0.010 in. and the resulting hole will be that much out of true. If we now take a second cut, the tool would still spring, but not nearly so much as before, and the resulting hole will be only 0.001 in. out of true. A third cut would probably be so nearly true that the error is not measurable.

However many cuts are taken it is good practice to allow a fair amount of metal to be removed by the last cut. Suppose the hole were round within 0.002 in., and suppose we had left only 0.004 in. to be removed by the last cut, then we would have to remove 0.003 in. on one side, and with only 0.001 in. on the other side of the hole, or a ratio of 3 to 1, and the probable result would be that, after taking the last cut, the hole is still out of true, say 0.001 in. It might even be if the tool is not entirely sharp, that the small amount of 0.001 in. which was left on one side of the hole will not be cut away at all, and that, as the machinist sets his tool by trial, he may have to bore out 0.004 in. on the thick side in order to enlarge the hole 0.003 in. Thus again the hole will be out of true 0.002 in., but this time the eccentricity will be toward the left instead of the right.

If, on the other hand, we had allowed 0.010 in. to be bored out on the last cut, the amount of metal to be

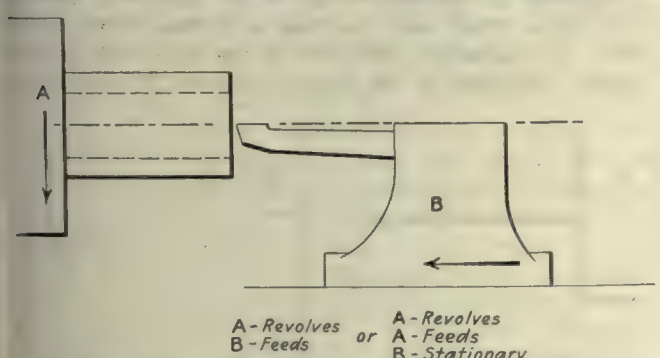


FIG. 70. BORING SET-UP, WORK CHUCKED

removed would have been 0.006 in. on one side and 0.004 in. on the other, allowing the tool to take a cut all around and making a hole very nearly true.

If the tool revolves while the work feeds the result will be the same as if the tool were feeding.

If the tool is held in a bar which is not supported, then all conditions are, of course, the same as with an overhanging tool, but if the bar is supported, a number of new conditions may arise. Such a bar would have two supports: It would be gripped at one end, and merely guided at the other. It may revolve, or it may be stationary. The guided part of the bar may be on the same side of the work as the gripped end, or it may be on the other side, or it may be in the work. The guided end may find its bearing in a revolving spindle, or in a stationary part, and the result will

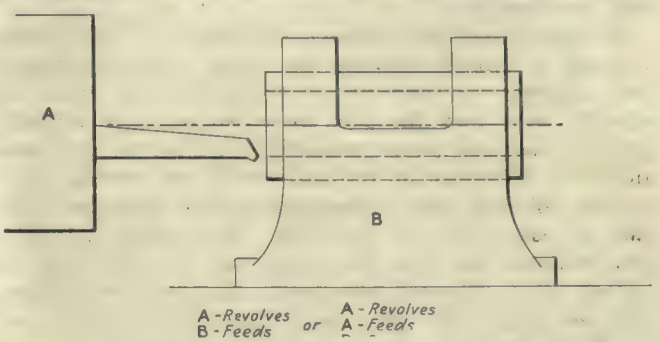


FIG. 71. BORING SET-UP, TOOL REVOLVING

be more or less modified according to which of these various conditions is before us.

The accuracy of the hole obtained by boring depends not only on the accuracy of the machine but also on the arrangement of tool and work. It may be taken for granted that there is always some looseness in the spindle, some looseness in the machine element which feeds, be it spindle or carriage, and that the direction of the feed is not absolutely the same as the direction of the axis of the spindle. But apart from these inaccuracies there are other causes which make the hole more or less faulty, either in direction or roundness or size or straightness.

Fig. 70 shows a piece of work which revolves as it is being bored out by a tool which is clamped in a holder, the holder being provided with feed movement. It is an arrangement such as might be found when we bore a piece by clamping it to the faceplate of a lathe, and holding a single point boring tool clamped in the carriage. Such an arrangement will produce a hole of which the axis is the axis of rotation of the spindle. If the spindle should be loose, then the axis of the hole will not be a straight line, otherwise it will. If the direction of the feed is parallel with the direction of the axis of rotation the hole will be cylindrical. Otherwise it will be more or less taper. If more than one boring cut is taken, so that in the last cut a practically uniform amount of metal is removed all around the hole, then the deflection and twist of the tool will be the same through the entire length of the hole, so that the size of the hole will be uniform.

The same results would be had if the element *A* were both revolving and feeding, and if *B* were stationary. This feeding may take place by feeding the entire head in which the work is held, or the spindle with its sleeve alone may be fed forward. In either case, the same results are obtained as before.

In Fig. 71 conditions are reversed: The tool is held in the revolving member, and the work in the fixture. This arrangement will give a hole of uniform size, but the axis of the hole will be parallel with the direction of the feed so that it will be extremely difficult to determine in advance the direction of the hole. It would only be possible to bore several holes with parallel axes, if one could depend with absolute certainty on

the accuracy of the fixture and the feed. The same results would be obtained if the tool had both revolving and feeding motion, and the work were held stationary.

In Fig. 72 the work is shown held in a fixture, and a boring bar is attached to the revolving member. The end of the boring bar is supported in a rest. If the bar revolves and the work holder feeds while the support for the end of the bar is stationary, the following may be expected:

We may expect that the axis of rotation of the spindle does not go exactly through the center of the stationary bar support, so that in revolving the bar must be slightly bent and the tool describes a circle slightly greater than one would measure by calipering over tool and bar. However, as the position of the cutting point of the tool does not change during the operation, this has no bad effect on the hole. We would naturally not measure the hole by calipering the tool, but by calipering the finished hole itself. The result will therefore be this: We will obtain a hole of uniform size, of which the direction of the axis is the direction of the feed.

The second condition shown in Fig. 72 would lead to poor results because it cannot be expected that the axis

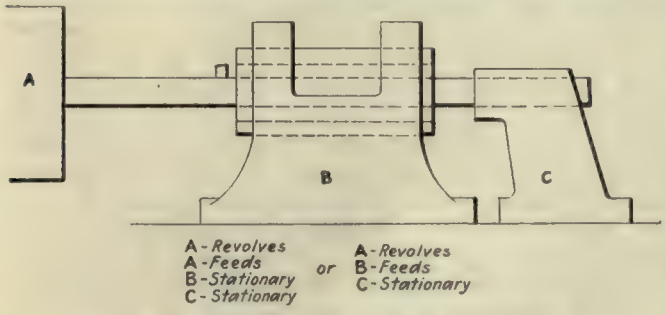


FIG. 72. BORING SET-UP, BORING BAR WITH OUTSIDE REST

of rotation of the piece *A* absolutely coincides with the center of the rest *C*. This would cause bending, but as the tool gradually approaches *C*, the amount of bending would gradually become less and the hole would not be of uniform size. Furthermore, as the hole in *C* may not be entirely in line with the direction of the feed, the axis of the hole in the work would become a curved line so that the total result would be a bell-mouthed hole with a curved axis.

If, in Fig. 72, feed were given to *B* instead of to *A*, conditions would be different again. As the tool bar between faceplate and rest would always be of the same length, the amount of deflection will be the same at any point of the hole so that the hole will be of uniform size. But as *C* may not be in line with *A* the axis of the hole will be neither the direction of the boring bar nor the direction of the feed, nor that of the axis of the spindle, but a straight line somewhere between these three directions.

In Fig. 73 the boring bar is supposed to be clamped to the carriage *B*, and the work to the revolving spindle. The boring bar is guided in the spindle. We find such a condition, for instance, in the Potter & Johnson automatic chucking lathe and in a number of other machines. As the length of bar between carriage and guide becomes shorter as we progress with the boring, the deflection of the tool must be a variable amount so that the hole will not be of uniform size. If *B* is not in line with the spindle the position of the tool point will be governed by the curved line which the axis of the bar assumes under the stress of bending. This curved line will be different according to the distance between tool point and spindle, so that not only will the hole be of uneven size, but its axis will be a curved line, and this curved line will be still further affected by the fact that the direction of the feed is probably not the same as the axis of rotation. This method of boring would not be acceptable at all if it were not for the fact that all the elements mentioned above may be kept small in a well-built and well-maintained machine, and if it were not that this method permits of very much heavier cuts than when the boring bar is overhung. It is, therefore, a useful method when the machine is in good condition, when heavy cuts must be taken and when no extreme accuracy is required.

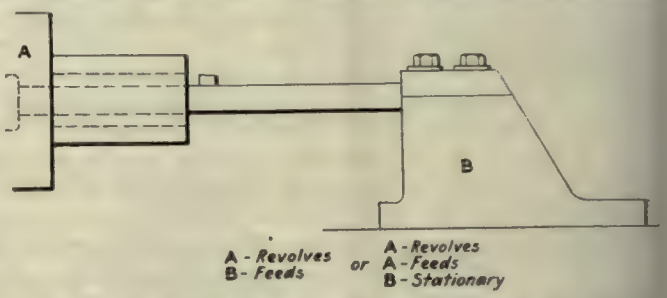


FIG. 73. BORING SET-UP, BORING BAR PILOTED IN CHUCK

Fig. 73 also applies if the work revolves and feeds, and if the bar is stationary. All the above considerations can also be applied in this case.

Fig. 74 shows a condition which should never be tolerated but which is found in a good many cases. In this arrangement the bar revolves and feeds (as for instance in a drill press), and a fixed rest or jig-eye *C* is provided. Such an arrangement is useful for drilling, but of very little or no use for boring. In the first case possible with the arrangement of Fig. 74, the spindle revolves and feeds, the tool is held in an overhanging bar and the amount of overhang changes as feeding progresses so that the deflection is constantly changing. This amount of deflection is necessarily great. The result will be a hole much larger on the left than on the right. Then, too, the piece *C* acts as a guide at the beginning of the operation but has very little effect when the tool is further down in the hole. Consequently the axis of the hole will be very largely controlled by the amount of metal to be removed,

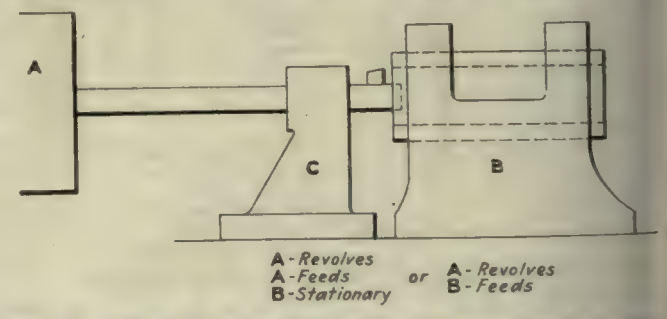


FIG. 74. BORING SET-UP, BORING BAR WITH INSIDE REST

by the homogeneity of the metal and by other conditions over which the machinist has no control. In addition the facts that the direction of rotation may differ from the direction of the feed and that the spindle may not line up with piece *C* will further affect the accuracy of the hole. The reason why such an arrange-

ment may be tolerated for drilling is that the drill cannot be guided except for the beginning of the hole and this arrangement will do that much. After the drill has once entered it will be guided entirely by the peculiarities of the metal and the grinding of the drill. Under ordinary conditions a hole will be produced by the drill sufficiently accurate for a mere drilled hole. Briefly, this arrangement is all right for drilling because we do not expect a drilled hole to be accurate, but this does not apply to boring.

If, in the arrangement of Fig. 74, *A* should revolve and *B* should feed, the distance between *B* and *C* would have to be much greater than shown in the sketch and the results would be even less satisfactory. However, such an arrangement is not ordinarily used.

In Fig. 75 is shown an arrangement which is quite commonly used in manufacturing. The boring bar is guided in two rests, C_1 and C_2, and is driven by universal joints or equalizing drivers from some revolving member. In this case, the axis of rotation is the common center line at C_1 and C_2. If the bar revolves and also feeds while the work is stationary, a hole may be generated of which the axis is the common center line of

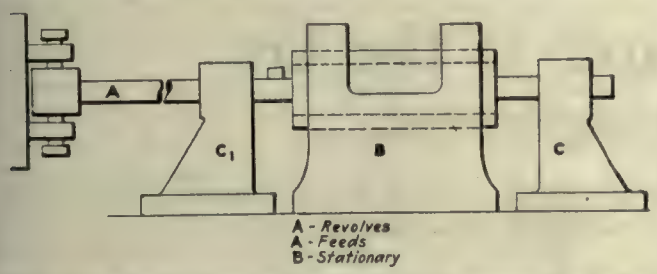


FIG. 75. BORING SET-UP, BORING BAR GUIDED BY TWO RESTS AND DRIVEN BY UNIVERSAL JOINT

C_1 and C_2. This shows that it is very necessary that C_1 and C_2 should be in true alignment. Any variation from such alignment would cause the bar to bend and assume the form of an elongated letter *S*, so that the axis of the hole would also have this form. Besides this defect, which is only present when C_1 and C_2 are not properly lined up, there is another factor which distorts the hole. The amount of deflection of the bar, due to the pressure of the cut, is very small when the tool is near C_1; it gradually gets larger until the tool reaches the center of its travel, after which the deflection diminishes again and becomes once more a minimum at the end of the hole, so that, even with true alignment of the rests C_1 and C_2, a hole will be generated which is larger in diameter at both ends than at the center. In the foregoing it was assumed that the looseness of the universal joint is sufficient to make up for whatever difference there may be between the feed and the center line of the bar. If this were not so, the bar would be cramped and would bend at some point of its travel. The bending would take place, primarily, near the universal joint, but it would also cause a certain amount of bending between the two rests. It is, therefore, important that such an arrangement should be made with sufficient looseness at the driving end. Sometimes the drive is so arranged that it is free in one plane but cramps in the other so that there is no bending when the tool is standing up and down, but there is some bending when the tool is standing horizontally. This fault would lead to a hole which is out of round at that portion of the bore where the bar was partially cramped.

The general arrangement of Fig. 75 may be modified by having the bar revolving only, while the work feeds as shown in Fig. 76. In this case, sufficient room must be provided between the rests C_1 and C_2 to accommodate at least twice the length of the hole to be bored. The tool will be in the center between the two rests, and, as it maintains its position in relation to the supports

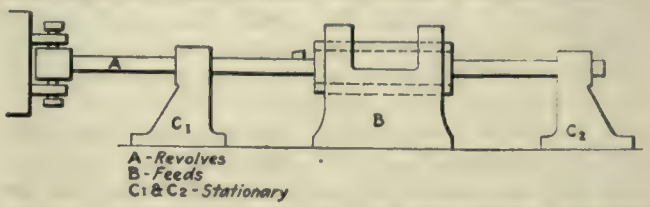


FIG. 76. MODIFICATION OF FIG. 75 WITH WORK FEEDING

for the bar, the amount of deflection will always be the same at any point of the bore. If the rests are properly lined up a hole will be generated with a straight axis and of uniform size. The direction of the axis, however, will be the same as the direction of the feed.

If the two rests are not in true alignment the bar will assume the shape of the elongated S as before, but as the tool is always located in the same relation to its supports this distortion of the bar does not affect the hole. If the bar is cramped at the universal joint there may be some deflection of the tool point when it is in a vertical position, and no deflection or a different amount of deflection, when it is in a horizontal position, and this will cause the hole to be out of round. Under these conditions, then, we will have a hole with a straight axis, of uniform section, but not round. The axis will be the direction of the feed as was mentioned before.

Fig. 77 shows the same arrangements as Fig. 75, except that now the two rests C_1 and C_2 are built in one with the work-holder *B*. If, with this arrangement, the tool rotates and also feeds, we will have exactly the same conditions as with Fig. 75. If the tool revolves, but the work feeds, we will have the same conditions as in Fig. 76, except that the bar will be shorter between supports, that consequently the deflection will be less, and that the deflection will not be uniform but will vary as in Fig. 75. The effect of cramping the bar also works the same as in Fig. 75.

The arrangement of Fig. 72 is sometimes reversed; that is, the elements *B* and *C* will rotate, whereas *A* is stationary. This is done when a fixture is fastened to the faceplate of a lathe. In that case it is always the tool that feeds. This arrangement is in all essentials the same as the arrangement shown in Fig. 73,

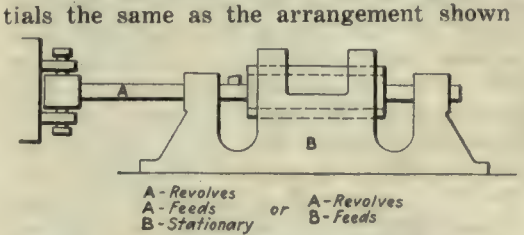


FIG. 77. MODIFICATION OF FIG. 75, RESTS INTEGRAL WITH WORK SUPPORT

with the exception that there is less assurance that the support *C* will line up with the spindle than with the arrangement of Fig. 73.

The arrangement of Fig. 74 may also be reversed by clamping *B* and *C* to a fixture on the faceplate of a lathe. If in such an arrangement *B* and *C* are both properly lined up with the spindle, the hole will have

an axis which coincides with the axis of rotation but as the amount of deflection varies from one end of the hole to the other, the hole will be tapered with the large end toward *C*. In an arrangement of this kind it is naturally *A* which feeds, and the direction of the feed may be different from the direction of rotation. But this would not affect the elements of the hole, provided that the bar fits closely enough in *C*, and provided that the length of the bearing in *C* is great enough so that whatever bending there may be in the bar will all take place between *A* and *C*.

If *B* and *C* are not in true alignment with the spindle we will have to deal with other conditions. If *B* and *C* are in alignment with each other but not with the spindle, we will have the same conditions as before except that the hole will not be bored in the same relation to the outside of the work as if the true alignment existed. In other words, the hole would be eccentric with the outside. The entire bar describes a small circle around the true center of rotation, with the exception of that part of the bar which is clamped in *A*.

If *B* is in true alignment with the spindle but *C* is not, and if we suppose that the center line of *C* is parallel with that of *B*, then the only thing which will be affected will be the size of the hole, but if the center line of *C* is not parallel with that of *B*, then a taper hole will be generated of which the small end is toward *C*. As the deflection of the bar itself would cause the small end to be at the other extreme of the work, the two conditions combined, that is, the deflection of the bar and the faulty alignment of *C*, may cause a barrel-shaped hole, larger in the center than at the two ends.

If both *B* and *C* are out of alignment with the spindle and also out of line with each other, there will be a combination of the faults mentioned in the previous two paragraphs. In this case the hole may be eccentric with the outside, the eccentricity may be different at the two ends of the work, and the hole may be taper or barrel-shaped. But in all cases the axis of the hole will be a straight line and will coincide with the axis of rotation.

(To be continued next week.)

Industrial Research in the Art of Man Management

The Executive's Policies Must Be Built Upon Experience — Each Plant Should Develop Its Own Standards — All Executives Must Contribute to Administrative Research

By ERWIN H. SCHELL

THE technique of administration has long been shrouded in vagueness and mystery. The man of "magnetism," of "power," of "influence" has been viewed with acclaim through the undiscerning eyes of the hero worshiper and the loyal henchman who follows and finds an innate satisfaction in that following. Today finds technical ability and skill in the scientific method of approach given second place in the scale of importance with which human value is measured in industry. The handling of men, leadership, the art of authority, is the greatest of all human assets in modern organizations.

The successful executive who has been reared under the influences of the American industrial regime has invariably been an exponent of the strenuous life. The onrush of economic progress has constantly besieged him with insistent problems demanding immediate decisions. He has been steadily facing a stream of changing conditions, the result of economic stresses of which he has little conception. He must, therefore, build his policies on experience rather than logic. His success is measured by his ability to profit by his errors. His conclusions in many cases will be far more influenced by his intuitions than by his reasoning, and he will often be observed, when questioned concerning the cause of his action, searching for reasons in support of a judgment which is founded upon the intuitive reaction of experience.

Standards of Administration Needed

This path of individual progress, while slow and costly, has been effective in many cases. In our manufacturing plants today there are many administrators who approach their personal problems of man management with a praiseworthy skill. It is to these men that education must turn for the acquiring of data with which to teach the coming generation. Industry must continue to profit from their experience through its transfer to their successors. The chief responsibility of every establishment is to raise the common level of administrative skill in the executive organization to the standards of their most successful leaders, to make the most effective technique of man management available for the use of all. In short, each plant should develop its own standards of administrative procedure. This is a work of the utmost seriousness. It asks the best collective thought of the executive group. The outside specialist has no place in this activity. It is a problem for the interior organization which is responsible for operation. Its solution becomes an intimate part of the industry's craft knowledge and should be considered as bearing the same relationship to the economic progress of the concern as its special formulas or processes.

Nature of Work Should Be Understood

In approaching this task it is most important that the exact nature of the work to be done should be thoroughly understood by those who are called upon to co-operate. The initial activity is essentially one of research, which in turn will have an educational value. Therefore each participant should view the proposed program of investigation in the light of his opportunity to contribute the fruits of his experience in the handling of men, so that from the resulting summation of data a procedure may be developed which will

incorporate the best ideas of the entire executive group, and may therefore be considered in the light of a standard. When members of an administrative organization are called together to consider such a program they are prone to view it in the light of a form of camouflaged education, and thereupon assume a receptive attitude and prepare to be taught. This attitude will not yield the desired result, and therefore at the outset each executive should be shown his responsibilities as a member of the research team, and strong emphasis should be placed upon the fact that his value in the work will be measured in direct proportion to his willingness to contribute of his own experience and methods.

"Book of Administration"

It should be made clear to each member that he has been appointed to serve as an associate author in the development of a "Book of Administration" for the factory, that his contributions in the research work will be received on a parity of importance with those of the other members, irrespective of his position in the administrative organization, and that the data thus presented will not influence in any way his executive standing. He should appreciate that an idea, while not intrinsically of value, may suggest a way to a most important conclusion, and therefore that his willingness to speak freely and frankly is as much to be commended as the number of his concepts which find their way into the final record.

Any condition which will tend in the smallest way to hamper the expression of ideas by the members of the group must be completely eliminated if the work is to be effectively carried out. Collective thought of a constructive sort is best accomplished when the persons participating do not hesitate to "think out loud." This procedure gives the entire group opportunity to reflect upon the initial conception and is much more efficient in making progress along a certain line of reasoning than is the case when the individual delays expression until he can protect his statements by suitable arguments, and verify the soundness of his ideas before giving others the opportunity.

An essential characteristic of the research conferences which distinguishes them from the usual gathering of this sort is that the flow of information will be from the conferees toward the chairman of the meeting, rather than in the opposite direction. The chairman should, therefore, be most careful to avoid the expression of personal opinions or ideas which will give the impression that he is trying to influence the group. His task is solely the assembling of data and his success will depend upon his ability to extract the necessary information from the other members of the conference.

In some cases this may be accomplished best through obtaining the criticisms of the group to hypothetical methods or procedures, or the use of concrete examples for discussion. Such technique demands that the chairman be well versed in the scope of the research which is being undertaken and have a clear sense of the boundaries of the inquiry—of the ground to be covered—so that he may obtain the collective experience of the group in a thorough and orderly fashion.

In order that the constraint which is present in the atmosphere of authority be removed it is desirable that the chairman be selected if possible from among the lesser executives, and that he be a person who is well known and liked by the members of the group.

The project should not be viewed, however, as an activity which is beyond the confines of administrative authority. The group may be termed the Research Committee and the members of this committee and the chairman should be appointed by the chief administrator. When first called together he should outline to them the exact work which he desires accomplished and have it clearly understood that he expects results, in the form of a "Book of Administration" representing the consensus of their opinions on the subject of man management, to be later published for the use of the executive organization. The work should be well organized and the meetings conducted on company time as part of the week's work.

Success largely depends upon the detailed way in which the material for discussion is arranged for each meeting. The members of the committee should be given at the initial meeting a clear idea of the entire field of research. The exact topics for discussion at each following meeting should be prepared and distributed in writing to the members some days in advance so that they may come with their ideas in form for presentation. These advance sheets should present the subject in sufficient detail to make it tangible and concrete. It should be made clear that no writing need be done by the committeemen, that suggestions or ideas submitted verbally by them in conference will be recorded by a secretary under the direction of the chairman but that the member's name will not be noted. The data thus collected by the chairman at each meeting will be later edited by him and rewritten as a chapter in the "Book of Administration," which will be presented to the group for criticism or correction at the following meeting.

Use of Questionnaire

The field of investigation covered at each meeting should be controlled through the use of a questionnaire in the hands of the chairman. The answers to the inquiries when properly sequenced and edited will form the subject matter of a chapter. It should be the endeavor of the chairman to obtain a statement from each member of the committee covering each inquiry, the main points of which may be dictated by him to the secretary in the development of his working notes for use in writing the chapter under consideration. It is obvious that such a procedure presents limitations upon the size of the committee and a membership of twelve men exclusive of the chairman and secretary would appear to be a maximum figure. Each inquiry should be clearly presented, accompanied, if need be, with concrete illustrations or suggested answers so that its exact direction and extent is well understood. Working notes should be dictated covering all responses, even though their value may seem slight, as the knowledge that the statements of each member will go on record provides incentives for active thinking.

Makeup of the "Book"

The subject matter of the first chapter may well consider the general duties of the executive in the particular plant in question. The things which he is paid to do, the activities which make him of value to the organization, should be topics for initial discussion. His functions with regard to machinery and equipment, materials and supplies, and to labor, suggest subdivisions of the question. In every organization there is found to be a variance in the degree in which the

functions of maintenance are separated from the activity of operation. The first chapter will, then, clearly indicate this dividing line in the particular factory.

The second chapter may comprise a summary of those prerequisite characteristics in the individual which mark him as executive timber—the qualities which must be present in the personal makeup even before any training or education in executive work is begun. The man who has had experience in the selection of executives can at a glance discard many applicants who apply for the opportunity. What are the characteristics which they lack? When the statement is made "You can never make a good executive out of him" what basic qualities are missing? The determination of these requisite elements of personality for the particular work in hand will be of great assistance in the selection of understudies for the administrative organization.

Following this consideration should come the discussion of those essential executive qualities which can be developed through training or education. It is encouraging to note at this point that in instances where these questions have been considered the number of characteristics found in this latter group considerably exceeds those in the former. Every successful executive can look back upon his own experience and find many necessary qualifications to success which he attained through study and personal effort. What are these qualities and how may they be developed in the understudy? A thorough treatment of these questions by the committee and the ultimate publication of their findings for use by the executive organization cannot but be of great practical value.

Next, what are the tools of man management? What are the levers by which the executive influences the will of his working force? By what means does he influence them to perform the tasks of operation which are the fundamental activities of production? In this instance the advance sheets should suggest the character of the answer. The realization that typical attributes such as fairness, cheerfulness, frankness, friendliness and courtesy have definite tangible, determinable uses in management and will each yield certain results when properly or improperly used is not a common one. The discussion of this topic must bring these and similar factors out of the ethical and philosophical atmosphere in which they are usually treated into the light of a practical and unemotional analysis, that their industrial value may be concretely stated and understood. Their worth must be shown to be as direct when applied in the technique of handling men as that of the cutting tool when used in the fabricating process.

Effects of Human Conduct

It seems most essential that a part of the book be devoted to a brief interpretation of the impulses and desires which are found in every person, a knowledge of which will serve to explain many cases of conduct which are surely not the result of a reasoning process. The existence of the parental impulse,* the desire to possess, the wish to learn, and other similar conceptions can be simply presented by the chairman and the committee members called upon to cite examples of the evidence of each of these natural tendencies as illustrated by actual shop occurrences. Where a presentation of this sort had been made to an executive group the number of concrete illustrations which were immediately available from the listeners was most enlightening and satisfying. Two chapters may be well given to a simple explanation of these highly important factors in human conduct. Furthermore, a most helpful aid to this material would be the presentation of suggested ways in which the satisfaction of each of these desires or impulses may be accomplished to the end that the industry as well as the individual may be benefited.

With these discussions as a background the group is prepared to deal with the procedures of man management with the aim of determining the proper methods by which their executive responsibilities may be discharged. What is the "one best way" of introducing the new employee to the job, of enlisting his good will toward the work, of maintaining high standards of promptness and attendance, of praising, of rebuking, of criticising, of arousing interest in the work, of providing work incentives, of making wage increases most effective? What are the requisite characteristics of a good order; how, when, and where should it be issued; should it be delivered verbally, in writing, or both? These suggestions are merely examples of a great number of topics which can be collectively considered. When conclusions are reached by the committee they should be illustrated by concrete examples of their application in the factory. A well prepared chapter on these items will go a great way in stabilizing and standardizing the executive labor policy and its value in raising the level of the administrative technique of the organization and in educating the new executives for their tasks will be very marked.

A Chapter on Labor Morale

The closing chapter should contain a presentation of the best means of coping with those administrative problems which are commonly found in the factory. A careful study of the employee complaint will undoubtedly yield most enlightening conclusions with regard to the best way in which it may be effectively dealt with and the labor morale strengthened. This question, when considered in the light of each of the different motives which may inspire the complaint, unquestionably yields itself to searching analysis, which can be clearly presented to the committee through the medium of the well-prepared questionnaire. How shall we eliminate conceit from the workman and save him for the company? How shall we deal with religious differences between employees? Jealously, revenge and dishonesty are among the greatest enemies of labor morale. How may their potency be reduced to a minimum? When the girls in a department resign owing to the presence of one who, while an excellent worker, is of lower moral status what is the right way to handle the situation?

Such difficulties as these are common in the experience of every executive. The collective contribution of solutions to these problems by a group of earnest-minded executives who have proven their ability to handle help cannot but be of assistance in raising the standard of technique throughout the plant.

Use of the "Book"

Upon the completion of the book and its approval by the chief administrator sufficient copies should be printed in loose leaf form to supply perhaps one-quarter

*The book "Instincts in Industry"—Ordway Tead—will be found to be most helpful in gaining a practical conception of this field of inquiry.

of the executive personnel. The copies should then be assigned to executives for a period of one week with the request that each chapter be commented upon in writing. At the end of four weeks the chairman should call a meeting of the committee and review in detail these comments, and recommend to the chief administrator any alterations or additions which seem necessary. The books should then be filed in the executive offices and be made available upon request. The appointment of an executive will carry with it the requirement that the person so retained shall be held responsible for a knowledge of the book content. Each year a new committee should be appointed, the chairman, however, being retained as permanent editor. This committee will consider in detail the possibility of improving the standards as set forth, in the light of the past year's experience, and shall submit its findings to the chief administrator for approval. Those suggestions which are approved will be introduced into the text and the books again circulated throughout the executive personnel. Thus an opportunity for constant improvement will be opened.

The benefits resulting from such a program are worthy of mention. In addition to the improvement in technique which will result from the research described there will be found to be a perceptible increase in the executive morale. The significance and importance of their responsibilities as man managers will be made clear, their acceptance of the work of the committee will be a ready one, for the book will be looked upon as a product of their own organization, developed by men whose knowledge and practical experience in their factory is known and relied upon.

Finally, it may be stated that the accomplishment will mark a turning point in the manner in which the executives view their tasks. It will become at once evident that man management is not an art of mystery, is not a birthright of genius, but is a practical field of activity based upon underlying principles and laws which are susceptible of thought and study. They will sense the great advances which may come through analysis and careful investigation in their work of administration and will realize that instead of relying upon their intuitions they may *think* about handling men, and by studying their own methods make stepping stones of their errors and constantly improve their effectiveness as leaders.

The asset value of such classified knowledge in the minds of the executive personnel of any organization which results from the research suggested, while intangible, will be very great. It will provide the basis upon which management may construct an operating policy which will place it in its true relationship between labor, capital and the public. The accumulation in our American industries of such resources of information concerning man management will go far to maintain for our country her much vaunted industrial supremacy and safeguard her mills and factories from the attacks of the anarchistic agitator.

Know Why You Do Things

By A. W. Forbes

On page 612, vol. 53, of the *American Machinist*, I criticised a machinist who always set his tool at the height of the centers of the lathe, and on page 72 of the present volume, I showed why it should sometimes be placed *below* the center. The Editor apparently drew the conclusion that I wanted to have the tool regularly placed in this manner.

It is well established practice to place the tool on a level with or above center, and I did not consider it necessary to say so; but there are exceptions to this rule as well as to most others. A first-class machinist should consider each job on its own merits and know *why* he is placing the tool above center, so that he will know *when* he should not do so.

A Suggestion

By Henry W. Armstrong

In many shops some form of bonus is given to the employees when the shop is making money. This is the time when extra money is least needed by the employee who is working steadily and living well. The time when money is most needed by the workman is when the shops are laying off men and jobs are hard to find.

Would not the following be a better plan? Instead of paying a cash bonus to the worker why not set aside 10 per cent, or whatever the bonus amounts to, and let this money accumulate for a non-employment fund to be used as a sort of pension when bad times arrive?

Suppose, for instance, that a shop works five years in prosperous times. Then there would be 50 per cent of the average yearly payroll laid aside drawing interest. Suppose also that the sixth year is a year of poor business resulting in unemployment and hard times, then there would be a sufficient fund to pay every worker 50 per cent of his weekly earnings every week for one year, even if the shop should shut down during that time.

Also the workers might be induced to lay aside a part of their earnings at interest for the same purpose. Another benefit of this plan would practically insure the loyalty of the men, and the amount usually lost through labor turnover would be saved. A man who was discharged or who left the firm would lose all rights to the fund except the amount he has paid in from his own earnings.

When a man died or was sick the fund could also be used to the extent of his share in it. For instance, for a man earning $1,500, after a year's service there would be available $150 as sick insurance, death benefit or unemployment insurance.

If all the first-class shops, or in fact most concerns employing workers, would adopt this plan it would practically eliminate hard times and periodical prosperity, and as the entire amount could not be drawn at once except in case of death, the tendency to blow in the whole amount would be lacking.

Of course the money should be placed with some good trust company so that there would be no possible chance of its being used for any other purpose by the employers and also to show the employees that everything was open and above board.

It seems to the writer, who has given this matter considerable thought, that the average concern could well afford to adopt such a plan as it is probable that the annual loss through labor turnover is at least 10 per cent of the yearly payroll in most establishments. This plan would also attract the best class of workmen to the establishments adopting it and efficiency would be greatly increased. However, this is only a suggestion put forth for what it is worth.

Frames for Fords

Punching, Forming and Riveting Frames for Ford Cars—Good Examples of Progressive Arrangement of Machinery

By FRED H. COLVIN
Editor, *American Machinist*

THE design of the Ford frame enables a comparatively plain strip of metal to be used, eliminating waste and making the punching and forming operation extremely simple.

The plate is first notched on one end and then punched, as can be seen by the two strips standing in front of the press in Fig. 1. This view also shows the knockouts or strippers *A* and *B*. It further shows the way in which the blanks are piled on the machine in front of the die so as to be handy for the operator.

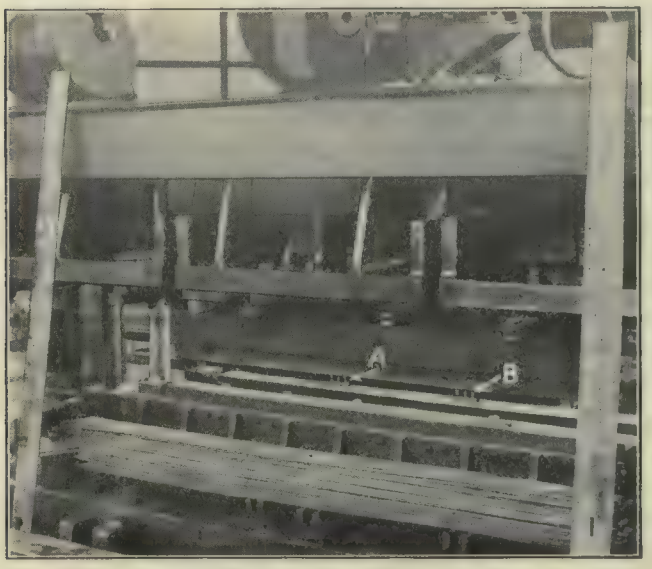


FIG. 1. THE PRESS FOR SIDE FRAMES



FIG. 2. FORMING A SIDE FRAME

Fig. 2 shows the side rail being formed, the man in the picture pointing to the side of the rail before it is forced completely down in the die. Fig. 3 shows the complete operation with the rail at *A* which was pushed out of the die by suitable knockouts, and also shows the same type of knockouts on the ram as were shown in the first view.

Forming the Cross Member

Forming the front cross member of the frame is shown in Figs. 4 and 5, the first showing the blanks in place in the dies, and the second the completed pieces, after the rams have made their strokes and returned to the upper position. The central parts of the dies recede as the punch descends, but the springs are sufficiently powerful to force the completed piece out of the die ready for removal. The strippers *A* and *B* prevent the piece being carried up by the return stroke of the press. By using two sets of punches and dies, two complete pieces are made at each stroke.

Forming the cross member for the rear of the frame is a somewhat difficult operation, owing to both the shape and the thickness of metal involved. Fig. 6 shows both the blank and the completed piece. The thickness of the stock is one-quarter inch.

The first forming operation, illustrated in Fig. 7, shows the blank in place and the punch just making contact with it. The substantial guides at each end, *A* and *B*, insure the alignment of the punch and die. In Fig. 8 the punch is at the completion of its stroke, while in Fig. 9 the punch is withdrawn and the completed piece is in the die ready for removal. Fig. 10 shows how two pieces are formed at each stroke.

The brake-lever quadrant is a comparatively simple piece to make. Before being assembled to the frame, the brake-lever notches must be broached, this being



FIG. 3. SIDE FRAME COMPLETED

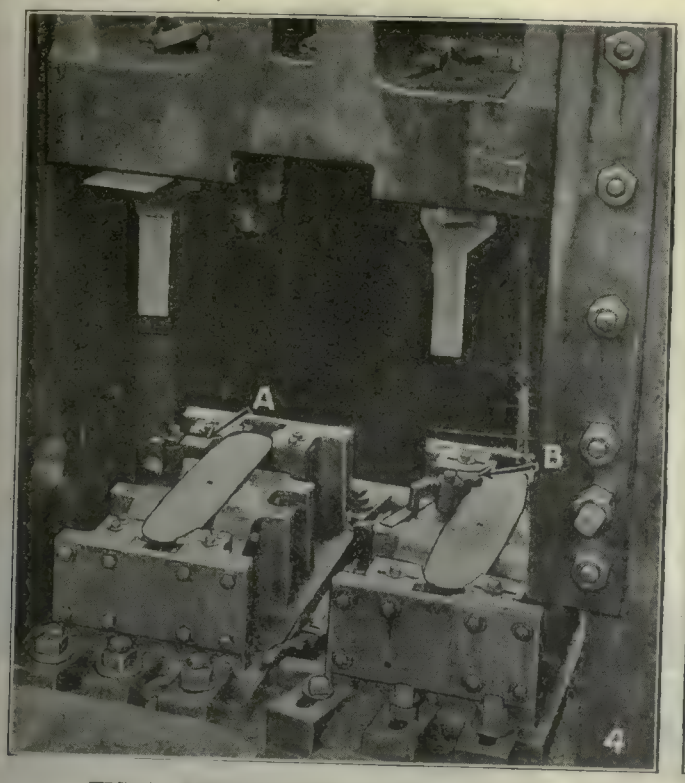


FIG. 4. FORMING FRONT CROSS MEMBERS

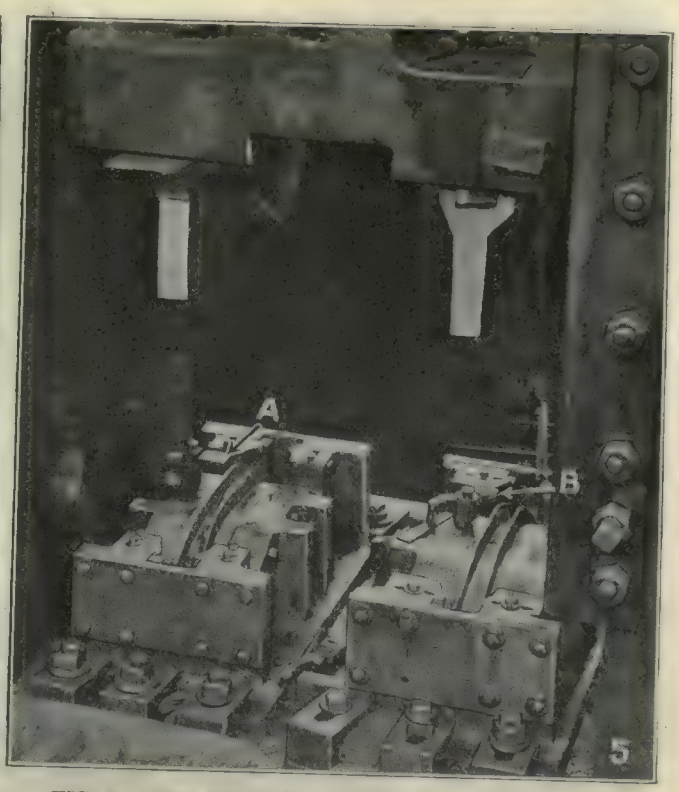


FIG. 5. TWO CROSS MEMBERS FORMED AT ONCE

done on the Lapointe machine shown in Fig. 11. The quadrants are held in the fixture at *A*, which is necessary to hold them firmly against the thrust of the broach teeth. A single stroke of the broach completes the notches as shown and the quadrants are then ready to go to the riveting presses for assembling.

Riveting Operations

These quadrants are assembled to the frames by cold riveting, as shown in Fig. 12, the quadrant being located by the shaped block *A*, and the rivets going into holes punched before forming. The small angle brackets for holding the body are riveted in the same way. Before assembling the cross members to the side frame, the parts are lined up by means of drift pins as shown at

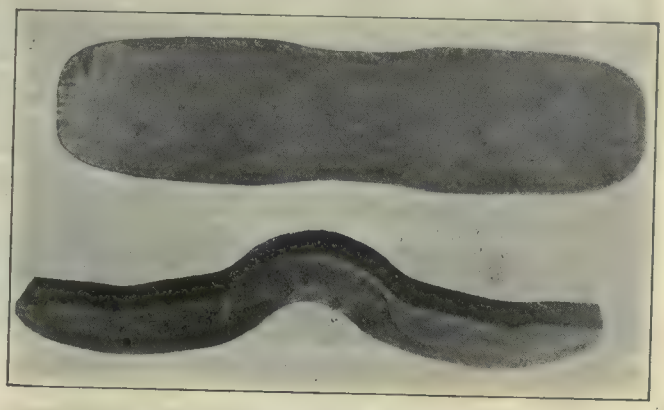


FIG. 6. THE REAR CROSS MEMBER

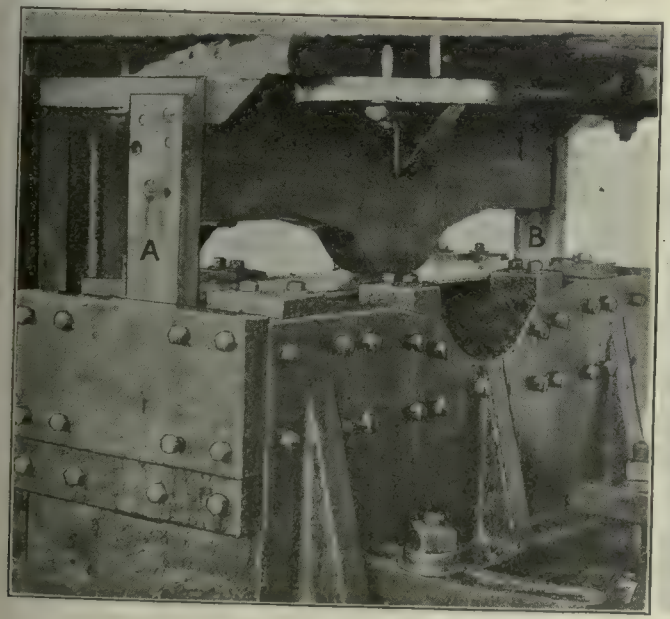


FIG. 7. THE PUNCH AND DIE

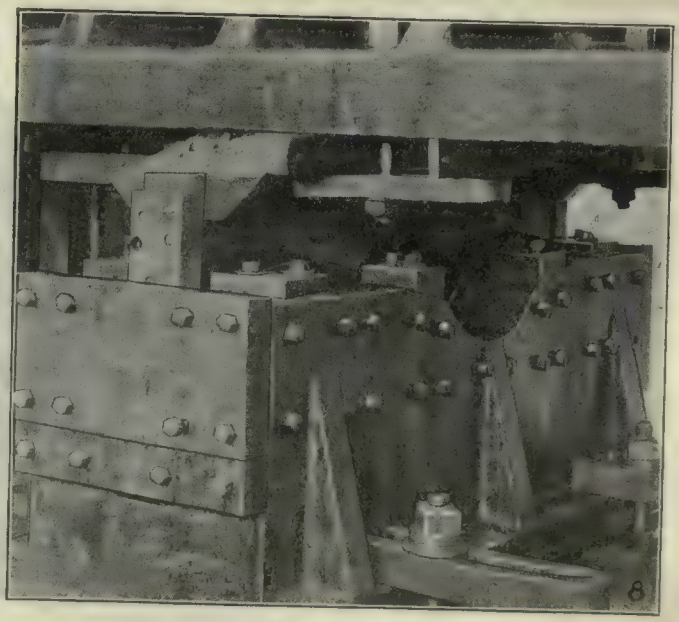


FIG. 8. THE END OF THE STROKE

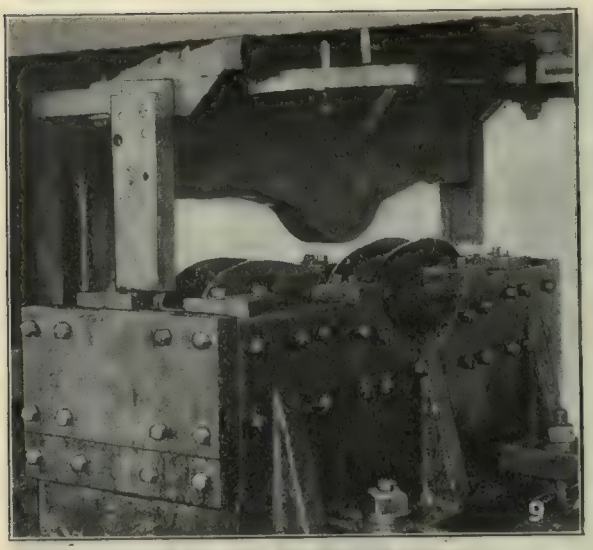


FIG. 9. THE FINISHED PIECE

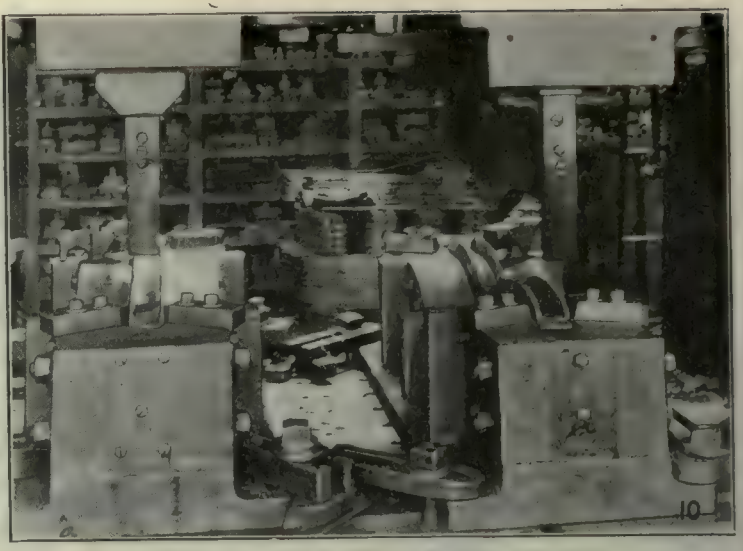


FIG. 10. THE DOUBLE PRESS USED

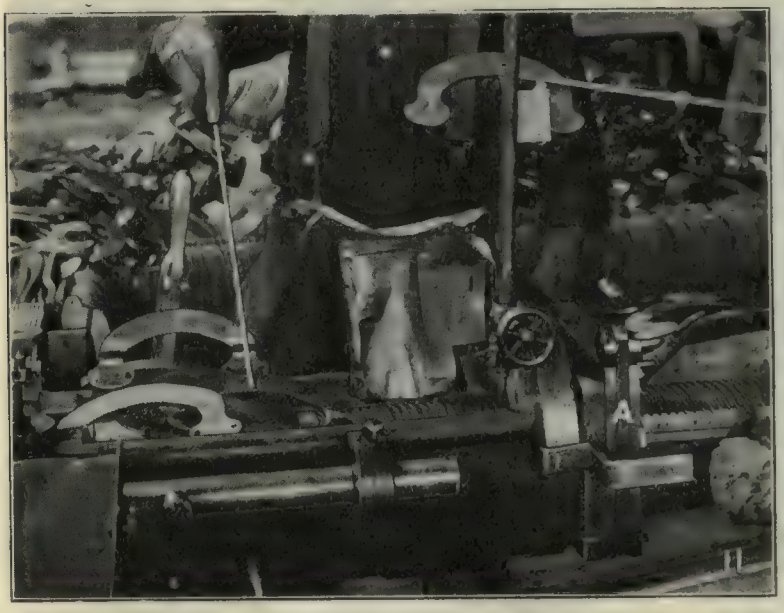


FIG. 11. BROACHING THE QUADRANT

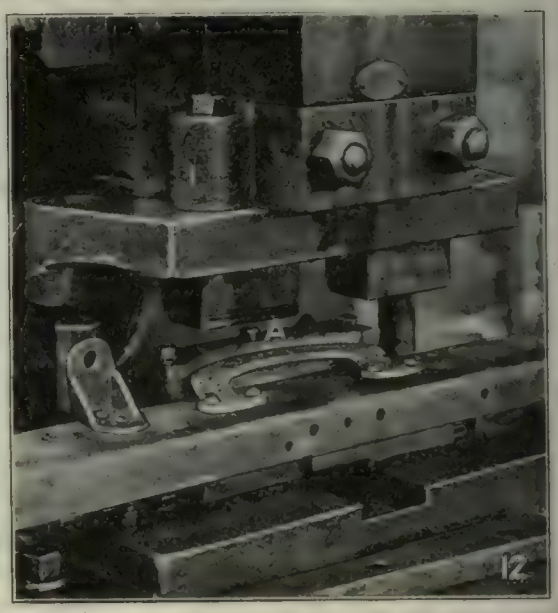


FIG. 12. RIVETING THE QUADRANT TO FRAME

A and *B* in Fig. 13. These enable the rivets to be easily placed and after one is driven the drift pin is removed by the method shown at *A*. The hook or claw is clamped to the side of the press frame, utilizing one of the gib screws as shown. The operator raises the frame until the head of the drift pin slips into the notch and a stroke or two of the press on the cross member loosens the drift pin which has been very firmly driven in place.

The riveting is then done as shown in Fig. 14, this press being fitted to one side of the frame, while the

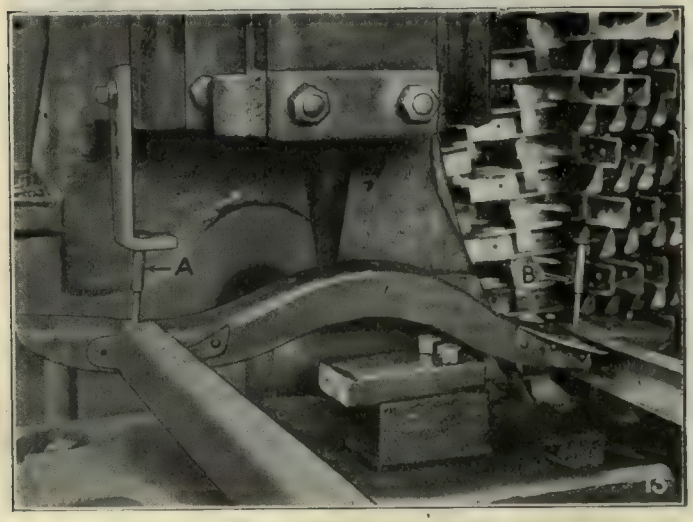


FIG. 13. KNOCKING OUT DRIFT PINS

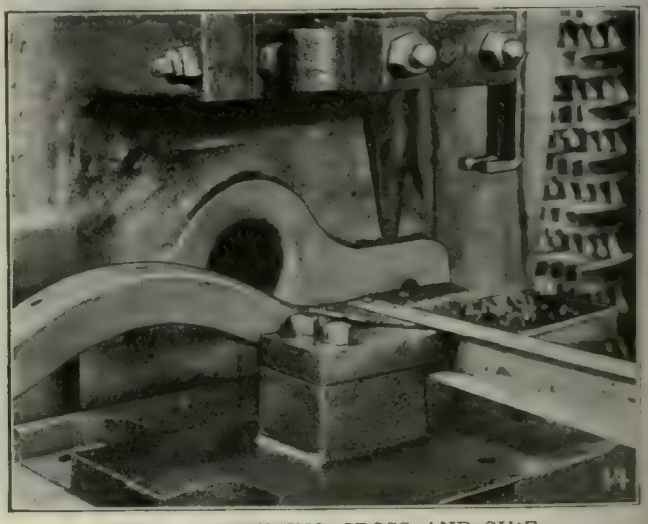


FIG. 14. RIVETING CROSS AND SIDE



FIG. 15. THE ASSEMBLING LINE

press shown in Fig. 13 is for the opposite side. Each press is provided with a hook for removing the drift pin on the side which it rivets. The same difference will be noted in the position of the anvils or riveting blocks.

Handling the Frames

Some idea of the way in which the frames are handled can be had from Fig. 15. The assembling begins at the farther end of the long track in the center of the picture, the brake quadrant having been riveted to the left side rail before reaching this assembling track.

It will be noted that while nearly all of the riveting presses are on the left of the track there is one at the right and also a drilling machine nearer the finishing end. These machines are so placed because their use at this particular point in the assembly has been found to save time and avoid reversing the frames on the track. The press at the right rivets the front end cross number in place.

The track itself is constructed of scantling of suitable sizes, the upper edge being protected with a steel strap,

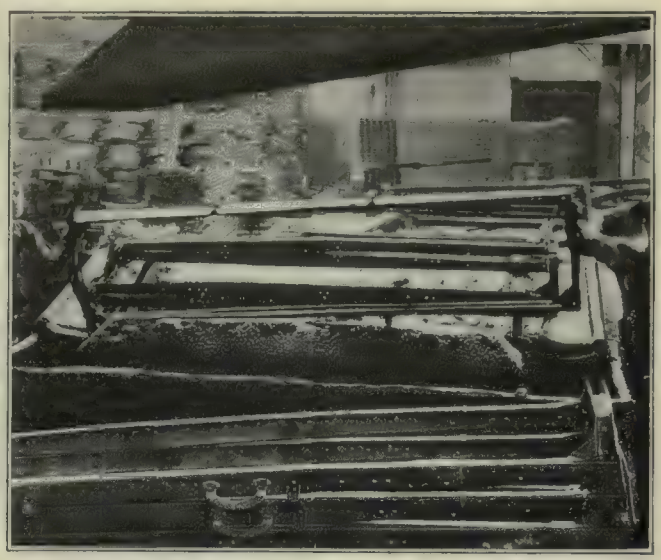


FIG. 16. PAINTING THE FRAMES

both to prevent wear and enable the men to move the frames more easily.

The height of these rails varies at different points but is always lower as the work progresses so as to avoid lifting. At *AA* there is quite a sharp decline ending in an abrupt curve. This is for the purpose of making it easy to turn the frame over and has been found to work out very satisfactorily. The assembling goes through like clockwork and the frames are turned out at a very rapid rate.

Painting

Last comes the first painting of the frames, which is done by dipping as can be seen in Fig. 16. The dipping tank is near the end of the assembling track and the frames are painted as rapidly as they can be handled. Over the painting tank is an exhaust head which removes the fumes and directly behind the tank, curving off to the right, is a track which carries the painted frame off to the storage pile which adjoins the shipping track.

These illustrations were obtained from the plant of the Michigan Stamping Co., Detroit, Mich., through the courtesy of President Charles E. French and Production Manager Oscar C. Bornholt.

Ford Differential Spider

THE spider for the Ford differential is of the three-pronged type, as can be seen in Fig. 1. The holes are first drilled at the rate of 90 per hour, after which they are broached one at a time on a Knowles key-seater at the rate of 225 per hour. Both sides are then faced, either with spot-facing tools in a Cincinnati drilling machine, or by special tools in the cross-slide of a Potter & Johnston automatic machine which handles 175 spiders per hour.

Chamfering

Chamfering is then in order, this being done on an Allen single-spindle drill, after which the three arms are cut to length on either a Garvin or Pratt & Whitney hand milling machine, the former being shown in Fig. 2. This illustration also shows the chute by which the work comes to the milling-machine table, as well as the height of the holding fixture. The fixture supports the spider by a central stud, and instead of feeding the table the fixture carrying the spider is revolved by means of the hinged lever shown. The pin *A* is used in driving the spider past the cutter, the lever *B* being connected with a ratchet so as to feed the spider continuously and mill all three ends.

Operations on the Arm

The arms are then centered in the special centering machine shown in Fig. 3, the work being mounted on an indexing turret so as to insure the proper centering holes. In this machine the drilling spindle is fed into the work by means of the lever shown.

The arms are next rough and finish turned for their

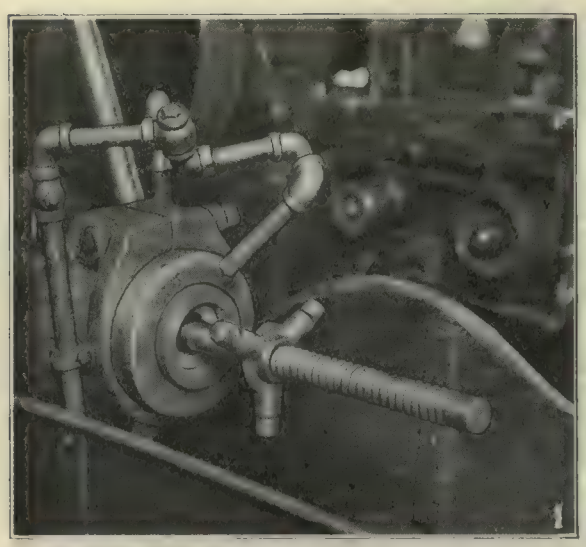


FIG. 1. BROACHING THE SPIDER

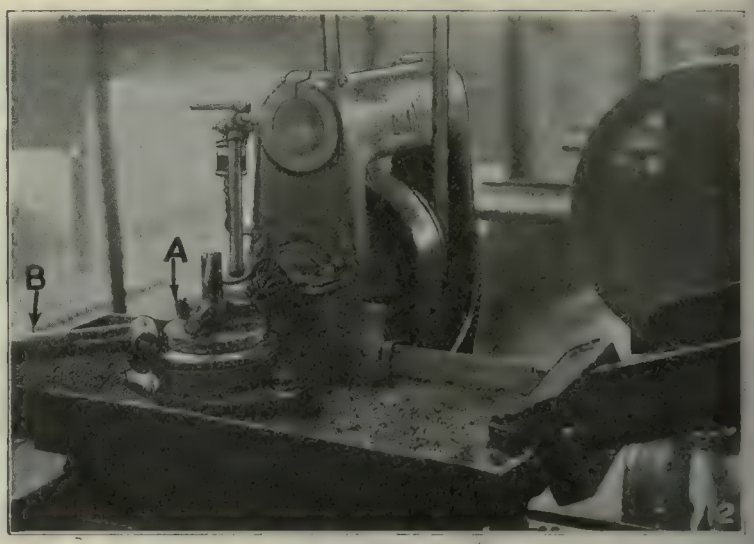


FIG. 2. MILLING ARMS TO LENGTH

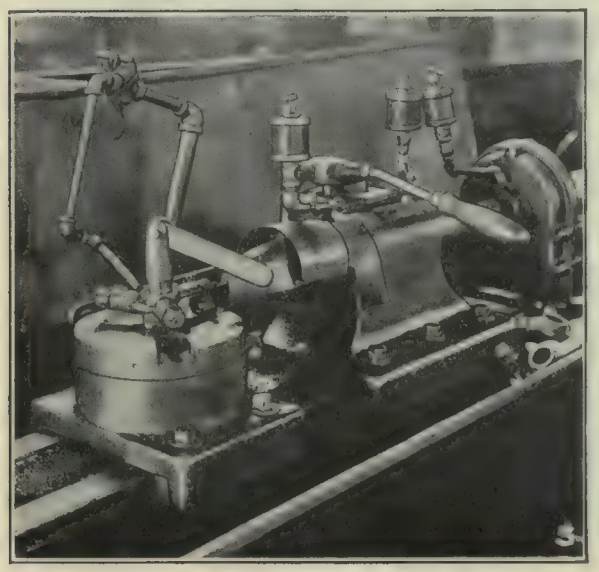


FIG. 3. DRILLING THE CENTER

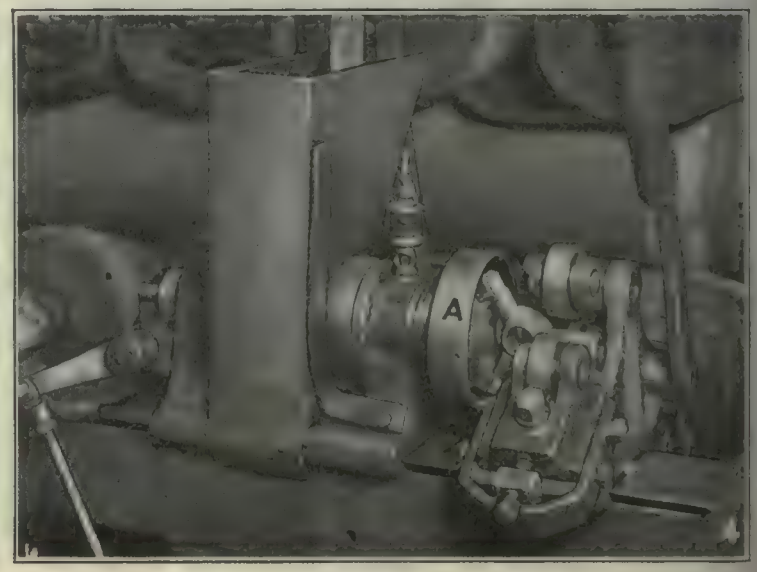


FIG. 4. FINISHING BY ROLLING

pinions and the outer bearing, and finally finish turned by rolling in the small special machine shown in Fig. 4. The driving head *A* carries suitable pockets for two of the three arms. The two lower rollers support the arm being finished while pressure is applied by the upper roller, this combination enabling the finishing to be done at the rate of 65 spiders per hour, which necessitates fixtures that can be readily handled.

The Ford Differential Gear Case

THE Ford differential is a compact unit, and the quantity required, 5,200 per day, is large enough to warrant such special tooling as may be considered advisable. The shape of this case is clearly shown from the two pieces at the loading station of the Bullard Mult-Au-Mat-ic, shown in Fig. 1. It will be noted that this machine carries two work spindles for each station, making a total of 12 spindles in all. The method of supporting the wrench for tightening can be seen at *A*. The wrench housing slides on the bar in front of the machine, and can be readily used on either chuck. Each station of the machine is double-tooled and double-lubrication pipes are also provided, as can be seen. The toolhead at *B* shows how a great variety of tooling can be accomplished in such a machine. Each machine handles 80 cases per hour.

The thrust washer surface and hub are next rough machined on another set of Bullard Mult-Au-Mat-ics, as in Fig. 2. Here the differential case is reversed, the case being centered by means of a central bolt *A* and driven by a jaw *B*, which takes all the tool thrust, and effectually prevents any slippage under the cut. This operation can be performed at the rate of 213 pieces per hour.

The finish turning of the radius comes next, this being done on Reed-Prentice lathes, utilizing special mandrels and toolposts, as in Fig. 3, which are designed with a view of rapid handling, as can be seen from the fact that the production is 200 per hour.

Three $\frac{13}{32}$-in. holes are next drilled on the inverted three-spindle drilling machine shown in Fig. 4. These machines handle 90 pieces per hour, the work being



FIG. 1. BORING AND REAMING DIFFERENTIAL GEAR CASE

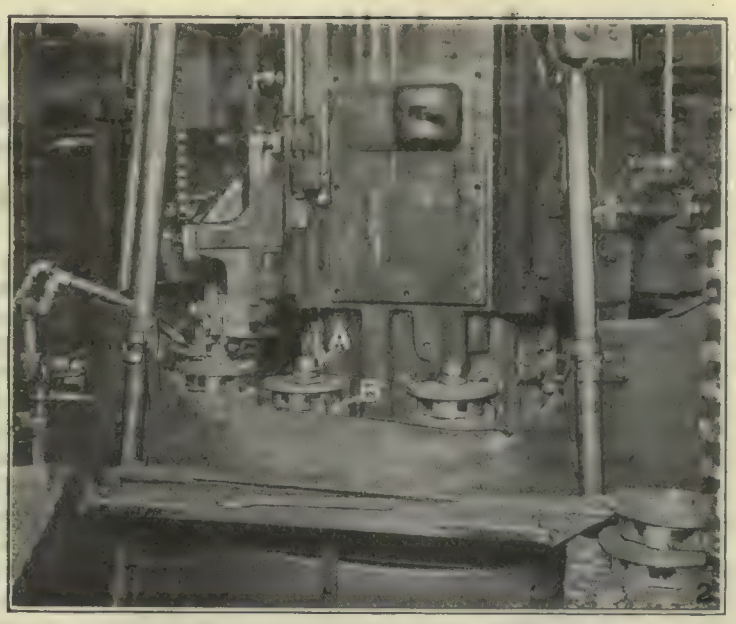


FIG. 2. TURNING THE BACK AND FACING THE HUB

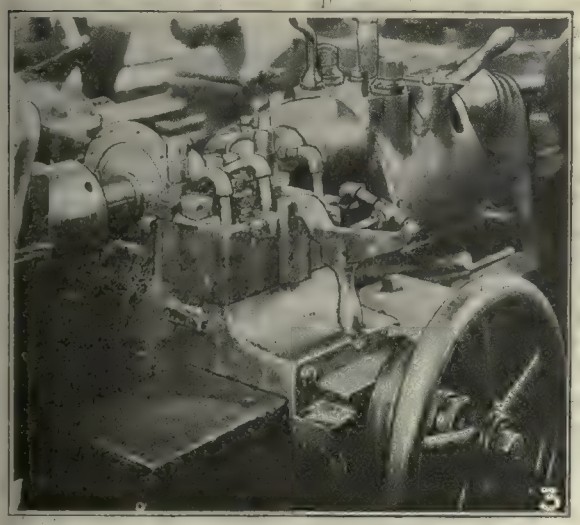


FIG. 3. FINISHING THE HUB RADIUS

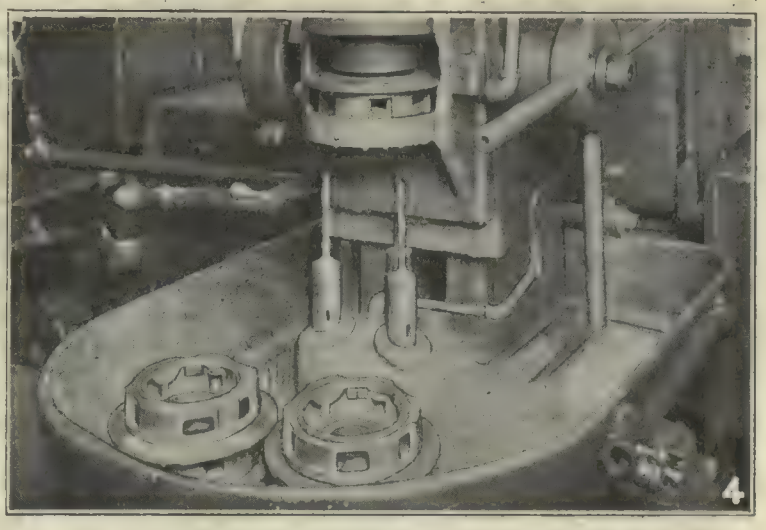


FIG. 4. DRILLING THE THREE CROSSHOLES

held in a quick-acting fixture in the removable head of the machine. After this another hole is drilled and the three holes already mentioned are burred and spot-faced. The cases are then filed on a Ford special filing machine, after which they are washed and inspected, and ready for the assembling department.

Want Ads

BY C. I. HEIKES

Your discussion of "Want Ads" and their apparent inability to do all that is expected of them is interesting because all the writers seem to view the subject from one standpoint—namely their own. Facts and theory both prove that this is bad practice. We are all actuated by more or less selfish interests, and it is by a proper understanding of this fact that most good advertisements are written. Likewise disregard of it usually means a disregarded advertisement. Take for example, the remarks of Charles F. Smith, on page 103 of the *American Machinist*. True, this is not an ad, but note the viewpoint of the letter. It is concerned almost entirely with Mr. Smith's qualities—or lack of them.

It is an old saying that it takes two for a quarrel. Just as appropriate is the fact that in an advertisement it takes two to get results, the writer and the reader. The average unskilled ad writer forgets that though he is most interested in the ad from his standpoint, the other fellow's is just as important, and that to get an answer the other fellow's is most important. For what the other man wants, what be believes and what he is willing to accept, is the factor that will determine the success of the ad. How then to reach the other man? A brief analysis and study of the ad will usually give some clue to the writer's character or wants. Often the ad explicitly states the wants, yet answers received often show that the applicant has completely disregarded the wants and registered his own instead, as is aptly stated in the letter of A. W. Forbes on page 107 of the same issue—"such letters naturally receive the least attention." On the other hand a letter which seems to understand the needs of the man who has written the ad and shows an honest ability and willingness to meet those needs gets attention at once.

For a rule to measure your ad by and also a guide in answering want ads the following might well be used—"consider the other fellow's wants, and adapt yourself to them."

Liability for Lack of Ventilation

Scope of Common and Statutory Laws—Liability Under Compensation Acts—Effects of the Safety Appliance Laws, or Factory Acts

By CHESLA C. SHERLOCK

AT FIRST thought employers may not feel that there is any legal liability imposed upon them in regard to providing an abundance of fresh air in their factories and shops. There may be some specific statutes requiring proper ventilation by employers engaged in certain occupations which subject the employees to an excessive temperature, especially during hot weather; but what liability is imposed upon the general employer, without reference to these special cases? Must the employer, speaking in this general sense, consider himself liable for sufficient ventilation in his place of work?

The employer's liability to his workmen divides itself at the present time into a consideration of his duties under two branches of the law: the old common law, and the statutory law which, in his specific case, is found in the factory acts, the safety appliance acts and the workmen's compensation acts.

The common law was founded on the general proposition that it was the duty of the employer to do two or three specific things toward safeguarding his employees. In the first place, he was held to furnish his workmen "a reasonably safe place in which to work." He was bound to furnish safe tools and appliances with which to carry on that work, and he was also bound to give the workman adequate instruction in the use of such tools, and to inform him of any conditions of which he might be familiar that would aid the workman in preventing injury to himself.

The Workman's Responsibility Under the Common Law

At this point, the common law ceased to impose any great measure of liability upon the employer. The workman was then expected to exercise due care, to concern himself with his own welfare, and unless negligence of the employer entered in, the workman was solely liable for all injuries and accidents which occurred. The workman was assumed to have reasonable knowledge and skill in the work, and if he continued to work where conditions were injurious to his health or well-being, he was held to have "assumed" the risks of injury or incapacity and could not, therefore, look to the employer for damages or compensation.

The question of whether the employer would be liable at common law for a failure to provide adequate ventilation in his place of work is more or less of a mooted question. It is evident, however, that where the conditions are unusually deplorable that the employer might easily be held liable, under the very first injunction that he must "provide a reasonably safe place in which to work."

A place poorly ventilated is not, it should seem, a "reasonably safe place in which to work." A workshop, factory or mill might be defectively ventilated and still be held to be "reasonably safe," but the temper of the courts is changing and they do not hesitate to liberalize those features of the common law which seem harsh and out of date under present, modern conditions of work. The employer who is in doubt had best play on the safe side and place a liberal construction upon that old phrase of the common law.

Of course, where the factory acts or the safety appliance acts take up the subject of ventilation specifically in certain employments, the employer, if he would avoid liability, has no choice but to comply strictly with the provisions of the law as it applies to him.

The courts have pointed out again and again that the employer cannot be held as an insurer of the health and well-being of his workmen. But he will not be permitted to trifle too lightly with these possessions of the workmen. He will be held, where there is no specific reference made to the subject by the statutes, to do all that other employers in the same employment are reasonably doing to make the place and the conditions of work safe.

There are many forms of work in which it is impossible to prevent excessive forms of temperature. In such a case, the employer will not be required by the law to provide the same variety of ventilation that he might be required to provide in an office room or a factory.

The feeling at common law was that if the workman was familiar with the kind of work and took up that occupation he could not hold the employer liable if the lack of fresh air injured his health or decreased his earning capacity. While it may be true that the employer has not, in such a case, furnished the workman with a "safe place in which to work," he has certainly furnished a "reasonably safe place," taking the nature of such work into consideration.

Defective Temperature Apparatus

There is, however, another feature to the matter which must not be overlooked. Suppose that the apparatus which the employer uses to gage the temperature, or the machinery he uses which generates the excessive temperature, happens to be defective and in fact carries a temperature many degrees greater than it registers or which is necessary for the work. One might conceive a case where a temperature fifteen or twenty degrees greater than necessary was carried. This might easily cause the workman to be overcome or so impair his physical vigor as to materially reduce his earning capacity. In such a case, the employer would doubtless be held liable in damages, under the common law, for the injury done, because the proximate cause of that injury was the employer's negligence in failing to keep his appliances in repair, or to inspect them.

Still another case under the common law may be mentioned where the employer might be liable. The employer is bound, under the common law, to furnish the workman adequate instruction and to give him the benefit of his superior knowledge in the trade or calling, especially where the workman is inexperienced, so that the workman may be warned of the dangers attendant upon the work.

Suppose that an inexperienced workman went to work in a room where an excessive temperature had, of neces-

sity, to be maintained. The employer did not tell him that until he became used to such temperature that he should leave the room at frequent intervals and get a breath of fresh air outside. The inexperienced workman remains in the room too long, failing to gradually acclimate himself to the temperature, and is overcome. Perhaps, it leaves him in such a condition that his earning capacity is materially reduced or his physical vigor permanently impaired. There can be no doubt but that the employer would be held liable for the payment of damages to this workman at common law, if the matter were properly presented to the courts.

The Employer's Common-Law Liability

The employer's common-law liability, then, is predicated upon negligence, as a rule, and unless this negligence is present, he cannot be held to pay for the injuries sustained. It is, broadly speaking, a negligence with respect to, or a failure to meet, the three fundamental propositions already mentioned.

In order that there may be no misunderstanding, we will again call attention to the fact that the employer can be liable under the common law only where he has expressly rejected the terms of the workmen's compensation acts, or where he is doing business in one of the six or seven states which have not, as yet, adopted the compensation system. However, where safety appliance acts and factory acts have specifically treated of the subject of ventilation, the employer is bound by them, as they abrogate the common law in so far as they change its provisions by specific mention.

Liability Under Compensation Acts

The liability of the employer for insufficient ventilation under the workmen's compensation acts, is slightly different than in other cases. The basis of liability under the compensation acts, as we have pointed out before, is not upon negligence, as under the common law, but upon the fact that injury has occurred as a result of an "accident" arising out of, and in the course of, the employment.

There are dozens of cases which might be cited upon the subject of atmospheric conditions under the workmen's compensation acts, which have pretty fairly defined the employer's liability.

For instance, it is fairly well settled that the employer is liable for overheating where the risk to such injury is materially greater than that which the people in the same locality are normally subjected to. This "common hazard" is the basis of operation in determining the employer's liability in such cases. If the temperature in a place of work is materially greater than it is elsewhere in the same community, the hazard to overheating is increased by the employment, and if the workman is overcome, the employer is liable for any injury done to him.

If the employment thus increases the hazard, the overheating is an "accident" within the meaning of the compensation acts. While the courts were a long time in doubt on the subject, this little finding from an English case is now recognized as authority on the subject: "Prostration by accident may be found to be an accident within the meaning of the compensation acts."

Where the employment materially increases the hazard to other diseases, or breakdown of the physical body, the employer will be liable, where the injury has been due to improper ventilation. Improper ventilation which results in pneumonia or tuberculosis, if such fact can be proved in evidence, would render the employer liable for the payment of compensation.

In one case, a workman was required to work in a damp place for several hours bailing water out of a grain elevator which had been flooded by the rapid rise of a river. The grain, only a few bushels of which was left in the bottom of the elevator, rapidly became moldy. While the workman was down in this dark, damp pit, he was compelled to breathe this air. Pnuemonia resulted and he died. It was contended and proved by his dependents that breathing the mold spores which were in the air, caused his death. The employer was forced to pay compensation.

The same ruling holds true in cases where dust is generated, by reason of the employment, greatly increasing the hazard of the workman to lung diseases and disorders. The mere fact that the workman is acquainted with the hazards of the work no longer excuses the employer from liability. He must either provide some means of getting pure air to the workmen, or he will be held liable under the workmen's compensation acts for the payment of compensation, when loss of earning power is sustained by workman as a result of such cause.

Specific provisions in the safety appliance acts, the factory acts or industrial codes relating to ventilation must be strictly complied with without reference to the workmen's compensation acts. The mere fact that the employer is to pay compensation in case injury occurs is not sufficient reason for holding that the compensation acts abrogate the safety appliance acts or other acts which seek to prevent injuries.

The two forms of legislation are entirely independent of each other and a compliance with the one form will not relieve the employer from the obligations of the other. What takes place between the compensation acts and the common law, does not take place between the compensation acts and the safety appliance acts or the factory acts.

The Factory Acts

In the latter case, the safety appliance acts or the factory acts seek to *prevent* injuries due to certain conditions which experience has taught are apt to rise out of the work. If these acts as passed by the authority under which the employer is doing business specifically provide certain forms of ventilation, the employer must obey them to the full letter and spirit thereof or he is very likely to find himself suffering other penalties and forms of liability which we have not mentioned here.

The compensation acts, however, seek to compensate injuries *after* they have taken place, and in spite of the measures taken in complying with the safety appliance acts, the factory acts, or the industrial code. The employer who takes this distinction into account is not likely to become confused as to his liability at the present time, provided he is operating in a state where the compensation acts are present.

Where the common law governs him, he will often find the safety-appliance acts further elaborating the common-law theories of a "safe place to work, reasonably safe tools and appliances, and adequate instruction and inspection," which he must satisfy as under the compensation system, but after the accident has occurred, he will find the common law regulating the manner in which the injured workmen can recover damages for the injury sustained.

There is a liability, under either system, for insuffi-

cient ventilation in the place of work, and it is the sort of liability which is best met in a preventive fashion. Ventilating systems are now perfected to such a degree that it is possible for employers in almost any line of work to take care of their employees adequately. And the employer should not allow these systems, once installed, to get out of repair. It pays to prevent, where there is a possibility of legal liability attaching.

Meeting the Present Emergency

By A MIDDLE WESTERN DEALER

WE ARE going through a crisis, and a very serious one. If there was ever a period that called for level-headedness and a belief in our country, now is the time. Beginning as far back as last April we saw from our records, and other indications, that the demand for machine tools in our territory was slipping. That stimulated us to put forth a greater effort to corral orders, and as we entered into the summer and latter months of the year, with business continuing to decline, we put forth every ounce of selling force that we could muster in our organization; also, we increased our advertising, hoping to keep our sales at a maximum, rather than permitting them to go to a minimum, and by so doing we kept our organization busy.

Sales Result From Not Cancelling Orders

In the meantime, even with declining sales, contrary to what is understood as good business judgment, instead of cancelling orders with our sources of supply we had our manufactureres fill our orders and increased our stocks of machine tools and supplies, believing that during this depression the demand, when orders were placed, would be for immediate delivery, and the concern who could make delivery would stand a better chance of securing the business if delivery could be made from stock.

I am very much pleased to state that the carrying of a large stock has meant orders for us during the past three months which we would have surely missed otherwise.

We have found it necessary (due to the fact that we had built an organization in size beyond our requirements, for war work and the subsequent busy period), to lay off a small percentage of our force. The old organization is practically intact, only those whom we looked upon as extras being affected by this reduction in force. We are carrying now an organization that is amply large to take care of what we have arbitrarily determined would be a normal business for us had there not been a war. It is our contention to continue our present force, with the belief that in the near future there will be a general improvement in business.

Buyers' Strike Waning

The "buyers' strike," which the newspapers frequently refer to, will be over before long and there will be a demand generally for merchandise and equipment of all kinds. Incidentally there will be a growing demand for motor cars, which, of course, is vital to much of the Middle West, inasmuch as its business is built up directly and indirectly on the automobile industry.

It has been somewhat pathetic to hear the viewpoints occasionally expressed relative to conditions in Detroit and other automobile cities, where about 60 per cent of all motor cars, passenger and commercial, are built.

As Hugh Chalmers recently remarked, there are too many people in this world who are lacking in a sense of humor who endeavor to make up for it by having, without any basis, an enlarged sense of "rumor," and unfortunately spread it.

Those who are not familiar with conditions have been of the opinion that Detroit has gone to the bowwows, which is far from true. It has, of course, felt the depression about the same as others in their respective cities and states. Those in the automobile territory are optimistic, and are so in a practical measure. Many of the plants are possibly carrying more men than needed, but they have found work for these men to do. They are putting their plants in order, rebuilding and repairing old equipment, in addition to building cars to fill orders, studying production methods, giving consideration to purchasing new and more modern equipment to help them reduce their production costs, etc.

Look for Improvement Soon

Summing up the whole situation, it looks to us as if business will open up before a great while, and we will then need our organization to look after the requirements of our customers, and even though our sales this year may not reach the volume that our organization is set for, on the other hand you can readily perceive what would happen to us if we were to lose our staff. While the business we are securing at present does not give us a large enough profit to pay our operating expenses, yet we are sure that the gross profits for the year as a whole will be enough to help us break even. Then again we feel that we should keep as many employed as our finances will permit, and it is with happiness that I can say that many of the concerns out this way are doing likewise.

It is interesting to know that during the past week there has seemed to be a better feeling or sentiment existing. Many of the plants are taking on more men, and are beginning to increase their output, and have advised us that they have received additional orders, which necessitated the increase.

How to Use a Hacksaw

By J. C. Nicholson

Some of us older mechanics learned to use a file skilfully before hacksaws were much in vogue, and then when the saw came we found using it one of the most laborious things imaginable. To any who are still in the throes of that labor, here's a word of advice: Just forget that you are using a hacksaw and imagine you have a file in your hands instead. It may not work equally well in all cases—much depends on concentration and on previous skill—but it has been a valuable aid to one man and is at least worth trying.

Repairing Air-Brake Hose Connections

Special Equipment Eliminates Much Laborious Work—Connections Are Salvaged, Hose is Scrapped—The Special Devices Described Are Pneumatic

By J. V. HUNTER
Western Editor, *American Machinist*

REPAIR work on air-brake hose connections at the Decatur car shops of the Wabash Railway Co. has had much of its laborious part eliminated by the development of special equipment. This great system has tens of thousands of freight cars in service with an air-brake hose connection on each end and the passenger coaches also have steam hose connections, so that the total number of these coming in for repair would be a man-sized job without the mechanical aids mentioned.

Practically all of the repairs are occasioned by the failure of the hose due to deterioration. Therefore no attempt is made to save the hose, it being destroyed by the methods developed for expeditiously salvaging the connections.

A Stationary Piston

The bolts in the end clamps are usually so rusted that it is not considered good policy to save them and they are therefore cut in two by either one of two air-operated shears provided for that purpose. The smaller of these, Fig. 1, serves largely for connections whose bolts are small and light. This shear is built of a forged-steel frame mounted on heavy timber blocking. Power is furnished by a 5-in. diameter air cylinder *A* which has been mounted so that the yoke of its plunger piston is attached to the lower stationary member of the frame and the cylinder rises when admission of the air causes it to work the arm of the jaw. The admission of air to the cylinder is controlled by a foot lever operating through the bar *B* to a spring-operated air valve at *C*. The yoke *D* over the upper arm controls the length of the stroke so that this may be adjusted by the setscrew *E* to prevent damaging the shear blade.

A heavier and more powerful bolt clipper, Fig. 2, is used to cut the larger bolts that bind the clamp on the steam hose. This machine requires two operators, one to hold the hose in position, as shown, and the other to control the air valve at the rear; but in the near future, by the application of a foot control lever, it is expected that only one operator will be required. A section of steel channel forms the base of this machine and on the rear end is mounted the 9-in. air cylinder *A*. The plunger of this operates through a combination of toggle levers, showing where the arms project through the safety guard at *B*, and these in turn work the shear head. The entire mechanism is inclosed in a sheet-metal case, so there is no danger to the operator.

A Two-Purpose Device

All who are familiar with rubber hose work know how the rubber lining attaches itself to the iron connectors, thus causing great difficulty when the removal of these is necessary. However, this shop has solved the problem in a very simple manner. In the illustration, Fig. 3, is shown a device that was first designed for holding a piece of air hose and driving the connectors in its end; but since this machine is also used for taking the coupler out of the hose, it is necessary to describe it in greater detail before showing how the preliminary operation is accomplished. The whole device is mounted on a large steel channel which has a vertical upright *A* at its back for mounting the air cylinder *B*. This cylinder serves for clamping the rubber hose in a fixture consisting of the stationary piece *C* and the movable shell *D* carried on the piston of the air-cylinder plunger. These shells are formed so that they inclose a length of hose, as shown, and tightly clamp it when the pressure is applied from the vertical air cylinder. The air cylinders mounted on the ends of the table are fitted with special tools for pushing the metal connectors into the ends of the hose; and also for the operation which must be performed first—that

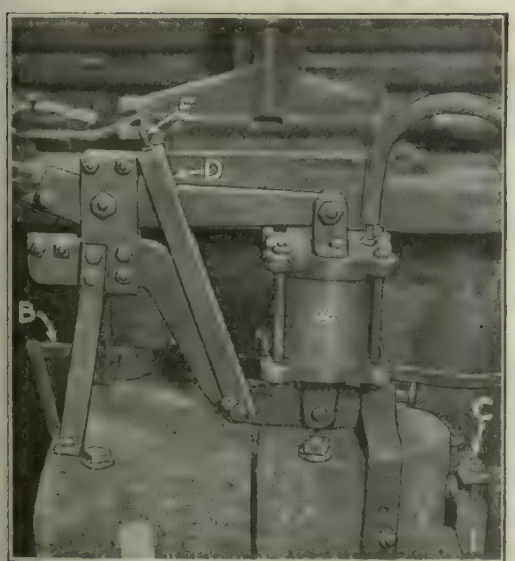


FIG. 1. SMALL AIR-OPERATED SHEAR FOR CUTTING HOSE CLAMP BOLTS



FIG. 2. HEAVY HORIZONTAL AIR-OPERATED SHEAR FOR CUTTING STEAM-HOSE CONNECTING BOLTS

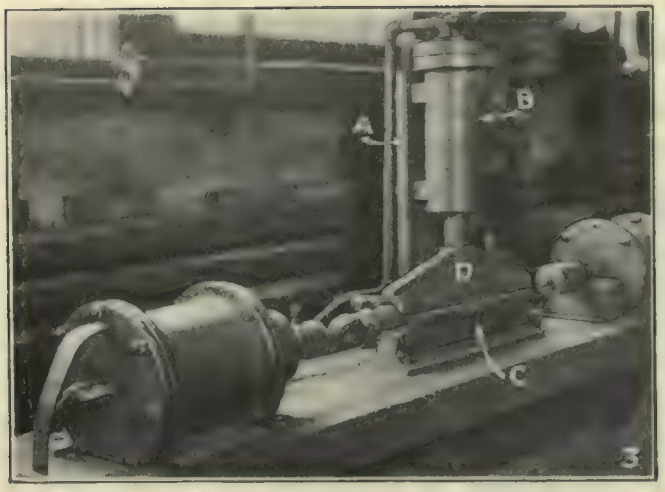


FIG. 3. DEVICE FOR REMOVING CONNECTORS AND INSERTING THESE IN NEW AIR HOSE

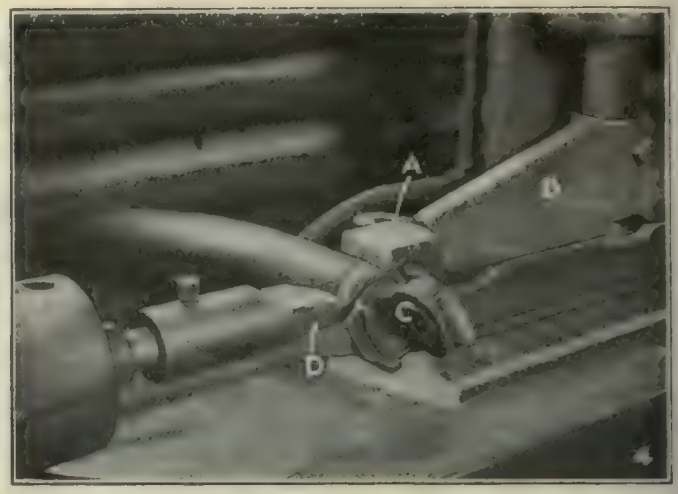


FIG. 4. METHOD OF SHEARING HOSE FOR SALVAGING CONNECTORS

of removing the connectors from the old pieces of air hose. In Fig. 4 is shown the method of removing the connector from old air hose. A U-shaped section of steel *A* is fitted with a round shank which permits it to be held in the hose clamps *B*. The jaws or inside edges of this U-shaped section are ground to knife sharpness and the distance between the two edges is just sufficient to pass over the stem of the air-hose connectors *C*. An air hose is laid in the position shown and the plunger of one of the horizontal cylinders carrying the pointed ram *D* is brought forward thrusting the hose into the block *A*. The latter serves as a stripper, shearing the hose away from the metal and freeing the connectors so that they readily drop out. Of course, it is understood that the clamps have been removed previously and this operation is done successively on the two ends, thus giving connectors ready for insertion in new sections of hose.

A larger, but similar, device has been made for performing this same operation on the heavier sections of steam hose. This stands vertically and is mounted on a section of steel channel. A 10-in. air cylinder serves to operate the ram and the piston plunger has been provided with a guide block which insures that it will be held properly in alignment. The stripper block is held by a setscrew in a bracket bolted to the same channel.

As previously indicated the operation of driving the end connections into a new section of hose is performed, as shown in Fig. 5, by clamping the hose in the air-operated vise jaws *A*. The plunger on the air piston is fitted with a socket *B* for holding different forms of tools. The illustration shows a straight mandrel that is provided for driving the pipe connections into one end of the hose. The hose is not removed from the vise for driving the coupler in the other end as this is served by the second cylinder, and the operations on both ends can be performed simultaneously if desired.

The device shown in Fig. 6 is used for pulling the ends of the hose clamps together for the insertion of bolts. It consists of two jaws, one stationary and held in base *A* while the other *B* is the upper end of the lever arm *C*. Both vise jaws are crescent in shape so that only their points catch the ends of the hose clamps.

When the movable jaw is operated by the application of pressure to the air cylinder *D*, the ends of the clamp are drawn together, thus making insertion of the bolts easy. The air for the cylinder is controlled by a valve, whose handle extends through the top of the table at *E*. Additional springs *F* are provided to draw back the plunger and release the clamping jaw when the bolt has been tightened.

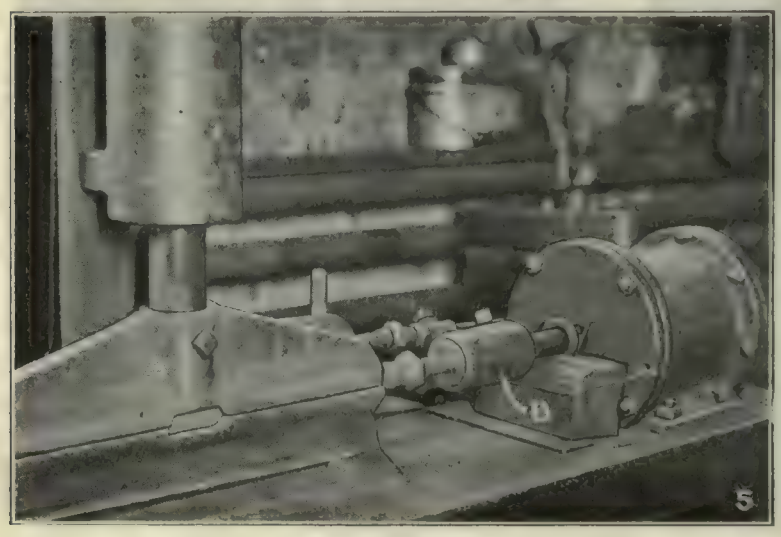


FIG. 5. PRESSING PIPE CONNECTORS IN AIR HOSE

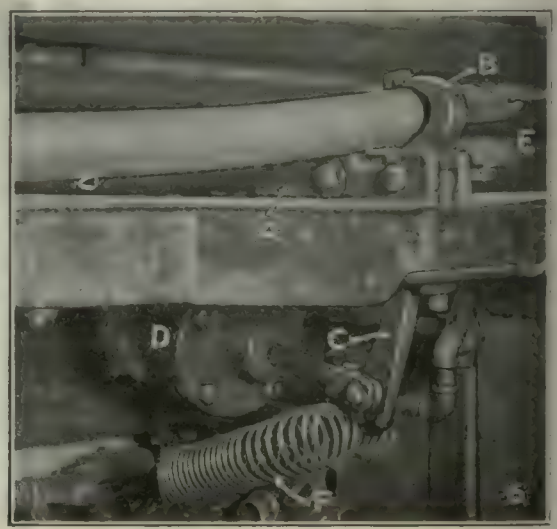
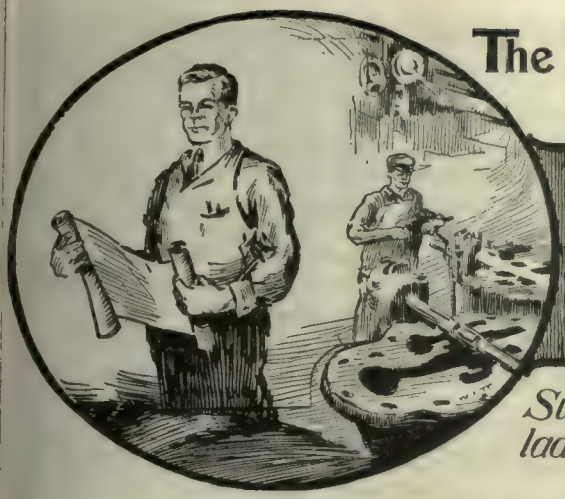
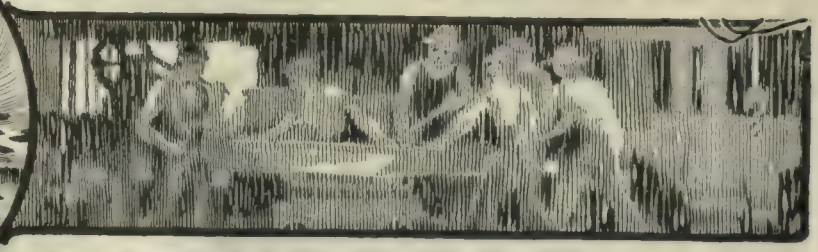


FIG. 6. DEVICE FOR HOLDING CLAMP WHILE INSERTING BOLTS



The Foreman and His Job



Suggestions for live foremen who wish to go up the ladder, and for firms who want better shop executives

By FRED H. COLVIN
Editor, American Machinist

WHILE we all know the value of teamwork in a general way, it is not always easy to apply it to our own cases. The desire to make a good showing for one's self or for one's department is very apt to put the necessity for team work into the background. The very spirit of competition, which has so many good points, brings out the trait of "Every man for himself and the devil take the hindmost," which is the very opposite of team work.

Whether your department is making a single piece or a complete assembly, it is easy to see that nothing is gained by having certain operations or certain pieces completed long before the rest. Suppose for example that you are making automobile cylinders. The output of your department depends on the number of completed cylinders which it can deliver per hour or per day. It does not increase your output to have the milling machine man mill twice as many cylinders as your boring machines can handle. If someone with a grouch has a grudge against the cylinder grinder and interferes with his work, it not only delays the grinder but also the whole department.

In the same way the practice of some foremen of trying to steal men or material from some other department in order to increase their own production, hinders rather than helps the output of the plant as a whole. And we must remember that it is the completed machine which brings in the money for the pay roll, and that if any department is behind from any cause whatever, it delays the output of the whole plant. This same spirit of unhealthy rivalry delayed the production of field guns for the army during the war. The gun division was separate from the carriage division and co-operation was lacking for many months. As either guns or carriages are useless without the other, time was lost by the failure to co-operate so as to have them both come along at the same speed.

Individual performance counts for comparatively little in the production of anything in large quantities unless each individual can be brought to a high average performance. It is better to get 75 per cent output of all the parts than to get 100 per cent of some and only 50 per cent of others. The machines cannot be completed until there are a sufficient number of *all* the parts.



A REAL TEST OF BIGNESS OF CHARACTER . . . HAVE A MAN TRANSFERRED FROM YOUR DEPARTMENT WITHOUT TRYING TO BLACKEN HIS REPUTATION

If for example, one department slights its work to such an extent that the next department must spend an unusual amount of time in performing its operations, the apparent increased output of the first department is a real detriment to the output of the plant as a whole. And not only is team work necessary between departments but also between the men in any single department, no matter how small it may be. This is why a group bonus is often much more satisfactory than an individual bonus, although sometimes both can be utilized to advantage. It is also one of the great reasons why many feel that the foreman should be counted in on a bonus for the output of his department.

Many plants have adopted the daily conference between the shop or production manager and the foremen of the different departments. It brings the men face to face each day, or as often as may be considered necessary, and reminds them constantly of the futility of one department trying to get ahead at the expense of any of the others. It makes the foundry man careful about promising castings several days before he knows he can get them out. It shows up the patternmaker if the delay is due to his not getting the patterns out when promised. It is very effective in preventing the common but un-

satisfactory practice of "passing the buck." These meetings show the management which foreman is actually producing the goods and which one is trying to lay the blame where it does not belong. They show those who produce results, and those who try to get by with excuses.

Teamwork however is not secured by simply desiring to help the other fellow out. A knowledge of how to do so is equally important. Good judgment or "common sense" is one of the best qualifications in this as in many other occasions which arise. It is the ability to watch the different details, to bring the various parts along in approximately the same quantity to the assembling department, that gets the desired results. Many a shipment of valuable machines has been delayed and a lot of money tied up because some comparatively insignificant piece had been overlooked. This is, of course, looked after and followed up by the production department "chaser" in many places, but the foreman who keeps things moving along without having to be chased, is in direct line for a deserved promotion.

Teamwork can be of great assistance in putting over any new plan or system which may be installed by the management. No matter whether the plan or system seems best to you or not, it is part of your job to try and make it work as planned. Some object to the installation of an employment department as taking away part of the foreman's rights and duties. But employment departments are part of all modern establishments of any size.

Co-operating With Other Departments

The foreman's relation with the employment department presents a good opportunity for him to show that he can work with the management and co-operate in making the plan effective. Here is one of the many places where teamwork counts and he should do his best to help the employment department secure results. By keeping in close contact with the employment department and seeing that it knows exactly what kind of men he needs; by trying to utilize the men selected or suggested; he will soon find that he receives much assistance and that the employment manager is trying to get the kind of men he wants.

No foreman can expect to get the best results out of every man who comes into his department, but he should try to find out the reason and correct it if possible. Certain temperaments do not seem to get on well with each other at all times and this plays its part in all sorts of work. There are bound to be men who will either not do their best work, or be happy under certain types of foremen, and it is folly to try to make people who are naturally antagonistic pull together unless it is absolutely necessary. By far the best way in such a case is to transfer the man to some other department. And here is where the employment department plays an important part.

It is for this reason that many shops have taken the power of direct discharge away from the foreman, and it is probably better so. If, after a fair trial their natures clash it is usually easier for all hands to notify the employment department and have the man transferred to another department. This should be done without any resentment or hard feeling and nothing should be done to make it hard for the man who is transferred.

It is one of the tests of real bigness of character to be able to ask to have a man transferred from your department without trying to blacken his reputation in any way. It takes a broad minded man to admit a failure of any kind, but men of this sort have a much larger future than those with narrow dispositions.

The foreman who is big enough to say: "Jones and couldn't seem to understand each other or get along very well, but he's a good man and ought to make good in some other department," will go a long way up the ladder of shop management. The man who is small enough to try to shift all the blame on the other fellow has no place in the modern shop.

Applying Magnetic Chucks to Best Advantage

By I. A. Hunt

Upon looking over recent numbers of the *American Machinist* the writer was surprised to learn that his article under the above title had started an argument. Since he is no longer connected with the manufacture of magnetic chucks of any kind his further remarks should be without prejudice.

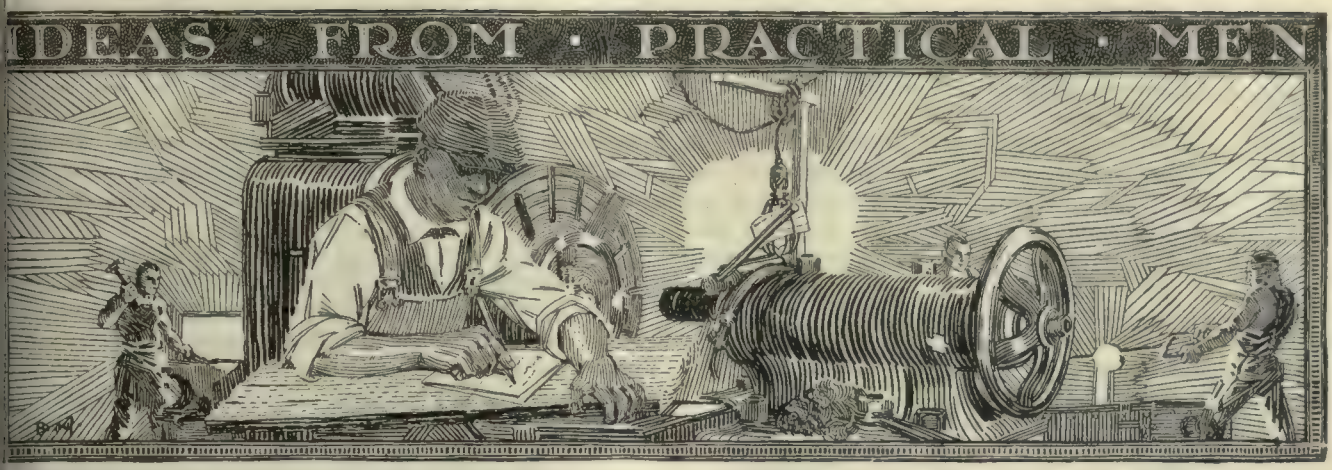
Like Amos Ferber, who states that C. A. Macready's criticism of the article puzzles him, I do not understand just what Mr. Macready has in mind. The points brought out in the original article are applicable to any make of chuck. If a solid top plate or auxiliary plate can be used in place of one in which the poles are insulated, then the manufacturers would surely like to know it, for it would eliminate a lot of expensive work in making top plates. But they would also have to be shown.

The basic principle of magnetic holding power is the flow of magnetic lines of force from the positive to the negative pole, and to complete this circuit through the solid steel plate placed on a magnetic chuck, as Mr. Macready suggests, would immediately neutralize the poles so that the lines of force would not enter any work that might be placed upon the chuck.

The only way in which a solid steel plate may be used as an auxiliary plate is to make it so thin that it cannot carry all the lines of force, thus allowing some of them to find a path through the work; but this condition is too limited to warrant the broad statement made by Mr. Macready.

As to the question of the expense of top plates, this depends upon the user. If he has a standard production job where many duplicate parts that are to be held by the chuck would require an auxiliary plate, then it will pay him to buy one to fit his chuck; if he has temporary use for an auxiliary top plate, a little ingenuity will enable him to make up pieces of steel that can be set over each polepiece and separated by non-magnetic metal like brass, or, if the work is stiff enough, the spaces between the poles can be left open. This stunt can be used on any type of chuck, although, of course, the steel pieces or extended poles must be placed in accordance with the arrangement of the poles.

The other criticisms are somewhat obscure and would seem to indicate a prejudice in favor of certain makes of chuck, whereas, such tricks as extending the poles to secure the best points of contact, etc., can be applied to any chuck if the basic principle of a magnet is remembered. The points illustrated in the original article are basic and intended to elucidate the magnetic principles in a way that will enable a mechanic to apply them to meet his requirements on any of the magnetic chucks now manufactured.



New Use for Drill Jig

By F. W. Shumard

The common method of machining the clearance in ston wristpins for the connecting-rod bolt is by means a radius cutter in a milling machine. Although the tures used are usually made to machine more than e pin, the cutter must "cut air" between pins, thus sing many seconds between loadings. Also, the cut- r must be kept quite sharp to reduce chattering and avy finishes.

The writer has found that the clearances can be t in a drill press. Fig. 1 shows a cold-rolled steel ston wristpin in which the $\frac{7}{32}$-in. radius is to be achined. Fig. 2 shows a drill jig that is used in a e-spindle drill press, using a standard $\frac{7}{16}$-in. high- eed steel twist drill ground in the ordinary manner. he jig holds two pins during the operation, and a oduction of 600 or more pins per hour is obtained. he accuracy and finish of the slots are much better an on those milled in a milling machine.

Referring to Fig. 2, two of the pins are placed in block *A* against the stop pads *B*. Cam handle *C* pushed down and displaces the clamping arm *D*, the end of which is screwed a steel cam plate *E* r the cam *F*. Clamping arm *D* swivels on pin *G* d has two steel shoes *H* at its other end. These oes swivel on screws *I* and contain the threaded clamp- g pins *J*; four of which secure the work. Block *K* is rewed and doweled to the main cast-iron base and rries the drill bushing *L*. The bushing has two radii milled in its bottom end to clear the work and thus permits of piloting the drill close to the work. After the drilling, and the clamping arm is free, the work is removed from the V-block by knockout *M*, a sharp lateral movement of which will kick the work out into a box over 2 ft. away from the jig, and during this movement the operator picks up the two pins he selected while the drill was in feed and places them in the jig the instant the completed pins are knocked out.

Since the cut is intermittent a press having a power feed must be used and all lost play taken up in the drill spindle.

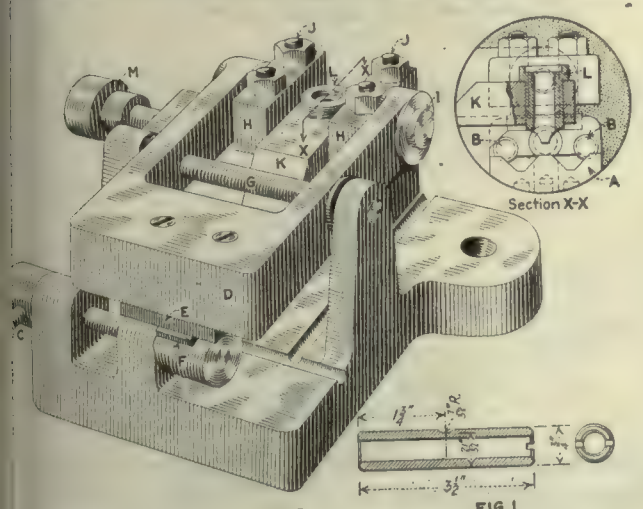


FIG. 2. DRILL JIG FIG. 1. PISTON PIN

Fixtures for Continuous Milling

By Lester Ferenci

I have found in my experiences in the tool line that in the design of fixtures the machine vise is very much neglected, and its value not fully realized. In many cases the cost of a fixture can be reduced from one-third to one-half by utilizing the vise as a base for the fixture. It is especially adapted to fixtures for small parts on the milling machine and shaper.

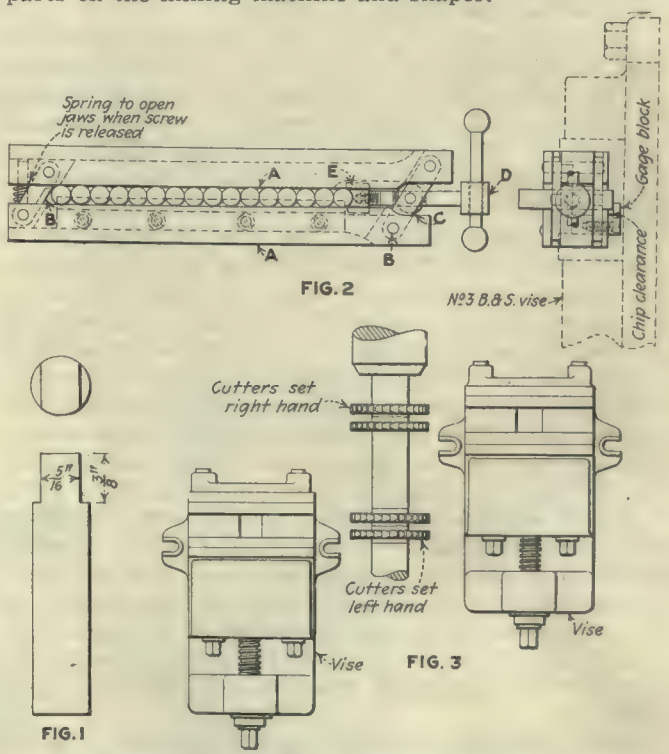


FIG. 1. THE WORK. FIG. 2. THE FIXTURE. FIG. 3. ARRANGEMENT OF VISES AND CUTTERS

Not very long ago we had a large quantity of the parts shown in Fig. 1 to make of drill rod cut to length, diameters varying for different lots from 0.375 to 0.437 in. and requiring straddle milling at one end. The job was done on a Brown & Sharpe automatic milling machine as a continuous milling operaton. Three small fixtures, similar to the one shown in Fig. 2, and clamped in machine vises, served the purpose excellently, doing away with the elaborate and expensive fixtures ordinarily required for such operations.

The machine was set with a fast feed owing to the small amount of stock the cutters were required to remove, and therefore the fixtures had to be fast working to keep the machine running continuously.

The fixtures consisted of two jaws *A* connected by links *B* at top and bottom. Between the two links at the right-hand end was mounted a floating stud *C*, through which clamp screw *D* tightened shoe *E* securely against the work. Further motion of the clamp screw brings the jaws against the work.

Two vises were set up on the milling machine table, separated by a distance of about 18 in., each vise in a separate keyway, and two sets of cutters working in opposite directions to correspond to the feed of the machine and to the position of the vises were set up. The arrangement of vises and cutters is shown in Fig. 3. As soon as the work in a fixture was finished it was replaced by the extra fixture, which had been loaded while the machine was cutting.

A Question of Design

By P. A. Fredericks

Most machine designers have probably at one time or another been called upon to locate a screw for moving a unit on its slide. If the screw has to support weight, or resist thrusts in addition to its functions of moving the unit, it is sometimes rather difficult to determine where it is best to put it. Take, for instance, a milling machine knee as shown in Fig. 1.

In this instance the screw at a distance *A* from the face of the column is expected to act both as a support for the weight of the table, work, etc., and as a means of accurately raising and lowering. A glance through catalogs of milling machines shows that the later designs have emphasized the importance of the supporting functions as shown, by bringing the screw farther out from the face of the slide. On some machines this is quite pronounced. Evidently the idea was to, as nearly as possible, locate the screw under the center of gravity of table and work, or possibly to minimize vibration by getting a brace out as far from the face of the slide as possible. The center of gravity, of course, varies considerably, as the table and work may stand anywhere on the top slide of the knee, and in addition it appears that serious inaccuracy in the operation of the machine may be introduced by bringing the screw out too far.

If, for instance, the screw is exactly on the center of the column slide as in the plan, Fig. 2 (which appears never to be done on milling machines), then the force applied to move the knee would always be central with the resistance. In such a case, although the knee might sag a trifle due to the weight of the table and work, the sag would always be the same amount and in the same direction.

But if the screw is moved out, then a couple is set up as soon as force is applied to move the knee either up or down. The result is that when moving up the end of the knee rocks upwardly and when moving down the reverse is true.

The tests on some machines where the relative distance *A*, Fig. 1, was considerable, showed a difference in reading of 0.003 to 0.004 in. taken on a dial indicator touching the column face 12 in. above the table. The difference showed as the direction of movement was reversed.

On a machine used for toolroom work, for instance in boring holes in jigs, this difference would be entirely too great. It would seem that this rocking movement, if other things were equal, would be least in the following instances:

A. Least when the distance *A* (Fig. 1) is least.
B. Least when the distance *B* (Fig. 1) is greatest.
C. Least when the slide fits close enough to avoid lost motion but not close enough to stick or bind.
D. Least when knee, column and slide are stiffest and most rigid.

It therefore would appear that unless there was considerable reason to move the screw out, caused, for instance, by the necessity of adding to the resistance of the unit or by limitations in the position, the screw for moving the unit should be placed as close as possible to the slide, since most of the other factors listed above are only capable of a certain amount of control in the average design. It goes without saying that the screw should whenever possible be set central with slide in the other projections.

A test of conditions similar to Fig. 1 with a movable screw and with varying position of weights placed on the table gave the following results:

A = 7 in.—Rocking movement = 0.0012 to 0.0015 in.
A = 10 in.—Rocking movement = 0.0017 to 0.0023 in.
A = 12 in.—Rocking movement = 0.0025 to 0.0038 in.

In the above the maximum rocking was when the weights were nearest the column, the minimum when

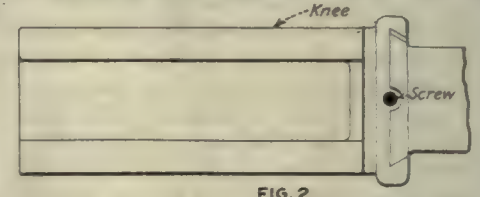


FIG. 2

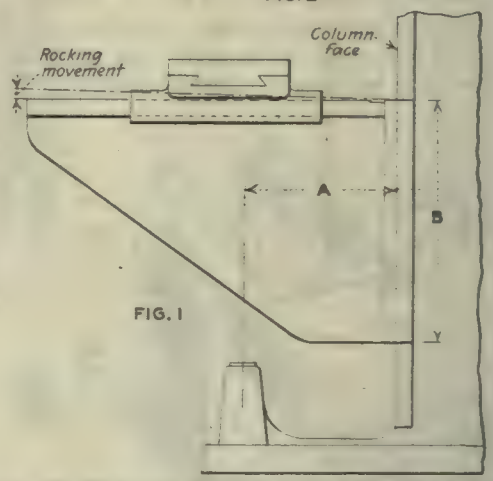


FIG. 1

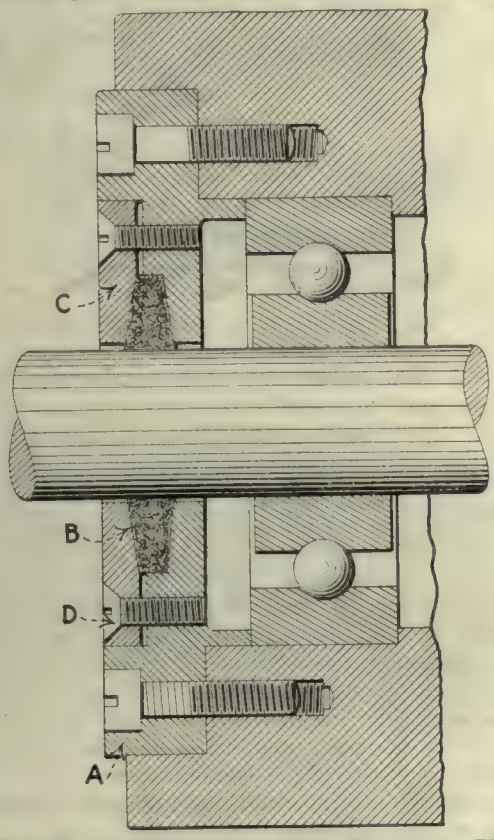
FIG. 1. ELEVATING SCREW LOCATED AWAY FROM COLUMN. FIG. 2. ELEVATING SCREW IN CENTER OF COLUMN

directly over the screw, and about half way between the two extremes when the weights were farthest out, though we had expected to find the maximum when farthest out.

Adjustable Oil Retainer Plates for Ball Bearings

By C. F. George

In designing some new machines it was desirable to use a considerable quantity of ball and roller bearings of various types and I anticipated trouble in packing the retainer plates to make and maintain an oil tight



ADJUSTABLE OIL RETAINING RING FOR BALL BEARING

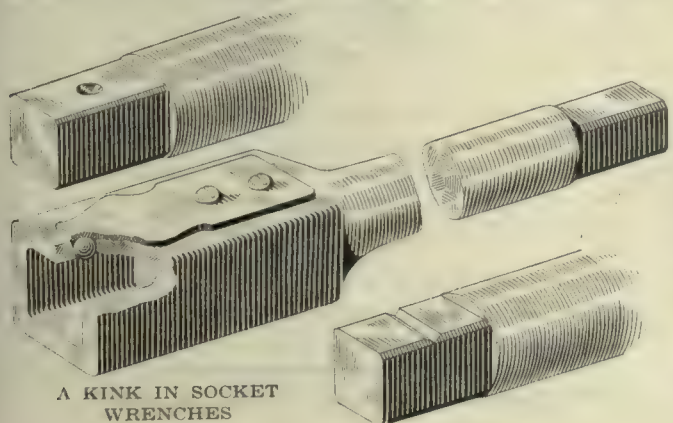
joint. I met the difficulty by devising the adjusting packing plate shown in the illustration.

The main retainer plate *A*, which holds the bearing in place, need not be moved after the machine is assembled. The felt *B* is inserted in position and the plate *C* moved along the shaft and held in place by the screws *D*. These screws also provide for adjustment of the packing.

A Socket Wrench Kink

By Hugo F. Pusep

A convenient little kink applicable to the socket wrenches commonly used for small taps and reamers is shown in the accompanying illustration. A description is almost superfluous, as the idea may be so readily grasped from the picture.



A KINK IN SOCKET WRENCHES

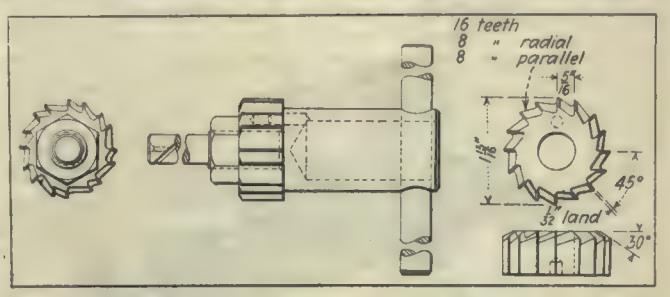
It will hold any shank that fits it without preparation of the shank; but if a stronger or more certain hold is desired, a groove or a countersink on one or more of the flats of the shank will serve that purpose.

A Valve-Seat Reamer

By C. H. Dengler

The accompanying illustration shows a valve-seat reamer to be used after the first machining of the valve seats and before the final grinding in of the valves. This tool is one of the many that helped to build the Hispano-Suiza airplane engine.

The cylinders of that engine are alloy-steel barrels screwed into an aluminum block, the valve seating directly in the barrel top. The first machining left chatter marks which were difficult to remove by grinding in the valves, but this tool smoothed them up and greatly facilitated the grinding-in operation. The pilot



DETAILS OF VALVE-SEAT REAMER

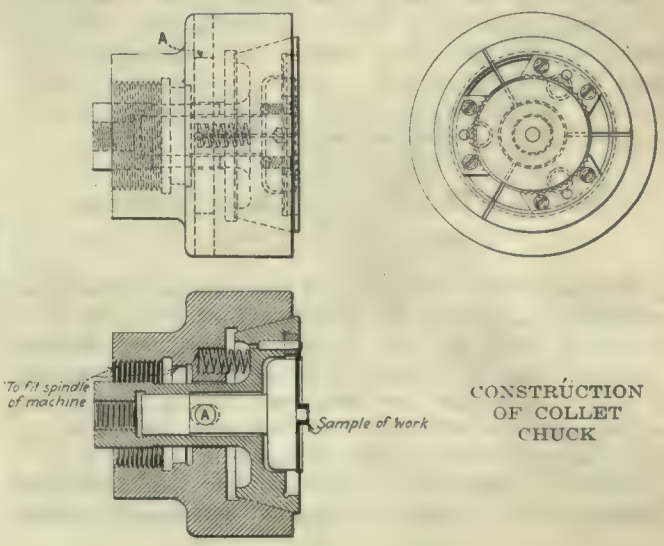
is made to fit the valve guides. The cutter has 16 teeth, 8 of which are radial, while each intermediate tooth is parallel to the one preceding it.

Collet Chuck for Holding Thin Round Work

By Edward A. Nevins

The illustration herewith shows a chuck for holding thin metal parts while machining them. It is so designed that when the jaws are closed on the work the latter is drawn back against the squaring plug which occupies the center of the chuck and is pinned to it by the dogging pin *A*.

This pin passes also through the collet, but the hole in the latter is elongated to permit sufficient end move-



CONSTRUCTION OF COLLET CHUCK

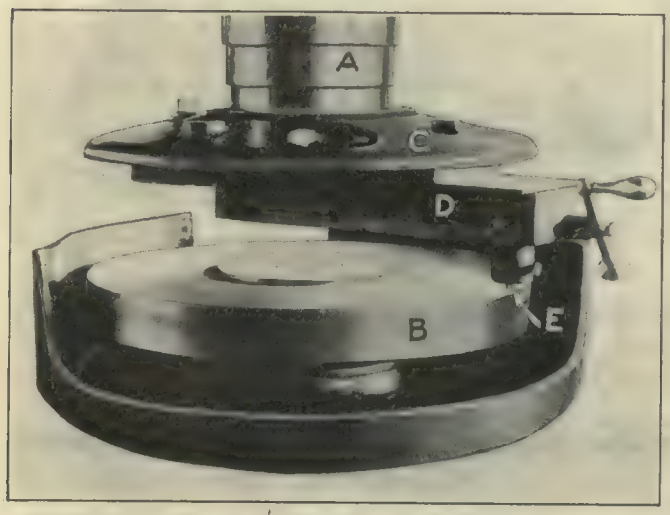
ment to open and close the jaws, which movement is derived from a draw-in rod and handwheel at the rear of the machine.

Separate jaws properly attached to the leaves of the collet serve to hold the work, and these may be made to suit whatever piece may be desired. Three coil springs force the collet forward, allowing the jaws to open as soon as tension on draw-in rod is released.

Facing a Part of a Machine in Place

By E. A. Dixie

We recently built a large number of machines which were in general shape somewhat like a vertical drilling machine, although they were intended for quite another purpose. The cone pulley *A* is carried on the spindle of the machine, and secured to the lower part of *A* is the plate *C*. Situated in a pan below is a sort of table *B*. It is essential that this table have its top surface accurately parallel with the lower surface of *C*. For this reason it was decided to surface *B* after all the assembling of the machine was completed.



THE MACHINE AND FACING FIXTURE

The slide *D* was designed and built especially for the surfacing job. It carries a tool *E*. While a star feed could have easily been arranged on the end of the feed screw of the surfacing slide *D* this was not done, but the job of feeding was turned over to an apprentice. The speed was quite slow (about five turns per minute), so that the operator had plenty of time to turn the crank handle the required amount each time it passed him. The result was very satisfactory, the face of *B* falling within 0.002 in. of being parallel with the lower surface of the member *C*.

Bending Rings in a Milling Machine

By George G. Little

We had to form some rings of brass rod of rectangular cross-section, and as the available rods were too light to do the work we had to do the next best thing—use something else. After some study over the matter it was decided that the best way was to rig up the milling machine with a set of rolls and use the arbor for holding one of the rolls, as shown in Fig. 1.

A pair of rolls 2 in. in diameter and 1-in. face with trunnions $\frac{3}{4}$ in. in diameter was put between two pieces

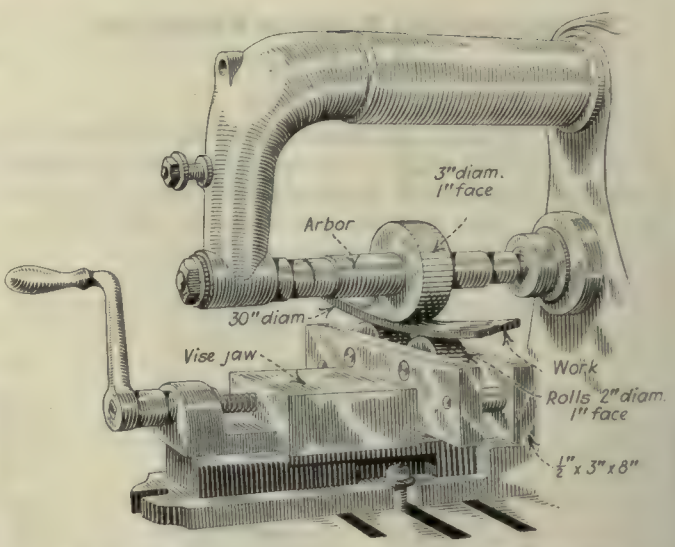


FIG. 1. ARRANGEMENT OF ROLLS FOR BENDING

of $\frac{1}{2}$ x 3 x 8-in. cold-rolled steel having two spacing blocks arranged to provide free turning of the rolls. A roll 3 in. in diameter and 1 in. long having a 1-in. hole was secured on the arbor with the usual spacing collars and nut.

The overhead arm supported the arbor while the two lower rolls were held in the machine vise. By raising the table in the usual manner the rolls were arranged properly to form the rings, which were 30 and 36 in. in diameter. Fig. 2 shows a similar method of using two rolls for flattening copper wire. The wire was No. 10, bare, soft copper and was reduced to 0.100 in. thick in three passes. The lower roll was made of cold-rolled steel 4 in. in diameter and fitted with a ball bearing which reduced the friction enough so that the friction of the wire between the rolls was sufficient to make the reduction in size and carry it through.

In forming the brass rings the stock was left 3 or 4 in. longer than the finished circumference and was but slightly bent in the first pass, the machine platen being raised by the vertical feed screw for each pass till the ring assumed the proper diameter.

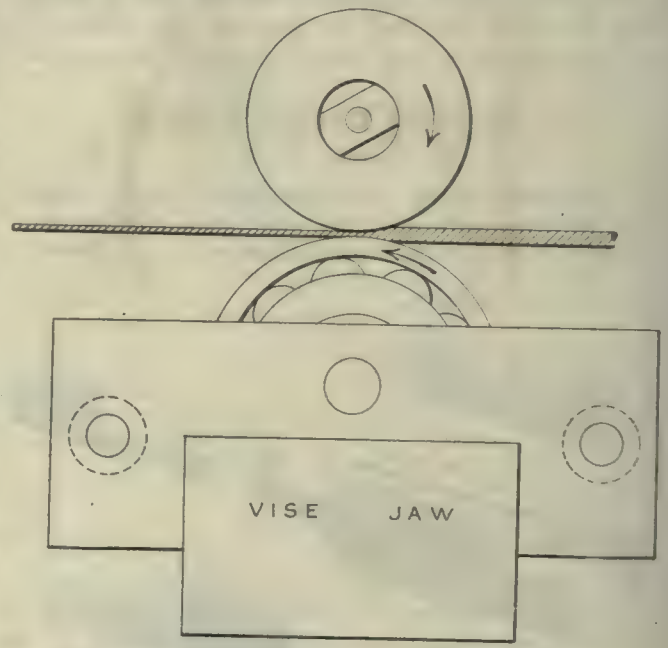


FIG. 2. ROLLS FOR FLATTENING COPPER WIRE

A Loose-Leaf Mechanical Encyclopedia

By C. V. Lovell

The encyclopedia is one of the most prolific sources of information that the knowledge-seeking world has access to, but owing to the rapid pace with which civilization is advancing the information found therein is often out of date. Therefore the ideal encyclopedia would be one that was revised from week to week. Also, from the standpoint of the average mechanical man, this source of enlightenment must not only be up to date but must contain an overabundance of things mechanical.

I have never been able to find a set of books on the market which fulfilled these requirements, and that is the reason why I began compiling the set, a part of which is shown in Fig. 1, that I call a "Loose-Leaf Mechanical Encyclopedia." Of course, I got most of the material from the pages of the *American Machinist*, or, in fact, my encyclopedia is the *American Machinist* bound in loose-leaf form and classified in such a way that I can find *what I want when I want it.* Also, I have



FIG. 1. THE LOOSE-LEAF ENCYCLOPEDIA

the *satisfaction* of knowing that the information I am procuring is up to date. I say up to date because I revise my encyclopedia every week.

Upon receipt of the magazine I first look through the index and mark all items in which I am especially interested. I then go through the subject matter and mark any items of interest which may have been overlooked in the index. I also thumb over the advertising matter and mark any pages that I may want for future reference.

I am now ready to bore the holes for binding, after which I remove the staples with a pair of pliers, separate the subject matter from the advertising and again separate the articles which I have marked from those in which I am not interested. The latter I file in a separate book, keeping the pages in numerical order and placing the regular index sheets in front.

Before proceeding further I might state that it is preferable to bore the holes for binding before removing the staples as the wood bit will then cut a clean hole without tearing the paper.

For this purpose I made the hardwood jig, shown in Fig. 2, to bore three ¼-in. holes for the screw-post binders shown in Fig. 3. The covers enclosing the encyclopedia are made of flexible pebble-grained leatherette and were obtained from the printer, cut to size and punched at a cost of $2.80 per hundred.

The backs shown in the center of Fig. 3 are made of the same material. They should be punched and folded to suit the thickness of the book to be bound. I usually start with only a few pages, using a short post binder about ¼-in. long and the two covers without any back.

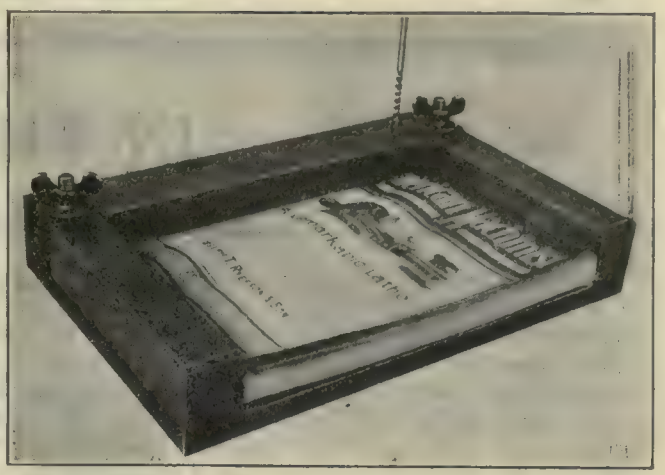


FIG. 2. A WOODEN BORING JIG

As the book grows from week to week I add the index sheets shown at the top of Fig. 3, which are made from white drawing paper with index tabs pasted on. These sheets also serve as a cross index in case two important articles which I wish to file appear on the same leaf of the magazine. For instance, on page 312 of the issue of Feb. 16, 1911, is an article describing a magnetic chuck which I filed in the book entitled "Chucks" and indexed "Magnetic." On the opposite side, page 311, is a drawing and a description of a compound die for making can tops. I also wanted this filed in the book entitled "Dies," indexed "Compound." I therefore make a note on this index sheet as shown in Fig. 3, telling where this article could be found.

By using this method of filing and indexing I am able to divide and subdivide the subject matter into its proper classification as it is a matter of only a few

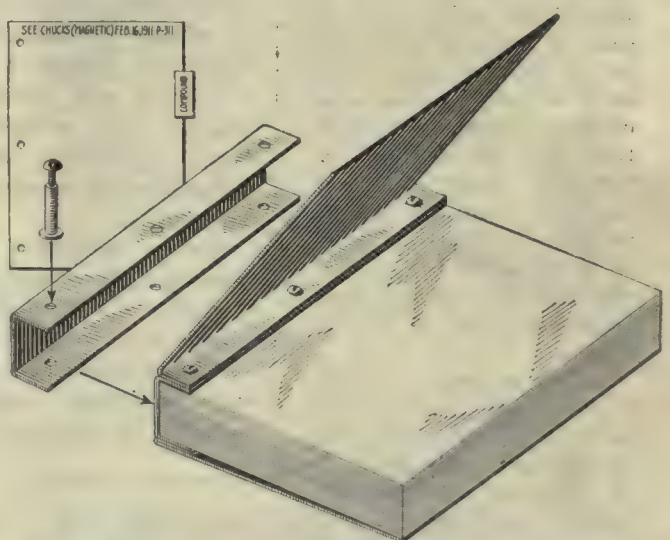


FIG. 3. METHOD OF BINDING AND THE INDEX SHEET

minutes to unscrew the post binders and insert the new sheets. For the titles I use white gummed letters ⅞ in. high pasted on the front covers.

This makes a very neat flexible book, but best of all, when I open it's covers, I find

WHAT I WANT
WHEN I WANT IT
WHERE I EXPECTED TO FIND IT
} UP-TO-DATE

IN THIS ISSUE

AFTER a brief introduction of less than a half column Associate Editor Hand, in the leading article, pushes right into a brass-tack description of tools and gages used in making phonograph tone-arms. It is probable that every man with mechanical knowledge has mused over the possible methods of turning out phonograph parts and no doubt those who read this article will feel that they owe Hand a vote of thanks for having improved an opportunity to show how at least one important part is made.

Under Special Correspondence, page 357, there is a good article on details of large airplane work. Details are important now as always, especially in airplane work, than which there is probably no work more interesting. So we'll let the details stand for themselves while we say a few things about the airplane question in its larger aspect. From time to time we have written of the future importance of the airplane both as a commercial tool and as a war machine. The nation is spending much money on battleships, little on planes. Which would you rather own in case of war—a battleship or the fleet of planes that could be built for the price of the battleship? It's high time that we get busy on bringing about such an obviously necessary change in policy and the way to do it is to show the people, who will then instruct their representatives in Washington.

As we go deeper into the subject of metal-cutting tools with DeLeeuw we realize how comprehensive is his series. We have advanced from a consideration of the cutting action of elementary tools through simple turning tools, lathe and planer tools and drills, to boring tools in general, which is the subject taken up this week, page 360. Boring tools are considered in the sense that boring is an operation of inside turning. We are told to keep in mind that in boring or inside turning the tool is presented to the inside of a cylinder instead of to the outside and that as a consequence there are new relations between the angles of the tool and the surface to be finished. These new relations are then explained.

Erwin H. Schell, in an article on industrial research in the art of man management, page 364, gives expression to a number of theories on the work of the executive. He holds that the executive's policies must be built upon experience, that each plant should develop its own standards and that all executives must contribute to administrative research. Inasmuch as we shall never know just how to handle men, because conditions are forever changing and because men change with them there will always be new ideas on the management of men that we shall welcome.

Well known to the machinery world are both the Fors and Colvin. We have them in combination this week page 368. There is a triple treatment, by which we mean that Colvin has written on three subjects. These are frames, differential spiders and the differential gear case.

In progressing from unsanitary and inefficient shops to the plants of today we have given very careful consideration to many things affecting product and production that our forbears no doubt passed over as of little moment. Among them is ventilation. Perhaps it is not widely known that there is legal liability for ventilation. Chesla Sherlock says that there is, so we are letting him tell about it—page 374.

We continue our comments on meeting the present emergency, page 376. We have gathered from these expressions of many manufacturers the impression that there is great confidence in the ultimate return of good business and that the present policy should be to retain the really important units of organization and build stock. There are others to hear from.

There is material in this issue on which to say much, and so we find at this point that there remains enough space only to mention Hunter's railroad article on repairing air-brake hose connections and Colvin's on the foreman and his job, pages 377 and 379.

We also call attention to the very good and true speech of George Ed. Smith, president of the Royal Typewriter Co., on the Foreign Trade Financing Corporation, page 392a. Mr. Smith says, "Until these long-term credits are available American goods will be stopped in the middle of their journeys, and a great barrier will remain in place in all parts of the world, checking the flow of American time sheets for the solution of filling American payrolls."

Coming Features

We indulged in much talk about the business we were to have, after the fighting was over, in reconstructing and equipping European industrial plants. There has been some business, but not in such volume as we expected. Next week Oliver F. Allen, formerly Major, 24th Engineers, will tell, as he sees them, the reasons why we have not done so well as we might have.

The third of the Magnetic Chuck articles will be a part of the issue next week. It deals entirely with the history of the magnetic chuck as related to Oakley S. Walker, whom She don calls "The Father of the Magnetic Chuck."

Hunter will have a railroad repair article dealing with equipment mounted on wheels. Such equipment includes traveling cranes, portable work benches, portable lathes and other apparatus.

Colvin will have an automotive article on pistons and connecting rods of the Studebaker and Essex. He will lay aside his production stories for a week in order to take up inspection.

Basset's fifteenth article on "Modern Production Methods," dealing with accounting for supplies, is scheduled for the next issue.

EDITORIALS

Watch the Quality More Closely

WE HEARD much of a letting down on quality of machine work during the war. Many shops bought machines knowing they would practically have to rebuild them before they were accurate enough to use. But there seemed to be no other way to get machines at that time.

The lack of quality, the variation from standards, was not however confined to machines. It extended to such supplies as machine screws, ball bearings, strip brass and cold-drawn stock. Unfortunately, a lot of this material is still on the market or else the carelessness as to accuracy continues.

Users of small machine screws complain bitterly of the time lost in securing screws which can be used. Standard sizes are not easy to find in stock and, when found, are so inaccurate as to be almost useless. As a concrete example, machine screws supposedly No. 2 with an outside diameter of 0.086 in. are difficult to obtain with usable accuracy. They vary as much as 0.020 in., in some cases being so small as to drop into a hole tapped with a full thread.

Strip brass, which could formerly be obtained within limits of a thousandth or less, now varies by many times this amount. The same is said of other supplies, including ball bearings and races in small sizes.

Such inaccuracies greatly increase the cost of production of the machines using them, and one of our great problems at present is to reduce the cost of manufactured products. We must get back to a sane, commercial accuracy of product if we are to maintain our place in machine manufacturing. Nothing will more quickly undermine our leadership than inaccurate and unreliable machine parts and products.

Be a Leader in Better Buying

THERE has been much bemoaning of our fate at not having a strong business Moses to lead us out of the wilderness of depression and of uncertainty. But it may easily be better for us if the emergency develops leadership, even in a lesser degree, in many. The "man on horseback" is no more desirable in business than in government.

Leadership of the autocratic variety has had its day in industry. It was in too many cases a "drivership" instead. Real leadership, which leads men to better things, which secures confidence and co-operation, will also secure production which has never been dreamed of.

Every locality has a few men to whom the rest look for leadership and suggestion. Now is the time for these men to utilize their leadership by starting a buying movement. Not indiscriminately, but in a truly thrifty manner by encouraging those whose products are properly priced. They should particularly favor those who refrained from boosting prices excessively when their products were in great demand.

Business thrift does not consist of hoarding, of refraining from buying. Thrift is rather the art of buying judiciously, of helping to keep business moving in order that our own business may keep moving along with the rest. Unless we buy the machinery and supplies we need, how can we expect others to buy of us?

Judicious buying is true business thrift—hoarding delays the return to normal buying and may bring disaster.

Automobile Design, Care and Repair

THE advent of the automobile has probably done more to spread a general knowledge of mechanics than anything which has been done in the way of educational work. There is a fascination about a self-propelled vehicle which attracts the average man and boy. Many a well-to-do business man who wouldn't think of looking at a lawn mower or a sewing machine, doesn't mind crawling under a car and studying its anatomy at close range. A drop of oil in his eye once in a while adds zest to the game.

In view of this state of mind of the average car owner, and also of the fact that the majority of owners must look after their own cars, it is up to the designer of automobiles to make vital parts more accessible and easier to repair or replace. The use of pressure and vacuum feed has made it possible to raise carburetors high on the motor so as to be more accessible. But there are still many places hard to get at, especially the oil pan or lower crankcase, the transmission, the differential and the brake adjustment, in too many cases. Oil cups and grease cups are too inaccessible in many cars, which means that they do not receive proper attention.

Square-ended pins in brake rigging which go into place nicely when you are working at the chassis from the top with no body in the way, are legitimate causes of profanity when you try to put them in place lying on your back in a dusty road. Square-ended cotter pins can also be about as mulish and contrary as any piece of machinery. Beveled or rounded ends in both cases would make it much easier all around, no matter where the work is being done.

Theoretically it may be all right to say that no owner should repair his own car, and that service stations have facilities for handling all repairs. In reality, however, many owners not only must do their own repair work but enjoy doing it. If they are mechanics they often feel that the work is more satisfactory when they do it themselves. Most of us, in fact, have been sadly and frequently disappointed in garage and service-station work.

Whether the work is done in one place or the other, however, the time required and consequently the cost to the owner, depends much upon the accessibility of the various parts. And as cost of operation plays a big part on the desirability of any car, this is a point well worth careful consideration by all builders. Simple design, substantial construction and "get-at-ability" are three points to be carefully watched by both builders and buyers.

SHOP EQUIPMENT NEWS

SHOP EQUIPMENT NEWS
A weekly review of modern designs and equipment.

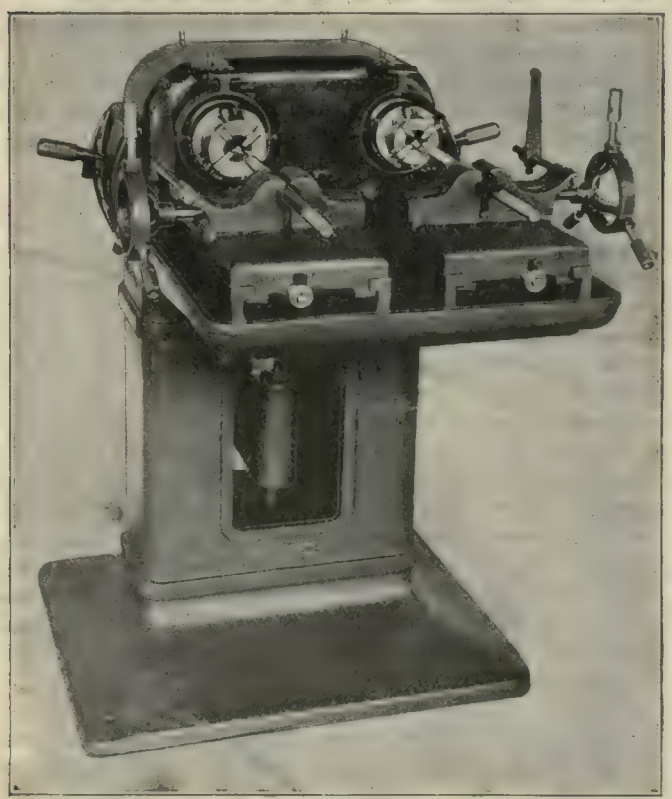
Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

CONDENSED CLIPPING INDEX
A continuous record of modern designs and equipment.

Geometric Two-Spindle Threading Machine

The Geometric Tool Co., New Haven, Conn., has placed on the market a two-spindle threading machine. It is stated that a number of threading combinations are possible with the machine. Both spindles may be fitted with die heads for external threading, or may be fitted with taps for internal threading. Or, one spindle may carry a die head and the other may carry a tap. It is recommended, for tapping sizes smaller than is practicable with a collapsing tap, that the machine be fitted with a ball-drive reversing tap holder.

The bed of the machine carries two spindles, which are mounted in large bronze bearings. The spindles are driven by a single pulley, located at the rear of the machine, but may be operated and controlled independently, by means of the change gear levers at either side of the machine. The speeds are indexed according to the size of work being handled, but may be varied.



GEOMETRIC ¾-IN. DOUBLE-SPINDLE THREADING MACHINE

Specifications: Greatest length that can be cut at one setting, 8½ in.; by resetting, 14 in. Countershaft speed, 373 r.p.m. Change speed lever can be set at ¼, ⅜, ½, ⅝ and ¾ in., the spindle speeds being, respectively, 225, 150, 113, 90 and 75 r.p.m. Size of countershaft pulleys, 12x4 in. Net weight of countershaft, 140 lb. Floor space, 31x45 in. Net weight, 820 lb.

Each carriage is fitted with a two-jawed chuck operated by a handwheel. Special bushings or holders can be furnished to suit various classes of work. An adjustable swinging gage on the side of the carriage provides an accurate means of setting the work for a predetermined length of thread. The adjustable stop on the trip rod ahead of the carriage governs the opening of the die head, and the adjustable stop back of the carriage controls the closing of the die head.

A single geared pump, driven from the main shaft by means of bevel gears and a flexible shaft, forces oil from the reservoir through the spindle and die head against the work. When a tap is being used, the oil is fed through pipes located on the outside of the machine. The lubricating system may be easily removed for cleaning or inspection.

When the machine is desired for general threading and tapping purposes it is fitted with a self-opening die head, collapsing tap and a ball-drive reversing tap holder. It is stated that it is possible to have a tapping range from ⅛ to 3 in. in diameter inclusive, where the pitch of the thread is fine. The machine will cut U. S. Standard thread diameters up to ¾ in.

Changes in Cone Four-Spindle Automatic Screw Machine

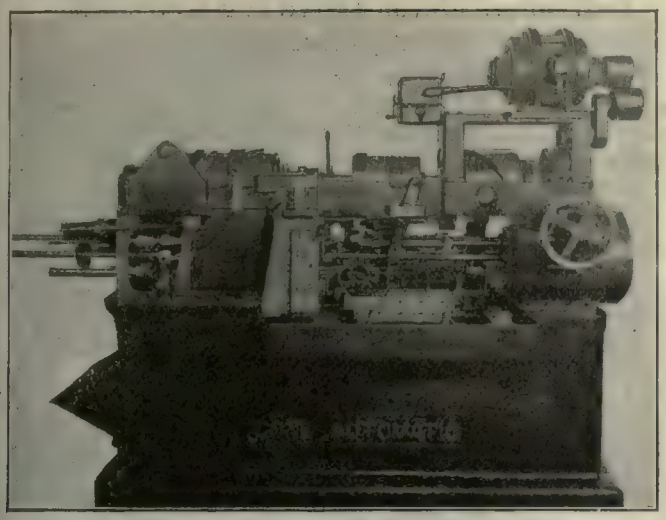
Changes in the design of the multiple-spindle automatic screw machine built by the Cone Automatic Machine Co., Windsor, Vt., have altered the appearance of the machine to a considerable extent, strengthened its working parts, and added convenience to its operation.

The principle of the Cone automatic, previously described on page 741, Vol. 47, and on page 817, Vol. 50, of the *American Machinist*, is retained in the present design.

The camshaft, from which all the movements are derived, is located at the top of the machine, where the cams can be kept free from oil and chips and are at all times conveniently under the observation of the operator.

The frame carrying the camshaft rests upon uprights that are a part of the lower or main frame of the machine and that carry the spindle turret and driving mechanism. The upper frame furnishes the support for two auxiliary spindles, while two other spindles are carried upon the turning toolslides, making four auxiliary spindles, by means of which operations of centering, drilling, inside or outside threading, counterboring, reaming, etc., may be performed.

The auxiliary spindles are independently driven through change gears that provide for various speeds, and by means of an idler gear any spindle may be run in



REDESIGNED CONE FOUR-SPINDLE AUTOMATIC SCREW-MACHINE

the reverse direction, either slower than the main spindle for die threading of large diameters, or faster than the main spindle for left-hand threading. The main spindles are of hardened and ground steel and run in bronze bearings, also ground. Spindle speeds range from 254 to 831 r.p.m. All spindles are interchangeable with those of the older type of machine. All auxiliary shafts run in roller bearings.

The turning tools are supported by slides that have bearings directly upon the bed of the machine and travel in a direction parallel to the work. Thus the tools are at all times supported directly under the cut, and there is no overhang to induce chatter or vibration.

The forming toolslides are of box-section with the outer face open, making for accessibility and ease of manipulation of the tools. The slides are unusually wide, thus providing widely separated bearing surfaces; but, being tilted up on edge, they take up little room. A tapered gib upon the upper bearing surface provides means of compensating for wear.

The base is of box section, underlying the whole machine, and has two clean-outs, one in the end and one in the rear, so that chips may be removed at any time without interfering with the operation of the machine. One end of the bed is partitioned off to provide a reservoir for oil or cutting compound, and the communicating channels are screened to keep the reservoir free from chips and sediment.

The machine has, as before, a single-speed drive, all changes of spindle speed being provided for by means of change gearing. It may be driven from a line shaft without the interposition of a countershaft, or furnished with individual-motor drive, as desired. When so equipped, the motor is mounted upon a special bracket directly above the camshaft at the right-hand end of the machine, the control box being located above and in front of the operating position, so that it may be quickly and conveniently reached by the operator. An adjustable idler keeps the belt at driving tension.

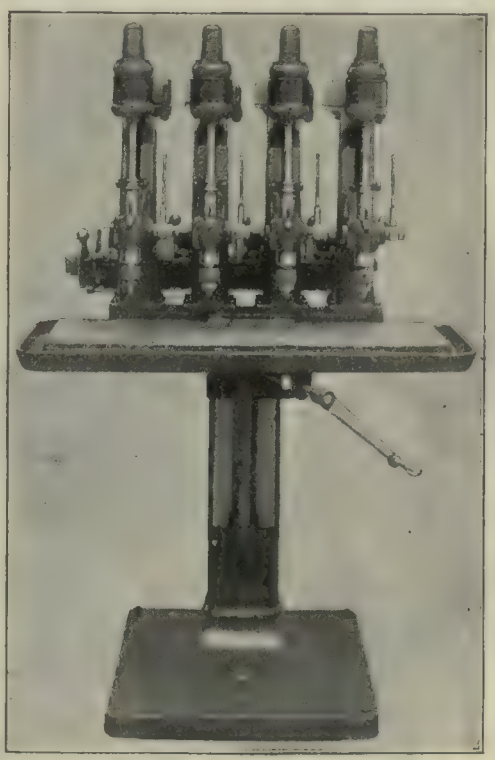
The cams, gears, and belts are all well guarded, the guards being removed in the illustration so as to show the working parts of the machine to better advantage. The machine is built in three sizes, the one shown in the illustration handling bars up to 1½ in. in diameter and producing pieces 6 in. long. It occupies a floor space of about 6 by 8½ ft. and its shipping weight is 8,000 lb.

"Pecorp" High-Speed Sensitive Drilling Machines

The Providence Engineering Corporation, sales office at 5 Nassau St., New York, N. Y., and plant at Providence, R. I., has placed on the market the high-speed sensitive drilling machine formerly made by the A. C. Mason Co., Inc., Paterson, N. J. The machine is made in both bench (Model E) and floor (Model F) types, and with either one, two, three, four, or six spindles, the illustration showing a multiple-spindle floor-type machine.

The essential characteristics of the machine are the same as explained in the description of the bench type given in the *American Machinist* on page 1030, Vol. 48. It is fully equipped with ball bearings, and the bearings and moving parts are covered, the only visible rotating parts being the driving pulley and the nose of the spindle. The drive is from the horizontal drive shaft, through gears to the vertical back shaft, and thence to the spindle through a horizontal belt, kept tight by means of a spring-loaded idler pulley.

The spindle is provided with a device for retaining the lubricating oil, a reservoir being incorporated in the sleeve, so that only occasional oiling is required. Oil which has passed through the lower bearing on the spindle is caught, when thrown outward, by the interior surface of the non-rotating sleeve, and then drops downward from the bottom of the sleeve, the object of this feature in the design being to protect the operator. Such attachments as a depth gage and an adjustment for lost motion are provided. The table is provided with a channel for catching oil and chips. The table of



"PECORP" HIGH-SPEED SENSITIVE DRILLING MACHINE, MULTIPLE-SPINDLE FLOOR TYPE

Specifications: Capacity in steel, drills $\frac{7}{16}$ in. in diameter. Drills to center of 14⅜ in., circle. Spindle: diameter, $\frac{13}{32}$ in.; travel, 6½ in.; speeds, 3,000, 4,500, 6,750 and 10,000 r.p.m. Traverse of feed rack, 2½ in. Speed of driving pulley, 1,800 r.p.m. Table, 12 x 14 in. Table to spindle, maximum: Model E, bench type, 7⅞ in.; Model F floor type, 20 in. Weight: Model E, 235 lb.; Model F, 500 lb. Multiple-head machines: distance between spindle centers, 7 in.; table size and weight increasing correspondingly for machines having 2, 3, 4 and 6 spindles.

the floor type of machine is counterbalanced, the multiple-spindle machine being provided with an elevating screw.

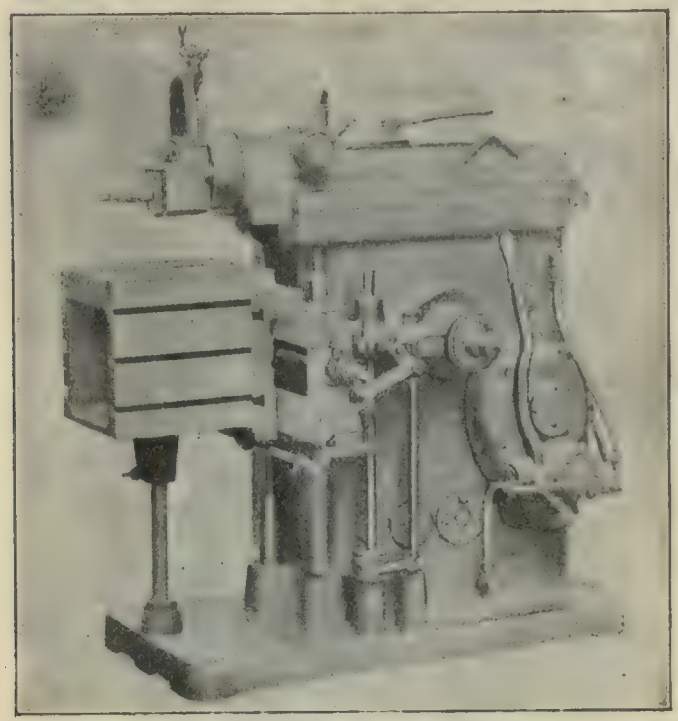
Samson Shaper

The shaper shown in the illustration is made by the Samson Works, Berlin, Germany. The following features are claimed for the machine by the maker: The gear for the link drive and its journal are not made in one piece, which necessitates the use of cast iron for both; but they are made of two parts, the journal being of steel, hardened and ground. This construction enables the gear to be fitted from above, whereby the opening in the two walls of the column, which impairs the rigidity of the machine, can be avoided. In order to relieve the journal, the gear has on the side facing the crankpin a wide tread, which is in contact with a hardened and ground cast-steel roller. In this way the pressure of the cut is effectively transmitted to the column.

The pressure of the roller against the gear can be adjusted by means of a screw.

The coupling of link and ram is not performed by a rigid joint, but is pivoted by a journal transverse to the motion of the link. The ram runs between two steel gibs. The adjustment of the feed table, ordinarily performed by the setting of the eccentric on the side of the machine, is actuated by means of the pawl. The adjustment of the telescoping connection between the eccentric or the rocker arm and pawl is avoided.

The feed during reversal of the ram is actuated by two cams fitted on the main drive gear, and is transformed into the reciprocating rotation of a vertical feed shaft by means of a completely encased train of spur and bevel gears. Forced lubrication is provided for all main parts, by means of a pump feeding a constant jet of lubricant to the main driving gear, link, rocker arm, roller and gears. The oil is collected in a trough.

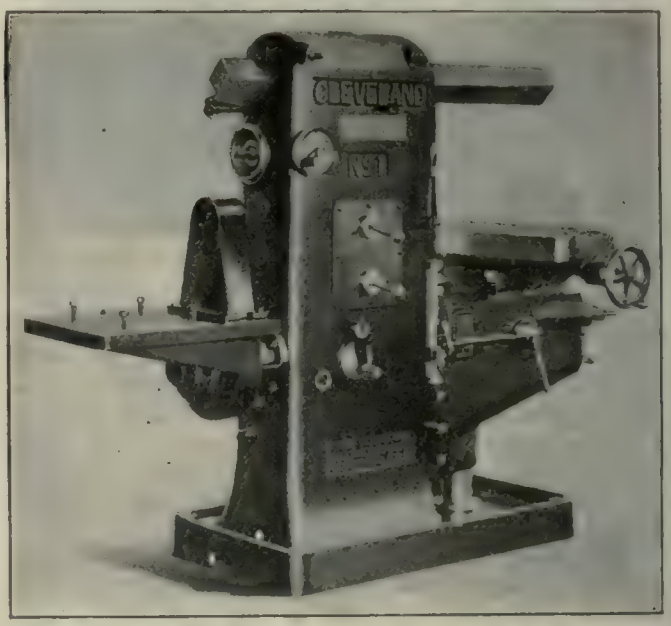


SAMSON SHAPER

Individual Motor Drive for Cleveland Milling Machines

The illustration shows the motor bracket and drive arrangement for Cleveland milling machines, recently made by the Clark-Mesker Co., 18511 Euclid Ave., Cleveland, Ohio. The bracket and drive are built in two sizes, to fit the No. 1 and No. 2 milling machines.

It is claimed that this direct-connected motor drive obtains the advantage of belt-driving by the incorporation of a friction clutch between the lower sprocket and the main drive-shaft. The grip of the clutch can be adjusted by a nut at the back of the clutch housing.



INDIVIDUAL DRIVE ARRANGEMENT FOR CLEVELAND MILLING MACHINES

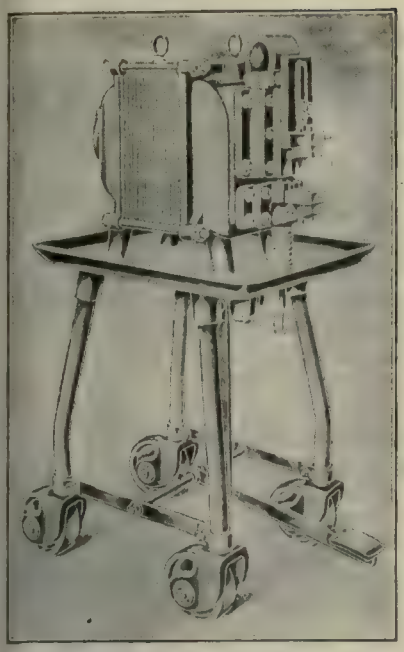
This drive can be applied to the present models of belt-driven machines by bolting the motor bracket to the column in place of the single-pulley belt-drive housing. The drive shaft sprocket and clutch are put in place of the belt pulley. The bracket is designed to support the motor high enough so that it will be free from the dirt of the floor. The sprockets and chain run in a bath of oil. A 2-in. Morse chain is used on the No. 1 machine, and a 2½-in. chain on the No. 2. The motor has a constant speed and runs at 1,200 r.p.m.

Electric Rivet-Heating Machine

The electric rivet-heating machine shown in the illustration is intended for use in the erection of steel structures, and for boiler shops, shipyards and motorcar, railroad-car and locomotive works. It is made by the Elektrische Schweissmaschinen Gesellschaft, Charlottenburg 4, Germany.

The transformer is placed on a cast-iron table resting on legs equipped with rollers. In the front of the transformer are the electrodes. The regulating switch has six steps and is encased and mounted in the rear. The switching on and off of the current, and the movement of the electrodes for feeding and removing the rivets is actuated by the treadle.

The machine is fed by a weak medium-tension alternating current, which is converted into a very strong low-tension current by the transformer of the apparatus. This latter current passes through the rivet, which is



ELECTRIC RIVET-HEATING MACHINE

put between the electrodes and is heated in a few seconds. The temperature is regulated to the desired degree by a step-switch. By using electrodes of a special kind it is possible to heat only part of the rivet, the shank or part of it, if this be desired. The maker claims great economy for the heater, because the transformer has an efficiency of 90 per cent, the heat generated is concentrated almost exclusively on the rivet, and the current acts only during the few seconds required for heating the rivet and is then automatically switched off. The process is clean and, as the temperature can be regulated, burning of the rivets can be avoided.

For heating 2 doz. 4½-lb. rivets only 1 kw.-hr. is said to be required. The machine is made in two sizes, for rivets up to ¾ and 1¼ in., respectively. The smaller size of machine heats 400 rivets per hour.

Hill Boring Tool

A boring tool suitable for use in bench and other small lathes is now being made by M. B. Hill, 10 Eden St., Worcester, Mass. The toolbar is held to the shank by a swinging link that permits it to be raised and lowered, to accommodate various heights of center, without throwing it out of parallel. The link is tightened upon the stud and upon the toolbar with a single screw.

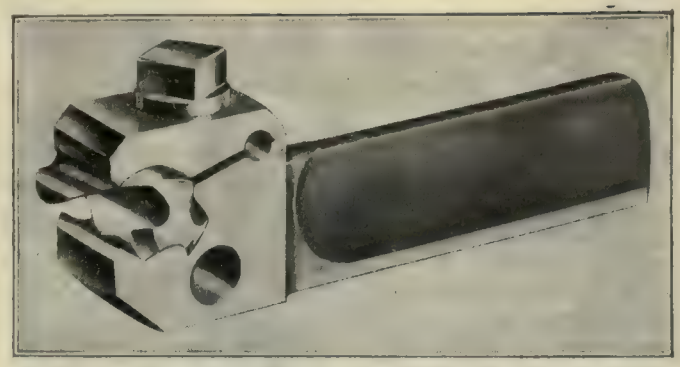


HILL LATHE BORING TOOL

Three toolbars are provided with each holder. A split bushing is furnished to adapt the holder to a smaller size of toolbar. Extra bars can be made from drill rod.

Montstream "Twisto" Tool and Holder

John H. Montstream, Hartford, Conn., has recently placed on the market the "Twisto" tool and holder shown in the illustration. The device is intended for use on lathes, planers and shapers, being adapted to general machining work. The cutting tool or bit resembles a three-lipped twist drill, it being provided with three helical grooves. The cutting is done on the ends of the bit, one edge cutting at a time. There are thus six cutting edges on the tool, it being necessary only to change the position of the bit in order to obtain a fresh cutting edge. The bits are regularly furnished in lengths of 2 in., it being stated that there are 6¾ in. of length of cutting lip available for wear on each bit. When sharpening the tool, only the ends of it are ground.



MONTSTREAM "TWISTO" TOOL AND HOLDER

The bit is clamped in the holder in a horizontal position, a long bearing being provided in the holder, so that the bit is securely clamped. It is allowed to project only a small amount from the side of the holder, so that there is no overhang and the tool is very rigidly supported. The bit is secured in position and released by means of the screw on top of the clamp. The shank of the holder is ⅞ in. thick and 1¼ in. high. It is adapted to fit the toolpost of a standard lathe, and toolpost adapters and raising plates can be furnished.

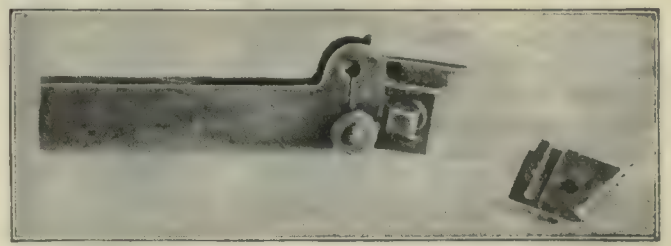
The holder is adapted for the use of disk tools. The shank of the tool passes through the hole used for the "Twisto" tool, and a strap passed through the lower hole in the holder serves to steady the edge of the disk. Disk-type threading tools can be furnished in any form desired, thus making the device adaptable to a very wide range of work. It is stated that the heavy construction of the tool and the absence of large overhang make the tool very steady.

Hill Threading Tool

A threading tool and holder that may be used either as a spring or as a rigid tool is shown in the accompanying cut. It is made by M. B. Hill, 10 Eden St., Worcester, Mass. The shank is pack-hardened. The cutting blades are interchangeable.

An adjusting screw passes vertically through the shank behind the blade, the back of the latter being hobbed to match the thread of the screw, so that vertical adjustment is obtained by loosening the clamping bolt and turning the adjusting screw.

A tapered bolt, which can be drawn up by a knurled thumbnut, fits a correspondingly tapered hole that passes transversely through the shank, and to convert the device from a spring to a rigid tool requires only that the thumbnut be tightened.



HILL THREADING TOOL

Lewis-Shepard Self-Loading Warehouse Truck

The Lewis-Shepard Co., 568 E. First St., Boston 27, Mass., recently placed on the market a self-loading warehouse truck. The truck is made in two sizes. The capacity of Model A is up to 800 lb. and that of Model B 1,200 lb. The truck is of all metal construction, and is equipped with Hyatt roller bearings. It can be handled by one man. Two side bars control the balance of the load. The hook is adjustable in two directions and may be placed in ten positions vertically and twenty-eight horizontally. It has no interfering projection back of the truck. It is stated that the handles are of such shape that the truck can be easily controlled.



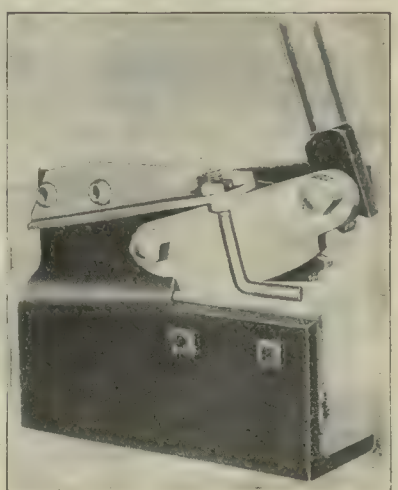
LEWIS-SHEPARD SELF-LOADING WAREHOUSE TRUCK

Specifications: Model A. Capacity, 800 lb. Extreme width, 23 in. Overall length, 57 in. Wheels, 8 x 2¼ in. Hyatt roller bearings, 1 x 2 in. Weight, 72 lb. Model B. Capacity, 1,200 lb. Extreme width, 23 in. Overall length, 63 in. Wheels, 8 x 2¼ in. Hyatt roller bearings, 1 x 2 in. Weight, 76 lb.

Chicago Steel Slitting Shear

The Dries & Krump Manufacturing Co., 2917 South Halsted St., Chicago, Ill., has recently placed on the market a bench shear, shown in the illustration, and known as the Chicago steel slitting shear. It is intended for use in machine shops, tin and sheet-metal shops, garages and factories. It will cut steel bars up to ⅛ x 2 in. and will slit steel sheets up to No. 10 gage.

The shear weighs 22 lb., this light weight being made possible by an all-steel construction. The frame is pressed from a steel section and is offset in order to allow sheets of any length to be slit. An adjustable hold-down is provided to keep the material from bending up while being cut. The leverage is obtained by means of a geared lever, the teeth of which mesh with those on the frame. The frame is 9 in. long and 6 in. high. The upper blade is 6¾ in. long x ⅜ in thick, and the lower blade is 4½ in. long x ⅛ in. thick. The blades are made of crucible steel. The handle is made of pipe and is shrunk onto the casting forming the gear. The shears are made with interchangeable parts.

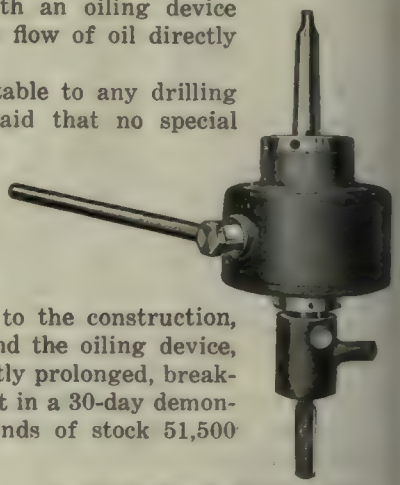


CHICAGO STEEL SLITTING SHEAR

John Reversing Tapping Chuck

The John Chuck Co., Milwaukee, Wis., has recently placed on the market a reversing tapping chuck of the type shown in the illustration. The chuck drives the tap by means of a device driving equally on each side of the tap shank. It is equipped with a five-point, positive, sensitive clutch. It is stated that the clutch is capable of disengaging within a limit of 0.001 in. when the tap reaches the predetermined depth. It has a balanced drive concentric with the spindle, reversing with a two-to-one speed ratio. The gears all run in oil. The chuck is provided with an oiling device which gives a copious flow of oil directly on the tap and work.

The device is adaptable to any drilling machine, and it is said that no special counterweight is required on the drilling machine spindle, because the chuck, having an aluminum body, is so light. It is stated that, owing to the construction, the sensitive clutch and the oiling device, the life of taps is greatly prolonged, breakage is reduced and that in a 30-day demonstration run on all kinds of stock 51,500 holes were tapped without any tap breakage. Three sets of standard tap drivers and retainers are furnished with each chuck as regular equipment. Special drivers and retainers will be made up to suit specifications, so that the device can be adapted to special work.



JOHN REVERSING TAPPING CHUCK

Specifications: Made in three sizes: No. 1, 0 to ⅜ in.; No. 2, 0 to ⅝ in.; No. 3, ⅛ to 1 in. Equipped with Morse taper shanks. Aluminum body. All wearing parts hardened alloy steel.

Hill Lathe Test Indicator

The test indicator shown in the accompanying illustration is being marketed by M. B. Hill, 10 Eden St., Worcester. Mass.

It is attached to the shank by a universal joint, so that when in the lathe it may be turned to any angle. Two sensitive points are provided, one of which may be removed by unscrewing the sleeve without interfering with the action of the other. A rabbetted slide covers the amplification movement, allowing easy access for repair or readjustment. A similar device, not attached to a shank, is made for general use.



HILL LATHE TEST INDICATOR

Exporting Time Sheets to Bring Back Payrolls

Shall We Import Goods, Gold or Securities?—Long-Term Credits Are Necessary in Our Export Trade—Real Headway Is Expected of the Foreign Trade Financing Corporation

THE solution of American labor's greatest problem—unemployment—is the exporting of American time sheets to bring back American payrolls. The products of American workmanship under our present credit system can go only part of the way in reaching the foreign buyer. To reach the foreign buyer, to keep American goods flowing, American industries running, and to bring back work for the four million pairs of American idle hands, there must be provided, at once, adequate machinery for granting long-term credits in our export trade. Until these long-term credits are available American cargoes will be halted in mid-ocean, caravans loaded with American goods will be stopped in the middle of their journeys, and a great barrier will remain in place in all parts of the world, checking the flow of American time sheets for the solution of filling American payrolls.

To Finance Foreign Trade Balance

These are the views of George Ed. Smith, president of the Royal Typewriter Co., a member of the organization committee of the Foreign Trade Financing Corporation, the largest of the corporations formed under the amendment to the Federal reserve act, known as the "Edge law," which permits the formation of banking institutions for financing the exports of American goods over such periods of time as will enable the rest of the world to do business with this country.

"For more than two years," says Mr. Smith, "the business men of the country watched and waited while the time approached for providing some means for preventing the complete disruption of our export trade. Since the armistice a $4,000,000,000 trade balance has piled up, and now a further balance finds difficulty in being financed. The National Chamber of Commerce, the National Foreign Trade Council, the National Association of Manufacturers, all agreed long ago that something should be done to solve this great problem. The opportunity came when Congress passed the "Edge act," and when a Committee of the American Bankers Association formed the plans for the Foreign Trade Financing Corporation, which by its very size and its nationally representative character is expected to make real headway in remedying the chief obstacle now in the path of American exporters.

Long-Term Credits Needed

"Foreign buyers need American goods more than ever; American manufacturers, business men and farmers need more than ever to supply what the farmer wants. They have the demand. We have the goods. By supplying that demand we could get rid of that great surplus, could keep busy six days a week instead of four, and could pave the way toward a new position for the United States in the international commerce of the world.

"Why can't this be done now?

"Because the commercial banks of the United States cannot go on extending long-term loans, and further because the American dollar is at such a high premium in foreign countries that foreign buyers cannot afford to do business with us on the short-term basis customary in this country. In granting short-term credits the limit has about been reached. It is only by giving the foreign buyer more time in which to pay for his goods that we can compete successfully with the rest of the world and sell our surplus products abroad.

"Now what is the reason for this four-billion-dollar trade balance, and why is it threatening to put us out of business with the rest of the world?

One-Sided Purchasing by Foreign Buyers

"Foreign buyers since the armistice piled up this four-billion-dollar trade balance as a result of purchases which would ordinarily have been stretched out over a period of years. Normally they would have purchased what they needed, and the balance of trade kept practically level, although it was turning in our favor; but instead of taking a sufficient amount of time so that demand would balance demand, or so that we would absorb direct securities from the other side, as England and France did in the past, this balance piled up through immense one-sided purchasing on the part of foreign buyers in a short time.

"Such a thing would not have happened if this balance of trade had gradually grown in our favor rather than to be dumped upon us. We would have had a gradual balance of trade to even up, and as it was gradual we would have absorbed securities as the natural way to balance up that trade. It was not possible to educate the people of this country as to the advantage of absorbing foreign securities direct, since they had been a debtor people so long that they do not know what to do as a creditor.

To Absorb Foreign Securities

"Therefore there had to be a medium through which to absorb these securities, first investigating their worth, and then pooling them and issuing debentures based on them to the people. It has been felt that the big jump in the balance of trade, with its consequent disruption of exchange, would undoubtedly not have come if securities had been absorbed to correct it. Therefore let us consider a proposition which will absorb these securities in sufficient volume to have some effect on the balance of trade. This is the reason for the immense size of the corporation.

"Let us see whether we want securities or not. In the first place, if we do not get securities in payment for goods we have sent abroad we are going to get other goods. Do we want a tremendous amount of imported goods dumped in on us? We want raw materials that we do not produce. We want many things, such as coffee, rubber, sugar, etc., cheaper, so that we will get more of the good things of the world that we do not produce for less of our individual effort. We want imports of certain goods, but we do not want four billion dollars' worth of manufactured goods dumped into the country when we are now able to produce more of manufactured goods than we can consume. Wouldn't it be better to absorb good securities and have foreign people pay us interest? In the last analysis, we must

import goods, gold or securities to settle our trade balance. We do not want the goods—we have taken all the gold foreign people can spare—and now we stand up against a wall because we cannot absorb securities. For the present we have taken more than enough from Europe that is movable. We do not want any more. We must become, as we would have become under normal conditions—a rich investing nation, as every other great exporting nation in the past has always become.

Biggest Problem in History

"The question then is whether this country will back up its export trade. It is not a question of whether the Foreign Trade Financing Corporation itself will succeed or will not succeed. The question is whether we can get behind the proposition and by group thinking and concerted action solve one of the biggest problems that has ever confronted our country. Put in another way, the question is whether we have to depend upon a crisis to show the country that it ought to have done what the brains of the country are now telling us we ought to know.

"The problem is one which it will take an immense institution to handle. We will say now that we want to solve one particular problem, and I will lay it in front of you concretely.

Put Our Dollars to Work

"There is in Australia today a market for American automobiles. We are not shipping them. Why? Because there is not a dollar market in Australia at this moment, and for that reason many of our men in Detroit are not working, and we are not producing the automobiles. We must create a dollar market in Australia in order to sell our goods there and keep our men working. How are we going to do it? By long-term credits. Is it right that we should have unemployed workmen in the country when we can by right action revive our market abroad? This is not being done out of charity of our hearts to help people who cannot help themselves. It is not an effort to make the League of Nations work. It is to develop the market for American products outside the United States. Why not take our dollars, put them to work, go on paying our workmen and keep up the prosperity of the country?

We Must Have Foreign Outlet

"We manufacture a tremendous amount of goods in America beyond the amount that is needed for home consumption. Naturally we cannot sell them in America. We need outside markets to dispose of them. When we cannot do this there is unemployment for the men who manufactured these goods. When all is said and done, when we export we export labor. Labor is the biggest part of all goods we export. Take the automobile. The manufacturer of this article does not make 10 per cent profit on his turnover. If he did he would be many times a millionaire. No, he makes nearer 5 per cent. Fifteen per cent of his cost goes to buying raw materials. The remainder goes into labor. In the end more than 75 per cent of his cost goes to the workman. What, therefore, we are trying to do is to take the time sheets out of the factories of America, export them, and bring back payrolls for our American workmen.

"When you finance foreign trade you only finance the time of our American workmen a bit further to its ultimate consumer.

"Let us take the automobile again. Suppose that you grant three months' credit. Where will that three months take the automobile? Make it simple. Probably to the top of the Andes Mountains, or half way across the Pacific Ocean. In three months the automobile has not reached the ultimate consumer. You haven't got it far enough toward the payroll for your workmen's time sheets.

"Some time ago we as manufacturers sat back and said to the parties in the other countries 'Come to our factory and get the automobiles, and pay us cash.' The farmer said 'Come and get my corn from the farm or the local elevator, and pay cash.' When our exports began to decline our producers relented a bit and financed their goods to the port of shipment, letting the buyer take and pay for them there. Now our exports have shrunken so far, and our available financial machinery has become clogged so much, that we cannot carry the goods any further along to the ultimate consumer. It is impossible for the foreign buyer to take goods on the terms made available by our commercial banks, and therefore we cannot sell the goods.

The People's Problem

"The explanation is very simple. We haven't the machinery to carry our work to its ultimate consumer. We used to say to the buyers 'you come and take our goods and use your own money to finance them.' Now that we can no longer do this we must either stop selling or find some way to carry our goods further along to the people who use them and consume them.

"This is not the bankers' problem alone. It is the people's problem. It requires *group* thinking, *group* action.

"Look at the people of Great Britain. They eat, sleep, work and live in export trade. There are forty million people thinking of export trade. Look at what they have done in export trade. Then wouldn't we rather have forty million people solidly back of the proposition to finance our exports than a hundred million people uninterested and unconcerned? This same thing is true of France and Germany.

Organization the First Step

"I think that having a hundred million people, all wearing the same hats, the same clothes, the same ties, the same shoes, all eating the same things, is a tremendous advantage for any nation. It gives a standardized market for the products of the country. That gives us a great advantage in going out and selling these standardized goods in the world's markets. But this great body of one hundred million people is unorganized, and you know that an unorganized majority in many cases will not do what an organized minority could.

Education Next

"The answer is this: We must educate the people. We must bring about group thinking, making the people realize that what we are doing is putting machinery in operation which will back their payroll. We must make them understand that it is their problem. If all of us sit aside and wait for somebody else to act, the task will never be done.

"I am thoroughly convinced that what we need in this country is to think together, work together, act together, in a real spirit, and then the financing of our foreign trade will go over and be one of the greatest propositions of the world."



NEWS SECTION

The National Machine Tool Builders Meeting at Cleveland

A special mid-winter meeting of the National Machine Tool Builders Association was held at Hotel Cleveland, Cleveland, Ohio, Feb. 24, 25 and 26. It was remarkably well attended, especially in consideration of the comparatively short notice which could be given, all sections of the country being well represented.

As with the regional meetings which have been held in various machine tool centers, much of the time was devoted to the question of costs. Scovell, Wellington & Co. presented a report which was approved by the association. This report outlines a plan for standard methods of cost accounting which includes a number of items too often overlooked. It points out the necessity of considering all factors which go to make up costs, such as interest on invested capital; rent on buildings, whether you own them or not; charging off the cost of drawings, patterns, jigs, fixtures; the cost of idleness; normal burden and unearned burden, and many other points which must be considered if we are to know total costs.

The factors which enter into making a correct analysis of costs so as to fix a proper and profitable selling price include not only manufacturing costs such as previously mentioned but selling and administration costs, taxes and profits. These must be taken care of if we are to have prices which will be high enough to make a safe business and yet not so high as to induce competition.

Fred A. Geier, president of the Cincinnati Milling Machine Company, spoke on proper financing for a machine tool business. He gave interesting statistics which showed by figures compiled from 70 strong companies for the ten years prior to 1913, that the net returns averaged 9 per cent on the invested capital. While no exact figures are available on the business since that period, careful estimates seem to show 10½ per cent as the net returns, including war profits and also the deduction of taxes.

J. B. Doan, president of the American Tool Works, spoke on the general business situation paying especial attention to the possibilities of demand and the necessity of keeping our eyes open to real business conditions. The importance of proper financing was pointed out as well as the danger of not appreciating the entire situation. The danger of deceiving yourself as to true conditions is one which should be carefully guarded against.

E. J. Kearney, president of the Kearney & Trecker Company, discussed the subject of running a machine shop in time of depression. He also pointed out the necessity of proper financing and recommended the use of the budget system for keeping track of expenses as well as for keeping them within bounds. He showed a form of budget to take care of the conditions found in a machine tool shop which helped to maintain business on a sane basis under unusual conditions.

Ernest F. DuBrul, general manager of the Association, pointed out the necessity for an understanding of economics as a basis for sound business management in any line. He has outlined a program for the association which will give it a mass of valuable information along many lines, data which will give a more stable basis for future calculations both as to probable markets and proper prices.

These proposed activities may be grouped under three general heads, Technical, Marketing, and Standardization and Research. They include statistics of costs, production, shipments, financial standards and finances in general. It is not the intention of the association to undertake such technical work as can best be handled by the American Society of Mechanical Engineers, but rather to co-operate with them and other technical societies along lines which are of interest and value.

On the evening of February 24, the members gave a testimonial dinner to George E. Merryweather as an appreciation of his work as Chief of the Machine Tool Division of the War Industries Board in Washington during the war. Details of this will be given in a later issue.

It is expected that the usual Spring meeting will be held in Atlantic City at about the usual time.

Locomotive Export Association Reports Big Sales to Europe

Successful operation during the past year, under the Webb-Pomerene Act, is reported by the Locomotive Export Association, New York City, which has filed its annual report with the Federal Trade Commission.

Large foreign orders were secured in Belgium and Roumania, and executed at the American plants which are members of the association.

Before the war, Great Britain and Germany controlled the European locomotive market. But in recent years the United States has been the only country prepared to ship locomotives.

Total exports of steam locomotives from the United States in the year 1920, numbered 1,711, valued at $53,629,847, showing an increase over the exports in 1919, which were 959, valued at $30,275,728.

Importation of Machine Tools Increases

There were greatly increased imports of machine tools in 1920 as compared with 1919, as is shown by the statistics just compiled by the Bureau of Foreign and Domestic Commerce. During 1920 11,517 machine tools passed through American custom houses. On these machine tools duty was paid at the rate of 15 per cent *ad valorem*. The value of the imports in 1920 was declared to be $447,104. This is by far the largest importations ever made in a single year.

In 1919 the value of machine tools imported was only $139,619. In view of the revision of the tariff which will be made in the near future, it may be of interest to list the value of machine-tool imports during various years. In 1910 when the duty was 30 per cent *ad valorem*, the vlaue of the imports was $177,002; in 1911, $191,082; in 1912, $154,786; in 1913, $281,326. In 1914 the duty was reduced to 15 per cent. This resulted in a considerable increase in imports which in 1914 totaled $306,096, which was the record year until 1920. Since 1914 the 15 per cent duty has remained in effect. In 1915 the value of the imports was $100,596; in 1916, $132,680; in 1917, $119,408; in 1918, $274,756.

Business Conditions as the Big Banks of the Country See Them

The First National Bank of Boston Senses a More Cheerful Attitude in New England

A more cheerful attitude toward business is apparent in New England as elsewhere in the country. This feeling of greater confidence in the trade situation is based on several favorable developments during the past thirty days, although the actual, tangible improvement has been very slight. In the first place, the money condition is gradually but steadily clearing, as evidenced by a continuous rise in the Federal Reserve percentage from around 42 to 49.3. So-called easy money, freely predicted to appear about this time, has not yet materialized. Two leading reasons account for this. Surplus money is being drawn on for investment in securities in large quantities—about $200,000,000 so far this year—and much of this is destined for permanent improvements. More important, however, is the very slow liquidation in business loans which were made when commodity prices were high and which are being slowly whittled down as inventories are reduced on the present comparatively low scale of prices. Stated differently, bank deposits which reflect current operations of business have been falling in harmony with lower prices of goods fully as fast as it has been possible to reduce outstanding loans during the present period of slack business. The strain on the banks therefore remains undiminished and money rates continue firm.

Although the time element has been quite generally underestimated, the tendency is in the right direction, although easy money seems still months away. Another feature, negative in character, is the January record of failures in this country and abroad. While fears of a disastrous panic had practically vanished last year-end, many fully expected a huge crop of failures, including important houses. Persistent rumors were circulated concerning the solvency of well-known companies—the more important the company, usually, the more persistent the rumors. This atmosphere has been dispelled. As a matter of fact, January failures were greater in number but less in liabilities than December, the heaviest month since June, 1914. The outstanding basic development of the past few weeks has been an improvement in the movement of raw materials to market, including grain, live stock, cotton and wool, and a freer exchange of manufactured goods, which has resulted in a considerable increase in business activity. That profits are very unsatisfactory is secondary; the prime thing is to move goods, and that fact is the foundation of the more optimistic feeling now prevailing. Deflation is proceeding steadily, prices generally receding and now reaching practically every item on the list. The process has, in recent days, affected the great steel industry, the independents having reduced prices below the corporation's level and made a start in wage reductions. The dominant factor making for a slow recovery in business is the unbalanced status in the process of deflation, with some commodities being quoted below prewar and production costs, while others have been as yet affected slightly, if at all.

When the various commodities approach their normal exchange value as compared with other commodities, a quickening in business can be confidently expected. Meanwhile revivals in those industries which have been thoroughly liquidated are taking place and account for the increase in activity in this section. New England was first to feel the shock of deflation; similarly, improvement in business has first appeared in this manufacturing community.

Our Foreign Trade in 1920

Though the foreign trade of the United States reached record heights for 1920, there is a general conviction among exporters and importers that the figures for the year, and more particularly for the month of December, fall far short of reflecting the present condition of the country's foreign trade, according to the Guaranty Trust Co.'s semi-monthly international trade survey, "American Goods and Foreign Markets." Regardless of what circumstances may have contributed to maintain the large volume of exports, the bank says, it remains obvious that a sound trade cannot continue indefinitely on the short-term credit basis which has characterized our foreign business during the last year.

The survey analyzes last year's trade, in part, as follows: The 1920 figures demonstrate, of course, that our customers overseas are in such immediate need of our goods that obstacles of prices and exchange conditions have somehow been, to a large degree, surmounted. But, what is of more vital significance, they further demonstrate the need of American producers and manufacturers for markets for their goods. Business under last year's conditions, however large in volume, cannot be permanently maintained.

December has added more than $400,000,000 to the already vast favorable trade balance of the United States, and coming months will witness further additions to the amount due us from the rest of the world, although cable reports just received from Department of Commerce representatives throughout the world indicate some improvement in general economic conditions since the first of the year, which may have a salutary effect on our trade with certain countries. In Great Britain progress in deflation is seen, speculation is decreasing, bank loans are increasing, and there are predictions of further rise in sterling and a lower rate on silver. Also, American money is reported to be flowing into England for investment. Some general improvement is also reported in Belgium and the Scandinavian countries, but in other parts of the world the department representatives report conditions essentially unchanged.

Analysis of the 1920 foreign trade figures shows that commerce with Europe, our oldest and best customer, has fallen off seriously in the last year, though our total foreign trade increased as a result of greater business with Canada, Mexico, South America and Asia. Exports to Europe fell from $5,185,980,000 in 1919 to $4,466,655,000 in 1920, while imports in the same years increased from $750,569,000 to $1,227,842,000. A four-fold increase in our trade with Germany is significant in considering the general European decline in trade.

American exports to the four principal South American countries increased more than $100,000,000 as compared with 1919, while imports showed an increase of only about $25,000,000. Trade with Cuba exceeded $1,200,000,000 in value in 1920, an increase of nearly a half billion dollars over 1919. Exports to Mexico increased about $75,000,000, while imports rose from $32,000,000 to more than $180,000,000. The value of our trade with China increased about $80,000,000 in 1920, divided almost equally between imports and exports. Trade with Japan, however, increased only about $16,000,000, of which $11,000,000 comprised exports to that country.

The currents of this country's commerce during 1920, and the enormous total value of our goods shipped to new markets, despite exchange drawbacks and lack of credit, serve as evidence of the almost unlimited opportunity for the expansion of foreign trade on a firm and permanent financial basis.

But the American people must thoroughly understand that the extent of this expansion, as well as the rehabilitation of our waning European markets, will be measured by the extent to which they co-operate with institutions that are in a position to place long-term credits at the disposal of countries in constant need of our surplus products.

National Bank of Commerce in New York Says Profitable Business Is Possible on Declining Market

Business sentiment is somewhat mixed, and while in some lines there is improvement, all signs indicate a period of hand to mouth business, based upon immediate requirements for prompt delivery. Whatever opinion may have been entertained a month or two months ago, it is now clear that the process of placing business upon a level fairly comparable with that which prevailed prior to 1914 is in progress. The process will be hastened by the readjustment of those basic commodities which have as yet remained almost untouched by the movement toward lower prices. Particularly is this the case with regard to iron and steel, the necessary materials for practically every industry.

Retail prices and labor costs have not kept pace with falling commodity prices. Labor costs must be readjusted to new price levels in an orderly fashion with the greatest possible recognition of the social problems involved. Viewing the matter as a whole, further lowering of retail prices must come before the business situation can be said to be once more in stable equilibrium. Retail prices, as is usual on a falling market, have lagged behind the downward movement of wholesale prices and their adjustment has been delayed by the introduction during the past few years of a temporary speculative element into the circle of distribution. These speculative middlemen, who for the most part serve no economic purpose, have largely been eliminated by rapidly falling commodity prices, but the effect of their presence is still felt to some extent in the unduly high cost of much of the present retailers' stocks, as well as in a general lowering of the standards of commercial morality and a disregard of trade conditions.

It is difficult to conduct business at a profit in a period of sharply declining prices. Precipitous declines in commodity markets are believed to be passed, except in the case of iron and steel and a few other commodities where the full forces of readjustment have not yet been felt. Even with a continued declining tendency, normal business at a satisfactory profit is entirely possible. The enormous expansion in the United States during the thirty years following the Civil War was carried on in just such an era of gradually declining prices.

It is time to come absolutely to a realization that the period of semi-speculative business in staple lines has passed. Not only must the machinery of trade be readjusted to more normal price levels, but there must be a return to the mental attitude of the time when strict integrity and a broad and thorough knowledge of trade conditions were recognized as among the necessary assets of the well-established business.

The inability of Europe to buy will continue to be a major factor for an indefinite period. This is directly reflected in the raw material markets of every country which is dependent on the European market to any important degree and indirectly in the export markets for manufactured products of every class. It is important in connection with the European situation that the effect of the establishment of an export business on a long-time credit basis should not be misunderstood. In the face of the present shortage of capital the sale of raw materials on any other terms than cash or an exchange of commodities does not alter the immediate situation. The sole result is the substitution of one kind of obligation for another. In other words, it will require years to make up not only the actual capital destruction which resulted from the war, but also the loss in capital accumulation and the disorganization of productive activity which resulted from it. American business should frankly recognize this condition. A reasonable export business can be done with due regard to established credit standards, and business on any other basis is undesirable. There is neither formula nor legerdemain by which poor credits become good, nor means whereby large business can be done with those whose credit does not permit or warrant such transactions.

Money Rates

Government demands as well as prospective corporate and individual borrowings together with the considerable proportion of credit still unliquidated will prevent any permanent easing of rates for the present. Somewhat easier conditions should prevail until the end of February when demands for funds to make income tax payments due March 15 are likely to result in another stiffening of money rates.

Wholesale Prices

Further substantial declines in commodity prices have occurred during the period Jan. 16 to Feb. 15, including both raw materials and semi-finished products. In the cotton and grain markets, prices which appeared to have reached a position of at least temporary stabilization just after the first of the year, have suffered new declines. Steel and petroleum prices which hitherto resisted the downward movement in other markets, began during the period under review to follow the course of other commodities. The slight improvement noticeable after the first of the year in the movement of wool and hides has not been sustained and in many grades of these commodities it can scarcely be said that a market exists at any price.

Railroads

December earnings for the most part continue disappointing, a reflection of the traffic slump which resulted in a surplus of 323,376 freight cars for the week ending Jan. 29, the latest period from which data are available. This is the largest number of idle cars reported by the railroads of the United States in ten years. The passage of legislation empowering the Treasury to make partial payment to the companies of the amounts due them under the terms of the government guarantee would materially aid many of the roads and substantially benefit the general credit situation by enabling the roads to settle outstanding accounts and make new commitments for materials. The final status of the railroads, however, depends upon the adjustment of railway wages to a scale commensurate with decreases in effect in other industries.

U. S. Chamber Approves Incorporation of American-Chinese Companies

The Foreign Commerce Department of the Chamber of Commerce of the United States has made public two principles it has approved looking to the federal incorporation of American companies doing business in China, and their exemption from certain taxes that other foreign companies do not have to pay. These principles are as follows:

"American companies formed primarily for China business and operating in China should be given the privilege of federal incorporation in order that they may have a standing as American companies, under a single set of legal requirements and regulations, which it has been difficult for them to get and maintain when operating under the laws of the individual States, the requirements of which vary and are not generally known in China.

"Such American-China companies, so far as taxation is concerned, should be placed on an equal footing with the companies of other competing countries."

This matter was brought to the attention of the National Chamber by American chambers of commerce in China. These chambers contend that federal incorporation is sought in order that companies made up and managed by Americans, in which more than fifty per cent of the enterprise is controlled by American capital, may operate under a single set of clearly understood requirements. For the success of a China business, it is pointed out, it is often advantageous to encourage Chinese capital to come into the corporation with American capital. In order to gain the confidence of the Chinese investor and of the Chinese business man who may enter into contractual relations with the corporation, it is regarded as most important that companies should operate under a single set of known requirements, rather than under the varying regulations of the individual states.

The question of exemption from federal and state income taxes and excess profit taxes on such corporation is of very immediate importance, these chambers of commerce and American

business men in China point out. American companies are meeting with hard competition in China, especially from British companies, for British laws have recognized the special requirements of the China situation, and have made it possible for British companies operating in China to do so without paying corporate taxes in England. American companies are at a distinct disadvantage in competition with such British companies, and apparently are at a similar disadvantage in competition with French and Japanese companies.

International Association of Machinists Urges Trade With Russia

The International Association of Machinists will exhaust every effort to carry through its plan to assist Russia in securing in this country such locomotives, tractors, machine tools, and other supplies as it is willing to pay for. E. C. Davison, the secretary of the Association of Machinists, discussed the matter at length with the Washington correspondent of the *American Machinist*. He is anxious to secure the co-operation of machinery manufacturers, machine-tool manufacturers, and others who would benefit by an increased demand.

The position of the Association of Machinists, Mr. Davison explains, is simply to act as an intermediary between the Russian groups desiring to buy machinery and the American interests that have machinery to sell. This service is to be performed without profit to the Association of Machinists, the main objective being to provide more employment for American machinists.

The Russian negotiations which the Association is conducting are only a part of the activities of the organization looking to the expansion of the foreign market for the product of machinists' work. With the cards falling throughout the world in a new deal, Mr. Davison believes that an excellent opportunity is presented to expand our foreign markets. In this movement, he says, he has the co-operation of a large number of American machinery manufacturers. He admits that some manufacturers have expressed disapproval of the Russian plan but he believes that a thorough understanding of the situation on their part would remove any doubts they may have. In this particular as well as in many others he believes that the interests of the manufacturers and the Association are parallel. He is convinced that the ability of the average American machinist is markedly higher than the average ability of the machinists in any other country. That fact combined with American business enterprise should make it possible to expand greatly our foreign trade.

So far as the Russian plan goes, Mr. Davison admits that there are difficulties to be overcome in arranging the financing. He is hopeful, however, that the obstacles can be removed. He is opposed to any censoring of the gold imports into the United States. He knows of no case where gold from Turkey or from any other country has been refused on the assumption that it may be tainted. It is his opinion that such a question necessarily must be worked out within the nation from which the gold comes.

Mr. Davison admits that there are differences of opinion in his own organization as to just what course should be pursued in the Russian matter. Some object strenuously to the proposal but he is trying to assure all concerned that any negotiations entered into by the Association will be thoroughly honest and above board. He believes it to be very necessary, however, to take prompt action in Russia before the opportunity offered there is seized by some other nation. He has on file numerous reports showing that the Russian requirements for machinists' products are very great.

Evolution of an "American Machinist" Article—IV

The *American Machinist* copy editor is shown in the illustration herewith doing his bit to polish up any rough spots that the associate editor may have missed. Everybody makes mistakes and only the constant checking up which an article receives before being published



insures its correctness. The ex-lieutenant shown here is responsible for all grammatical and typographical errors; hence, from now on if you discover any you'll know where to place the blame. Besides being copy editor he assists on news articles and occasionally draws cartoons. On the opposite page he tells you of his nightmare.

To Repeat Course in Boxing and Crating

The practical course in boxing and crating, which has been established by the Forest Service of the U. S. Department of Agriculture, will be repeated during the weeks of March 7 to 12 and May 2 to 7. The course is conducted in the Forest Products Laboratory, Madison, Wis., and is in charge of J. A. Newlin and C. V. Maudlin.

Chamber of Commerce Demands Repeal of Excess-Profits Tax

An almost unanimous demand for the repeal of the excess-profits tax has been made by the membership of the Chamber of Commerce of the United States in a national referendum vote, the result of which was made public in Washington on Feb. 27. The ballot was taken on a report of the Chamber's Committee on Taxation advancing fifteen proposals for changes in the present method of Federal tax levies.

Although the committee recommended substitutes for the excess-profits tax, the vote of the Chamber's membership on these proposals was not conclusive. A considerable majority voted against an increase in income taxes, proposed as a means of substituting some of the revenues derived from the excess-profits tax, and at the same time there was a majority vote against any form of sales tax.

A proposal that excise taxes be levied partly to take the place of the excess-profits tax was carried.

In the Chamber's referendum system a two-thirds vote is necessary to carry. The propositions submitted and the vote on each follows:

1. The excess-profits tax should be repealed—for, 1,718; against, 44. Carried.
2. Revenues now derived from the excess-profits tax should be obtained mainly from taxes on incomes—for, 571; against, 1,004. Not carried.
3. There should be excise taxes upon

some articles of wide use but not of first necessity—for, 1,217; against, 504. Carried.

4. Should a sales tax be levied instead of the taxes mentioned in propositions 2 and 3?—for, 704; against, 855. Not carried.

5. Should a sales tax be levied in addition to such taxes as are mentioned in propositions 2 and 3?—for, 763; against, 894. Not carried.

6. Members voting in favor of question 4 or question 5 are requested to indicate the type of sales tax they advocate:

a. A general turnover tax—for, 511.
b. A limited turnover tax—for, 180
c. A retail sales tax—for, 541.

7. There should be a moderate and graduated undisturbed earnings tax on corporations—for, 640; against, 1,063. Not carri d.

8. Each individual stockholder of a corporation should pay his own normal tax—for, 693; against, 975. Not carried.

9. Income from any new issues of securities which may lawfully be made subject to Federal tax should be taxable—for, 1,386; against, 275. Carried.

10. American citizens resident abroad should be exempt from the American tax upon incomes derived abroad and not remitted to the United States—for, 1,252; aganist, 456. Carried.

11. Profits arising from sales of capital assets should be allocated over the period in which earned and taxed at the rates for the several years in the period—for, 1,411; against, 243. Carried.

12. An exchange of property of a like or similar nature should be considered merely as a replacement—for, 1,547; against, 142. Carried.

13. Net losses and inventory losses in any taxable year should cause redetermination of taxes on income of the preceding year—for, 1,350; against 323. Carried.

14. Ascertainment by the government of any tax based on income should precede payment—for, 1,215; against, 749. Carried.

15. Administration of income taxation should be decentralized—for, 1,321; against, 390. Carried.

The vote makes it clear that business men are united in their view that the excess-profits tax hampers business operations and retards the progress of readjustment. Among the objections to the tax as pointed out by the committee are that it produces inequities; that it is difficult of administration; that price reductions will decrease revenues from this source, and that the tax encourages extravagance.

A striking reaction was shown in the vote against increasing income taxes. It was obvious to the voters that such increases would fall on the middle class of incomes, since little more can be derived from smaller incomes and because taxes already are so high on the larger incomes that those receiving large incomes are investing in tax-free securities and thus defeating the purpose of the tax.

New Officers of Concrete Mixer Association

At the annual election of officers of the Concrete Mixer Association of the United States recently held in Chicago, Clifford F. Messinger, general sales manager of the Chain Belt Co., Milwaukee, was elected president for the coming year. W. B. Knickerbocker of the Knickerbocker Co., Jackson, Mich., was elected vice-president. A. T. Scannell of the Archer Iron Works, Chicago, Ill., was elected treasurer.

1920 U. S. Foreign Trade

The U. S. Department of Commerce has announced that America's foreign trade in 1920 was the largest in the country's history, totaling $13,507,000,000. Exports were valued at $8,228,000,000 as against $7,920,000,000 in 1919, and imports at $5,279,000,000.

Peru to Have Exhibit of Foreign Manufactures

The following communication has been received from Eduardo Higginson, Consul-General of Peru, New York:

"I wish to inform you that the Peruvian government will this year celebrate the centennial of Peruvian independence, and for this purpose has voted the sum of £600,000, or approximately $3,000,000.

"In connection with the centennial it has been arranged to hold an exhibit of manufactures of other countries and to this end the Peruvian government has granted concessions to the Peruvian Centennial Exhibits Co., 42 Broadway, New York, and A. Smeraldi, Lima, Peru. Information relative to the allocation of space can be obtained from the above-mentioned.

"It is needless to point out that the opportunity presented to American manufacturers and merchants is not likely to again occur for a considerable length of time. The buildings in which the two expositions are to be held will very probably be centrally located in the city of Lima and the exposition itself will undoubtedly be of great interest to consumers and merchants throughout Peru."

A. S. T. M. Issues Statement

The American Society for Testing Materials, Philadelphia, Pa., has issued a statement of the work of the Joint Committee on Investigation of Phosphorus and Sulphur in Steel. This is the third statement that has been issued, the second having been distributed in May, 1920.

The Nightmare of the "American Machinist" Copy Editor

The machine shown in the accompanying illustration is put out by the Blankety-Blank Tool Co.

It is a multiple-spindle, 4-jaw, double-sprocket, single-arm with back gears connected to a shaft in the coolant pump which is run by a set of helical gears meshing with the sliding head on the automatic treadle and indexed to the case-hardened hand wheel running in a bath of oil supplied by a chain-driven, sandpaper diskwheel welded to a set of belt shipper forks which



engage a gang of cutters on the crossbar, thus assuring correct alignment of the base flange on the manifold and containing the valve-stem bushings for indexing the hardened steel guide pins attached to the special tool-guide bearing, serving as an automatic stop for the drilling operations of the horizontal, radial thermodynamic setscrew which locks the drop-forged direct current sandblasted handwheel at the left of the ball-and-socket-joint crankpin blowoff capscrew, making a complete cycle with the electrolytic polyphase wormwheel and finished reamed in a home-made hot-drawn, hydro-electric gear-cutter locknut with a set of rocker arm pipe tongs V-connected to a self-contained standpipe in the wheelbase.

Senators Norris and Reed on the Government Employee Section of Patent Office Bill

Several efforts on the part of Senator Norris, of Nebraska, to secure the approval of the conference report on the Patent Office bill have failed and, at this writing, it is believed that he will abandon the section of the bill which authorizes the Federal Trade Commission to administer patents for employees of the government. The Senate is willing to approve that portion of the bill which increases the salaries of the technical men in the Patent Office and which allows the expansion in the size of the present force. The House already approved the conference report including the federal employee patent plan.

Senator Norris, in explaining the controverted section of the bill, says that it simply allows any employee of the government who has made an invention or obtained a patent to turn it over, if he desires, to the Federal Trade Commission. That commission is authorized to license corporations or individuals to manufacture patented articles on the terms fixed in the lease. The license fee is to be paid into the Treasury of the United States. Out of that sum the President is authorized to give to the employee who made the invention what, in the opinion of the Chief Executive, is a fair and proper compensation to the inventor.

Senator Norris pointed out that experimentation is necessary after an invention may have been secured based on an achievement in a laboratory or on a small scale. When something novel is developed by a government employee it is open to the public. The co-operation of some private activity is secured to perfect its manufacture on a commercial scale. As soon as its merit is proven the invention is open to competitors, who get the same advantage as does the concern which expended time and money for the experiments. The result is, Senator Norris continued, that most of these inventions are not developed. He stated that the hearings disclosed that an inventor may be absolutely robbed of his patent under existing law unless he has sufficient money to carry litigation to the Supreme Court of the United States. He stated that patent attorneys agree that the only thing that an inventor who is not wealthy can do when his patent is infringed by someone with means is to sell his patent for whatever he can get, because otherwise he would be worn out in the court, even though it were conceded that his patent is valid. Some powerful companies, he declared, find it very profitable to suppress patents so as to prevent competition in their line. "The government gives a monopoly to an inventor," said Senator Norris, "on the theory that it will be used by the public. Sometimes there are interests who can make more money by suppressing a patent than they can by utilizing it. There are thousands of patents being suppressed and have been suppressed for years. The very monopoly that the people give for their own benefit is used to their detriment and expense."

Senator Reed, of Missouri, stated very frankly that the bill would not pass with the government employee provision in it if he can prevent it. "If I draw a government salary," declared Senator Reed, "and John Smith is working in a garret I ought not to take any advantage over John Smith because I have a government place. This is an attempt to take a class of persons already in the employ of the government and put them under a particular governmental protection and to do that when, as a principle of equity, their inventions made through their contact with the government business, for which the government pays them, ought by right to belong to the government. I am willing, however, to permit a government employee to take out a patent because it stimulates them to exertion, but when he takes out his patent he ought to stand on the same footing as do other persons.

"So far as I am concerned I am not going to pay the price of putting the patent business into the hands of the Federal Trade Commission or into the hands of the President. I am not going to favor the principle of licensing by the federal government. It means special licenses to special people, and in this case a board as incompetent to pass upon patents as I am to pass upon music. The Federal Trade Commission has been a failure in everything it has undertaken, except the mere collection of statistics, and those have to be checked up."

Japanese Steel Works Buys American Equipment

Seventeen carloads of electrical equipment for steel mill operation were recently delivered for installation with what is stated to be the first electrically driven steel blooming mill, to be erected in connection with the plant of the Imperial Steel Works of Japan, located near Tokyo, according to the *Indian Trade Journal*. The mill will be capable of rolling steel ingots measuring 500 by 500 millimeters and weighing 3,000 kilo-normal, or 5,000 kilo-maximum. It will be operated by a 35,000-hp. single unit motor of the reversing blooming mill type, taking direct current at a voltage of 600 and operating with a speed range up to 100 r.p.m. To supply power to the motor a flywheel motor generator set of 2,800 kw. capacity, 600 volts d.c., 368 r.p.m. is to be installed.

Insures Its Employees

The Leland-Gifford Co., of Worcester, Mass., manufacturer of machine tools, etc., has insured its employees through the Ætna Life Insurance Co., of Hartford, Conn. The policy on each employee varies in amount from $500 to $1,000, according to length of service. The amount of insurance is approximately $300,000.

British Governmental Support of Privately Owned Airplane Companies

Last summer while in England it was the privilege of a correspondent of the *American Machinist* to attend a meeting where the possibility of obtaining government assistance for privately owned airplane companies was the subject of discussion. As he was a guest of the committee it was understood that he should be silent as to what was heard. A communication from London was, however, recently received, which releases him. It runs as follows:

"It is announced by the air ministry that the cabinet has approved, subject to parliamentary sanction, the grant of a sum for the direct assistance of civil aviation. The ministry states that during the financial year, 1921-1922, payments under the grant will be limited to a maximum sum of £60,000 and will be made to British companies operating on approved aërial routes. The amounts to be paid will be calculated subject to the above limitation in regard to the total sum available within the year, on the basis of 25 per cent of the total ascertained gross revenue of each company (exclusive of the government grant) earned by the carriage of passengers, mails and goods on and after Jan. 1, 1921.

No differentiation will be made with regard to the class of load carried and payments will be allotted on the return for each period of three months treated separately, provided that the company can show that a minimum of 45 days in each period of three months (or such other factor of regularity as may be determined later by the air council) flights have been completed in both directions by aircraft of British manufacture fitted with British made engines within a fixed minimum period of time allowed for each journey.

The routes at present approved are London to Paris, London to Brussels, and London to Amsterdam. Extensions to these routes and additional routes, such as England to Scandinavia, on which the possibilities of a service employing flying boats or amphibian machines or a mixed service of sea and land aircraft can be demonstrated, may be approved from time to time if satisfactory proposals are received by the air council.

The maximum time allowed for journeys between London and Paris, between London and Brussels and between London and Amsterdam will be four hours from airdrome to airdrome (or such other time limit as may be determined later by the air council).

Payment of the grant will be subject to the production for departmental inspection, when required, of such accounts and records as the air council may deem necessary. Any British company intending to run on the routes and notifying the air council of this intention will become an 'approved' organization by fulfilling the conditions laid down."

It will be noted that there is a great

deal more to this than merely the subsidizing of privately owned airplane companies although that in itself is sufficient to commend it to most thinking men.

The companies must be British, British airplanes must be used and they must be equipped with engines of British make—all of which will mean work for a number of men.

The trained staffs of these companies will be available to handle war planes and to instruct others should such a contingency arise.

Let us hope that the United States government may take a hint from this and do something before all our war-trained aviators have died of senile decay.

Director of Naval Aviation Warns of Disaster to Aerial Defenses

Disastrous curtailment of our aërial defenses, particularly at the Panama Canal and along the Pacific Coast, is inevitable under the naval appropriation bill, now before the Senate, according to a statement by Captain T. T. Craven, director of naval aviation, today.

The appropriation bill as it passed the House carried $6,915,431 for naval aviation and stipulated new development for which no money was provided. Other bills which have been proposed call for the construction of aircraft carriers at a cost of $35,000,000 each, but make no provision for the design or manufacture or development of the equipment which they are to carry.

The current appropriation bill virtually amounts to the destruction of naval aviation, said Captain Craven, and its destruction will mean perhaps a fatal blow to commercial aëronautics and the aircraft industry, without which it is not practicable to have adequate aërial defense. It will require from a year to a year and a half to begin to obtain equipment, he said, even if appropriations were immediately available.

"Unless the Senate increases the naval aviation appropriation," said the director, "we will be compelled to relinquish Coco Solo, the naval air station from which the aërial defense of the Panama Canal is conducted. Cessation means exposure of the canal to attack from the air; and if attack ever is made it is certain to be made first through aërial bombardment.

"The aviation detachments serving with the Atlantic and Pacific fleets cannot be maintained. Present equipment consists for the most part of planes left over from the war. Under the bill as it now stands we have not sufficient funds to install modern radio on these planes. The planes themselves, for the most part, will have to be junked before the end of the year.

"The project to construct one of the world's largest dirigibles—the ZR-1—in the United States (work on which had already begun) will have to be abandoned. Competitions in naval aircraft design which were entered into by the American aircraft industry will be terminated. The result will be serious embarrassment, possibly fatal injury, to the lighter and heavier-than-air aircraft industries in the United States, to which we must look for the development of our designs and the manufacture of our equipment.

"Even the operation of the great rigid ZR-2, purchased abroad at a cost of $2,500,000, will be limited to the Atlantic coast, as the plans for an airship terminal in southern California will be killed. This means that the Pacific coast will be deprived of the principal element in long-distance aërial defense.

"The proposal to establish within the Navy Department a Bureau of Aviation is in danger of being sidetracked. Aviation officers in the navy will be helpless until such a bureau is formed, giving them identity and authority. The controversy in Congress, instead of scrapping the capital ship, appears to have scrapped naval aviation.

Why American Business Should Aid Starving China

An old friend, a sister republic, a good customer, past, present and prospective, is in dire distress and calling to America for help. China, in her five northern provinces, is facing the worst famine in her history, perhaps the worst disaster in all recorded history. Continuous drought for eighteen months has caused the failure of three successive crops. The next crop will not be harvested until June. For the next four months the population must be fed from outside sources or perish of starvation, and they are freezing as well as starving, for long ago they sold the timbers of their houses, and even most of their clothing, to buy food.

To meet the situation the President has appointed the American Committee for China Famine Funds, with Thomas W. Lamont, of New York, as chairman, and headquarters at the Bible House, Astor Place, New York.

The immediate need, the American Committee reports, is for money, which is cabled over to Peking and there disbursed and accounted for by a local committee of representative American business men and missionaries, including Hon. Charles R. Crane, American minister. The sum of $5, it is estimated, will feed a single Chinese until the next harvest in June. Checks should be sent to Vernon Munroe, treasurer, American Committee for China Famine Fund, Bible House, Astor Place, New York City.

War Department Machine Tools and Vocational Training

During the week ended Feb. 12 machine tools to the value of $3,958.42 were sold by the War Department as surplus property. These tools cost the Government originally $31,321.81. This brings the total sales of surplus machine tools to $14,320,623.11, or 44 per cent of the original cost of these tools.

Due to delays in securing surplus machine tools from the War Department the Federal Board for Vocational Education will have to buy a larger number of tools than otherwise would be the case. The demand for mechanical training from former soldiers is so great that the government is expected to become a much larger purchaser of metal working machinery. Of the 79,000 men who have applied for vocational training it is estimated that fully 35 per cent are taking up work which will necessitate mechanical instruction. The Vocational Education Board has received surplus machine tools from the War Department to the value of $250,000.

Personals

GEORGE J. BLANTON, who for the past four years has been connected with the engineering sales department of the Chain Belt Co., Milwaukee, has been made New York district manager.

S. T. THOMPSON has relinquished the office of purchasing agent of the Duplex Engine Governor Co., Inc., Brooklyn, N. Y., and has taken up the responsibilities of the sales department in the capacity of director of sales. The vacancy left by Mr. Thompson has been filled by C. F. GUTTZEIT, who heretofore has been assistant purchasing agent.

H. A. FISHER left the employ of the Merchant Shipbuilding Corporation of Chester, Pa., where he held the position of master mechanic, to take a position as plant engineer for the Worcester Pressed Steel Co. of Worcester, Mass.

GARLAND DANIEL of Greensboro, N. C., has been named receiver for the Southern Truck and Car Corporation of Greensboro, a concern capitalized at $1,000,000. The receiver will continue operation of the company.

GEORGE LAHUSEN, JR., formerly of the E. L. Essley Machinery Co., Chicago, has taken a position with the Badger-Packard Machinery Co. of Milwaukee, Wis., representing them in the southern Wisconsin territory.

O. W. SANDERSON, formerly assistant engineer of mechanical inventions with the B. F. Goodrich Co., Akron, Ohio, has resigned his position to become secretary and treasurer of the Empire State Engine Corporation, with executive offices in New York City.

J. S. GREEN has severed his connection with the Canadian-Ingersoll-Rand Co. of Sherbrooke, Quebec, and is now with the Fuller-Lehigh Co., Fullerton, Pa., as superintendent of shops.

RICHARD M. PAYNE is now sales engineer for the Eastern Service Co., Boston. He was formerly with the Bethlehem Steel Corporation, Boston.

GEORGE W. COOKE, formerly general superintendent of the Pierce Arrow Motor Car Co., Buffalo, is now employed in the same capacity by James Cunningham Sons & Co., Rochester, N. Y.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Embossing Machine, Rotary

Julius Merey, 2842 N. Maplewood Ave., Chicago, Ill.

"American Machinist," Jan. 27, 1921



This machine is intended for embossing letters in sheet metal of flat, bent or cylindrical form. It consists primarily of two heads mounted on a heavy cast-iron table. The head at the left carries the embossing rolls. The rolls or dies are made of interchangeable segments, so that any combination of letters or figures can be put in place. The shafts carrying the dies are driven by gears through a positive clutch from a 16-in. pulley back of the headstock. The machine is automatically stopped at the completion of each embossing operation, the rolls at the same time being automatically moved $\frac{3}{8}$ in. apart, so that the work can be removed. The machine can emboss three rows of letters simultaneously in 16-gage sheet steel, 3 hp. being required. It weighs about 2,000 lb.

Die Head, Self-Opening Style "E"

Victor Tool Co., Inc., Waynesboro, Pa.

"American Machinist," Jan. 27, 1921

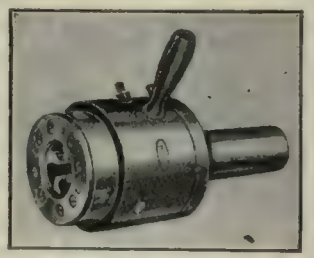


The illustration shows the head, which is intended for stationary use, in the closed position. The same tool adapted to rotary use, as in a drill press, is known as the Style "R" head. The chasers, when in the cutting position, are supported along their entire length back of the cutting edges. The tool can be adjusted for size to enable the cutting of tight or loose threads by turning the large knurled, graduated collar, a range of about $\frac{1}{16}$ in. both under and over size being obtainable. A locking screw holds the collar in place. The standard shanks are hollow, thus permitting the threading of long rods. For cutting close to shoulders, the chasers can be extended through the cap. The head is made in two sizes, one with a capacity from $\frac{1}{8}$ to $\frac{3}{8}$ in. and the other from $\frac{1}{4}$ to $\frac{3}{4}$ in.

Die Heads, Self-Opening, "H & G"

Eastern Machine Screw Corporation, New Haven, Conn.

"American Machinist," Jan. 27, 1921



The heads are made in three principal styles. Style "A" is for automatic screw machines, such as the Cone or Gridley. The added sizes in which the head is made are $2\frac{1}{2}$ and 3 in., with capacities of $1\frac{1}{8}$ to $2\frac{1}{4}$ in. and of 2 to 3 in., respectively. The other sizes range down to $\frac{1}{4}$ in. Style "C," which is illustrated, is intended for use on machines such as turret lathes, where the die head does not rotate. The added sizes are 2, $2\frac{1}{2}$ and 3 in., having capacities of 1 and 2 in., $1\frac{1}{2}$ to $2\frac{1}{2}$ in. and 2 to 3 in., respectively, the other sizes being smaller. The third head is intended for use with Brown & Sharpe machines, a $\frac{7}{16}$-in. size being added. It is stated that the heads can meet practically all requirements in thread cutting.

Air Compressor, Electric, Portable, "Imperial Type-14"

Ingersoll-Rand Co., 11 Broadway, New York, N. Y.

"American Machinist," Jan. 27, 1921



This compressor is similar in general characteristics to the gasoline-driven compressor described on page 736, Vol. 51, of the *American Machinist*. The motor, which can be furnished for either alternating or direct current, is fastened to a sub-base bolted to the cast-steel main frame. The compressor is driven by a belt and has two cylinders cast en-bloc. Plate-type air valves are used for both intake and discharge. Specifications: Capacity, 118 cu.ft. of free air per minute. Pressure, 100 lb. per sq.in. Compressor: two cylinders, 6 x 6 in.; speed, 525 r.p.m. Motor, 25 hp. Receiver: capacity, 8 cu.ft.; size, $1\frac{1}{2}$ ft. diameter x 5 ft. high. Wheels: front, 30 in.; rear, 36 in.; face, 6 in.; tread, 4 ft. 8 in. Weight, about 4,450 lb.

Tapping Machine, Semi-Automatic, Multiple-Spindle

Langelier Manufacturing Co., Arlington, Cranston, R. I.

"American Machinist," Jan. 27, 1921

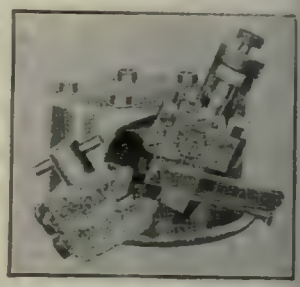


The machine, as illustrated, is fitted for tapping simultaneously nine $\frac{1}{4}$- and two $\frac{5}{16}$-in. holes in a meter case, the production being stated as six cases per minute. It is started by depressing a treadle, the round leather belt from the motor under the table being moved onto the forward driving pulley. The main spindle of the tapping head is thus set in motion through gearing. The work is carried on a table which is raised mechanically, feeding the taps into the work. When the taps have penetrated to the desired depth, the belt is automatically shifted to the reverse pulley, thus reversing the taps and lowering the table at a speed about twice that used for tapping.

Box Tool, "Micro"

Cruban Machine and Steel Corporation, 63 Duane St., New York

"American Machinist," Jan. 27, 1921



This tool is intended for use on screw machines and automatic lathes. It is provided with a 1-in. shank, and can handle bar stock up to 1 in. in diameter. The tool-bit can be adjusted to or from the work, a dial being provided so that the movement can be read directly in thousandths of an inch. The micrometer screw can be locked in place. The "V" guides are controlled by spring pressure. They can be held in place by the locking stud, after their proper position has been determined by allowing them to spring against the stock. In order to lock them in position, screws are provided back of the guides. The high-speed steel toolbit is provided with a notch at the end, into which an adjusting nut is placed. The tool is thus prevented from slipping while in use.

Threading Tool, Spring

Ready Tool Co., Bridgeport, Conn.

"American Machinist, Jan. 27, 1921



The tool has a goose-neck, so as to allow the cutting of smooth threads and the decreasing of chatter. The cutter is made of high-speed steel and held at an angle of 15 deg. from the vertical. The side angles are so ground as to cut a 60-deg. thread. Only the top surface of the cutter is ground when sharpening the tool. The cutter is secured on the left side of the holder by means of a dovetailed joint, so that threads can be cut close to a shoulder. There are teeth on the back of the cutter and in the front of the dog holding it in place. The dog is clamped to the holder, so that the cutter is prevented from slipping. V-shaped cutters, as well as U. S. Standard chasers, are carried in stock. The tool is made with right-hand offset, and is $\frac{1}{2}$ x 1 x 7 in. in size.

Grinding Machine, Piston-Ring, Automatic

Persons-Arter Machine Co., 72 Commercial St., Worcester, Mass.

"American Machinist," Jan. 27, 1921



This is primarily an attachment which can be placed on the company's standard rotary-table grinding machine. The illustration shows the attachment in place on a machine constructed especially for this purpose, single-speed chain drive to the work table being used instead of the usual belt on three-step cone pulleys. The attachment feeds piston rings on and off the work table automatically, is operated by compressed air taken from the air lines of the shop, is a complete unit in itself, and depends upon the machine of which it thus becomes a part only for the timing of its movements. The air cylinder is underneath the work table, a balanced D-valve being used, and the piston rod being provided with rack teeth which engage the gear to be seen on the vertical shaft.

Clip, paste on 3 x 5-in. cards and file as desired

S. M. HERSHEY has been appointed sales engineer of the Precision Grinding Wheel Co., of Holmesburg, Pa., a suburb of Philadelphia. Mr. Hershey was formerly district sales manager at Philadelphia for the Heald Machine Co., of Worcester, Mass.

WALTER H. BAKER, former president of the Charleroi, Pa., alloy steel plant acquired by the Electric Alloy Steel Co., was named a member of the board of directors of the latter company at its recent annual meeting.

L. A. LENHART, until recently with the General American Tank Car Corporation in Chicago, was named vice-president and general manager at the organization of the board of directors of the Youngstown Steel Car Co., Youngstown, O., held recently.

Business Items

Steel products and automobile rims will be manufactured by the Caddenhead Auto Rim Co., which has begun construction on the second unit of its plant and shops at Tarrant City, Ala., near Birmingham.

JOHN MOHR & SONS announces that it has consolidated its Chicago and South Chicago works. Its general offices are now located at 96th and Calumet River, South Chicago, Ill.

The American Emery Wheel Works, Providence, R. I., has increased its capital stock from $100,000 to $1,000,000.

A change has been made in the official force of the Newton Steel Co., Newton Falls, Ohio. H. M. Steel who has been located here having direct charge of operations in the plant has moved to the general offices of the company in Youngstown. He will continue as vice-president and general manager of the company: F. P. McGlyar has been named superintendent of operations at Newton Falls.

At the annual meeting of stockholders of the Union Metal Co., Canton, Ohio, held here this week, C. C. Barrick was elected president and general manager; D. C. Barrick, secretary; C. L. Eshleman, vice-president; L. M. Barrick, treasurer.

A certificate of partnership under the name of American Foundry has been filed by Nicholas A. Buotich and Bare Skarpa, both of San Diego, Cal.

On Feb. 19, the main office of the Becker Milling Machine Co., the Reed-Prentice Co. and the Whitcomb-Blaisdell Machine Tool Co. was closed and the new main office is now located at 677 Cambridge St., Worcester, Mass., which is the Prentice Department of the Reed-Prentice company.

A manufacturing plant which will include machine shops, foundry, etc., will probably be established in Atlanta as the result of the organization and incorporation in that city recently of the National Bean and Pea Picker Company with a capitalization of $250,000. The company will manufacture a bean and pea picking machine recently invented.

Amalgamated metal products will be manufactured in the new plant of the Cole Engineering Corporation at Chattanooga, Tenn., officials stating that the building has been almost completed and operations are expected to start in the near future. About $60,000 was invested in the construction of the plant. The company also operates a plant in Pennsylvania.

The Perfection Patents, Inc., has been organized at Syracuse, N. Y., to make fire extinguishers. The capital of the concern is $50,000.

The Kilby Frog and Switch Co., Birmingham, Ala., has increased its capital stock to $300,000.

New Publications

Factory Organization and Administration. By Hugo Diemer, formerly Professor of Industrial Engineering, Pennsylvania State College. Three hundred and ninety-eight 6⅜ x 9-in. pages, illustrated with diagrams and forms. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City.

The third edition of Mr. Diemer's well-known book has been revised and slightly enlarged to bring it up to date with modern procedure. The principal changes occur in the chapters relating to general organization, employment and industrial relations, and functional control of production.

While intended as a reference book for the actual practitioner in manufacturing work it has had, in previous editions, a wide use as a textbook for college and technical students.

The closing chapter contains a complete bibliography of works management. It is divided into the following subdivisions: Reading and study necessary for the man who aspires to success in business administration and industrial management; a business or shop library for managers and employees; a bibliography of the classical or pioneer literature of works management or industrial engineering prior to 1904; a standard reference library of industrial management and industrial engineering; a comprehensive library of supplementary reading for a school of engineering or school of business administration or public library.

Trade Associations. By E. H. Naylor. Published by The Ronald Press Co., 20 Vesey St., New York City.

There are over 1,000 trade associations in the United States. E. H. Naylor, an experienced executive of such organizations, has written a practical helpful book that ought to be interesting to both volunteer and professional workers in this field of economic activity. His chapter on statistics might well have carried some suggestions as to successful methods of using the statistics that are gathered. Perhaps some day some one will study the various activities now or heretofore carried on by trade associations, and compile a classified list of these activities with an index to the associations that have tried out each particular activity. Such a list would enable the busy executive to locate reliable sources of information that might save much effort in starting activities that for one reason or another do not go as well as hoped for.

There is a real reservoir of valuable knowledge to be tapped by some recording of experience along these lines. Such a source of information does not probably already exist or a note of it would no doubt have been made in Mr. Naylor's book.

The author deserves the thanks of many co-workers in the trade association field and his book deserves a place in the library of every business man interested in association work, as an officer or member of such a body. It is the first book printed dealing with the subject in a comprehensive way and should be followed by others.

Trade Catalogs

Cost Cutting Tools. McCrosky Tool Corporation, Meadville, Pa. Catalog No. 8, 6 x 9 in., sixty-four pages. Among the information which this book contains is how to solve reamer trouble; how to revolutionize drill press work; how to increase lathe output; and how to save time and increase the quality of production. The book is replete with illustrations of reamers, chucks and collets, turret attachments for lathes, milling machines, and "Searchlight" lamp brackets.

Bushings. Reliance Machine and Specialty Co., 101-103 Green St., Jamaica Plains, Boston, Mass. This is a small circular giving details of its "Reliance" bushings.

Precision Bench Lathe and Compound Slide Rest. Stark Tool Co., Waltham, Mass. Circular, pp. 4, 8½ x 11 in. This circular describes and illustrates its precision bench lathe and its improved compound slide rest. It gives full specifications of each.

Reamers. Gisholt Machine Co., Madison, Wis. This is a three-page circular giving a brief description of its manufacturing reamer. Its principal dimensions and sizes are given.

C-H Brakes. Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Catalog No. 850, 8½ x 11 in., pp. 80. This catalog describes and illustrates shoe brakes for both direct- and alternating-current service. Tables of dimensions and ratings are included.

Proof Book. Edward R. Ladew Co., Inc. 428 Broadway, New York. Catalog, pp. 31, 5½ x 7½ in. This booklet is a compilation of evidence of the dependability of Hoyt leather belting in service, with a brief discussion of some of the fundamentals of belting.

Stewart Furnaces. Chicago Flexible Shaft Co., 5600 Roosevelt Rd., Chicago, Ill. This folder describes and illustrates some of the standard types and sizes of its Stewart furnaces, and gives a list of some of the work done by them.

Factories That Fit. Frank D. Chase, Inc., 645 North Michigan Ave., Chicago, Ill. Booklet, 8 x 5½ in. This company has recently compiled an illustrated booklet on "Factories That Fit" and gives its conception of the importance of sound engineering design in factory construction.

Forthcoming Meetings

The National Metal Trades Association will hold its annual convention at the Hotel Astor, New York, on April 18, 19, 20, 21. Homer D. Sayre, Peoples Gas Building, Chicago, Ill., is secretary.

The Engineering Section of the National Safety Council will hold its annual meeting in Philadelphia on Feb. 28. This meeting will be held jointly with the Philadelphia section of the A. S. M. E.

The annual meeting of the American Welding Society will be held in the Engineering Societies Building, 29 West 39th St., New York, on April 22.

The Society of Industrial Engineers will hold its national convention in Milwaukee, Wis., on April 27, 28 and 29. Geo. C. Dent, 327 So. La Salle St., is business manager.

The National Foreign Trade Council will hold its eighth annual convention in Cleveland, Ohio, on May 4, 5, 6 and 7. J. G. Hammond, care of the Council, 409 Park Bldg., Cleveland, is secretary.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The American Society of Mechanical Engineers, 29 W. 39th St., New York, will hold its spring meeting in Chicago, May 23 to 26 inclusive, at the Congress Hotel.

The Society of Automotive Engineers, 29 West 39th St., New York announces that its summer meeting will be held at West Baden, Ind., on May 24 to 28 inclusive.

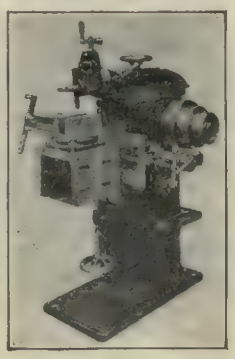
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Shaper, 8½-In.

Brown & Ward, Ltd., Birmingham, England

"American Machinist" (European Edition), Sept. 18, 1920

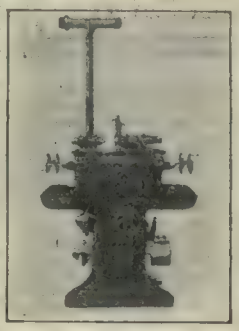


This machine is said to be plain and well built. It has a long crank, which swings from the bottom of the base. The table is T-slotted and carries a swiveling vise, the jaws of which are made of hardened steel, are 6 in. wide and open 5 in. The horizontal travel of the table is 12 in. and the vertical movement 7½ in. The table is 9 x 9 x 7⅜ in. The crossfeed is automatic. The toolhead has a vertical movement of 2 in., having a micrometer adjustment. Shafts up to 1½ in. in diameter can be keywayed under the ram, an adjustable screw support being available at the back for lining up the shafts. The floor space is 2 ft. 8 in. x 3 ft. 2 in.; weight, about 920 lb.

Grinding Machine, Precision, Instrument

Harry F. Atkins, Ltd., Qld Fletton, Peterborough, England

"American Machinist" (European Edition), Sept. 18, 1920



This is a rigid, self-contained universal grinding machine adapted to small, fine work. It has ball bearings throughout, excepting in the bearings of the heads. The traverse mechanism is stated to be smooth in action, and the reverse positive and fully under control. It is said that the abrasive wheel can be made to work between two shoulders, grinding the diameter and the shoulders at the same time with the power traverse in action. The traverse of the table is obtained from a heart cam, the stroke being varied by altering the position of the fulcrum of an oscillating lever. The drive is obtained from a small drum countershaft overhead, attached to the machine. The tank from which the centrifugal pump draws its supply is formed in the base. The capacity of the machine is 5 in. diameter by 6 in. long.

Microscope for Brinell Depressions, Etc., "Talyden"

Taylor, Taylor & Hobson, Ltd., Leicester, England

"American Machinist" (European Edition), Oct. 2, 1920



This device measures the diameters of depressions made when testing metals, etc., by the Brinell method. A graticule is incorporated, enabling diameters up to 7 mm. (0.275 in.) to be measured. The microscope objective forms an image of the object viewed twice the size in the plane of the graticule, and both image and graticule are in turn magnified and viewed by the eye-piece at the top, the total magnification being 16 diameters. It is stated that the field is flat, well corrected and free from distortion and objectional color fringes, and that the instrument is guaranteed in accuracy to within 0.02 mm. (about 0.001 in.). It stands about 7 in. high and weighs 1¾ lb.

Vise, Attachment, Universal, "Allan & Magowan"

Alfred Herbert, Ltd., Coventry, England

"American Machinist" (European Edition), Nov. 6, 1920

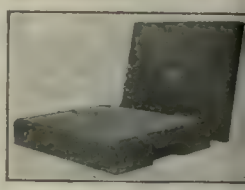


The purpose of this attachment is to enable material of practically any form to be held in a standard vise. The attachment is made in three sizes: 4, 5 and 6 in. wide. The cut shows the smallest, an extra jaw being added for the 5-in. size and two jaws for the 6-in. size. Two such attachments form a set. One is slipped over each vise jaw, being positioned by a lug at one side which prevents end movement in one direction. The grips are of tool steel; they can be furnished in any desired form on the working face and serrated either vertically or horizontally.

Surface Plates, Glass

A. Leonard & Co., Croydon, England

"American Machinist" (European Edition), Sept. 18, 1920

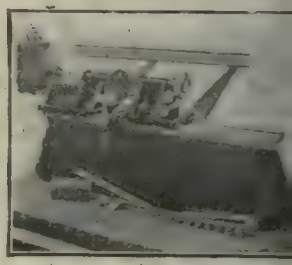


These plates are said to be guaranteed to within one-quarter of a ten-thousandth of an inch, i.e., 0.000025 in. They are made from plate glass, ¾ to 1½ in. thick, according to the size. They show from 100 to 120 hardness on the scleroscope. Should at any time the surface of a plate become slightly hollow the surface can be reground. The plates are made in the following sizes: 6 x 4½ in., 8½ x 6½ in., 14 x 11 in. and 24 x 19 in. Their main use is for toolroom work. The base of the plate is ground dead true to the top surface enabling the plate to be placed on the bed of a machine or elsewhere for lining-up purposes.

Measuring Machine, Comparator, Optical, 12-In.

A. Leonard & Co., Ltd., Croydon, England.

"American Machinist" (European Edition), Oct. 2, 1920

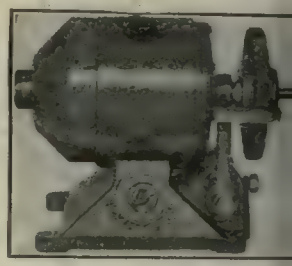


The machine is intended to register accurately length measurements up to 12 in. within a limit of 0.0005 in. It has a heavy-section box bed, on the machined top surface of which are mounted two headstocks, one fixed and one adjustable. Each headstock carries an anvil, the measurement being made between the anvils. The fixed headstock carries a light box and the optical element, also the amplifying mechanism. The amplifying mechanism is so designed that any slight movement of the main body adjusts the ratio between the two sides of the first lever, maintaining the ratio of 7 to 1. The smallest lever is the most important feature of the whole unit, as any slight error on this causes considerable alteration to the scale. A total magnification of 1,000 can be obtained.

Grinder, Electric, Bench

Wilson-Wolf Engineering Co., Ltd., Bradford, England

"American Machinist" (European Edition), Oct. 30, 1920

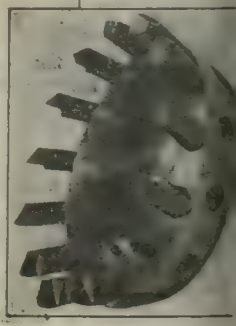


This grinder has been redesigned. The motor is compound wound and dustproof, and has ¾ hp. at 3,200 r.p.m. It is said to be able to stand a heavy overload and rough treatment. The wheel is 6 in. in diameter by ¾ in. wide. A universal work rest is fitted. The grinders have rubber pads under the bases and therefore need not be bolted down. They are said to run quietly. The grinders are stocked wound for 100 to 110 volts and for 200 to 250 volts, but motors for other voltages can be supplied.

Cutter, Face-Milling, Inserted-Tooth

Alfred Herbert, Ltd., Coventry, England

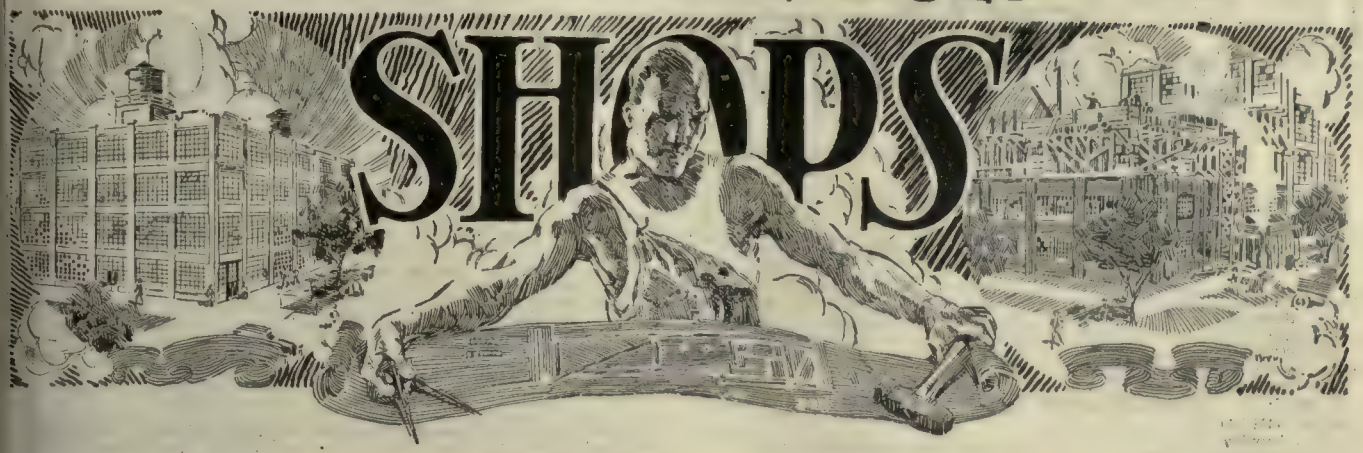
"American Machinist" (European Edition), Nov. 6, 1920



This cutter consists of high-speed steel inserted teeth of round section secured in a steel body. It is claimed that, though the teeth are held so that they will not move under the heaviest cuts, they can be removed quickly. The holes in which the cutters are secured are inclined to the axis of the cutter body, so as to provide rake on the periphery and end cutting edges, and the shank of each individual cutter is milled flat with serrations across it. Cutters of this type can be furnished to suit any milling machine.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Mass., Lowell—The W. W. Carey Co., nc., Bway.—one complete oxyacetylene velding outfit, (give lowest price and list of parts).

Pa., Philadelphia—A. Leahan, c/o Bahls, 9th and Market Sts., metal manufacturer —circular rig saw.

Pa. Philadelphia — H. L. Rieder, 347 North 4th St., manufacturer of showcases —double spindle shaper.

Fla., Orlando—The Motor Parts Service Co., C. Williams, Pres.—lathe, 8 in. swing, 4 in. between centers.

Va., Richmond — The Auto Radiator Fender and Repair Shop, 1031 West Broad St.—electric hand drill press with bench attachment.

Va., Richmond — Broske & Ehmig, 1504 West Broad St., auto repairers—
One light lathe.
One gasoline street pump.
One cylinder grinding outfit.

Va., Richmond — The Chesterfield Auto Repair Shop 724 West Broad St.—cylinder grinder and gear press.

Va. Richmond—J. C. Elliotts' Garage, 502 West Broad St., auto repair shop—
One drill press.
One portable electric drill.
One light lathe.

Ill., Chicago—The Union Bed Spring Co., 100 Blackhawk St.—punch press with 2½ in. to 3 in. stroke.

Mich., Detroit — The Lincoln Tool Co., 34 Hubbard Ave.,—miscellaneous machine shop equipment.

O., Dayton — The F. H. Bickford Co., Commercial Bldg., manufacturers of machine tools and small parts, F. H. Bickford, Pres.—several Brown & Sharp automatic screw machines.

Wis., Milwaukee—F. Goethel, 491 12th St.—Sheet iron roller and shear, 3 ft. wide or more, for sheet metal works.

Wis., Waterford—O. R. Graf—garage repair machinery.

Wis., Waupun—The Safety Fender Co., E. H. Luebke, Purch. Agt.—machine tools and sheet metal machinery for the manufacture of automobile fenders.

N. D., Jamestown—J. Arneson, machinist and engr.—machinery for rebuilding tractors and steam engines, reboring all kinds of cylinders, manufacturing tanks, stacks, etc.

Que., Montreal—I. W. David, 134 Bloomfield St. — equipment for garage on St. Dominique St.

Machinery Wanted

Conn., Hartford—The Newington Metal Goods Co., 284 Asylum St.—single action power press, to correspond with a No. 4 or 5 Farrel foundry power press (used).

Mass., West Springfield—(Springfield P. O.) J. Rose, 87 Norman St.—portable saw mill outfit.

N. Y., Utica—The Utica Gas & Electric Co., 222 Genesee St., one 75 ton electric traveling crane.

Tenn., Memphis—D. D. Woollard, Chamber of Commerce, complete equipment and machinery for cotton picking, etc.

S. C., Denmark—Chamber of Commerce, R. A. Easterling, Pres.—complete equipment for pulp mill.

Va., Richmond—J. A. Umlauf, 1326 West Broad St., upholsterer—
One swing saw.
One cylinder for Champion hair picker.
One double set hackles.

Ill., Rockford — The Water Dept., T. Conners, Supt.—one traveling crane.

O., Columbus — The Western Fuel Co., Outlook Bldg., A. Breuholtz, Pres.—shaker screens and picking tables for Mine 10 at Orbiston.

Wis., Cedarburg — F. Wetzel, manufacturer of special furniture—one trimming saw, power operated.

Wis., Milwaukee — The Morning Dew Products Co., 986 Oakland Ave., L. F. Bond, Purch. Agt.—special machinery for the manufacture of oleo and dairy products, also tanks for its branch at Ironwood, Mich.

Wis., Milwaukee — The Wisconsin Ice & Coal Co., 216 West Water St.—ice making machinery.

Wis., New London — The Wisconsin Cabinet & Panel Co., F. L. Zang, Genl. Mgr.—equipment and new surfacing machines.

Wis., Oconomowoc — The Oconomowoc Canning & Product Co.—new machinery.

Tex., Galveston—The Julo Bottling Co., Galveston, subsidiary Southern Beverage Co., 200 West Camden St., Baltimore, Md.—bottle washers and bottling machinery for its plant at Baltimore.

Ont., Amherstburg—The Conklin Planing Mills—machinery.

Ont., Guelph—The Sterling Rubber Co.—special equipment for the manufacture of rubber products.

Metal Working

NEW ENGLAND STATES

Conn., Hartford — The Hartford-Buick Co., 51 Elm St., has awarded the contract for the construction of a garage, sales and service building, containing 30,000 sq.ft. floor space, on Connecticut Blvd. Estimated cost, $125,000. Private plans.

Conn., New Britain—Horwitz & Rotstein, 184 Arch St., have awarded the contract for the construction of a 1 story garage on Arch St. Estimated cost, $10,000.

Mass., Boston—The Boston Elevated R.R., Massachusetts Ave., has had plans prepared for the construction of a 3 story, 55 x 500 ft. repair shop at Forest Hills. Estimated cost, $500,000. M. Fernald, c/o owner, Engr.

Mass., Boston—The Boylston Garage Co., Boylston St., is having plans prepared for the construction of a 6 story, 48 x 134 ft. garage. Estimated cost, $500,000. J. C. Spoffard, 36 Bromfield St., Archt.

Mass., Springfield — Chaplin & Chaplin, 374 Main St., will build a 1 story, 50 x 180 ft. garage, etc., on Pecousic Ave. Estimated cost, $40,000. A. W. Cobb, 374 Main St., Archt. Noted Feb. 3.

Mass., Springfield—The Chapman Valve Mfg. Co., Pine St., is having plans prepared for the construction of a 1 story, 50 x 275 ft. foundry with two 20 x 275 ft. wing additions. Associated Architectural & Engrg. Co., 145 State St., Archts.

Mass., Whitinsville—The Whitin Machine Wks. is having plans prepared for the construction of a 3 story garage and storage warehouse. Estimated cost, $150,000. J. D. Leland, 41 Mt. Vernon St., Boston, Archt.

Mass., Worcester—The R. P. Power Fdry. Co., Albany St., will soon award the contract for the construction of a 1 story foundry. Estimated cost, $40,000. Private plans. Noted Feb. 3.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Durabilt Fly-Screen & Mfg. Co., 1326 North Spring St., recently incorporated with $50,000 capital stock, is having plans prepared for the construction of a 1 story, 57 x 67 ft. plant. G. H. Frankton, Pres.

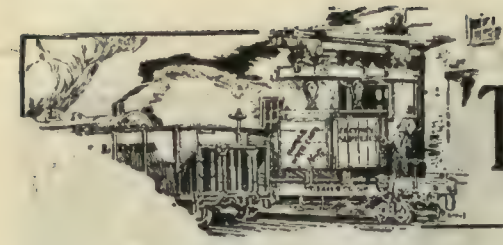
N. Y., New York—(Borough of Bronx) S. Garry, 523 West 187th St., has had preliminary plans prepared for the construction of a 1 story, 123 x 140 ft. garage on Jerome Ave. Estimated cost, $50,000. Dunningan & Crumley, 394 East 150th St., Archts.

N. Y., New York—(Borough of Bronx) The Shakin Realty Co., 220 Bway. has had plans prepared for the construction of a 1 story, 75 x 225 ft. garage on Inwood Ave. Estimated cost, $60,000. Dunningham & Crumley, 394 East 150th St., Archts.

N. Y., New York—(Borough of Bronx) S. B. Steinmetz, 449 East 150th St., will build 1 story, 100 x 100 ft. garage on Southern Blvd. and 172d St. Estimated cost, $35,000.

N. Y., New York — (Borough of Manhattan) The S. P. Bldg. Co., 3011 Barnes Ave., is building a 1 story, 99 x 100 ft. service station on 162d St. Estimated cost, $30,000.

N. Y., New York — (Borough of Manhattan) The White Fuel Oil Eng. Co., 742 East 12th St., will soon award the contract for the construction of a 2 story, 99 x 103 ft. foundry at 732-8 East 12th St. Private plans.



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Year Ago
CINCINNATI		
No. 2 Southern	$31 52	$44.60
Northern Basic	29 52	42.80
Southern Ohio No. 2	33.25	43.80
NEW YORK—Tidewater Delivery		
2X Virginia (Silicon 2.25 to 2.75)	33.77	47.65
Southern No. 2 (Silicon 2.25 to 2.75)	36.16	47.70
BIRMINGHAM		
No. 2 Foundry	28.00	41.00
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25–2.75 sil.	30.09*	45.35*
Virginia No. 2	35.74*	43.25*
Basic	31 40†	43.00†
Grey Forge	31.26*	42.50*
CHICAGO		
No. 2 Foundry local	29.00	43.25
No. 2 Foundry, Southern	34.17	46.60
PITTSBURGH, including freight charge from Valley		
No. 2 Foundry	28 00	43.65
Basic	25 00	42.90
Bessemer	27.00	43.40

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	*Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.58	$3.58	$3.97	$3.58	$5.50	$3.58	$3.97
Soft steel bars	3.48	3.45	4.12	3.34	5.00	3.48	3.87
Soft steel bar shapes	3.48	3.45	4.12	3.48	....	3.48	3.87
Soft steel bands	4.18	4.18	4.82	6.25	6.25	....	....
Tank plates	3.78	3.78	4.17	3.78	5.00	3.78	4.17

*Add 10c for trucking charge to Jersey City and 15c. to New York and Brooklyn from warehouse.

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$2.25 $2.35	$4.25
Warehouse, New York	3 23	4 57
Warehouse, Cleveland	3.52	3.42
Warehouse, Chicago	4.12	3.52

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York *Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55	4.68	6.80	4.50	4.68
No. 12	3.60	4.73	6.85	4.60	4.73
No. 14	3.65	4.78	6.90	4.65	4.78
No. 16	3.75	4.88	7.00	4.75	4.88
Black					
Nos. 18 and 20	4.20	5.58	7.30	5.30	5.55
Nos. 22 and 24	4.25	5.63	7.35	5.45	5.60
No. 26	4.30	5.68	7.90	5.50	5.65
No. 28	4.35	5.78	8.00	5.60	5.75
Galvanized					
No. 10	4.70	6.13	9.00	5.95	6.10
No. 12	4.80	6.23	9.10	6.05	6.20
No. 14	4.80	6.23	9.10	6.05	6.20
Nos. 18 and 20	5.10	6.63	9.40	6.35	6.50
Nos. 22 and 24	5.25	6.78	9.55	6.50	6.65
No. 26	5.40	6.93	9.70	6.65	6.80
No. 28	5.70	7.13	10.00	7.95	7.10

*To these prices 10c. must be added for delivery in Jersey City and 15c. for New York and Brooklyn.

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.50	$5.25	$4.84
Flats, square and hexagons, per 100 lb. base	6.00	5.75	5.34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Co'd rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	40
Malleable nickel sheet bars	42
Hot rolled rods, Grades "A" and "C" (base)	65
Cold drawn rods, grades "A" and "C" (base)	77
Copper nickel ingots	42
Hot rolled copper nickel rods (base)	52
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb lots sells as follows, f.o.b. New York: $\frac{1}{32}$, 8½c. per lb.; ⅛, 8c.; $\frac{5}{32}$ to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	6.50	8.00	9.00
Spring steel (light)	10 00	7.00	12.00
Coppered bessemer rods	9.00	8.00	7.00
Hoop steel	4.58	4.04	4.18
Cold-rolled strip steel	9.00	8.25	9.25
Floor plates	5.75	4.00	6.03

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Steel Inches	Steel Black	Steel Galvanized	Iron Inches	Iron Black	Iron Galvanized
⅜ to 3	57½%	44%	⅜	15½–16½%	+10½–11½%
			½	19½–20½%	1½– 2½%
			¾ to 1¼	24½–25½%	8½– 9½%

LAP WELD

Steel Inches	Steel Black	Steel Galvanized	Iron Inches	Iron Black	Iron Galvanized
2	50½%	38%	2	20½–21%	6½– 7%
2½ to 6	53½%	41%	2½ to 6	22½–23%	9½–10%
7 to 12	50½%	37%	7 to 12	19½–20%	6½– 7%
13 to 14	41%	....			
15	38½%	....			

BUTT WELD, EXTRA STRONG PLAIN ENDS

Steel Inches	Steel Black	Steel Galvanized	Iron Inches	Iron Black	Iron Galvanized
⅜ to 1½	55½%	43%	⅜ to 1½	24½–25½%	9½–10½%
2 to 3	56½%	44%			

LAP WELD, EXTRA STRONG, PLAIN ENDS

Steel Inches	Steel Black	Steel Galvanized	Iron Inches	Iron Black	Iron Galvanized
2	48½%	37%	2	21½–22½%	8½– 9%
2½ to 4	51½%	40%	2½ to 4	23½–24%	11½–12%
4½ to 6	50½%	39%	4½ to 6	22½–23%	10½–11%
7 to 8	46½%	33%	7 to 8	14½–15%	2½– 3%
9 to 12	41½%	28%	9 to 12	9½–10%	+2 –2½%

Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅜ to 3 in. steel butt welded	44%	28%	42½%	33⅓%	57½%	44%
2½ to 6 in. steel lap welded	39%	24%	44½%	29½%	53½%	41%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 6%. Cast iron, standard sizes, 15% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	13.75	15.00	18.50
Tin in 5-ton lots	33 00	34.25	61.50
Lead	4.62½	5.75	9.00
Zinc	6.00	7.00	8.85
ST. LOUIS (In carload lots)			
Lead	4.22½	5.25	8.87½
Zinc	5.60	6.00	8.50

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

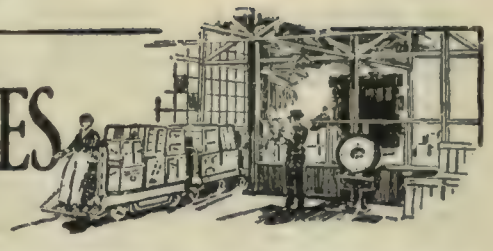
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	21.00	22.50	29.50	23.00	31.00	24.25	36.00
Copper wire (carload lots)	16.00	17.00	29.25	19.00	29.50	24.00	27.00
Brass sheets	18.75	20.25	26.50	24.00	29.00	26.50	27.00
Brass pipe	23.50	25.00	32.00	25.00	34.00	21.50	35.00
Solder (half and half) (case lots)	22.50	27.75	39.00	26.00	40.50	21.00	38.00

Copper sheets quoted above hot rolled 24 oz., cold rolled 14 oz. and heavier add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill, 1,000 lb. and over, warehouse; net extra:

	Current	One Year Ago
New York	16.75	23.75
Cleveland	20.00	27.00
Chicago	21 25	26.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f.o.b. mill + less 8% for carload lots..... 11.50

	Warehouse			
	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	13.70	15.00	14.30	15.50
New York	12.50	14.00	13.50	14.50
Chicago	14.50	15.00	14.95	15.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	6.00	10.87½
Chicago	6.50	11.50
Cleveland	7.50	13.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	11.50	17.00	10.00	10.50
Copper, heavy, and wire	11.00	16.25	9.50	9.00
Copper, light, and bottoms	9.00	15.00	9.00	8.00
Lead, heavy	4.00	7.25	4.00	3.75
Lead, tea	3.00	6.00	3.00	3.00
Brass, heavy	7.00	10.00	7.00	10.00
Brass, light	5.50	9.00	5.00	5.50
No. 1 yellow brass turnings	6.00	9.00	5.50	6.00
Zinc	4.00	5.25	3.00	3.50

ALUMINUM—The following prices are spot from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.2@28.1	24.50	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	23.50	33.00
Chicago	24.50	29.00
Cleveland	22.00	32.00

BABBITT METAL—Warehouse price per pound:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	70.00	90.00	46.00	71.00	35.00	70.00
Commercial	30.00	50.00	16.50	21.50	9.00	15.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	List	+$3.00	$1.00	$1.00	+ 1.15	1.25
Hot pressed hexagon	List	+ 3.00	1.00	1.00	+ 1.15	1.25
Cold punched hexagon	List	+ 3.00	1.00	1.00	+ 1.15	.90
Cold punched square	List	+ 3.00	1.00	1.00	+ 1.15	.90

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	60%	40%
Chicago	70%	50%
Cleveland	70%	55%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	45%	60%	50%
1⅛ and 1¼ in. by 3 in. up to 12 in	25%	50%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York.....$4.50 Cleveland.....$3.50 Chicago.....$2.50

For cast-iron washers, ⅝ and larger, the base price per 100 lb. is as follows:

New York.....$6.00 Cleveland.....$4.00 Chicago.....$4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	+40%	50%	40%
Larger and longer up to 1 in. by 30 in	+40%	40%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	35%	20%	10%	30%
Chicago	net	10%	net	10%
New York	50%	10%	25%	10%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	45%	50%	45%
Tinned	45%	50%	30%

Structural, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York...$5.20 Cleveland..$5.00 Chicago....$5.08 Pittsburgh..$3.90

Boiler, same sizes:

New York...$5.30 Cleveland..$5.10 Chicago....$5.18 Pittsburgh..$4.00

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	24.50	27.00	29.00
Brass	23.50	24.00	28.00

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅜-2 in. inclusive in rounds, and ½-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.50 per 100 lb.

In Cleveland—$8.50 per 100 lb.; New York price is 8@8½c.

COTTON WASTE—The following prices are in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
White	7.50@13.00	13.00	13.00	14.25
Colored mixed	7.00@11.00	9.00–12.00	10.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.25	$2.00	$2.25
Philadelphia	2.00	2.75	2.00
Cleveland	3.25	4.00	2.50
Chicago	2.50	2.25	2.25

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.70	$3.50	$3.40
Philadelphia	3.65	3.65	4.25
Chicago	4.50	4.00	5.00

COKE—The following are prices per net ton at ovens, Connellsville:

	Current	One Month Ago	One Year Ago
Prompt furnace	$4.50	$5.00@$5.50	$6.00
Prompt foundry	5.50@6.50	6.25@7.00	7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	0.85

LINSEED OIL—These prices are per gallon:

	New York		Cleveland	Chicago	
	Current	One Year Ago	Current	Current	One Year Ago
Raw in barrels, (5 bbl. lots)	$0.73	$1.87	$0.90	$0.75	$1.66
5-gal cans	0.76	....	1.15	0.90	1.86
1-gal. cans (2 to case)	0.76	....	....	....	....

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	15.00	17.00	13.00	15.50
25 and 50-lb. kegs	13.25	14.75	15.25	17.25	13.25	15.75
12½-lb. keg	13.50	15.00	15.50	17.50	13.50	16.00
5-lb. cans	16.00	17.50	17.00	20.00	16.00	18.50
1-lb. cans	18.00	19.50	18.00	22.00	18.00	20.50

500 lb. lots less 10% discount. 2,000 lb. lots less 10-4% discount. 10,000 lb. lots less 10-7½% discount.

Pa., Bolivar — The Miller Garage Co. will soon award the contract for the construction of a 2 story, 50 x 100 ft. garage. Estimated cost, $50,000. W. R. Myton, 1st Natl. Bank, Johnstown, Archt.

SOUTHERN STATES

Fla., Tampa — The Burger Repair & Constr. Co. plans to build a plant for the manufacture of portable band saws.

W. Va., Logan—J. W. Fisher plans to build a 40 x 86 ft. garage.

MIDDLE WEST STATES

Ill., Chicago—M. Fesel, 2136 Wilson Ave., will soon award the contract for the construction of a 1 and 2 story, 100 x 110 ft. addition to his garage on Western and Montrose Aves. Estimated cost, $60,000. J. K. Neebe, 2522 Aubert Ave., Archt.

Ill., Chicago—The Hannifin Mfg. Co., 621 South Kolmar Ave., manufacturer of special machinery, has had plans prepared for the construction of a 2 story, 90 x 160 ft. factory on Knox and Wellington Aves. Estimated cost, $200,000. M. J. Hannifin, Pres.

Ill., Chicago — O. Johnson, 7722 Paxter St., will soon award the contract for the construction of a 1 story, 72 x 165 ft. garage on South Stony Island Ave. near 69th St. Estimated cost, $30,000. A. G. Lund, 449 West 63d St., Archt.

Ill., Chicago — The Sampson Mfg. Co., 4244 West Lake St., manufacturers of gas and electric fixtures, has awarded the contract for the construction of a 1 story, 40 x 125 ft. factory at 3244 West Lake St., to replace the one which was recently destroyed by fire. Estimated cost, $12,000.

Ill., Chicago—G. F. Weiland, 6153 Kimbark Ave., will soon award the contract for the construction of a 1 story, 98 x 130 ft. service station at 6850-8 Parnell Ave. Estimated cost, $50,000. W. S. Armstrong, 127 North Dearborn St., Archt.

Ill., Chicago—Zimmerman, Saxe & Zimmerman, Archts., 64 East Van Buren St., will open bids about March 10 for the construction of a 2 story addition to factory at 1755 Northwestern Ave., for the Runzel Lenz Electric Mfg. Co., 1751 Northwestern Ave.

O., Cleveland—The Lindsay Wire Weaving Co. plans to build a 2 story, 100 x 200 ft. factory at 14025 Aspinwall Ave. Estimated cost, $75,000. H. L. Lindsay, Pres. Private plans.

O., Columbus — The Jeffrey Mfg. Co., North 4th St., manufacturers of elevating, conveying and mining machinery, is having sketches made for the construction of a 1 story, 125 x 350 ft. factory. Estimated cost, $250,000.

O., East Cleveland — (Cleveland P. O.) C. Mornono Garage, 12432 Superior Ave., Cleveland, will receive bids until March 10 for the construction of a 2 story, 52 x 120 ft. garage on Superior and Bender Aves. Estimated cost, $60,000. Whitworth & Johnson, 413 Engineers Bldg., Cleveland, Archts.

Wis., Manitowoc—The Hamacheck Bleser Co., Flat Iron Bldg., plans to build a 3 and 4 story, 80 x 100 ft. garage on South Water St. Estimated cost, $80,000.

Wis., Oconomowoc — The Oconomowoc Canning & Product Co. plans to build a 3 and 4 story, 70 x 125 ft. addition to its factory on Main St. Estimated cost, $100,000. P. Binzel, Pres.

Wis., Waupun—The Safety Fender Co., c/o A. H. Luebke, plans to build a 2 story, 60 x 185 ft. factory on Main St., for the manufacture of automobile safety fenders. Estimated cost, $50,000.

Wis., Wausau—The Marathon Electric Mfg. Co., Plumer Island, plans to build a 2 story, 50 x 150 ft. addition to its factory. Estimated cost, $75,000.

WEST OF MISSISSIPPI

Mo., Kansas City—D. L. Piggot, 12th and Prospect Aves., plans to build a 1 story, 113 x 144 ft. garage. W. E. Harris, 2110 North 5th St., Kansas City, Kan., Associated Archt.

Mo., Kansas City—The Sunshine Safety Lamp Co., 1005 McGee St., has awarded the contract for the construction of a 2 story, 50 x 115 ft. factory.

Tex. Weatherford — O. Jones plans to build a showroom and service repair shop.

CANADA

Ont., Ottawa—The Beach Fdry. Co., Hinton Ave., will build a 240 x 360 ft. iron foundry. Estimated cost, $35,000.

General Manufacturing

NEW ENGLAND STATES

Mass., Charlestown — (Boston P. O.) Shea & Donnelly, Summer St., Boston, will build a 1 story, 90 x 160 ft. mill on Roland St., here, for dressing and cutting of building stone. M. Sullivan, Boylston St. Boston, Archt.

Mass., South Braintree—(Boston P. O.) The Monatiquot Rubber Wks., Co. plans to rebuild its rubber reclaiming plant on Hancock St., which was recently destroyed by fire. Estimated cost, $100,000.

Mass., Worcester—The Worcester State Hospital, Belmont St., plans to build a cold storage plant. Estimated cost, $50,000.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Julo Bottling Co., Galveston, subsidary Southern Beverage Co., 200 West Camden St., Baltimore, plans to build a 2 story, 30 x 60 ft. bottling factory on North Ave. and Sherwood St., here. Estimated cost, $20,000. G. R. Callis, Jr. Amer., Bldg., Archt.

N. J., Trenton — The Trenton Zinc & Chemical Co., Broad St. Bank Bldg., plans to build a zinc plant. Pierce & Skoogmark, 140 Nassua St., New York City, Archts.

SOUTHERN STATES

Ga., Savannah — The Centennial Milling Co., 671 South Main St., Memphis, Tenn., plans to build a 2 and 3 story, 150 x 200 ft. mill construction building to have a daily packing capacity of 4,800 bbl.

N. C., Ayden — The Free Will Baptist Denomination plans to improve and build additions to its printing plant. Estimated cost, $100,000. J. E. Sawyer, Chn. Building Com.

MIDDLE WEST STATES

Ill., Chicago—Mariner & Hoskins, 4035 Kinzie St., chemists and Engrs., have awarded the contract for the construction of a 1 story, 40 x 100 ft. addition to their factory.

Ill., Chicago—W. W. Nugent & Co., 146 West Superior St., manufacturers of oiling systems, filters and devices, will soon award the contract for the construction of a 1 story, 50 x 128 ft. factory at 410 North Hermitage Ave. Pierce & Hauber, 10 South La Salle St., Archts.

O. Canton — The Continental Clay Co., Zinninger Bldg., plans to build a 2 story, 105 x 285 ft. sewer and hollow tile plant. Estimated cost, $350,000.

O., Canton — The Roller Printing and Paper Co., 215-25 Duvalt Ave., S. W., plans to build a 3 or 4 story, 62 x 100 ft. printing plant. Estimated cost, $50,000. T. B. C. Voges, Pres.

O., Cleveland—The Atlas Wheel Co. plans to build a 1 story addition to its factory at 2146 Scranton Rd. Estimated cost, $100,000. H. F. Arndt., Pres. Private plans.

Wis., Milwaukee—The Wisconsin Ice & Coal Co., 216 West Water St., plans to build a 1 and 2 story, 120 x 132 ft. ice making plant on Cambridge Ave. C. Ringer & Son, 432 Bway, Archt.

Wis., New London — The Wisconsin Cabinet & Panel Co. is having plans prepared for the construction of a 2 story, 60 x 180 ft. veneer mill, etc., on Main St. Estimated cost, $75,000. F. L. Zang, Genl. Mgr. Private plans.

Wis., Two Rivers—The Wisconsin Pail & Basket Co. is having plans prepared for the construction of a 2 story, 60 x 165 ft. basket factory on Main St. Estimated cost, $100,000. J. F. Conant, Pres. K. Conant, care of owner, Archt.

WEST OF THE MISSISSIPPI

Ark., Little Rock — The People's Ice Co., 712½ West 9th St., will soon receive bids for the construction of a 1 story, 150 x 200 ft. ice plant on 9th and Thayer Sts. Estimated cost, $100,000. Moody, Knight & Lewis, 512 A. O. U. W. Bldg., Engrs. and Archts.

Ia., Cedar Rapids—The Peterson Baking Co., 316 6th Ave. E., will soon open bids about March 20, for the construction of a 2 story, 40 x 100 ft. factory on 3rd St. and 6th Ave. E. Estimated cost, $50,000. H. A. Rundquist, Mgr. Hatton, Holmes & Anthony, 323 Masonic Temple, Archts.

Minn., Brainard—The Farmers Terminal Packing Co., 319 Guardian Life Bldg., St. Paul, plans to build a 3 story, cold storage plant. Estimated cost, $50,000. H. E. Edmunds, Secy. and Treas. Private plans.

Minn., Browerville—Nathe & Alden have awarded the contract for the construction of a 2 story, 40 x 80 ft. creamery on Main St.

Mo., St. Louis—The Missouri Car Co., 410 Fullerton Bldg., is having plans prepared for the construction of a street car factory along the tracks of the Chicago, Rock Island and Pacific R.R. and Ladue Rd. Estimated cost, $150,000. Private plans.

Mo., St. Louis — H. Paul & Sons, 1309 North 15th St., manufacturers of mirrors and show cases, have awarded the contract for the construction of a 1 story, 20 x 50 ft. factory at 1321 North 15th St. Estimated cost, $35,000.

N. D., Williston—The Farmers Creamery & Produce Co. plans to improve its creamery and install new refrigerating plant, 2 pasteurizing machines, etc. H. C. Blankenship, Secy.

Okla., Springfield—The city plans to install an ice and cold storage plant. Address the Mayor.

Tex., Uvalde—W. A. White, Box 247, plans to establish a plant for the manufacture of soap.

WESTERN STATES

Utah, Monticello—Local farmers in conjunction with the Anglo Amer. Mill Co., c/o J. W. Hanson, plan to build a flour mill. Estimated cost, $15,000.

CANADA

Man., Transcona—The Dept. of Railways and Canals, Ottawa, has awarded the contract for altering and building additions to its coach paint shop, here. Estimated cost, $22,000.

Ont., Amherstburg—The Conklin Planing Mills is having plans prepared for the construction of a planing mill, storage building and lumber sheds. Estimated cost, $75,000.

Ont., Guelph—The Sterling Rubber Co. plans to rebuild its plant which was partially destroyed by fire. Loss about $75,000.

Que., Hull—J. B. Larose, 102 Montcalm St., plans to rebuild his mattress factory. Estimated cost, $25,000.

See "SEARCHLIGHT" for Business Opportunities

American Machinist

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Selling Machinery in Europe Since the Armistice

Conditions in the Devastated Countries—European Trade Customs—The Shortcomings of American Business Methods—Points on How to Develop Foreign Business

By OLIVER FIELD ALLEN

IT HAS been two years since the Armistice was signed, a great amount of reconstruction is actually completed, and yet American machinery manufacturers have supplied comparatively little factory or contractor's equipment to Europe. America has been told of the awful destruction; of thousands of industrial plants completely demolished; of whole towns and cities in ruins; and of the scarcity of all kinds of tools and supplies. And it was all true. Even the armies ran short. Neither the British nor the American Army engineer services had anything like the amount of tools they wanted in the fall of 1918, to say nothing of the limitations imposed on civilian establishments. Private plants not actually engaged in necessary production for military needs were either taken over by some army service or wrecked and the tools used in an army shop. At the same time there were thousands of tons of the best American machine tools and supplies lying about our American docks and seaboard warehouses, waiting for ship capacity to take them over. The Belgians were wise enough to buy, through Government agencies, a considerable part of these stocks, and use them advantageously to get their shops going quickly.

When the fighting ended the American manufacturer naturally thought he could combine a patriotic duty to help in world reconstruction with the quick and profitable sale of machinery available because war production had stopped in the United States. He knew that large quantities of American tools had been used by the allies, both in civilian plants, and in French, English and American army work. So he felt that they needed no introduction. He did not know how many of the tools, and what large quantities of supplies, used in even the American army engineer shops, were of French and British manufacture. Nor, perhaps, did he appreciate the quantity of fine tools released in Europe from war production.

As soon as he could get the necessary passport, the owner, president, or some other important man, went from many establishments to France not later than the middle of 1919. Sometimes he took engineers or other assistants with him. If he represented a company or group which had long established and going connections over there before the war, and could "carry on" with old, affiliated interests, he was fortunate but still had his troubles. We are here more interested in those trying to establish profitable connections for export business, where they have not existed before. These American business men were most cordially and courteously welcomed, but most of them did not get any orders. It is perhaps no exaggeration to say that for the great majority the total selling price of all business resulting directly from those visits was less than the traveling expenses for the trip. And that is no disparagement



FIG. 1. MAIN MACHINE SHOP OF THE SOCIETE D'ELECTRICITE ET DE MECANIQUE AT GHENT, BELGIUM

This illustration shows it in the condition in which it was left by the Germans at the time of the armistice. This plant was used as a German artillery repair shop during the war and was consequently not demolished, but practically all of its machinery was taken away.



FIG. 2. THE SAME PLANT AS SHOWN IN FIG. 1

The photograph was taken on the first of April, 1920, and shows complete restoration of tool equipment. This plant recovered a large part of its stolen machinery and also shares in the American machinery purchased through government agencies referred to in the text.



FIG. 3. LESQUIN MACHINE SHOP OF THE CIE. FRANCAISE THOMSON HOUSTON NEAR LILLE

This shop was not quite completed in 1914 when invaded by the Germans. Note the very effective lighting and use of motor driven tools representing the best French engineering at the beginning of the war.

of the men who went over; they were among the very best men in their own lines at home, thoroughly successful American business men, who worked conscientiously and continuously while in Europe. Unfortunately, they were playing at a game where the handicaps against them were very heavy and where they did not have the right outfit to play with. It was something like playing golf with a tennis racquet or baseball with a golf stick and tennis balls. All good enough in their own places, but not successful in such a combination no matter how skilled the player.

Language a Handicap

Perhaps the most apparent handicap is language. Very few Americans speak French, Italian, Spanish, Flemish or German at all. Still fewer know their idiomatic engineering and technical terms. We had our troubles on that score in the army. Theoretically an interpreter is easy to get and solves the problem of both interviews and correspondence. Actually many of us in the engineers gave them up long before the armistice. It is unfair to expect the average, even well-educated man to really know two languages as to the technical details of several lines of trade. If he does he has a better job than acting as interpreter. And when he does not know he does some funny things. One passed on a request for me for a pumping unit and translated the French expression which clearly means a centrifugal pump as a piston pump. If he has been educated in English, or working for an English concern he cannot get out of the habit of treating our gallons, when talking of capacities, as being the same as the British imperial gallon, which is much larger, and the ton as the British ton, which is even a little bigger than the metric.

I have, more than once, listened in at a conference between two well informed men in the same line of work, each of whom would most carefully explain his own side of the question in his own language, and wait in awed silence, while the interpreter translated, amazed that it was possible to express it all in so few words in the other language, both in blissful ignorance that the translator with his own limited knowledge of the subject and the foreign language was only "hitting the high spots." Both sides ended with a dissatisfied feeling which they could not understand. And yet the interpreter was doing his best all the time. There was a case where it was appropriate for me to "butt in" and clear the air. Having finished my few words of explanation we looked for the interpreter only to find that he had quietly sneaked out. The joke was on me, for I had to finish the job. In another case a very complete list of machinery was prepared and checked. The purchaser came to me and asked where a certain lot of supplies was. I happened to know about the transaction and that there was nothing of the sort included. I called for the list. The purchaser pointed to the item, properly spelled and very plain, but actually covering something with a quite different trade name. Fortunately the things supplied were of more value than the name given them implied and so the matter was easily adjusted.

Confusion of Measuring Standards

Due to the different systems and standards of measurements employed in various parts of the world, the manufacturer who sends descriptive matter abroad including engineering data expressed only in our usual American terms, is frequently handicapped by the foreigner's equally general use of entirely different units. This includes not only such units as those of dimensions, weights, screws and pipe threads, but the ways of defining such things as pressure, vacuum, torque and temperature involved in giving ratings and operating conditions.



FIG. 4. VIEW OF THE SAME BUILDING AS SHOWN IN FIG. 3

This illustration shows the plant in the condition in which it was found upon the retirement of the Germans in the fall of 1918. A large part of the machinery and structural steel had been taken to Germany. The plant has been rebuilt with improvements and is now again in operation.

Another handicap is trade customs, perhaps better expressed as "shop practice." While our machine shops, rolling mills, etc., differ from each other in details of their ways of doing things, the migration of mechanics, foremen, superintendents and engineers, coupled with the interchange of information through our technical papers, such as the *American Machinist*, and the meetings and publications of our engineering societies, has been sufficient to establish certain pretty well defined ways of doing many things all over the country, and has resulted in the development of machine tools, hand tools, standards for stock, dimensions, etc., which are quite unique to the United States. The same thing has happened in Europe, and as the developments have not been along exactly the same lines, many things normal to American shop requirements and very efficient here do not fit European conditions.

To illustrate: In Western Europe, thin, smooth iron castings are used for a great many things, from water closet flushing tanks to electric switch boxes for which we use sheet metal, entailing very different machines for the manufacturing processes. Parts that we would mold they machine out of the solid or vice versa. They will sometimes spend more labor and care in the foundry, such as making more accurate and stable cores and doing loam molding, thereby getting castings requiring very light finishing cuts, where we allow greater tolerances in the foundry and take much heavier cuts in machining. A Belgian rolling mill will produce rails, a great variety of structural shapes, plates, etc., each large mill meeting the requirements for nearly all steel products which a rolling mill can furnish, while our mills specialize on a limited group, as rails, or structural shapes, or plates, etc. Belgian mills are designed and equipped to do all of them well and cheaply. The limited market and necessity of competition have brought about this condition.

The official of the American manufacturing establishment who went over was a business man in the habit of having the reputation of his goods and the purchaser's general knowledge of them help greatly to sell them. In America we are prone to let purchasing agents buy on reputation, price and time of shipment without as close a study of the details of design, construction, durability, etc., as is frequently made in Europe. This same official was perhaps the man who



FIG. 5. HOMES OF THE SUPERINTENDENTS AND ENGINEERS

They are shown as they existed at the time of the invasion. This shows the attractive conditions under which employees of the European industrial establishments frequently live. These buildings as well as the plant shown in Fig. 3, were destroyed.



FIG. 6. ANOR FORGE SHOPS, FRANCE

This view shows a solid wall, typical pre-war arrangement.

originally developed the machines he offered, or he grew up with the business; but generally he has been too busy with the administrative or financial affairs of his company in recent years to follow in detail all of the changes in design, and to know why his machine is now made just as it is.

The European engineer is a highly educated, well-trained man. Sometimes, from our point of view, the theoretical part of his education over-shadows the practical, but no one who knows him in the aggregate can question the thoroughness and soundness of his training. The result is, he asks very pointed questions. No important job can be closed without going through an engineer's hands and if he finds the foreign seller's representative cannot answer concrete, pertinent questions about details of the particular machine he is going to buy, he loses interest at once. I think those manufacturers who are selling the most in western Europe will agree that (war purchases being now eliminated) you cannot sell there on bluff, on reputation gained in another country, or even on low prices and prompt shipments, unless you can convince the purchaser that your machine is really suited to his requirements and will operate economically with low upkeep during a long life.

Intelligent Salesmanship

Does the American, wishing to develop his foreign business, ever think how much chance a foreigner would have to come into his office and sell a tool such as he usually buys from some old friend, no matter how good it might be? What would his own superintendent say to specifications in French, dimensions in millimeters, international screw threads, chucks which would not fit his drills and spare parts to come from Europe? And how seriously would his purchasing agent consider the offer of a foreign salesman, who brought an interpreter with him, who could only point to machines in use in another country and who did not know the requirements of the American shop?

If the personal representative of the American manufacturer is thus handicapped by lack of accurate, detailed information when he goes personally to see the foreign purchaser, how much more so is he if he is trying to sell by mail or through some general agent.

Several cases, some of them involving very large orders, have come to my attention where a foreign proposal was received by mail, or through a commission house, showing so plainly that the man who prepared it did not understand the conditions that it was read once, politely acknowledged, but never seriously considered.

For certain classes of merchandise the commission export and import house is an economically sound intermediary between the American producer and the foreign user; but except in those rare cases where it has developed a highly trained technical staff and become virtually the export department of the American factory, it not only is unable to present the product intelligently, but adds another item of expense to the already high-priced American goods. Dealing through such an agency also involves additional delay and chances for errors by forcing everything to pass through another set of people.

Negligence and Dishonesty

The last handicap I will discuss (for I wish only to emphasize important typical features) is one I dislike to have to mention, but refer to it because I feel that

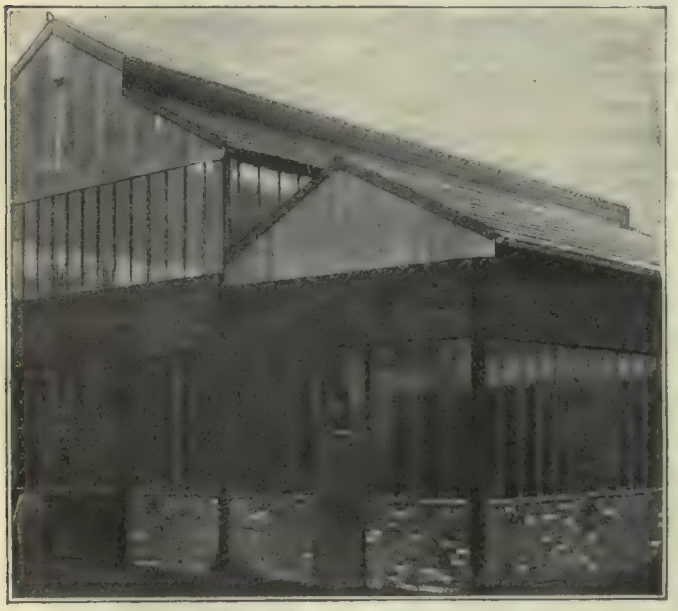


FIG. 7. THE SAME BUILDING SHOWN IN FIG. 6. As reconstructed in April, 1920. Attention is called to the increased size and the great improvement in the window arrangement.

it is the duty of every American, and especially of American manufacturers, to show in no uncertain terms the most positive denunciation of carelessness and dishonesty in filling foreign orders. Carelessness shows itself in incomplete study of requirements, "sloppy" manufacture, defective packing, incomplete tagging and marking, not only of boxes but of parts to be reassembled abroad; in failure to include adequate drawings and instructions for setting up, starting and operating. Of what use is a machine, no matter how fine it is, if after a two thousand mile voyage some important part is found broken, ruined by exposure, or missing? The percentages of such troubles with the shipments from those American factories doing the most export trade are bad enough—the others are awful.

Worse than negligence is dishonesty. A member of the A. E. F., after demobilization, took the agency for a certain American product. Through his personal acquaintance made in the trenches, he sold several cases. When the cases arrived and were opened the top layers were per contract and samples but the majority of the contents were very inferior. An engineer for a large French manufacturer came to the United States after the armistice. He got samples of a certain product and took them home. They were tested and found suitable. A good sized order was placed. When the goods arrived they were not anywhere near equal to the samples.

Exchange Rates and Labor Cost

The handicaps I have mentioned are among those which always exist, irrespective of fluctuations of exchange, adverse effects of import duties or differences in cost of labor. The questions of rates of exchange and relative value of money as related to both wages and cost of living in America and in Europe are economic questions outside of the scope of this article. It may be pointed out, however, that much of the raw material entering into the construction of machinery, such as iron and copper, has to be largely imported into Frence, Belgium and other European countries, and our competition in their markets is after all largely a question of the comparative cost of the necessary labor and general expense involved in production and merchandising, after the American and the foreign products have been put on an equal footing as being suitable to the purchaser's requirements. The meeting of requirements comparable not only with the local products but with those of other foreign countries which can compete in the same territory is essential.

We must not hide excessive costs nor high overhead behind a camouflage screen of adverse exchange conditions or peculiar foreign specifications. The advantages are not all on the other side. For instance, good steam coal now costs about 300 francs a ton in France which is equal to about $20 at present rates of exchange. It is plain that power used to produce machinery costs more there than here. Many food supplies cost more there now, even when purchased with money bought with American dollars. To the native, the cost of living in western Europe has increased far more than it has here, and yet they are beginning to undersell us in neutral markets, in spite of the fact that we usually produce in greater quantities from more standardized designs.

Why? For one thing, they are working harder and far more hours per day. We have our vacations but we want an amount of time for play all the time which seems excessive in Europe. The fifty weeks in the year when we are supposed to work, we demand daylight time enough before or after work to keep our automobiles in order. The difference was emphasized while we were soldiers. We Americans played, or went sight-seeing, for all the leave time we could pry out of that orderly room dictator, the "Top Sergeant." No so the "poilu." He spent the first day or two of his "permission" resting and visiting, then worked hard for ten days, usually at his old job. Another day or two of play, his two weeks were up, and back he went to fight. That custom was so universal that in at least one sector some American engineer shops recruited most of their men employees in the summer and fall of 1918 from French soldiers on leave. The only stipulation, beyond paying the official published rates of wages, was to pay cash whenever the soldier decided his working leave time was over so that he could personally hand the money to his family before he started back to the front. In peace times the gardens,

the rabbits, the chickens, etc., which reduce expenditures for sustenance, to say nothing of odd jobs which either actually bring in money or at least reduce expenses, occupy much of the time outside of working hours. I recently made several automobile trips through the devastated regions, in the much-fought-over areas both east and north of Paris. Schedules were such that we frequently started early and stopped late. I found the French men and women hard at work in towns and on farms before seven in the morning and coming back from work at seven in the evening. They were actually working, by the thousands, eleven or twelve hours per day. Even in Paris factories on an eight-hour basis are frequently working ten hours a day.

(To be concluded next week)

Empty Shops and Crowded Homes

By Entropy

During the war almost every shop that could get hold of a profitable order felt the patriotic urge to build additions and enlarge so as to gather in all the profits that could be had. In other words, to "Make hay while the sun shone." Then after the war there were many who felt so reluctant at parting with their profits, and not knowing that stock dividends would be passed as non-taxable, put up still more buildings. The result is that the country as a whole has a greatly increased potentiality for manufacturing.

One of the most exasperating predicaments for a firm to be in is to be "real-estate poor." That is, to have more real estate than it can afford, and to see regular sure-enough profits dissipated in paying taxes, interest and insurance.

In the natural course of events the shop that is in this condition finds that the best thing to do is to sell enough goods to keep the factory filled with workers, even though a small profit, or even no profit at all is made. When a shop is so affected and cuts prices to get orders there is apt to be some upsetting of the business of all its competitors. They can either meet the cut or they can wait until the cut-price shop has accepted all the orders it can absorb and then go after the rest of the business at the old prices. But when, as now, nearly every shop needs work we have a new condition, and one that is giving a great deal of concern to many people. In one instance a very well-known concern which expanded, not merely because it saw a profit but because the government begged it to do so, the problem has been attacked by endeavoring to merchandise its own goods directly to the user, and its shops vacated by the war machinery are being turned to the manufacture of goods related, in use at least, to the standard line of the company but of greater real need. Its regular line is almost entirely in the class of luxuries. Its new side lines, while partly in the luxury class, are mingled with household necessities.

It seems rather as if for some time to come we are apt to have a very poor market for luxuries and over-priced necessities. The buying public gives every evidence of being either broke or satiated. Or it may merely have sensed a failing market, and no good sport no matter how much he would like to throw away his money, likes to buy on a falling market. On the other hand, there is a great shortage of necessities of the kind that normally carry only a limited profit. Therefore it seems as though the best bet for some years would lie in the staples. It seems almost inevitable that the luxuries already bought by our people in their flush moments will be squeezed out into the market as second-hand goods, with scarcely a mark of usage on them.

Machine Tools Not Luxuries

On the other hand, there are things which are not luxuries, and yet under present conditions not necessities. Among these and of special interest to us just now are machine tools. There must be at least double the floor space available for their manufacture that there was six years ago. Machine tools cannot be forced on a market. Cutting prices does not add to the demand at all. Price cutting by a single shop may shift the flow of orders slightly but it cannot affect the total orders. No one buys lathes to store away against an expected demand unless for a very few months only. The demand cannot be stimulated except by stimulating all business. The manufacturer is as helpless as old King Canute when he tried to sweep back the tide. All he can do is sit and wait for business to come in; then he has to fight to get his share of it. But when there is none to share his efforts are not likely to be crowned with success.

However, a machine-tool shop is after all only a machine shop, and machinists are usually adaptable people. Does it not seem reasonable for machine-tool shops to have other lines, possibly less profitable in rush periods but such as will carry the organization through lean days without a net loss? Of course, it is difficult to find another line which will need exactly the same proportion of the different machines which constitute the equipment of any given shop. It was easy for a great number of shops to change over to the manufacture of munitions during the war, if there was a profit in sight, and it ought not to be more difficult for shops to change over to avoid a loss. There is another thing to be considered, and that is the desirability of keeping an organization intact so that business may be carried on profitably when another rush sets in. Men in machine-tool shops are not of the type that one pulls up by the roots without danger of their not growing again in the same place. They are not in the habit of going away for a time and coming back to the old shop. Their pride is too great, and when occasionally one does come back he is apt to find so many strange faces that he soon gets homesick and drops out to stay.

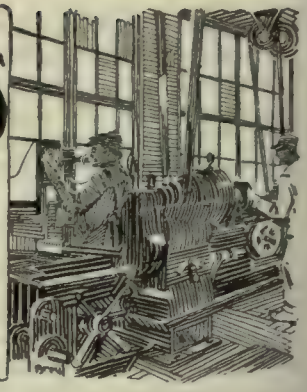
Helping the Housing Situation

The fact that shops are laying off men is sure to help the housing situation. This may seem paradoxical, but when money becomes scarce a great many small families are sure to "double up"; that is daughter and her new husband go to live with her folks, or married sisters get their husbands to take a flat together; single men who have afforded rooms by themselves will bunk in together and share the rent, and so on. To some extent this has already been forced on salaried men by the high cost of living and the low percentage of increase in salaries, but wage earners have greatly expanded in their demands for space as compared with pre-war periods. This may not be without its compensations for the rest of us, for if the demand for housing lets up it will not only give more time in which to meet the demand but it may reduce the cost of building by not creating additional competition for materials and labor.



MODERN PRODUCTION METHODS

By
W P. Basset
of
Miller, Franklin, Basset & Co



XV. Accounting for Supplies

How the Cost of Non-Productive Materials Gets Into the Final Cost of the Product—Correct and Incorrect Pricing Methods

THE only element of overhead expense which remains for us to treat is the non-productive material or supplies. As stated in a former article, non-productive materials are those which contribute to the manufacture of the product, but which cannot be allocated as a direct charge to a given unit of the product because they are not directly apparent in the finished goods.

Admittedly, materials which do appear in the finished product are sometimes treated as supplies because the cost accountant is not sufficiently analytical to devise an accurate method of measuring the amount that goes into each item of product. Occasionally, however, it is most practical to charge such items into overhead expense and so avoid the clerical effort which would be required to allocate them properly to their final resting place as productive material. If the error be not great, the clerical expense caused by insistence upon exact figures may easily be out of proportion to the benefit which is achieved. However, the capable cost man will continually strive to get as much as possible of the non-productive labor and of the non-productive material charged to the product as direct items.

At first glance it seems that material, whether productive or non-productive, is exceedingly easy to account for. As a matter of fact it is, provided that, first, accuracy of reporting the use of materials is observed, and second, that they are charged into the costs at a correct price. In the third article of this series, on "the need for systematic stock-keeping," we discussed the physical arrangement of stockrooms and the system of issuing stock. In that article, we were considering it principally from the standpoint of production planning, but the method outlined had also in mind the need for accounting for stock from a cost point of view.

I know that some executives allow the slackest of storekeeping methods because they, rightly enough, have a horror of the kind of red tape that some accountants recommend. To some accountants, absolute accuracy is a religion. They set up as a goal the records rather than the commercial use of the cost system. Therefore, when I say later on in this article that materials are to be issued on requisition I assume that good judgment will be used.

Some supplies are so inexpensive that extensive routine in issuing and accounting for them is not worth while. In machine shops I consider it a silly waste of effort to expect machinists to requisition a handful of waste; and yet I have seen it done. The sane thing is for the foreman to requisition a several days supply for his department and place it where workmen can help themselves. If it is wasted the departmental analysis of expense will soon enough show up the increased usage and steps can be taken to bring the conditions back to normal. The stock kept in the plant is often called "current" stock and that in the stockroom, the "reserve" stock.

Rivets are another common material which it is better to issue to the shop in keg lots rather than to demand a requisition for 10 or 15 at a time.

Large castings and items like plate steel can be charged into the product from the specification sheets. Actually, of course, such items are seldom kept in a stockroom under lock and key but are stored in some space handy to the department where they will be processed. When an engine or boiler is finished it is

STORES INVENTORY CARD.
THE HERKIN CAN CO

ARTICLE LOCATION B 5 B

ORDERS			RECEIPTS					WITHDRAWALS					BALANCE		
DATE	ORDER NO	QUANTITY	DATE	PURCHASE ORDER NO	QUANTITY	PRICE	AMOUNT	DATE	REQUISITION NO	QUANTITY	PRICE	AMOUNT	DATE	QUANTITY	AMOUNT

FIG. 70. STORES INVENTORY CARD

apparent that a certain quantity of these heavy materials must have been used. Every month or so a physical inventory of those classes of stock may be taken as a check on the usage.

Stores Inventory Card

The first record needed in the routine of gathering the cost of supplies is the stores inventories card, Fig. 70, which is kept in the cost department. This differs from the record kept by the production department, in that it maintains a record not only of the quantity of the supply on hand, but also gives the price paid for it. The entries in the first division, headed "Orders" are actuated by the copy of the purchase order which is sent by the purchasing department to the cost department. The source of entry for the division headed "Receipts" is the receiving slip and invoice. It is of course necessary that the receiving slips and invoices first be reconciled to agree as to quantity before the entry on the inventory card is made. Under the division headed "Withdrawals," a record is kept of the supply requisitions which have been filled. "Balance" is self-explanatory.

It is apparent that the inventory records which are maintained by the cost department merely give the detail of the controlling ledger accounts. Each individual stores inventory card bears the same relation to its ledger account that the individual account of any debtor to the company bears to the accounts receivable account in the general ledger. In other words, the various inventory accounts of the main ledger are the controlling accounts of the cost department's detailed inventory.

While it is not my purpose in this article to discuss the accounting for the direct or productive material, it may be well to note that Fig. 70 is suitable for that purpose. Fig. 71 is a variation which is used in keeping a record of finished parts. While it will not be discussed until later, it seems well to show this form at this time, inasmuch as its purpose is much the same as that of Fig. 70.

Account No. 60
Stock and Cost Record

Part No. _____

Part Name _____ Material _____

Mo.	Origin	Quantity	Total Cost	UNIT COST					QUANTITIES USED					
				Mat'l	Labor	O. H.	Total	Extras	Month and Order No.	No. of Pieces	Balance Available	Month and Order No.	No. of Pieces	Balance Available

FIG. 71. FINISHED PARTS INVENTORY CARD

The requisition not only gives authority to the stock man to make the issue, but it also serves as a record which will show for what purpose the supplies or materials were used. The requisition is comparable to a bank check, made payable in materials rather than in money. It shows, as does the check, the authorization for the payment and to what department the payment is made, and like the modern voucher check, it also shows for what purpose it is made.

The expense requisition form is shown as Fig. 72. In order that it may readily be distinguished from the requisition for productive materials, we have found it well to have in the upper left-hand corner a large letter *E*, standing for "expense." A glance at the requisition will show that it supplies space for filling in the order number and the expense designation—by which is meant the class of expense, such as repairs to material, repairs to equipment, repairs to tools, material supplies and so on. In the space headed "charge account number," the correct ledger account is entered. This is necessary because sometimes expense materials may be withdrawn from stores and instead of being charged to expense will be charged to some asset account. It may even be diverted for use in the finished product itself and so become productive material. On the requisition, there is also a place to make a charge to the department which receives

E EXPENSE REQUISITION COST COPY DATE

ORDER NO	EXPENSE DESIGNATION	CHARGE ACCT NO.	CHARGE DEPT.

QUAN	DESCRIPTION	PRICE	AMOUNT

DELIVER TO DEPT. _____ SIGNED BY _____

FIG. 72. EXPENSE REQUISITION

EXPENSE REQUISITION DISTRIBUTION

Department / Item.	Boiler	Power	Office	Tool Room	Gen. Factory	Automatic	Milling	Lathe	Planer	Polishing	Hardening	Assembling	Shipping	Selling	Total
Belting.						30 90	38 70	28 10	67 32	18 00		10 00			210 12
Mach Repairs.				32 24		20 30	93 30	51 25	12 11						394 00
Bldg Repairs.					51 27										51 27
Supplies Misc.	18 25	18 12		38 40	59 15	37 12	34 15	19 12	10 20						234 51
Repairs to Tools.				23 30		20 10						29 85			73 25
Small Tools				63 20	7 20	30 40	19 20	30 20	40 90			31 90			240 00
Repairs to Equipt.	5 00		7 90		22 [illegible]										34 90
Hardening Materials											124 65				124 65
Abrasives.										63 90					63 90
TOTAL	24 25	18 12	7 90	166 14	140 12	363 62	185 55	145 67	130 45	81 90	124 65	71 75			1456 73

FIG. 73. EXPENSE REQUISITION DISTRIBUTION

DAILY DISTRIBUTION OF REQUISITIONS

CHARGE							CREDIT						
Total	Machinery	Buildings	Goods Finished & In Process	Selling Expense	Manufacturing Expense	Date Month Jan.	Castings & Forgings	Bar Stock	Iron & Steel	Hardening & Carbonizing	Lumber & Packing Mat's	Material Purchased Finished	General Stores	Total
3378 93	40 00	25 00	3208 93		105 00	1	1575 93	1881 10	697 00	5 00	50 00		50 00	3378 93
						2								
1563 17			1526 17		37 00	3	993 12		427 15	5 00	30 00	170 00	37 00	1563 17
965 25			920 00	5 25	40 00	4		920 00					45 25	965 25
2897 12			2869 02		28 10	5	978 00	1700 02	691 00	5 10			18 00	2897 12
1628 12			1560 62		67 50	6	525 00	630 02	190 00	5 00	40 00	200 00	38 10	1628 12
2453 02		2 50	2398 22	2 50	49 80	7	1178 82	547 50	480 00		10 50	190 00	47 00	2453 02
2276 74			2198 64	5 00	73 10	8	897 93	491 29	897 42				55 10	2276 74
						9								
1486 49			1470 59		65 90	10	692 39	379 80		5 00	30 00	300 00	71 30	1486 49
2505 80		175 90	2280 90		49 00	11	1267 80	587 20	475 00	2 50	40 00	110 10	45 00	2505 80
2223 95			2176 75		47 00	12	1903 10	280 10		7 75			32 00	2223 95
2287 70			2249 20		38 50	13	1101 00	340 00	685 10	5 10	12 00	100 50	60 00	2287 70
1877 60	350 75		1470 65		51 00	14	790 20	403 80	581 00	4 20		98 00	51 00	1877 60
1683 20			1661 20		22 00	15	502 20	390 00	721 00		50 00		20 00	1683 20
						16								
1231 40			1190 20		41 20	17	220 00	581 00	321 10	8 00	18 00	30 10	41 20	1231 40
1809 35	10 25		1776 85		66 75	18	1120 32	475 00	1220 3	5 00		20 00	61 00	1809 35
1857 62			1831 62		21 00	19	995 12	673 10	110 20	1 00	41 00		21 00	1857 62
1218 71		2 75	1127 26		88 20	20	371 10	287 10	492 00				68 00	1218 71
1194 60			1143 60		51 00	21	642 30	391 00	298 10		22 00		51 00	1194 60
2166 74			2141 74		25 00	22	981 15	672 01	462 08		31 00		20 00	2166 74
						23								
2579 12	8 15		2453 79		117 18	24	1186 02	427 50	695 10	25 00	10 00	180 50	102 00	2579 12
1992 12			1942 12		50 00	25	813 02	742 50	381 60				50 00	1992 12
1408 49		3 96	1348 78		55 75	26	910 10	154 25	287 10				61 00	1408 49
1199 83			1156 83	7 50	35 50	27	510 11	287 20	321 02	42 00			39 50	1199 83
1599 04			1557 29		41 75	28	670 08	675 20	212 01				41 75	1599 04
1371 31			1296 31		75 00	29	485 19	387 00	429 12				75 00	1371 31
						30								
2024 22			1984 22		120 00	31	850 10	910 12	152 00				112 00	2024 22
48867 04	409 15	210 11	46765 80	20 25	1456 79	Total	21781 38	13864 02	10066 13	126 65	384 50	1348 18	1299 18	48867 04

BASIS FOR JOURNAL ENTRY

Debit \ Credit	Castings & Forgings	Bar Stock	Iron & Steel	Hardening & Carbonizing	Lumber & Packing Mat's	Material Purchased Finished	General Stores	Total
Manufacturing Expense				126 65	971 80		960 28	1456 73
Selling Expense					10 20		10 05	20 25
Goods Finished & In Process	2178 138	1361 385	988 503		2 50	1348 18	1348 06	46765 80
Buildings		35 01	175 10					210 11
Machinery		215 18					190 88	406 06
Total	21781 38	13864 02	10066 13	126 65	384 50	1348 18	1299 18	48867 04

FIG. 74. DAILY DISTRIBUTION OF REQUISITIONS

the material. The lower part of the requisition is given up to space in which to describe the material, the quantity issued, price and so on. It is well to have a definite understanding as to who in the plant is authorized to sign expense requisitions in order to prevent waste.

Requisitions and the Cost Department

After the storekeeper has issued the material called for, the requisition is sent to the cost department, where it is priced and extended. A clerk in the cost department enters on the inventory card, under the head of "withdrawals," the quantity, price and amount. The requisitions are then sorted first by departments and then by expense designation. At the end of the month, the requisitions under each classification are added, thus giving the figure which shows the amount of expense incurred for supplies against each of the classifications of expense which we desire to maintain on our expense analysis.

Requisitions for productive materials are handled in exactly the same way, except that instead of sorting them in the cost department by departments, they are sorted out to the different accounts and then subdivided into the accounts which are to be credited.

Thus we might have a productive requisition for material withdrawn from the forgings inventory. What we desire is, of course, to obtain the credit to the forgings inventory at the end of the mouth and a corresponding charge. So by sorting the requisitions to the accounts which are to be charged with the material, and then sub-dividing them to the accounts which are to be credited, we can, at the end of the month, by adding up the requisitions, arrive at the amounts which we must have.

In order to analyze the use of expense materials so that we may get the proper items into the expense analysis, we use the form shown in Fig. 73, "the expense requisition distribution." This sheet totals the requisitions for supplies which have been used for the month and shows in which department and for what purpose they were used.

The form shown in Fig. 74, "the daily distribution of requisitions" is filled in daily for a month. In a very small shop, four or five times a month will suffice. It is an analysis of all requisitions, both for direct and indirect materials. It is solely a mechanical means by which the charges for material of all kinds and from all storerooms are gotten into their final resting place. If indirect material was always used for non-

productive purposes, and if materials ordinarily purchased for use as direct materials were never diverted to use as non-productive material, we would be able to get our analysis from Fig 73. As we have seen in former articles, however, this is not always true. It is therefore necessary to have such a distribution as that shown on Fig. 74. You will note that this form is divided vertically into approximately even sections by the date column. To the right are the various accounts which have been credited by having materials withdrawn from them. To the left of the date column are the accounts which should be charged with those amounts. These columns are totaled and in the lower right-hand corner they are condensed so as to show the journal entries to the ledger accounts which are necessary. By means of this sheet, we get the correct debits and credits to the various ledger accounts for all material used, both direct and indirect. This form, Fig. 74, does for materials what Fig. 67 does for labor. Fig. 75 shows how the ledger accounts look after the entries shown on Fig. 74 have been made to them. We have simply added to the ledger accounts, as they appeared at the end of the last article, the figures which we developed in this one.

Price Considerations

I have seen many methods used for pricing materials and it is my experience that this is one of the points which to many men present unnecessary complications. Of course, if material markets were completely stable and materials cost the same year in and year out, there would be no difficulty involved. But as business men know to their sorrow, there is no stability in material prices.

Confusion in cost accounting frequently comes when an executive tries to solve the problem of how he shall charge to the finished product a material which has been purchased at many different price levels. The difficulty seems to be that the average executive confuses cost accounting and estimating.

If a man has in his storeroom 30 tons of bar stock, 10 tons of which cost him $60 a ton, 10 tons which cost $80 a ton and 10 tons which cost $100 a ton, it is entirely proper for him in figuring his selling price to get the profit which would come from considering that the stock used in his product had cost him the higher price, provided, of course, that he is able to make the sale on that basis. To reverse the condition, he is generally driven in a declining market to set a price based on the present material costs; which would mean in the case of the man just mentioned, that he would have to figure that the material in his product cost him $60 instead of the $100 which it may actually have cost him. Not that he would do this willingly, but competition generally forces him to it.

However, estimating for the sake of making a bid, or figuring a selling price, has nothing to do with costs. If, on the rising market the material used was

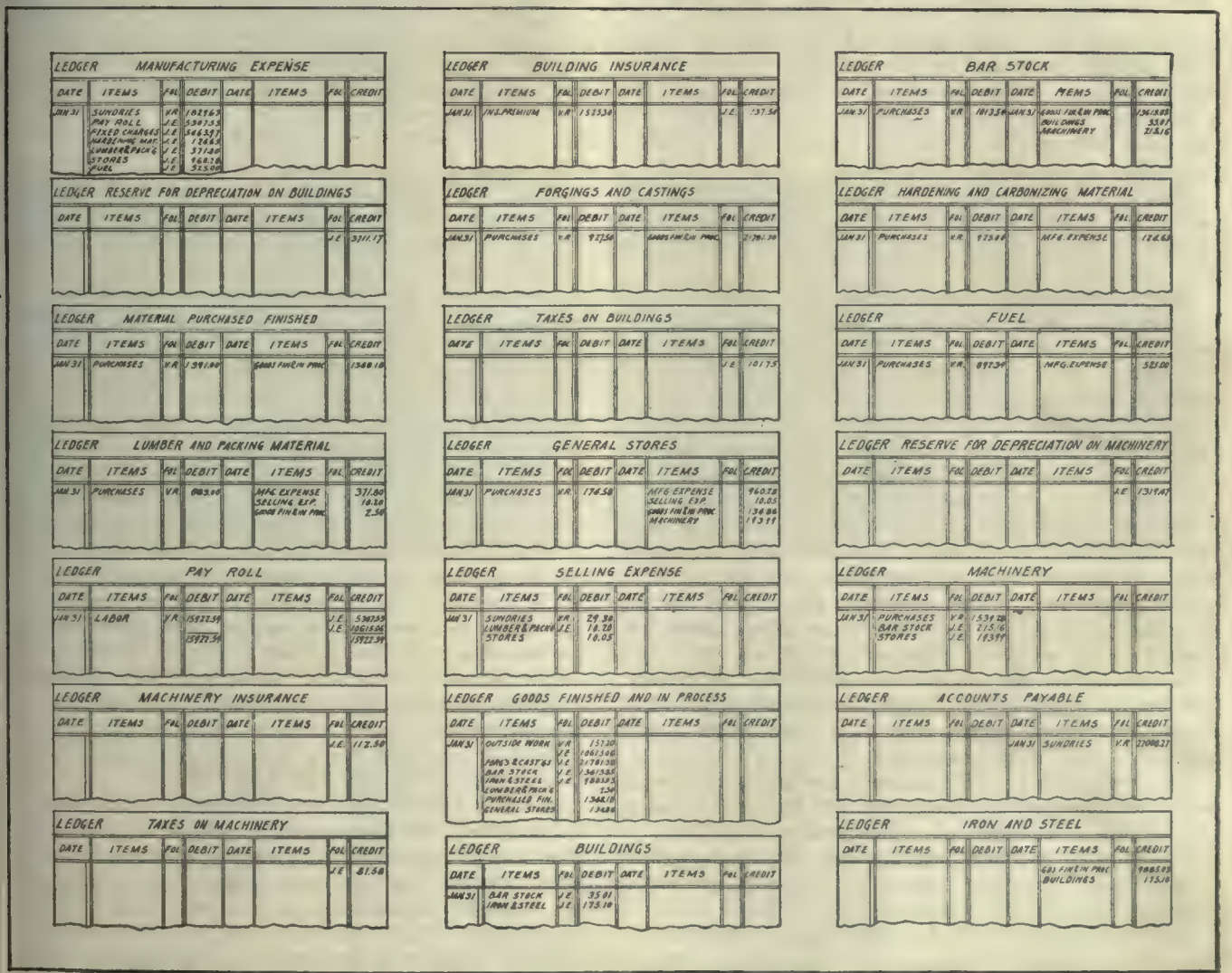


FIG. 75. APPEARANCE OF LEDGER ACCOUNTS AFTER ENTRIES IN FIG. 74 HAVE BEEN MADE

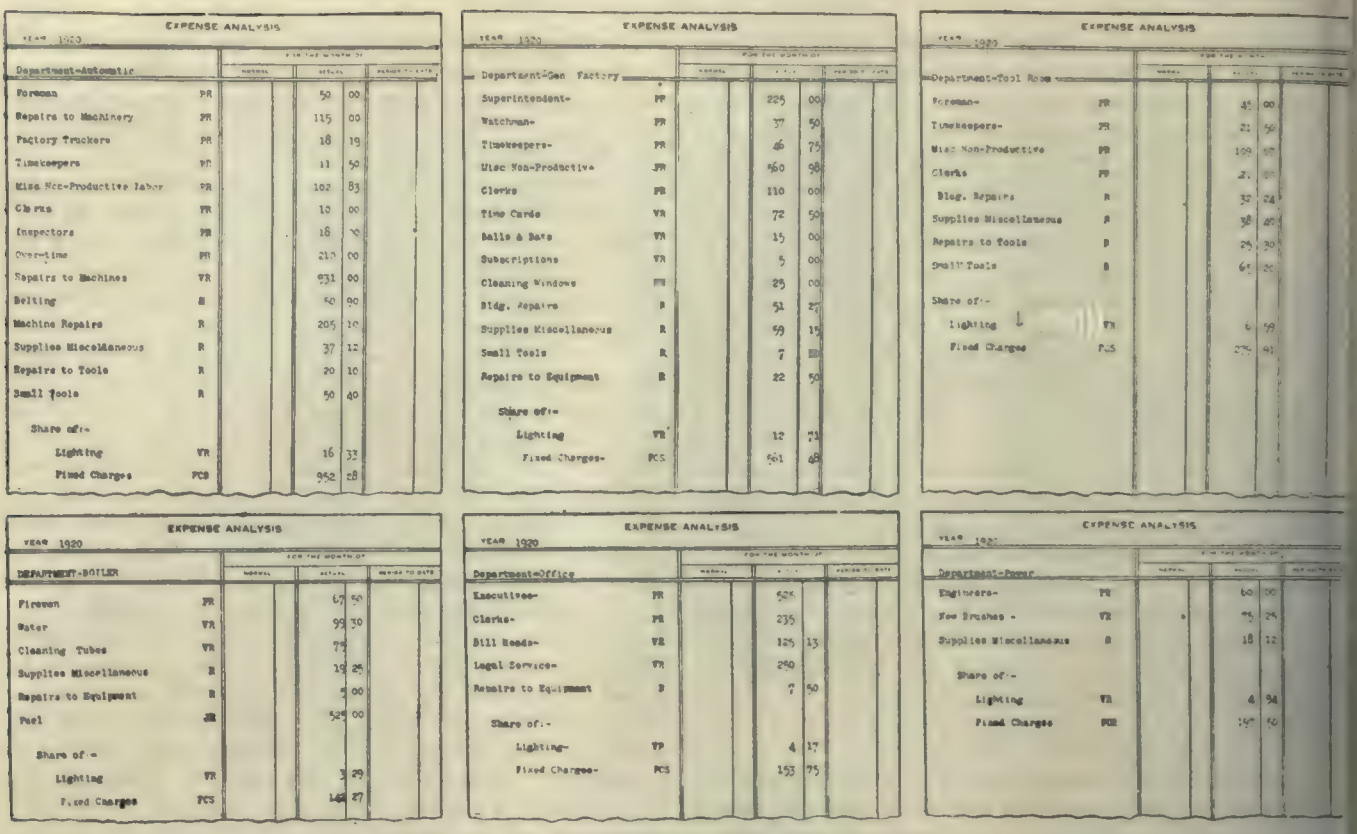


FIG. 76. DEPARTMENTAL EXPENSE ANALYSES

purchased at the lower figure, the cost must be calculated on that basis and in the declining market if the actual material which goes into the product cost $100 a ton, that is the figure which must be carried into the costs although it might be necessary to estimate the selling price on the basis of $60 steel.

It is essential that the cost figures reflect the actual operations of the business. An estimate is a different thing and is ordinarily dictated by outside conditions over which the manufacturer has no control.

Confusing estimates with costs has led to many entirely inaccurate methods of pricing materials. In order to keep the costs and the stores inventory 100 per cent correct, some method of pricing must be adopted which will make the total of the physical inventory check dollars-and-cents-wise with the inventory record upon which the inventory records in the main books of accounting depend; providing, of course, that there have been no actual physical shrinkages.

One common but completely incorrect method of pricing requisitions is to use a so-called standard price which is used throughout the year. We discovered a plant, which, in a period of rising prices, had set the standard price on its materials when prices were low. The standard was not changed throughout the year, although the market price of the material rose rapidly. The result was that the concern was selling much of its product below actual cost at a time when nearly any price could have been had.

Another common and incorrect method is to charge out the materials at the price on the last invoice, irrespective of whether materials purchased earlier at a different price had been used or not. By this method, a completely incorrect figure is reached when the physical inventory is taken.

Another method which has met with a great deal of favor is to use an average price, averaging in the old price with the price of material received later and set ting up a new average each month, when the store inventory is relieved. This also is incorrect.

The only correct method that I know of is the on dictated by common sense, which is to charge out th material at the price actually paid for the oldest mate rial in stock, first. This is sometimes called th "exhaustion of lot" method. It will occur to the reade that it is not necessary in practice actually to us that material first which was received first, but tha in pricing out the inventories the price of the firs lot received should be used until a quantity equivalen to that lot has been exhausted. The physical inventor is priced in the same way.

To exemplify the use of this method let us conside the case of the man already mentioned who had o hand 30 tons of steel, consisting of three lots of 1 tons each. In pricing out this steel in a rising market he would use the figure of $60 a ton until 10 ton of steel had been used, whether or not it was the actua 10 tons of steel which was used. When this 10 ton had been used, he would commence charging steel a $80 a ton until 10 more tons had been used and s on. The same method in pricing holds good whethe the materials are "productive" or direct charges, or ar indirect expense materials. By this method, agreemen is maintained between the physical inventory and th book inventory.

Distribution of Overhead

So much for the actual method of pricing. In Fig 76 are shown the departmental expense analyses whic have already been shown in former articles. You wi note, however, that we have added to these analyse the expense materials properly chargeable to eac department. In later articles, we will show how thi overhead expense is distributed to the product.

Locomotive Shop Equipment on Wheels

Locomotives Transferred to Repair Pits by a Traveling Crane—Time Saved by Taking Portable Workbenches and Machine Tools to the Work

By J. V. HUNTER
Western Editor, *American Machinist*

THE locomotive shop of the Chicago & Alton Railroad Co. at Bloomington, Ill., is notable because of the acreage it covers and the great amount of work handled under one roof. It is what railroad men term an overhead-transverse shop with twenty-eight repair pits extending transversely in the main bay and to which locomotives are carried by an overhead crane. The machine and pipe shops are located in a bay on one side of the main bay and the boiler shop in a bay on the other side. The building is 325 ft. x 515 ft., which indicates something of the problems involved in running back and forth with different repair jobs. A part of this running about has been dispensed with by the use of some of the special devices herein illustrated.

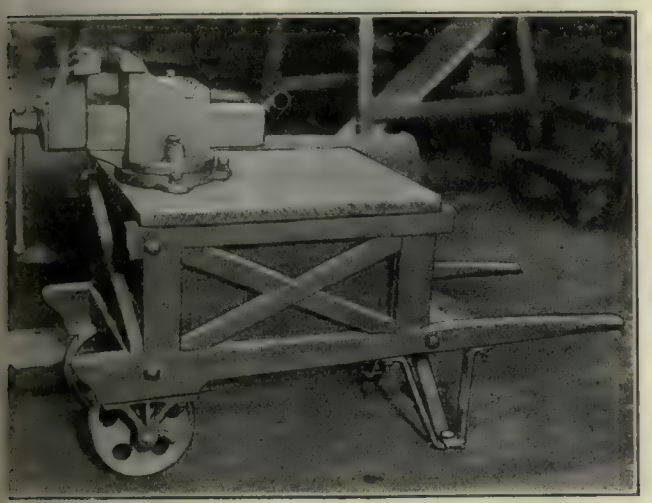


FIG. 1. MACHINIST'S PORTABLE WORK BENCH

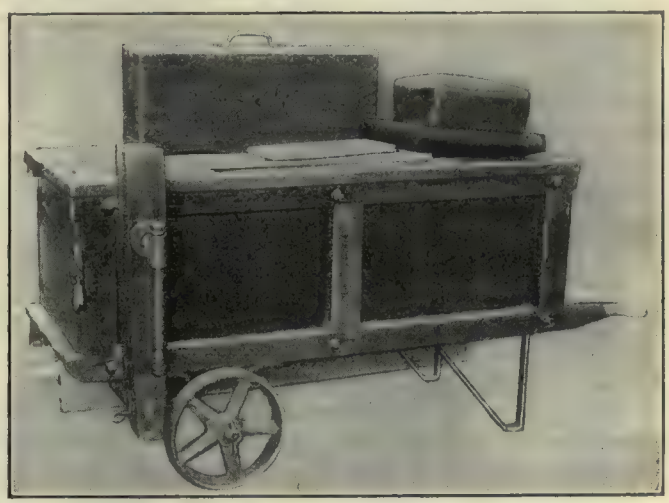


FIG. 2. CARPENTER'S PORTABLE WORK BENCH



FIG. 3. WAGON FOR TRANSPORTING BOILER LAGGING

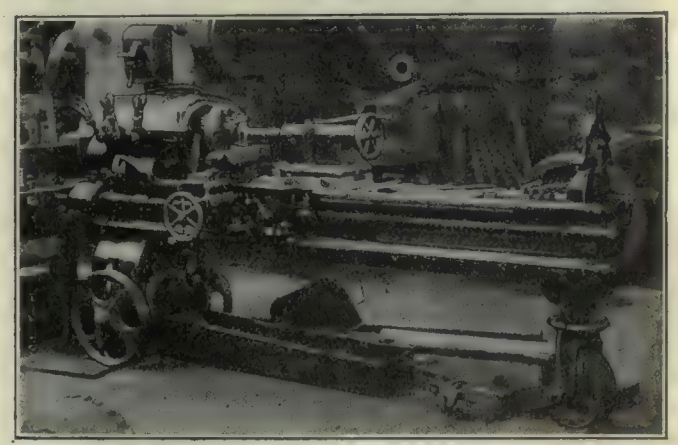


FIG. 4. LATHE WHEELED INTO AISLE

The machinist's work bench, Fig. 1, is wheeled right into the wide aisle between the pits. It is a stout bench of standard height built on an ordinary freight-handling truck. A vise heavy enough for almost any job is mounted on the end so that its weight comes over the wheels. The space under the bench is fitted with a couple of tool drawers that open toward the truck handles and can be padlocked when closed. The pipe-fitters have similar trucks with pipe vises substituted for the machinist's vise.

The carpenters who have work to do in cab-building and fitting are provided with the wheeled work-bench, Fig. 2. The bench is somewhat longer than the machinist's bench owing to the nature of the work. It is built in the tool locker form so the workman can carry a full set of tools with him and keep them safe. A standard wood-workers' vise with wooden jaws is provided on the bench.

In line with the foregoing the men who put the lagging on the boilers have the truck, Fig. 3, for carrying all their tools and materials. This truck replaces the wheelbarrows used for the purpose in many shops and in fact replaces several wheelbarrows. It has compartments or bins for the tools, slabs of lagging, and asbestos cement. The latter is contained in a bin having a slanting end so that its contents can be easily shoveled out.

Pins, bolts and other parts requiring lathe work are turned and fitted right on the job. Four or five Lodge & Shipley lathes, as shown in Fig. 4, can be wheeled into the aisles alongside of the engines and the work handled where it can be more quickly fitted. The lathes are self-contained units with the driving motors mounted beneath the headstocks. Current can be taken from convenient receptacles on near-by columns. A single wheel on a pivoting trunnion carries the outer end of the lathe bed, and the handle by which it is pulled and steered can be turned beneath the bed and laid on the floor out of the way.

Acetylene Equipment Easily Handled by a Truck With Large Wheels

Since the acetylene torch has come to play so important a part in locomotive repair work of today, numerous wheeled trucks have been devised for handling the heavy gas tanks. However, the truck shown in Fig. 5 has several novel features that commend its use. Large wheels are used to make easier going over rough spots and tracks. When stationary, the gas tanks rest firmly on the floor but for moving, a little tilting by the handles throws their centers of gravity more nearly over the axle, so that little effort is required for balance.

A sheet-metal tool box is provided for the welder's torches and equipment and it will be noted that this box is mounted on trunnions so that it will always remain in an upright position.

Even the boiler makers use wheels for easier transportation of their special equipment, and the boiler test-pump shown in Fig. 6 is easily taken from one boiler to another for test purposes. The pump unit is a standard locomotive air pump that now derives its power from compressed air used in the steam cylinder. The former air cylinder has been bushed, greatly reducing its diameter and correspondingly increasing the testing pressure available.

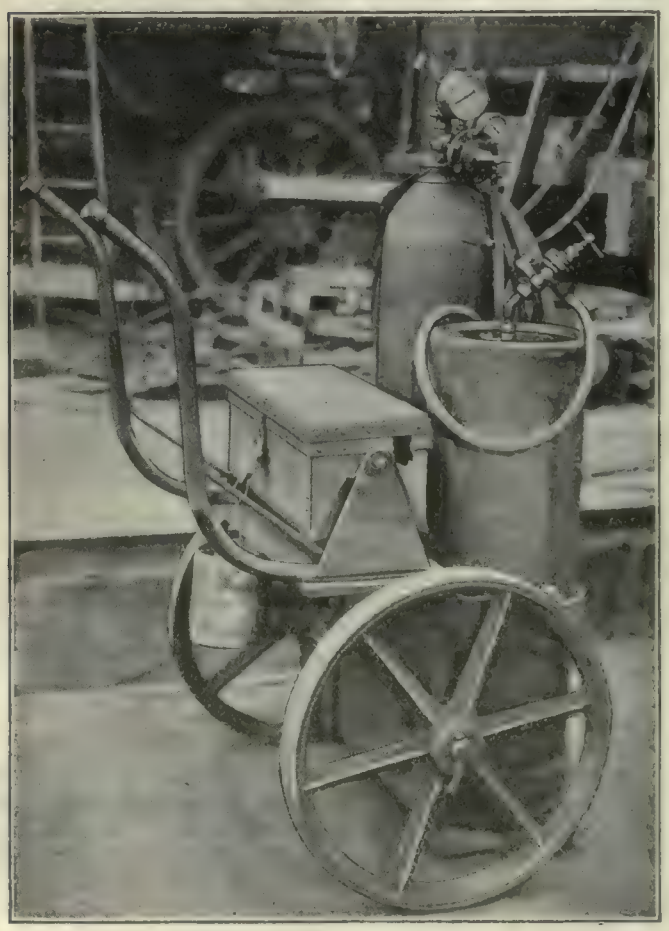


FIG. 5. SPECIAL TRUCK FOR ACETYLENE WELDING OUTFIT

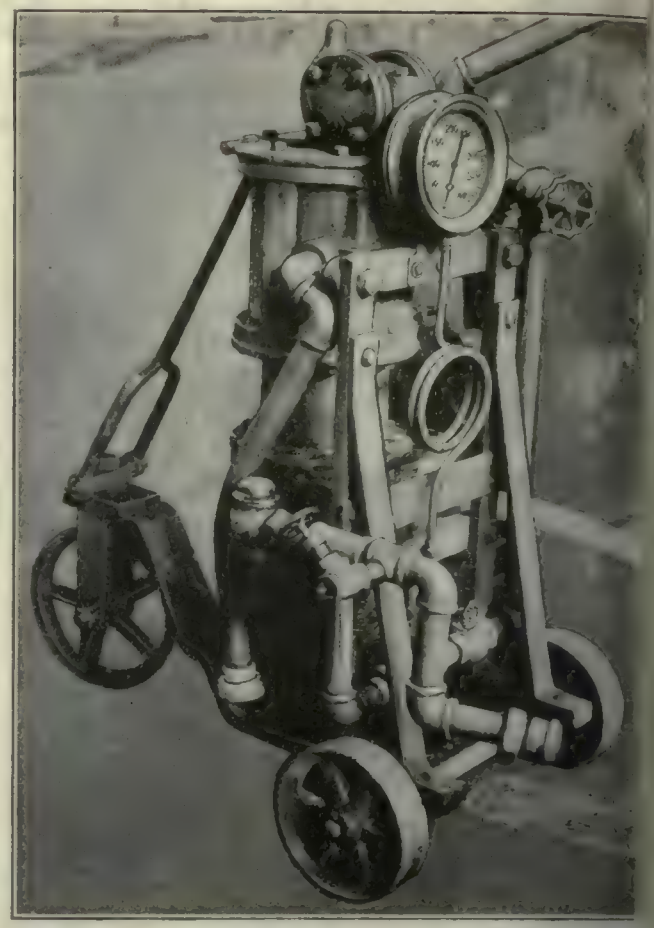


FIG. 6. A BOILER TEST PUMP MOUNTED ON WHEEL

Laying Out a Circular Arc When Center is Unknown or Unavailable

By R. H. Stalnaker

I have read with much interest the article under the above title by Wm. S. Ayars on page 112 of the *American Machinist*.

However, as Mr. Ayars' equation (7) involves the determination of the radius, it would seem that the simpler formula (8) is the preferable form. The use of this equation can be still further simplified by factoring the expression under the radical, thus:

$$x = R - \sqrt{R^2 - y^2} = R - \sqrt{(R + y)\ (R - y}$$

There are several typographical errors in the formulas as printed, the corrections being as follows: y should be y^2 in the formula in the next to the last line in the left-hand column on page 112.

The quantity under the radical in equation (7) should be

$$\sqrt{\left(\frac{L^2 + h^2}{2h}\right)^2 - y^2}$$

In the comparison of values obtained by different formulas on page 113, the difference for the value for y should be 0.60 in. instead of 0.06.

Training Trade Teachers

rowth of Vocational Training Necessitates the Training of Competent Faculty—A Problem for Manufacturers—How Toledo Organized a Course of Instruction

BY LAURENCE PARKER
Vocational Director, Toledo, Ohio

VOCATIONAL or trade evening classes, part-time and co-operative classes, organized under the Smith-Hughes law, are now well known to most us. The training of the teachers for such classes, very important and interesting kind of work, has en given but little publicity.

The teaching of trades is a new road opening before e skilled mechanic. It is fascinating work. Not ly is the teacher supervising the operation of the achines in the school shop, but he is training the nds and brains of boys d men, that they may be- me "master workmen."

In Toledo the training of rade teachers" is in its cond year. It is supported om Smith-Hughes funds d is under the direction f Prof. E. L. Usry, of hio State University, who akes frequent visits so as etter to direct the course. he work is under the local pervision of the Voca- onal Director of Toledo. lasses meet two evenings ch week for two years, a tal of 64 weeks of in- truction. There are no es in connection with the ork. The requirements or admission are as fol- ws:



"EVERY MAN SHOULD BE ABLE TO MAKE PLAIN, SIMPLE SHOP DRAWINGS—"

1—At least five years of experience in the trade that is desired to teach.
2—The equivalent of an eighth grade education.
3—Good health and good moral character.
4—Giving promise of usefulness as a teacher.

It is made clear to those taking the work that appointments to teach cannot be guaranteed. Neither oes the man have to promise to teach should the hance come. There will be a great demand for these en in the future, provided that the training work as been well done. In Ohio it is required that graduates of this course be used for all Smith-Hughes nstruction when available.

The outline of the work as presented in Toledo is s follows:

First Year

Shop Drawing—Two hours a week for the first 16 weeks.
Shop Mathematics—One hour a week for 32 weeks.
Theory of Teaching Trades—One hour a week for 32 eeks.
Practice in Teaching—Two hours a week for the last 16 eeks.

Second Year

Shop English and Shop Science—Two hours a week for 2 weeks.
Trades Organization and Practice in Teaching — Two ours a week for 32 weeks.

The work is not presented in exactly this order in some other cities in Ohio, and we shall probably shift it somewhat from year to year until a satisfactory program has been worked out.

Instruction in the First Year

Considering the first subject of instruction, every man should be able to make plain, simple shop drawings, with the use of a pencil, compass and a rule of some sort. It is surprising how many shop men of skill there are who cannot do this. The instruction in shop drawing includes not only this phase of the work but also the making of free-hand blackboard drawings. There is no way to get things over as effectively as by means of chalk talks; but to make them effective, training is necessary. The instructor for this class has to be chosen with care, for his class is made up of men who cover a wide range of ability in drawing.

Shop mathematics are taught not only for the purpose of brushing up the mathematics of the trade teacher, but also to show him how to present mathematical problems to his class when it is best for him to do so.

The theory of teaching trades sounds as though it were a dreary subject, but it proves an interesting one indeed. It includes the simple fundamentals which should guide teacher or foreman when he must teach a man how to get out his work. The course consists of one hour of lecture and discussion throughout the first year. As this is not an exact science, and since people differ so in their ideas as to how men should be handled, there are always lively discussions.

Because of the connection with the vocational evening classes of the Toledo Public Schools, a splendid opportunity is provided, not only to recruit the best candidates for the teacher training classes, but to determine the best possible practice in teaching for them by observation in the evening school classes and by assisting the instructors. This has proved to be helpful to men in their trades. Then too, all men love to criticize the efforts of others. After the class has been on the side lines and watched an evening school instructor put over his work, discussion wages fast and furious.

Subjects of the Second Year

To many men the second year is more interesting than the first. Shop science is taken up. This is

probably most successfully taught by some man who has been a physics or a chemistry teacher and who has left school work and gone out into industry in some such capacity as industrial chemist. He must have had contact with the practical sides of industry, or he will prove a failure.

Instruction in Trade English a "Sand-Papering" Process

The instruction in trade English is a sort of general sand-papering. It includes putting patches on the grammar of the workman, as well as the following topics: Keeping of notebooks, writing of reports and business letters, and encouragement in keeping up with the printed page in connection with the trade being studied and the allied trades. It is an interesting subject and does the average skilled mechanic a world of good.

The Second Year

More practice in teaching is given throughout the second year, and in connection with it comes the subject of trade organization. There are many things that a skilled mechanic does without conscious thought; they have become second nature to do them, just as buttoning clothes and lacing shoes. Too often the only things that stick in his mind are the hard things or the things which he has had trouble with. When he teaches the apprentice boy in the shop or the boys in the school shop he is apt to start too far above their understanding of the trade, and to take for granted that "any fool ought to know" the things that he himself does sub-consciously. It is to overcome this that trade analysis is intended. It trains the man to break his trade up into its elements, and to grade the parts according to the best order in which they should be taught so as not to kill interest, to discourage the student or to make spoilage excessive. This subject has proved a revelation to the aver e mechanic.

One man who was at work on the subject this summer came to us in surprise and declared, "I learned my trade 17 years ago in one of the best shops. I have worked at the trade ever since and have done some studying through the years. When it came to the anaylzing of the trade and outlining it as I would teach it, I have discovered that there are many things that I have taken for granted or merely thought that I knew all these years. I have had to spend considerable time at the library patching up my understanding of the trade."

An Interesting Subject

This, in brief, is the description of the course. It is a hard thing to describe it and make it sound as interesting as it really is. The course and each subject are changed from time to time to make them fit more closely to the particular needs of the men taking the work.

We find that the course appeals to foremen and to those who wish to become foremen some day, as well as to those who desire to train as trade teachers.

It is one thing to teach men to go out into the world to earn their living and to make things. It is infinitely more interesting to train the men who shall do this teaching. It is the pattern making of trade or vocational education.

Shop Layouts

By John Jacobs

Does it pay to make a shop layout on the drawi board? Most emphatically yes, it does. One of t very large auto plants that was prominent in war wo used this method with good success. A department w organized, which was called, the "Planning Depa ment." Its personnel was composed of expert practic and theoretical men, who would consult each oth freely. When a new department was to be organize or changes of any description were to be made with a department, the planning department would recei orders to make the layout.

The procedure was as follows: First a board w covered with cross-section paper of one-tenth-inch di sion. This was pasted to the board with library photo paste and then wet thoroughly by means of sponge. After it had dried it was perfectly smoot The next step was to cut dummies, as they were terme of cardboard, to the greatest outside dimensions of t machines to be placed. A lathe dummy would inclu he taper attachment or if motor-driven would inclu space required for motor. A radial-drilling machi dummy would include space required to swing the arr Milling-machine, shaper and planer dummies wou include space for the extreme travel of the tables if any other fixture or stock box would be an adjun to the machine, the dummy would include the spa required by such appurtenances. All dummies wou be cut to the scale 0.2 in. equals one foot. After t man commissioned to make the layout was satisfied wit his conception, the foreman was called in and allowe to criticise and if both of these men were satisfi the dummies were pinned to the board and the supe intendent was called. When he was satisfied, blu prints of the layout were made. Usually no particul attention was given to the overhead work such as belt countershafts, etc., because at this plant a competer maintenance man will take care of that end of the wor However, in a small shop overhead work would have t be given due consideration.

On this layout every post, down spout, pilaste drinking fountain and door was marked to scale. I the planning department room was a permanent con plete layout of the whole plant which contained som 5,000 or more machines. The layout was an exa miniature replica of the plant, a part of which wa five stories high. Perhaps the readers may appreciat the value of this. It was so comprehensive that visito would usually be taken there first so they would gras the general plan and *modus operandi* of the plant.

In the planning department was also a file contai ing a record card for each machine. On this ca was given the name of the machine, the selling agent name and address, the manufacturer's serial numbe the shop record number, the cost of the machine, t factory order number, the date of order, the date receipt, the date installed, the department in which was placed and a sketch drawn to scale with dimension Another file contained load cards, one for each machin filed departmentally. Copies of time studies also wer filed and they were consulted when a new layout wa contemplated.

The whole plan was simply a graphic method establishing records and statistics, which is not onl helpful but is becoming more and more a necessity.



Inspecting Pistons and Connecting Rods

Importance of Inspection Methods to Quality of Product — Some Methods in Use on Essex and Studebaker Pistons and Connecting Rods

BY FRED H. COLVIN
Editor, *American Machinist*

ONE of the inspection benches is shown in the headpiece as well as the piston storage rack at the back which is quite similar to that used by the Chandler and other companies. This rack is mounted on good size wheels or casters so as to be easily moved about the shop. The benches shown are of a convenient height and covered with sheet metal so as to make it easy to prevent the accumulation of dust and dirt on the inspection surfaces. Each bench has a large drawer for needed gages and other inspection instruments, the

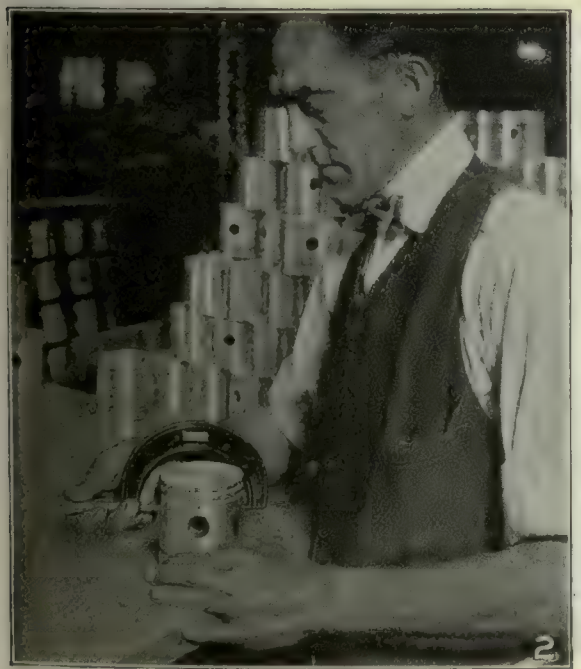


FIG. 2. MEASURING DIAMETER OF PISTONS



FIG. 3. MEASURING THICKNESS OF PISTON WALLS

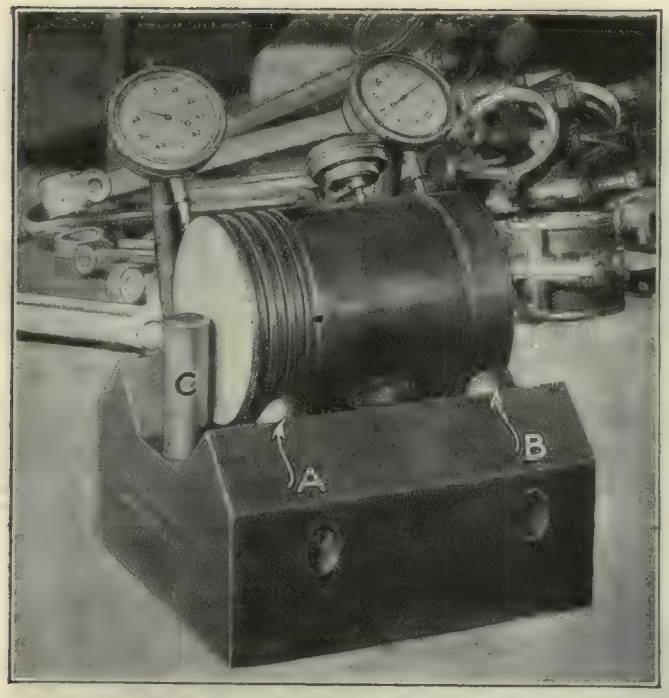


FIG. 4. TESTING THREE DIAMETERS

whole being arranged for the convenience of the inspector.

These benches are located near the motor assembly so that no time need be lost in getting the inspected pistons into the motors. The motor assembly frames can be seen in the background.

Various kinds of gages are used, Fig. 2 showing the micrometer in use measuring the diameter of the piston at various points. In Fig. 3, a special gage is shown for measuring the thickness of the walls of the piston. Its operation can be readily seen by noting the long multiplying lever which magnifies the variations in the wall thickness. A spring holds the heel of the pointer in contact with the wall so that it is only necessary to move the gage up and down the skirt of the piston to note the variations shown by the outer end of the pointer.

It will be noted in the stock of pistons at the left, that all holes are drilled both in the ring groove at the lower end of the skirt and over the piston-pin hole just below the second ring groove. The latter holes are at the upper part of the relieved portions over the piston-pin boss. This view also shows the grooves in the end of the piston-pin hole into which the retaining ring snaps to prevent the piston pin working out and coming in contact with the cylinder walls.

The Essex pistons are of die cast aluminum alloy.

Studebaker's Methods

The method of the Studebaker's shop differs considerably from those just shown, but some of the leading fixtures are extremely interesting as will be seen.

Fig. 4 shows the gages for piston diameter for two different sizes of pistons. The upper row is for pistons for the 3½-in. diameter cylinders while the lower row is for motors having 3¾-in. cylinder bore.

This gaging board gives six diameters ranging from 3.4945 to 3.497 in. for the smaller piston and from 3.8695 to 3.872 in. for the large piston. This gives a maximum of 0.0055 in. and a minimum of 0.0030 in. in both cases and it will be noted that these dimensions are all below the basic size which is in accord with the best accepted "standard hole practice." By use of this arrangement six sizes of pistons can be gaged, allowing selective assembly by picking out those which have just the right amount of clearance in the cylinders as the motors are assembled.

The gaging instrument shown in Fig. 5 indicates both the diameter and the eccentricity of the piston at three different points. The piston is supported on hardened steel blocks, two of which are shown at *A* and *B*, and is located endwise by the stop pin *C*. After the piston has been placed in position and the diameter readings taken, it is revolved slowly and any eccentricity noted.

Testing for Squareness of Hole

Then comes the test for the squareness of the hole with the piston body as shown in Fig. 6. The gage plate *A* with the pin *B* at right angles to it is mounted on the upright *C* so as to be convenient for the inspector. Looking toward the light, the inspector places the piston on the pin B and by looking between the piston and the plate *A*, he can at once see whether the hole is square with the outside of the body or not. This is a very convenient testing device and one which can be used in many other cases.

The pistons are then weighed on the scales, shown in Fig. 7, and each piston stamped both as to size and weight. This makes it easy in assembling to pick the right set of pistons for a given motor.

The method of testing connecting rod alignment is

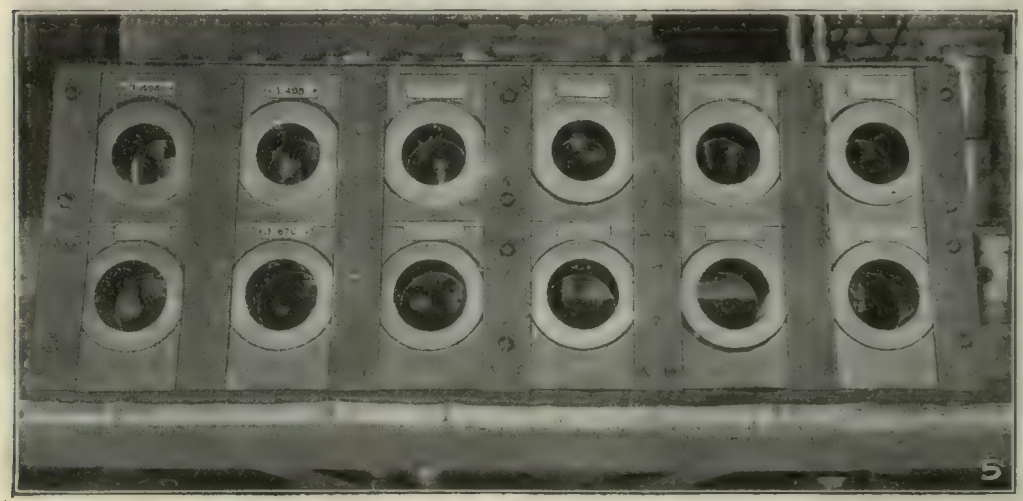


FIG. 5. SELECTIVE GAGES FOR PISTONS



FIG. 6. GAGING SQUARENESS OF HOLES

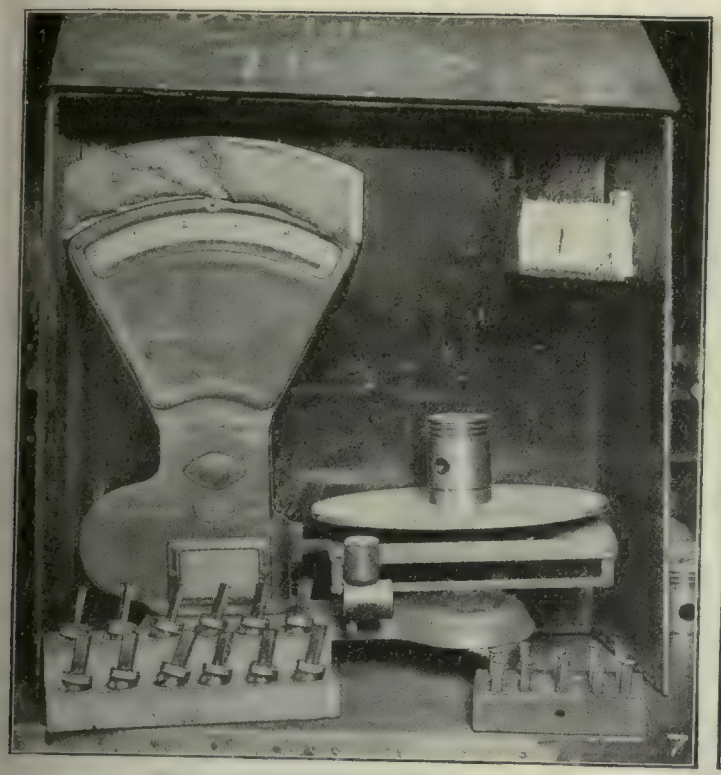


FIG. 7. WEIGHING THE PISTON

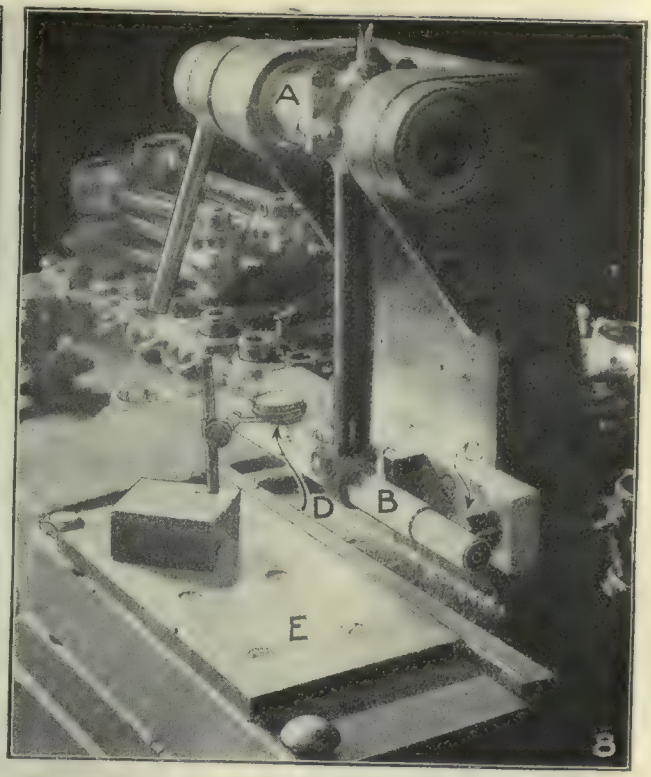


FIG. 8. TESTING ALIGNMENT OF CONNECTING ROD

shown in Fig. 8 where the plug *A* holds the large end of the rod while the bar *B* in the small end easily detects any variation in alignment in either direction. Two accurately ground pins, one of which is shown at *C*, test the alignment in one direction, while the dial indicator *D*, mounted on a base which moves on the surface plate *E*, shows any variation in the opposite direction.

After being tested for squareness the connecting rods go to the departments shown in Figs. 9 and 10, where the rods are inspected both for total weight and for balance. Fig. 9 shows a rod just being placed on the scale for total weight while Fig. 10 shows how the heavy end of the rod is weighed with the small end suspended from a suitable rod.

Behind the operator in each case is an open rack or bin, in which the rods of different weights are put together. These open bins make it possible for the next inspector to pick the different rods for the second inspection from the other side and to again sort them with reference to both the total weight and the balanced weight. This method also solves a transportation problem as the rods pass through the weighing department to the point where they are assembled to their pistons and from there to the motor itself.

When the connecting rod has been assembled to the piston, the assembly is tested for alignment in the fixture shown in Fig. 11. Here the upper end of the rod is held in position by the plug *A*, while the plate *B* tests the squareness of the piston with the rod itself. The plate *C* simply insures the piston being vertical with the rod, while the plate *B* shows how much if any, the piston is out of square owing to its pinhole.

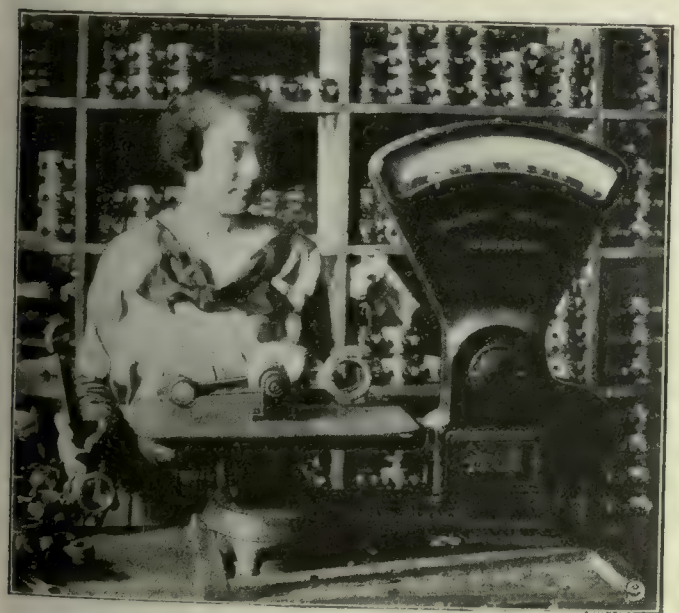


FIG. 9. WEIGHING THE ROD



FIG. 10. WEIGHING THE LARGE END OF CONNECTING ROD

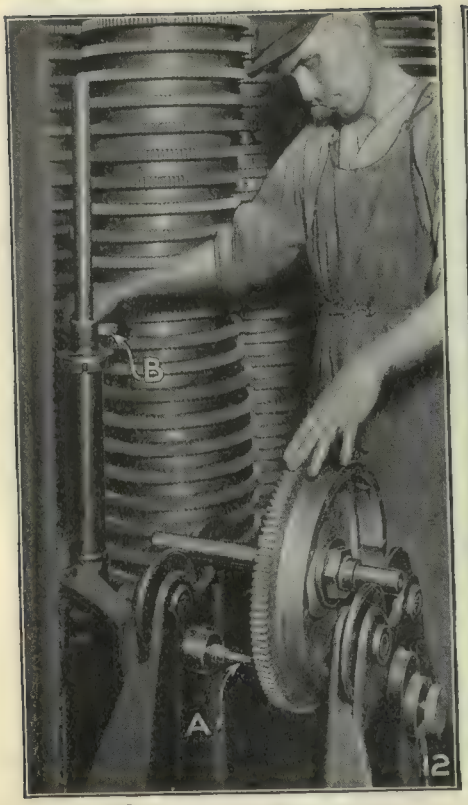


FIG. 12. TESTING FLYWHEELS FOR SIDE MOTION



FIG. 13. INSPECTING VALVE ROD GUIDES

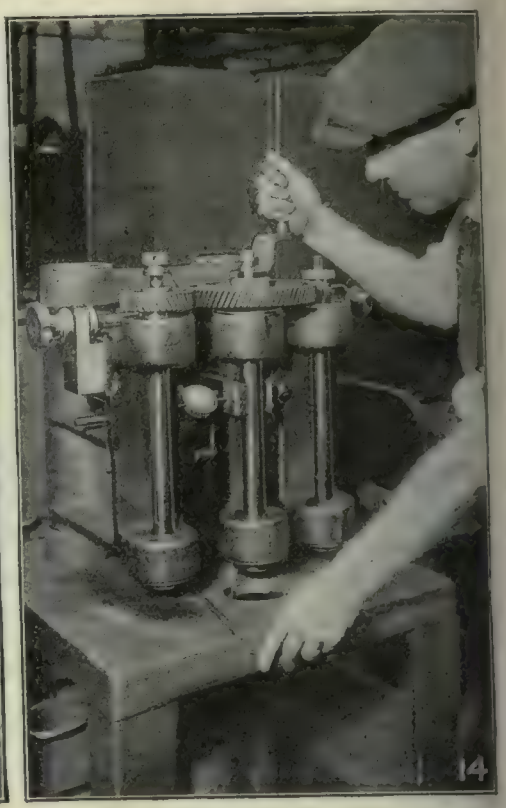


FIG. 14. TESTING CONCENTRICITY OF GEARS

The flywheel of the Essex motor is very carefully tested for concentricity and side motion. Fig. 12 shows the roller testing stand used with a flywheel mounted in position. It also shows the plunger *A* which tests the side motion, this being moved near the wheel or into contact with it, by the handle at *B*.

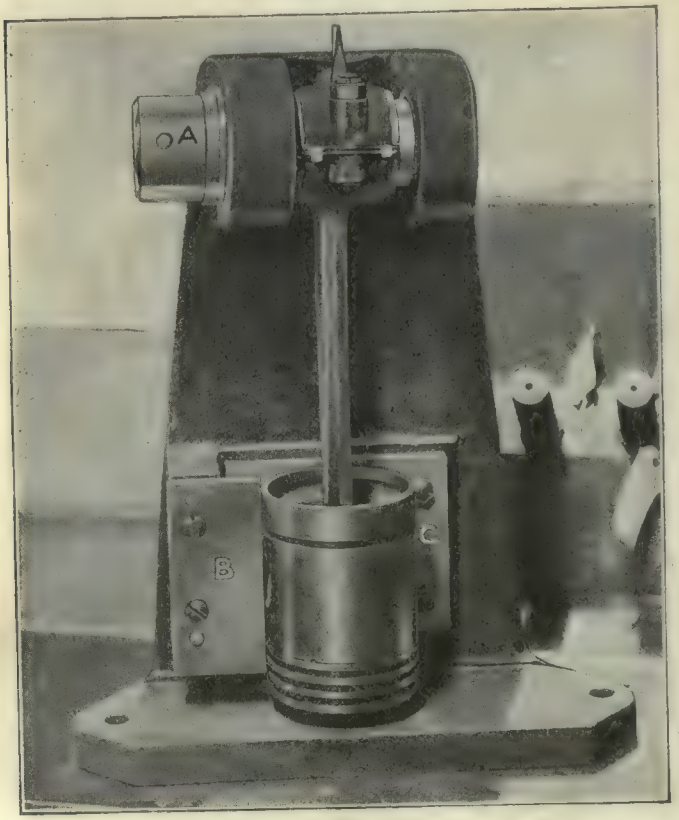


FIG. 11. TESTING ROD AND PISTON FOR SQUARENESS

Fig. 13 shows the fixture used for inspecting the valve push rod guide. The guide is mounted on a mandrel and revolves between centers, the two dial indicators shown, telling the eccentricity between the hole and the outside.

The testing fixture shown in Fig. 14 handles the helical timing gears, the dial indicator showing the movement due to any lack of concentricity in the gears. The handle by which the gears are revolved can be easily changed from one gear to another, so as to make either one desired the driven gear. A third shaft is provided for testing the generator gear, which is driven from the large gear in the center. Both the outside gears can be adjusted with relation to the central gear by the hand nuts shown.

Personality

By W. D. Forbes

The power of personality, brought up by J. E. Bullard on page 505 of the *American Machinist*, is most interesting, as are also the remarks he made on trade unionism. Personality is born in a man but it can, without doubt, be cultivated if a start is made early enough in life.

It is extremely difficult to exactly define what personality is; certainly it is not always best expressed by words as it can be far better shown by the manner of a person. Let me give an example which I take from my own experience.

I was living in France and wanted a position, so I obtained some letters of introduction to a man known the world over.

I presented the letters, obtained an interview and subsequently a position. When I left the office after the interview I was what the boys call "chesty" for I felt that the man had been on the lookout for a young man just like me for a very long time and now that he had

found me he felt that he could settle back, feeling that my department would give him no further trouble, and I would show him that he was a judge of men. I soon discovered that every man in the employ of my chief had exactly the same feeling and we all worked together in a way which gave results. In my later intercourse with the chief I never knew him to say bluntly, "Well done" but the very way in which he inspected your work carried with it an air of satisfaction and praise, and if anything was not just to his liking he was able to so point it out that you would not sleep until you had met his wishes perfectly.

In my school of engineering another form of personality was shown by the regard we students had for one professor. He had the marvelous ability of making each student feel that he was particularly interested in him and we all felt that if we "flunked" in examination on the professor's particular subjects we would be disgracing him. He also conveyed the impression that he was really a fellow student, not merely an instructor and the result was that we strained every nerve to pass all his subjects without fail. Again, a proprietor was leaving his works when a man who was rather drunk stopped him and asked for a job stating that there was not a machinist in the state better than he. The proprietor asked the man if he could prove it and was assured that he could, and he added, "You know that all good machinists go on a drunk at times."

"That may be true, but my friend," said the boss, "a man who gets drunk often does not stay a good machinist long. Come in Monday and I will give you a job if you will agree that you will only get drunk when I do."

The man came in to work and to my knowledge did not get drunk for 19 years. He was finally given the best work in the shop and the pride he took in the trust placed in him kept him straight. He told me one day that what started him straight was the statement of his boss that a good machinist did not stay good long if he got drunk, and this followed by the confidence reposed in him did the work.

Appreciation an Aid

All of us have felt the desire to make ourselves of true value provided we felt in so doing we would be appreciated; without that feeling none of us can do our best. I have read a lot of shop papers and in all of them there seemed to run the constant expression of "Get out more work." Now this does not please the workmen, they resent being educated as we may call it, just for the boss's advantage. I have seen men praised in shop papers, but after the praise there was always the admonition "More work" or "Do better next time." It is far from a question of more pay that makes men contented; it is a feeling that they are a useful part of the business which pleases them. That they are working with the boss and not only for him.

The great majority of machinists have been contented in the past and hundreds of homes all over the country prove that their wages have not been so low that they could not save. True; I believe that the good machinist has not had enough more pay than the poor machinist to make things look fair, but the trade is one which has advantages in steady employment and comfortable surroundings, so as to somewhat offset the lower pay as compared with some other trades. The discontent which is supposed to exist all over the country among machinists is largely a myth, as any one going among good machinists can easily prove. The discontent is manufactured by agitators who can work their jaws much better than they can their hands and make far better pay at it.

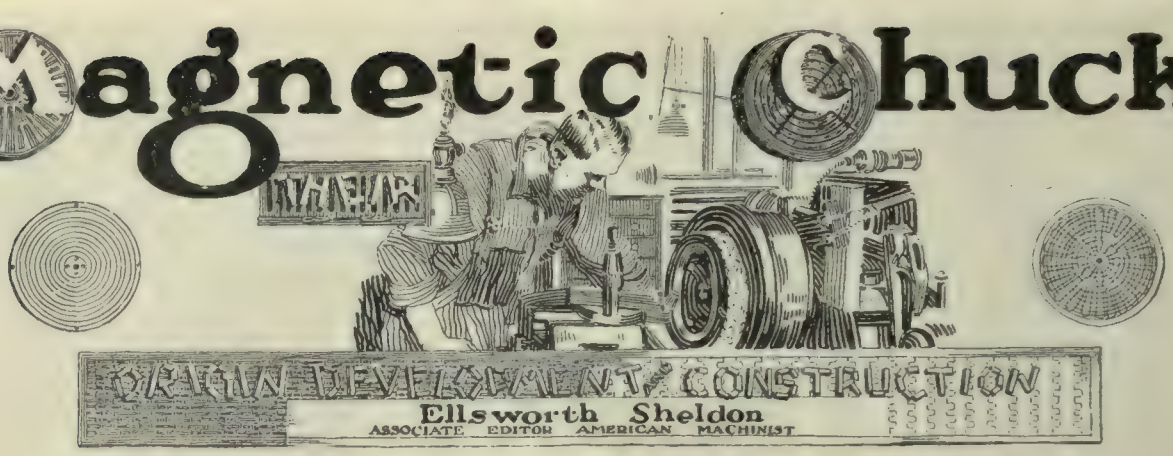
There is a "cure all" despite Mr. Bullard's ideas to the contrary, but it is slow in action. It is proper education and by that I do not mean a change in the public school system but a change in the reading matter given to the working man. The trade papers are of the very greatest help in this direction but they do not go to the working man, as I consider that they should. We all see that the value of a subscription lies in the purchasing power of a subscriber and a man standing at his lathe or planer has little such power, and I should doubt if a machinist's subscription is of any commercial value to a trade paper, even at the price of five dollars, which is, I think, the "top notch" at which a mechanic is able to pay for a weekly paper. So the trade paper does not fill the mission of a widely circulating educational paper. I can not see how what may be termed an educational shop paper can be made to pay, but I do not think that that is a reason why the proprietors of shops all over the country should not be willing to put up the money for a purely educational shop paper. The trade unions spend money like water to educate their members in their way of thinking, while the business men spend money to fight, but they do it in an unsystematic way. Anything that is fundamentally bad can be cured—whatever is good in the system of unionism will last—and it is only by proper education of its members and those outside of it that the bad can be shown up and thrown out—and there will have to be a lot thrown out. The personality that I remarked upon shows up everywhere. All the readers of the *American Machinist* know that the articles of some of its writers are more acceptable to them than are others. It is largely how what they have to say is put, and that is personality. It is individuality which holds the trade unions together and when that begins to wane the end is drawing near. The obedience that once was in the ranks of unions has been largely swept away; first by the efforts of the I. W. W.'s and then by the great increase of its membership. These facts show the chance now at hand to educate properly. When the leaders cannot control the members of their unions then they can not be forced to keep their bargains or break them and the power of the union is lessened.

To give proper education its exact meaning is more than hard but it does mean that the men should be disabused of the idea that all education is given them only with the idea of resulting in their producing more work.

The trade unions have taught the proprietors their lesson and they have remembered and really learned, while on the other hand the trade unions have simply learned that power is sweet and its taste has turned their heads; they have reached and passed their zenith; they have not learned and remembered. The fundamental idea of unionism is today lost sight of; what it now wants is only power, power that if obtained would not or could not be used wisely and in fact would only be used to advance some one man or group of men—and either spells disaster. No man can serve two masters but the trade unions say there must be no master; yet they themselves have most exacting ones. The words to be found in the "Deserted Village" are true:

"Just experience proves on every soil
That those who think, must govern those who toil."

Magnetic Chucks



Ellsworth Sheldon
ASSOCIATE EDITOR AMERICAN MACHINIST

III. The Father of the Magnetic Chuck

Real Inventor of the Magnetic Chuck—Early Experiences—Experiments with Magnetic Brake—Magnetic Chuck an Accidental Discovery—Growth of the Business.

IT IS proverbial that there is nothing new under the sun; yet there occasionally comes into our industrial life a device that has no apparent precedent and for which no recognized demand exists.

Presumably nobody ever begged James Watt to devise a machine that would make the wheels go around; assuredly no one ever implored Alexander Graham Bell to perfect an instrument by means of which a man in New York could hold converse with a man in San Francisco; yet both the steam engine and the telephone became indispensable almost from the moment that they became practicable. The magnetic chuck is in a sense to be considered as belonging to the same class. It was without practical precedent, and because nobody knew of it there was no demand for such a device. People got along very well without it when they were ignorant of its possibilities; yet many modern production methods would be out of the question were it not for the readily available means offered by it for holding work on planer or grinding machine without the use of bolts or straps.



OAKLEY S. WALKER

Although the magnetic chuck made its first public appearance in 1873 it apparently did not impress the mechanics of a half-century ago as being a valuable accessory to the machine shop, for from that date to 1896 nothing was heard of it, and so far as I am able to learn none were in use in this country.

The first chuck could hardly be considered a practical tool. Partly because of structural weakness inherent in the design; further, because of the lack of distribution of its magnetism; and principally because there was at that time no dependable and generally available source of electrical energy to operate it, the device was more in the nature of an interesting experiment of amateur dabblers in the then comparatively little known science of electrotechnics, than a practical tool.

The reader will remember that one of the patentees of the original chuck of 1873 was an Englishman by the name of John Thomas Oakley, while the name that was later to become synonymous with magnetic chucks was Oakley S. Walker. This similarity of names will promptly lead the reader, as it did the writer, to suspect that there was more than mere coincidence involved; but Mr. Walker assures me that such is not the case, and that until the early patent was cited to him from Washington upon his application for protection of his idea he had never heard either of John Thomas Oakley or of such a device as a magnetic chuck other than his own.

To Mr. Walker must therefore be given the credit not only for the development of the magnetic chuck to a point where it has become an indispensable part of the equipment of an up-to-date machine shop, but also for the conception of the device, as well as for the foresight to recognize the value to which it would eventually attain and the perseverance to keep everlastingly at it until he had compelled its recognition by the trade.

Like many another valuable invention the magnetic chuck was the accidental outcome of a search along other lines. Early in his career the inventor had been interested in mechanisms for braking railroad trains, and it was while working upon a new application of this kind that he discovered his device to have a much wider and more valuable application in an entirely unpremeditated field than in that for which it was designed.

Oakley Smith Walker was born in the village of South Rutland, New York State, some years before the Civil War. His father died from injuries received in the war, leaving the boy with a mother and several sisters for whose welfare he was partly responsible.

His first factory experience was in a wood working shop, but this sort of work did not satisfy his penchant for mechanics and after two years of making handles for feather dusters, brushes, etc., he became apprenticed in 1873 to Ryther & Pringle of Carthage, N. Y., who

conducted a general machine shop and jobbing business. Here he served three years and having completed his apprenticeship went to work for the Eames Vacuum Brake Co. of Watertown, N. Y., where was built one of the most successful of the braking devices before the advent of the Westinghouse Automatic Brake.

With the Eames Co. he remained for several years; going in 1879 to England for the purpose of installing and demonstrating the Eames brake on some of the railroads of that country. It was while engaged in this work that he obtained the experience with mechanisms for stopping swiftly moving railway cars that was to lead indirectly to the invention of the magnetic chuck.

Some years later we find him in business for himself in Watertown, where he manufactured a machine for grinding lathe centers and experimented with the machine for grinding twist drills that was afterwards to become so well known as the Walker Twist Drill Grinder, probably the first machine on the market for the purpose. On a selling trip to New England he became acquainted with Milton P. Higgins, then superintendent of the Washburn shops of the Worcester Polytechnic Institute, with whom he made arrangement to bring his business to Worcester and develop the twist drill grinding machine. Pursuant to this arrangement he removed to Worcester in 1887 and remained at the Washburn shops for three years.

About the year 1885 Mr. Higgins, with George I. Alden, a professor at the Institute, purchased the emery wheel business that had but a short time before been developed by F. B. Norton and founded the industry now known as the Norton Co. to make grinding wheels; later engaging Mr. Walker as their master-mechanic to establish a machine shop.

Mr. Walker had been for many years a dabbler in the science of electricity; as a young man he had built experimental telephones, following the principle of the Bell instrument, with which the people had become familiar during and after the Centennial period of 1876; he had made several magnetic clutches for stopping and starting machine tools; and was much interested in the electrification of the street railroads that was at this time (1890-1895) in full swing.

It was here that his early association with railway brakes showed its influence, for Mr. Walker's experiments took the form of devices for stopping, instead of machinery for running, the electric cars. Every newly equipped city line and interurban road had to have larger and heavier cars than any of its predecessors; every motorman had to find out by experiment just how fast he could go without killing too many of the populace. Hand braking was inadequate to the purpose of stopping the swiftly moving interurban cars, and nobody as yet had dared to propose the compressed-air operated brake of the steam railroads with its necessary accompaniment of air pumps, tanks, complicated valves and systems of piping.



FIG. 50. THE MODEL BRAKE SHOE

It occurred to Mr. Walker that if his favorite exemplification of power—electromagnetism—could be relied upon to make a car go it surely could be depended upon to stop it—the electric brake was obviously the appropriate apposite to the electric car; therefore he built the model brake shoe shown in Fig. 50 to test the practicability of the idea.

This model was arranged to be suspended from a frame exactly as in a real car the brake would be suspended from the truck frame, and a model car wheel made upon which it could demonstrate its braking power. The pocket to be seen in the illustration about midway of the shoe held the coil of wire that surrounded the central core of the magnet; the core being a projection from the bottom of the pocket and cast integral with the shoe, its outer end coming even with and being finished as a part of the concave surface of the latter so that it took its share of the bearing upon the wheel. The current for operating the model was supplied by a single cell of dry battery, this small current serving amply to demonstrate the possibilities of the device for braking purposes when the larger currents obtainable from the line or the car motors were available.

Though Mr. Walker did not at that time see it in such a light, he had here a perfect working example of the single-magnet chuck. The active pole was the outer end of the projecting core (the end toward the wheel); the magnetic currents from the other end of the core were led by the surrounding metal to the remaining surface in contact with the wheel. Though the holding surface was concave it was made so only to match the wheel; if it had been flat and the device fastened to bench or machine table it would have been a chuck.

Though the model worked to perfection, the idea was destined to failure as a practical brake for the reason that long before the difficulties attendant upon its application could be worked out the standard compressed air apparatus, against which no other device need be for an instant considered, was on the job. One car, however, on the Worcester North End Railway, a line then under construction from Worcester to Greendale, was equipped with the Walker brakes.

The obvious source of energy for such a device on a trolley car would be the trolley wire, but it is entirely conceivable that a trolley might run off the wire and leave a runaway car helpless at a critical moment; therefore the experimental brakes were so wired into the car circuit that the brake coils could be shunted across the terminals of the motor armature, thus providing the safety factor.

Mr. Walker cheerfully admits the failure of the device. It worked perfectly—altogether too perfectly—for when the brakes were applied the swiftly running motor armature, impelled by the momentum of the car, promptly generated so much current that its own windings were burnt out.

Though the defect might easily have been remedied by interposing a graded resistance in the circuit, Mr. Walker recognized the inadequacy of the device because of the lessening braking power as the speed of the car decreased and because there would be no braking power at all to hold a standing car on a grade.

Conception of the Magnetic Chuck

He was the more willing to acknowledge the failure for the reason he had become impressed with the capacity of the electromagnet for holding on to things and at once turned his attention to the possibility of using it to hold work on a grinding machine. The surface grinding machine was at this time in extensive use as a tool-room machine principally for the purpose of finishing the surfaces of hardened work, and as the pieces were almost always to be finished over the entire exposed surface it was very difficult to hold them by means of bolts and straps, while a vise was also in many cases impracticable.

The idea of simply laying a piece of work on the table of the machine and having it stay there without any apparent means of holding it appealed strongly to Mr. Walker, as indeed it might to any one after sundry futile attempts to get a strap on it that would not interfere with the operation, and the electromagnetic method seemed to be the ideal one by which to accomplish such a purpose. As it would be impracticable to make a magnet of the table itself the logical conclusion was an extraneous device to supply the magnetism. The outcome of the experiments was the first practical magnetic chuck, built in the Norton shop in 1895.

The Magnetic Chuck a Success

The device was a success from the start. It required no argument to convince practical mechanics of its practicability; there remained only to combat the misgivings with which anything electrical was looked upon by people unfamiliar with electricity. Some were afraid that they might get hold of it in the wrong place and be killed; others were afraid of it on general principles, without being able to advance any reason for their fear. One man wrote Mr. Walker to ask if he could use the chuck in an iron frame building without danger of magnetizing the whole structure.

Everybody was afraid of magnetizing watch springs, and for this fear there was some justification for the early chucks were unquestionably leaky of magnetism. Watches were carefully put away before the wearer of one would approach the grinding machine and if anybody's watch should stop for any reason—even though there might be a piece of chewing-gum in the machinery—why! "the 'lectric chuck done it."

The First Commercial Chucks

Mr. Walker's first commercial business was with the L. S. Starrett Co. of Athol, Mass., who placed orders for several large chucks. These, though of considerably different construction than at present, were of the single-magnet type, literally as well as technically, for in a chuck 4 ft. long there was but one core and one coil, the latter wound in the shape of a flattened oval nearly as long and wide as the chuck.

After the coil was placed in these chucks and the connections made the chuck was finally closed by pouring the lead that separated and at the same time bound together the opposed pole faces. No thought was given to the possibility of repairs ever being needed and years after, when a ground developed in one of the original chucks and it had to be opened, the only way to accomplish it was to build a bonfire in the yard and melt out the lead; an operation which was, naturally, detrimental to the coil.

Many Difficulties to Overcome

Minor difficulties developed in course of the operation of the chucks; a condition to which all new devices and most old ones are subject. One of the first obstacles to be overcome was the general lack of a suitable source of energy for the chucks. Central stations were then the exception rather than the rule; many factories had no electric current other than that supplied by the lighting dynamos and these were seldom run except for an hour or two in the afternoon and a few minutes in the morning—sometimes not at all in summer. More numerous still were the shops that were without even this temporary supply. One of the first adjuncts, then, was the small generator that could be set up on a shelf, run by a small belt from the main line shaft, and left to take care of itself most of the time. Fortunately for the success of the chucks such machines were available and Mr. Walker made arrangements whereby a generator could be supplied with each chuck that was not otherwise provided for.

The Need for a Demagnetizer

Another trouble that demanded prompt attention was the permanent magnetization of all pieces of hardened steel that came in contact with the chuck. As over 90 per cent of the work handled in this way was of hardened steel the problem was not easy of solution. It was known, however, that by placing a piece of permanently magnetized steel in a rapidly alternating magnetic field and slowly withdrawing it the magnetism could be partially neutralized; and complete demagnetism had been effected by repeating this process in the sphere of influence of a solenoid through which was passed an alternating current.

As alternating currents were even less available than the direct, and as such alternating current machinery as was then on the market often generated as high as 133 cycles per second, Mr. Walker designed a machine to produce the necessary alternations mechanically.

The Walker demagnetizer, which will be explained in detail in the construction article on the Walker chuck, is a device which, by means of a revolving magnet, causes a rapid reversal of polarity in the exposed pole-faces of the machine and thus fulfills the required conditions. They are still built in large numbers, but are not so necessary as an adjunct to the chuck as they once were, partly for the reason that the 60 cycle alternating current, now so readily available, when passed through a solenoid is a practical demagnetizer for small work, but principally because in these later days a much larger part of the work handled on magnetic chucks is soft and therefore does not retain magnetism.

The Demagnetizing Switch

A means of counteracting the residual magnetism of the chuck was soon found to be necessary in order to release the hold upon large pieces of work. Such pieces would cling to the chuck face, even after the electric current had been cut off, with sufficient tenacity to make removal difficult and disagreeable, especially as such pieces usually had very sharp corners after grinding.

The answer to this problem was the reversing switch,

by means of which a current is momentarily applied in an opposite direction to that in which it has previously been flowing. A lifting stress being applied to the work, a touch of the switch blades upon the opposite contacts will release it instantly.

Another and more serious defect developed when the chuck began to be used as a factor in production. For toolroom use it was seldom required to hold pieces so small that they did not cover one or more of the non-magnetic gaps in the work-holding surface, and thus complete a magnetic circuit. In production work, however, a chuck might be covered with small pieces, many of which would rest upon but one polepiece and thus would be likely to be swept off when struck by the wheel; the momentum of the blow stripping all other pieces in front of it from the chuck.

This difficulty led to the endeavor to distribute the polepieces more widely over the holding surface by making individual pole-faces smaller and grouping them more compactly. The experimental room at the O. S. Walker Co.'s plant contains many experimental chucks and models, some of which are the subjects of the Walker patents while others are not patented.

Though all Walker chucks now on the market are of the single-magnet type it is not to be supposed that Mr. Walker did not recognize the possibilities of other types, as the model room discloses experiments with the multiple magnet type as well as many forms of independent magnets. Indeed, one of the experimental chucks, that was under severe and long continued service test in connection with the manufacture of a certain special machine part, is made largely of wood, only the magnets themselves being of metal. It was due more than anything else to the necessity for holding very small pieces and for changing them rapidly that competition developed in 1912; previous to which date Mr. Walker had the field to himself. Many and complicated were the devices constructed for this purpose; some by Mr. Walker and others by competitors. These will be discussed separately under the head of Auxiliary Devices.

The Growth of the Business

The first large chuck for the Starrett Co. was built in the Norton shops, and it was not until 1897 that Mr. Walker regularly began manufacturing. Working by himself at the Washburn shops his business soon outgrew his capacity to handle it alone, and he secured a place on Union St. on the second floor of a blacksmith shop, where he installed a few tools and employed two or three men to help him.

For three years the business grew slowly as the value of the chuck began to be appreciated by manufacturers, until it was necessary to secure larger quarters. The second shop was also on Union St., where after a few years of continued growth it occupied several floors and was doing a business that warranted building the present commodious plant at Greendale.

For some years Mr. Walker has been troubled by defective eyesight and in 1918 was compelled to retire from all active business. A new company was formed to whom Mr. Walker transferred all but a small portion of his holdings, which up to this time had always represented a controlling interest, built a beautiful new home in the residential part of the city of Worcester and settled down to enjoy life as well as a man suffering from such an affliction may; which, as he assures the writer, is quite well indeed.

He is far from being an old man, is in excellent physical health, and takes great delight in his garage, which he has fitted up with workbenches and a few electrically driven tools, where he spends many contented hours, known only to the master workman who has no cause to worry about the future, in inventing new things, mechanical and otherwise.

Though Mr. Walker is already well represented in the patent office, having nine patents on magnetic chucks alone, it is the writer's guess that he will again be heard from in other fields in the near future.

Cutting Metric Screw Threads on An American Lathe

By Archibald M. O'Brien

The interesting account by Chester Josselyn, page 120b of the *American Machinist*, which gave a very convenient substitute for the usual constant, 5:127, used in determining change gears for cutting metric threads, recalled to mind another constant used for the same purpose, which was described in a British publication some years ago and which the writer at once copied in his note book.

This constant or ratio is 63: 1,600 and has some advantages over 4¼: 108 used by Mr. Josselyn; it gives results somewhat nearer the theoretical metric pitch, for example:

$\frac{63}{1{,}600} = 0.039375$ in. a plus error of only 0.000005 in. per milimeter, or 0.000127 in. per inch. This constant has the additional advantage of being very convenient to use in calculations, as will be noticed in the examples given below.

The method of finding the numbers of teeth in gears to be used for cutting any desired metric thread is the same as for either of the other constants, thus: Write the constant as a fraction and multiply by figures representing the threads per inch (single) of the lathe screw and the desired pitch in millimeters; the result will be the ratio of change gears required, provided that there is no permanent gearing between the lathe spindle and screw.

For example, to cut an 8-mm. thread on a lathe with lead screw of 4-pitch single thread,

$$\frac{63}{1{,}600} \times 8 \times 4 = \frac{63 \times 32}{1{,}600} = \frac{63}{40} \times \frac{32}{40}.$$

The figures above and below the line represent the driving and driven gears in the train.

Proof:

$$\frac{63}{40} \times \frac{32}{40} \times \frac{1}{4} = \frac{63}{200} = 0.315 \text{ in.}$$

Subtracting from this 0.31496 in. (8 mm.) we have a plus error of 0.00004 in. or 0.00032 in. in 8 threads.

To cut 2½-mm. pitch on a lathe with a screw of 2-pitch single thread:

$$\frac{63}{1{,}600} \times 2\tfrac{1}{2} \times 2 = \frac{63 \times 5 \times 2}{1{,}600 \times 2};$$

$$\frac{63 \times 10}{3{,}200} = \frac{63}{80} \times \frac{10}{40} = \frac{63}{80} \times \frac{20}{80}.$$

Proof:

$$\frac{63}{80} \times \frac{20}{80} \times \frac{1}{2} = \frac{63}{640} = 0.0984375 \text{ in.}$$

Subtracting from this 0.098425 in. (2½ mm.) we have a plus error of only 0.0000125 in. These results are very fair approximations, good enough for any but precision screw threads.

Reinecker Turbine Reduction-Gear Hobbing Machines

Three Large German Machines for Hobbing Gears Up to 19½ Ft. in Diameter—Traversing Hob Used

SPECIAL CORRESPONDENCE

THE increase in the use of high-speed steam turbines for ship propulsion has brought with it developments in the reduction gearing necessary to step down the rotor speed to that of the screw propeller. For the larger ships the helical and herring-bone gears have become so huge as to require special gear cutting machinery for their production. Several machines for this work have been built by J. E. Reinecker, A.-G., Chemnitz, Germany, and some of them are illustrated in the accompanying photographs.

In Fig. 1 is shown one side of a machine built for hobbing gears up to 13 ft. in diameter and 6 ft. in width. The table, which will carry a load of 33 tons, has secured to it a large indexing gear cut as accurately as possible. The change gears of the indexing mechanism are at the extreme left of the gear box in the lower left-hand corner of the illustration. Both the main vertical housing and the counter-weighted saddle mounted on it are provided with hand and power mechanism for traversing and elevation respectively. The toolslide swivels on the saddle so that the hob may be adjusted to any desired angle.

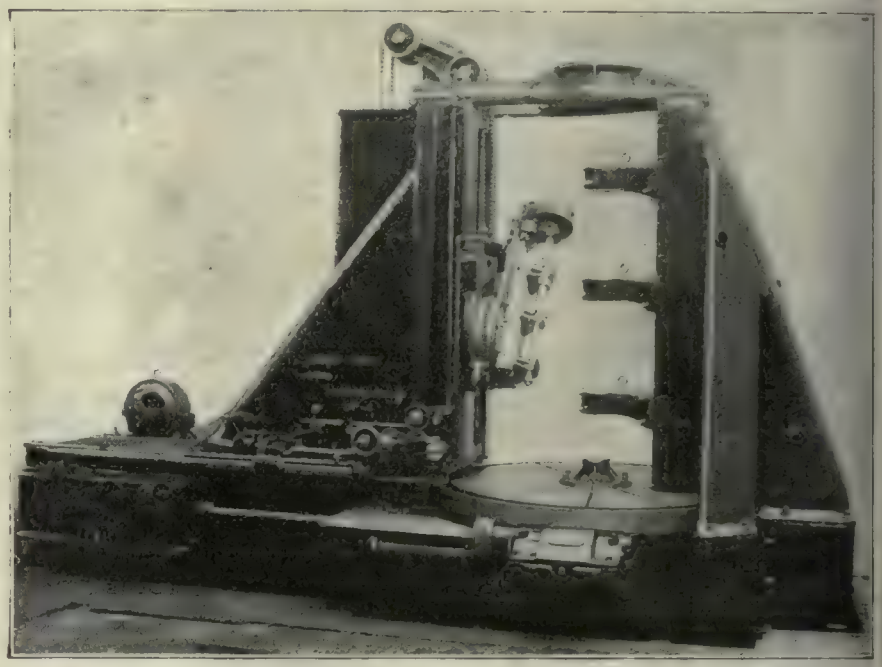


FIG. 1. REINECKER GEAR HOBBING MACHINE, FRONT VIEW

A novel feature in the operation of the machine is that there is a continuous transverse movement of the hob while it is in action so that the full cutting width is in service and wear is practically uniform. The change gears at the foot of the vertical housing regulate the travel of the hob.

Tooth depth is governed by traversing the vertical housing, which is fitted with a vernier scale for close adjustment. Two worms located at opposite sides of the machine are used for indexing. One worm has transverse adjustment, while both worms are adjustable for depth of mesh.

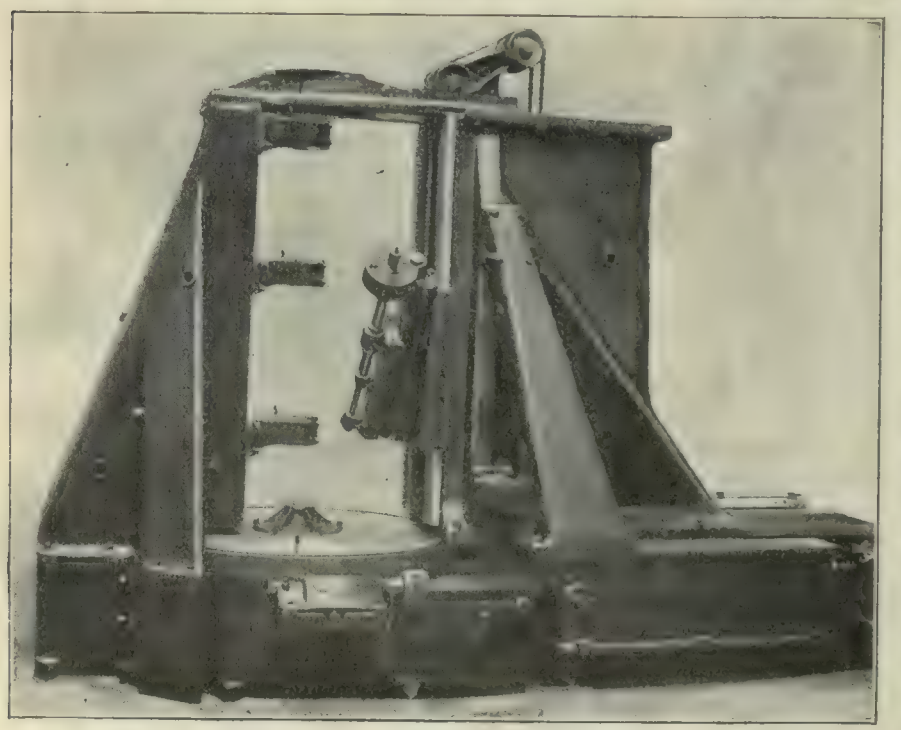


FIG. 2. REINECKER GEAR HOBBING MACHINE, REAR VIEW

The Table Thrust

The revolving table is mounted on a spindle that rests on a large thrust bearing and is further supported and guided by a beveled ring of large diameter. A relieving device consisting of a heavy lever is located beneath the table support so that the height of the table can be adjusted for varying loads by taking up the end thrust. The table spindle is hollow so that work mounted on a shaft can be taken care of. The motor is located at the rear of the massive bed and, as may be seen, is mounted on the box containing the

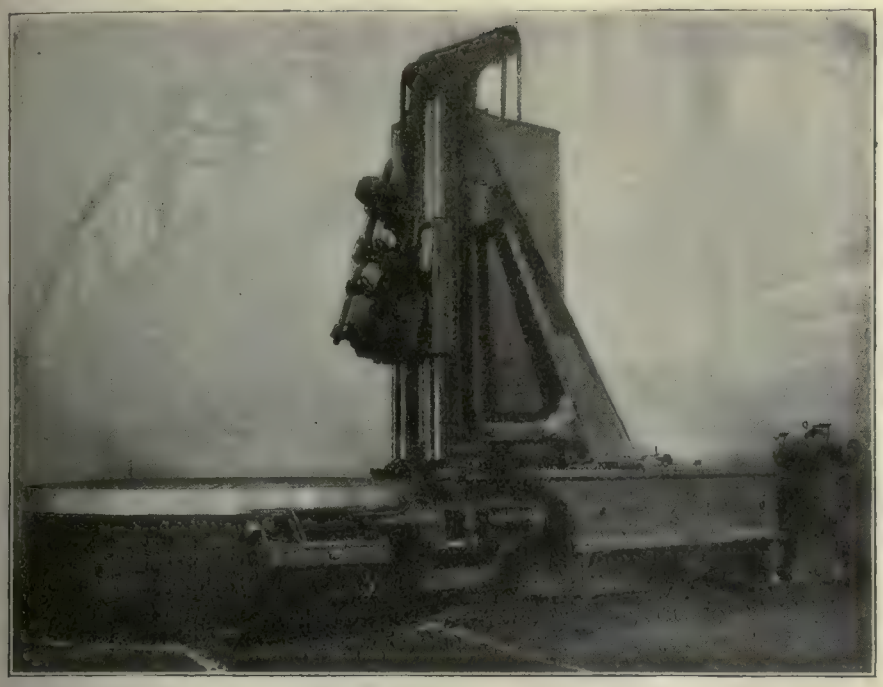


FIG. 3. GEAR HOBBING MACHINE FOR 19½-FT. GEARS

driving gears. The gears run in an oil bath. For heavy work an auxiliary upright supported on a separate bed is used to stiffen the main vertical housing. The support and bed are seen at the center and right in Fig. 2.

When it is desired to cut pinions a third upright, seen at the left in Fig. 2 and at the right in Fig. 1, opposite the main housing, is mounted on an extension of the base. When the cutting depth has been adjusted the two housings are locked together at the top by a horizontal cross-piece.

Fig. 3 shows a larger machine of the same type which can handle gears up to 19½ ft. in diameter and 6½ ft. in width, and weighing up to 95 tons. This machine is not fitted to cut pinions.

In Fig. 4 is shown a large horizontal pinion-hobbing machine built on the same principle as the other machines illustrated.

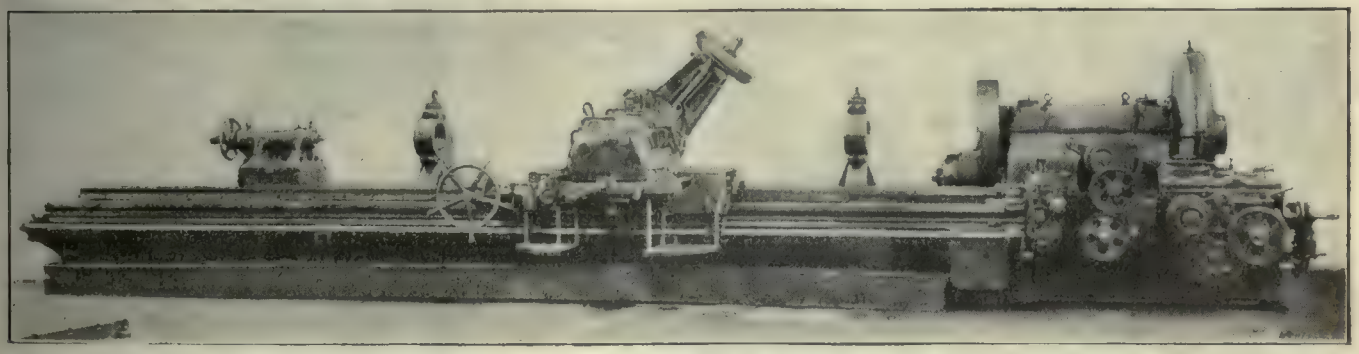


FIG. 4. PINION HOBBING MACHINE

The Cost of Unnecessary Service

BY JOHN R. GODFREY

On page 237 of the *American Machinist*, S. O. Livingston voices a grievance which is well worth considering at this time—or any other. Doesn't it show that we have overplayed the "service" game in many particulars? And is it not fair to ask why the man who never asks for service, either because he does not need it or because he does not know he needs it, should pay for the unnecessary and unreasonable demands of a few? For every dollar spent in this way has to be paid for by the customers of the machine.

I'm a great believer in "service" in many cases. When I'm fortunate enough to drive "Lizzie" off for a day's run in the summer, or maybe a week, I like to have the battery service station man look at my battery, give it a drink if necessary and tell how its blood pressure is. But I'd much rather have him charge me a fair price for his time—and the water—because tipping is bad enough in hotels, and he wouldn't expect it from a "Lizzie" driver anyhow. In the same way I'd much rather pay a small fee for "free air" than to try and think of something to buy so I won't look like a piker. I use the "free air" because I'm too lazy to pump it by hand, but I'm willing to pay for it. As I said before, I'm a believer in service but I believe it ought to be sold instead of given away. Of course in reality it is sold but the wrong man pays for it. I mean sold—as a paying investment—to the man who needs it.

Automobile service stations give a regular service at so much per month. Typewriter and adding machine companies do the same. Why not learn a lesson from them? Why not put some of our salesmanship into selling service—as well as the machine itself?

If I already have your machines in the shop and send a wire for two more machines, you are at no selling expense in this deal. If I do not need service, or don't know I need it and so don't ask for it, why should I pay for something I don't get?

There has been too much free service given. We all know cases where makers of machines have done a hundred or more dollars worth of engineering work for supposedly prospective customers who had no intention of buying a machine. What they wanted was suggestions which they could use on other machines of a similar type, or to know how such matters were handled by others. Of course you had a perfect right to do this, but I helped pay for it in the price of the machine I bought. That's what I'm kicking about.

Isn't it time to get the selling of machine tools on a more business-like basis? Isn't this free service one of the first things to go after?

Metal Cutting Tools—V*

(Continued from last week's issue.)

BORING tools may be divided into two classes: Single and multiple tools. The single tool is either made in one piece, or is a tool inserted in a holder. In jobbing shops, toolrooms and so on, the single boring tool is often made of a piece of round stock forged down and given the proper shape at the end by forging and grinding. A tool of this nature is generally clamped in the toolpost of the lathe and the toolpoint is brought to center by packing under the shank. The proper positioning of the toolpoint depends entirely on the skill of the operator. In order to have proper working angles with a relatively large amount of variation which will necessarily be met under these conditions, the tool-point must have a small contained angle and becomes weak and unfit for heavy cuts. On the other hand if a holder is used it is generally provided with some flat surface which will locate it square in the toolholder, and make it possible to grind the tool to a given height, so that it is easier to set a boring tool to the proper position with an inserted tool than with a single tool.

The O. K. Boring Toolholder

Fig. 78 shows a boring toolholder as manufactured by the O. K. Tool Co. This holder can be placed in the toolpost of a lathe and assures to a certain extent the correct setting of the tool; that is, the toolholder cannot swivel around its axis. If the toolbit is properly ground it will naturally present the proper angles to the work. On the other hand the height of the tool is not determined by the holder but must be readjusted after every grinding or setting. Figs. 78, 79, 80 and 81 show various types of boring toolholders as made by the O. K. Tool Co., the Lovejoy Co., J. H. Williams & Co., and the Ready Tool Co. In all these cases the tools are held in round bars and the round bars in their turn are held in square shank toolholders, so that after grinding the tool and placing it again in the boring bar, it will present the same angle to the work as it did before grinding, and only the height will have to be adjusted—just as in the O. K. square shank toolholder described above. But if it is necessary to move the round bar in the toolholder in order to bore a deeper hole, this adjustment of the angles of the tool is disturbed.

The most common multiple tool is the double-end boring tool, which is merely a plate of steel ground to the proper angles, and held in a slot of the boring bar. The tool is made in a great variety of ways, but its essential features are that it has two cutting lips and that it can readily be removed or inserted. Its main requirement, in common with all multiple boring tools, is that both lips should do an equal amount of work. In order to do so, the two lips must be in one plane at right angles to the axis of the boring bar, or to be more correct at right angles to the direction of the feed. If the boring bar is supported at its far end it will also be necessary to have both sides of the tool at equal distances from the center of the boring bar so that each half of the tool shall bore to the same diameter. But if the end of the boring bar is not supported, then a small difference in the diameter of the two cutting edges would not materially affect the result as the boring bar will naturally assume a position which divides the cut evenly. If a single-point

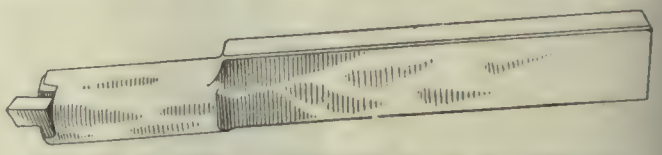


FIG. 78. BORING TOOLHOLDER MADE BY THE O. K. TOOL CO.



FIG. 79. BORING TOOLHOLDER MADE BY LOVEJOY CO.

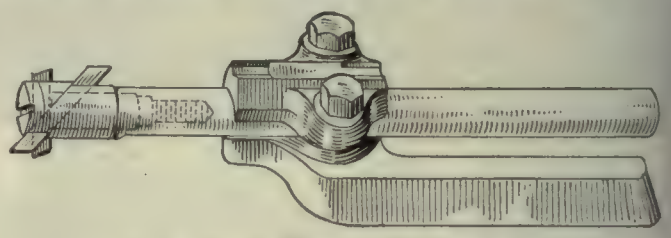


FIG. 80. BORING TOOLHOLDER MADE BY J. H. WILLIAMS & CO.

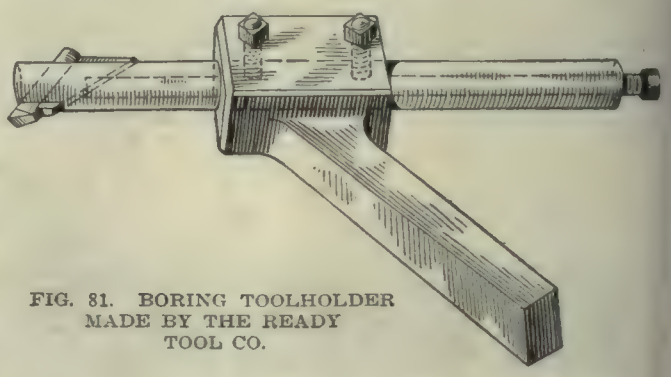


FIG. 81. BORING TOOLHOLDER MADE BY THE READY TOOL CO.

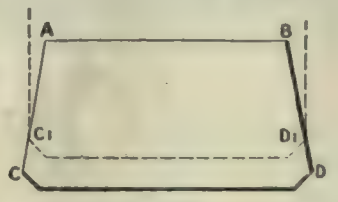


FIG. 82



FIG. 83

FIG. 82. DOUBLE-END BORING TOOL. FIG. 83. SLOTTED DOUBLE-END BORING TOOL

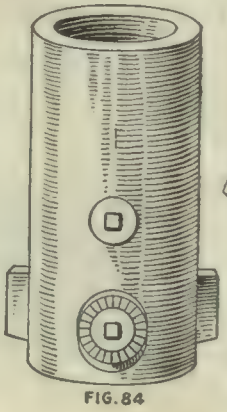


FIG. 84

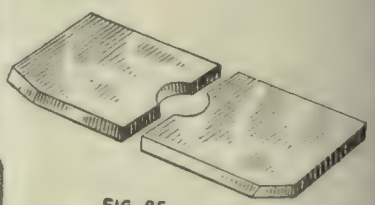


FIG. 85

FIG. 84. DAVIS BORING BAR WITH TOOL IN PLACE. FIG. 85. DAVIS BORING CUTTER

*For the author's forthcoming book. All rights reserved.

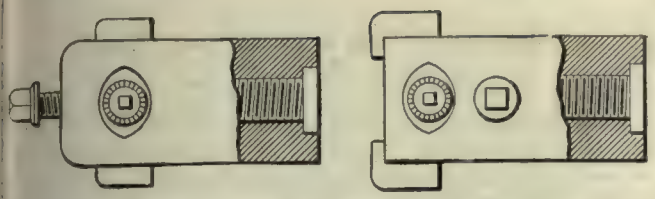


FIG. 85a. GENERAL UTILITY TOOL. FIG. 85b. TOOL FOR BORING BLIND HOLES



FIG. 85c. COMBINATION ROUGHING AND FINISHING TOOL



FIG. 85d. SAME TOOL AS 85c. WITH CENTER INSTEAD OF PILOT



FIG. 85e. TURRET LATHE TOOL WITH STRAICHT PILOT



FIG. 85f. TAPER SHANK TOOL FOR BLIND HOLES. FIG. 85j. TOOL TO BE SUPPORTED BY JIG BUSHING



FIG. 85l. TOOL FOR TWO-DIAMETER WORK IN TURRET LATHE

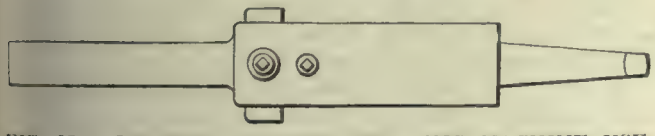


FIG. 85n. PILOTED BAR FOR DRILLING MACHINE USE.



FIG. 85o. TOOL FOR BORING BLIND HOLES WITHOUT BOTTOMING. FIG. 85q. DRILLING MACHINE TOOL FOR BLIND HOLES WHEN BOTTOMING IS UNNECESSARY



FIG. 85p. PILOTED BAR FOR TURRET LATHE WORK

tool is used, in a round (cored) hole, the deflection of the tool will be greater when it meets a larger amount of metal to be removed, and consequently the axis of the hole follows some curved line, or, as it is generally expressed, the boring tool follows the irregularities of the hole. This following of the hole is minimized when a double-end tool is used, because if one side of the tool is deflected on account of the heavy metal it meets, the other side of the tool will be pushed into the metal and will be compelled to take a heavier cut. Even at that the double end tool will also follow the hole, but the curved line of the axis of the hole will be very much straightened out.

Objection to the Double-End Tool

The main objection to the double-end tool is that it loses its size. In order to have side clearance, it would have to have a shape such as shown in Fig. 82, in which *AB* is shorter than *CD* (very much exaggerated). When the tool is ground as far as the dotted line, the line C_1D_1 will be shorter than the original side *CD*. For this reason, double-end tools are quite often made as shown in Fig. 83. A slot in the tool permits a screw with taper point to expand the tool to its proper size. When this method of keeping the tool to size is employed, it is more necessary than ever to grind the tool while it is in the boring bar in order to make the two lips perform the same amount of work. The various makers of small tools and, for that matter, various individual manufacturing shops, have elaborated on the double-end tool and have given it adjustable features. Fig. 84 shows the end of a Davis boring bar with the tool in position and shows its adjustable feature. Fig. 85 shows the cutter itself, which, as will be seen, consists mainly of two individual cutters held in position by a wedge. Where such a bar is used with a pilot, it is advisable to grind the tool in position in the bar. For a stub bar, it is generally satisfactory to grind the tools to a gage and then place them in a bar. The following arrangements of such a bar are recommended by the Davis Boring Tool Co. for the following operations:

See Figs. 85a, b, c, and so forth.

Recommendations of Davis Boring Tool Co.

85a is the ordinary boring tool which is threaded onto a spindle or onto a special shank or fixture or adapter to connect it with the spindle. It is a general utility tool which can be used for a number of various purposes and on a number of various machines.

85b is a modification of the previous tool specially adapted to boring blind holes.

85c is a combination tool containing a roughing and finishing blade, spaced a sufficient distance apart to let the cutting edge of the roughing blade clear the rough bored hole before the cutting edge of the finishing blade starts to work.

85d is a similar combination tool, but whereas 85c has a pilot, 85d has a center. As the tool is shown, it would be adapted to be held between centers of a lathe and to be driven by means of a dog while the work could be held on the carriage.

85e is particularly adapted for a turret lathe where the boring bar can be piloted in the spindle.

85f is for the same purpose as 85b, but whereas this latter tool was a general utility tool, 85f has a shank which limits its application to those machines which have the proper taper. 85b would be more use-

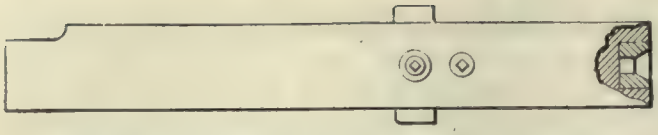


FIG. 85r. SINGLE-CUTTER TOOL WITH CENTERED END

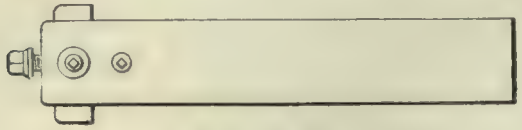


FIG. 85t. BORING MILL TOOL

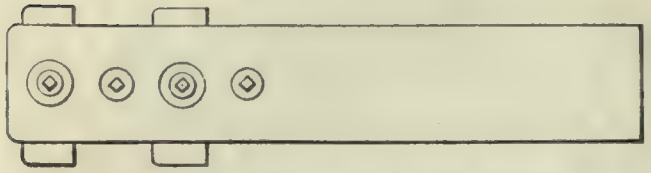


FIG. 85u. TOOL FOR TURRET LATHE WORK WHERE PILOT CANNOT BE USED

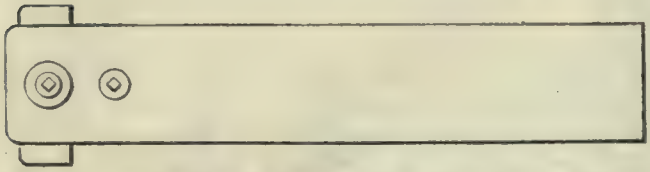


FIG. 85v. SINGLE-BLADED TOOL OF SAME TYPE AS 85u

ful where a variety of jobs has to be done, whereas 85f is of greater value for manufacturing purposes.

85j is a tool which is supposed to be supported in a jig bushing.

85l is an arrangement often used for turret lathe for two diameters or for one diameter and counterbore.

85n is a piloted bar with taper shank well adapted to drill presses, and where the bar is guided in a fixture.

85o is a compromise between 85a and 85b. It is adapted to boring blind holes, but without bottoming.

85p is built along the lines of 85n, but its shank makes it specially adapted to turret lathe work.

85q is especially adapted for drill press work of the same nature requiring 85o, but the bar is longer and adapted to a greater range of work.

85r is of the same type as 85d, but using one tool only.

85t is well adapted to boring mill work such, for instance, as car-wheel boring, etc., and where a standard hole has to be reproduced frequently. This tool is often arranged with two blades, one for roughing, one for finishing.

85u is particularly adapted to turret lathe work where a pilot cannot be used.

85v is of the same general arrangement as 85u, except that it is shown here with only one blade.

The above tools are shown particularly for the purpose of demonstrating the great variety of arrangements of boring bar and tools in actual use. There are many other arrangements used in practice, depending on the nature of the work to be done, and the nature of the machine on which it is to be done, whether the tool is to be used for general purposes or for special jobs. on the degree of accuracy required, and on a variety of other considerations.

Educating Workers in the Plant

By Frank H. Williams

When a plant needs more skilled workers than it has should it go outside for them or educate some of its employees to handle the higher positions?

Of course the answer to this question depends quite largely upon the plant's immediate needs. If it requires more skilled workers at once and simply must have them, then, of course, it will be necessary to bring them in from the outside. But, if the plant executives can foresee a need that will develop within a comparatively short space of time, then it would seem as though the best plan would be to educate some of the workers employed by the concern at present to hold down the more responsible jobs.

There are a number of reasons why the latter plan is better than importing new people. In the first place those workers who are already familiar with the plan and with some of the activities for which they are to be educated will probably take hold of the new work very readily and not "flivver" on the job, as some outsiders are very apt to do. Consequently, the expense of hiring and firing the newcomers will be entirely done away with. Again, the workers who are educated by the plan for higher jobs will be sure to give the concern the best sort of loyal service. Also, the bringing of men up from the ranks will engender a fine feeling toward the company among all the employees. Finally, such workers are certain to fit into the organization with less rumpus and disarrangement of schedules than will outsiders.

An Educational Plan

The fact of the matter is that the plan has so many advantages that the comparatively small expense involved in conducting the necessary classes should not deter the majority of plants from putting the plan into effect, whenever possible. In most cases where this sort of a plan has been adopted, the employees take great interest in the matter. For instance, the Fort Wayne Electric Works of the General Electric Co. recently started a business course, including accounting and law for those employees who showed enough interest in the matter to attend the classes. No hope of promotion was held out to those attending the classes, but it was stated that the employees who took the course would better understand the company's methods, as well as receive a general course of study which would make them more efficient in all accounting work.

At the first session of the class eighteen employees were enrolled. The class meets every Monday and Wednesday evening from 5:45 to 7:45 o'clock and, in addition to the regular class periods, the course contemplates from eight to twelve hours home study each week. The course is divided into five semesters and extends over a period of two and a half years. It is, of course, offered free to employees of the company who are interested in work of this nature.

Naturally a man has to be pretty ambitious to do so much extra work every week along the same lines as his regular daily occupation. Naturally, also, the company will look to the members of this class when it is seeking men for higher positions in its accounting department. Such a plan of study might not be adaptable to smaller plants, but it should go well in all large plants and tend to work a very real advantage. A plant manager may well consider this matter at present, so that needs may be met when they arise in the future.

Meeting the Present Emergency

By a Builder of Machine Tools

I HAVE an abiding faith in our country and its resources, and especially is my faith strong in the great body of men who are responsible for the industrial welfare of our country. As soon as the multiplicity of perplexing problems now confronting the country can be analyzed and properly classified, business will resume.

Just now we are suffering from mal-assimilation, due to the malformation of the automotive machine-tool and textile industries and a few others, together with malformation of administrative organization, which has added increasing taxation to industry. All of these have resulted in producing a case of general nervous prostration.

There has been much price inflation, too much for easy adjustment now, and general business will not be resumed to any appreciable extent until the cost of raw materials is brought to a more nearly normal pre-war basis. This, of course, is equally true of the prices of fabricated materials in all lines, as well as to labor costs.

I firmly believe that we have got to get back to pre-war normal conditions and adjust upward from that level, rather than to adjust downward from the present levels to what may appear to each individual producer as a good, safe guess.

The quicker we all realize that the war is over and get back to first principles and make a new start the sooner will business revive. This will require united action, and it must be with the co-operation of labor. Prices cannot be brought back to pre-war normal without very substantial reductions in the cost of labor. In fact all industry is suffering from a very aggravated case of "inflationitis" and it will take some very bitter medicine to restore a healthful condition. But the medicine must be taken no matter how bitter and the sooner we all realize this and swallow the dose the quicker we will get the taste out of our mouths and get back again to safe industrial conditions.

In our own case we are operating on our regular schedule of fifty hours per week, and have not found it necessary to curtail our working force. We could handle more business, as our orders are not so large in volume as we might wish. But our stock was so entirely exhausted during the war period that it now affords us an opportunity to replenish it, which is most desirable.

The automotive industry has been very largely over-expanded. Its shrinkage will be painful to many lines of industry, in fact it cannot help but effect most seriously the entire industrial system of the country. But I look for greater development in the automotive trade through a wider and more general use of the motor truck, the tractor and also in a much further development of the airplane.

I firmly believe that no 5, 10 or even 20 per cent reduction in prices that have, during the past four or five years, been advanced to 180 per cent or 200 per cent and beyond, will ever stimulate trade. The operation is bound to be a painful one, it will be bitter medicine, and the quicker it is over the better for all concerned. But the inflation must be taken out of prices, and we will have to get back as nearly as possible to pre-war conditions as a basis from which to make a new start, and then adjust upward from that level as may be found necessary in each individual case to meet changed conditions.

By an Eastern Sales Manager

IN A sense, the present situation is one which can be viewed as an opportunity for industry. Unquestionably, industry today is getting a much-needed overhauling, and when we have passed through these unpleasant times we will find ourselves on a much healthier basis. To us now, of course, the process of readjustment is unpleasant and difficult. We are bending every effort and devoting all of our energies at this time to conservation of resources, eliminating all unnecessary expense.

Building for the future in these times is a most important item. The promotion of sales propaganda through sales engineering work should be indulged in to whatever degree the treasury can stand, and the development of new types of machines and equipment for future demands goes without saying. The particular need in this line is for machines that will effect economies in production.

Many small concerns were established on insecure foundations that were possible because of the unusual trade conditions prevailing in the past four years. They had no rational future plans and built up no reserve. Business will be reduced to those companies who have established themselves on a firm and healthy basis, the standard makes of this country. Concerns who have sprung up over-night will undoubtedly be eliminated.

Cultivate Other Fields

While the automobile industry is slowly resuming its place as the biggest consumer of machine tools, other fields must be cultivated by the machine-tool builder. There is no single industry to which he may turn, but there are many lesser ones in which modern tools should replace home-made and worn-out machines in order that they may survive the period of keen competition into which we are entering. The tool builder thus finds a market, and the manufacturer of consumption goods is enabled to reduce his cost of production to a profitable basis, even at the lower retail prices which are certain to prevail.

At present the shelves of manufacturers would not indicate an immediate return of buying, but now that the first of the year has passed the immediate needs will have to be supplied and for a short period there may be a brisk return to buying. When this has passed there will be another lull, and not until summer or into the fall shall we commence to feel the first of the demands of this country. Present conditions will naturally eliminate from consideration any great amount of export business.

This is probably the first time in history when business depression has been simultaneous in Europe and at home. During other seasons of stagnation the foreign market has been a relief into which over-stocks could be shifted. Present exchange barriers prevent this trade and we must await the completion of the domestic cycle of over-production, under-consumption, stagnation, resumption of buying, and manufacturing activity.

A Question in Factory Management

By L. L. Thwing

Mr. Forbes' solution of his snagging problems, as told on page 865, of *American Machinist*, by the use of "Tech" students suggests several things. For one thing, fifteen years ago a "Tech" student was commonly understood to be an undergraduate of one of the large technical schools. Today the phrase may mean a student of a technical high school, or even of a correspondence school. However, any such "Tech" boys may be assumed to be more apt in learning the duties of a machine operator, and the very fact that they are alert and intelligent accounts for the accurate observation by Mr. Forbes that they are very likely to make what appears to be very inexcusable mistakes; mistakes that are not generally made by boys of a more stolid temperament.

If you put a boy with an alert mind on a monotonous repetitive job that requires but a small part of his attention you may be sure that sooner or later the larger part of his mind will occupy itself with more interesting thoughts, and as a result he has helped to increase the scrap pile. On the other hand it is not at all impossible that he has done more work, or better work, than his neighbor, and this might be enough to offset the loss in the piece that he spoiled. There are any number of managers, superintendents and chief draftsmen who would make highly unsatisfactory snaggers or polishers.

Technical Graduates in Demand

There seems to be a place—even a demand—for technical graduates at the snagging bench and the drilling machine and again in the superintendent's or shop manager's chair. We see a good many enter at one end of the tunnel and very few come out. The process of working up to the shop manager's chair seems to be not only a difficult one, but one whose processes have not been closely examined.

It may be assumed that any boy who selects a mechanical course in a technical school has done so because he is at least interested in mechanical problems, and it is not entirely unreasonable to assume that if he likes mechanics and mathematics he is somewhat proficient in them. We are more likely to enjoy doing those things that we do well. He certainly did not choose a technical school because it was easier than a college; and after he has spent four years in school and is ready to put his foot on the lowest rung of the ladder of professional success he is likely to find that rung, or at least the second or third one, guarded by a thoroughly capable graduate of the college of hard knocks who defies anyone to mention to him a single great invention that was made by a college graduate.

We are graduating many mechanically trained men each year; men whom, we must assume, have at least a certain amount of foundational training that the shop educated man does not have. If we are to admit that technical schools are good for anything, we must admit that their graduates are, on the whole, better material for the future superintendents of our machine shops than any other class of men. But how many arrive? How many even stick to mechanical or engineering work? If we assume that 50 per cent of the graduates do not have those qualities which make for success along mechanical lines, and if we allow for 25 per cent more to have been side tracked by those intangible and uncontrollable forces which may be grouped under the genera heading of bad luck, we still have 25 per cent left. W know that 25 per cent of our "Tech" graduates do no find executive or professional work along mechanica lines at the climax of their struggles, and we ma strongly suspect that not 25 per cent of our mechanica engineering graduates are working in mechanical line even if we stretch the word mechanical to its fu elastic limit.

One reason for this condition is the fact that eng neers appear to be in great demand for everythin except recognized engineering problems. Consequentl we have sales engineers, efficiency engineers, publicit engineers, and even "correspondence engineers."

Value of a Technical Education

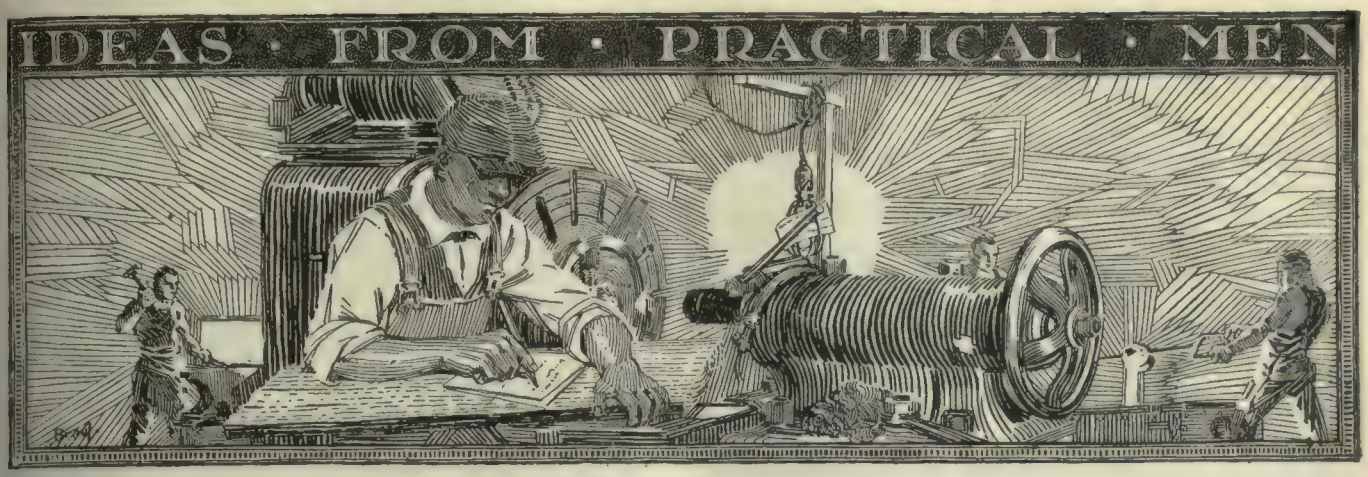
Some years ago the writer happened to be in an offi where several technical graduates were pessimisticall reviewing the direct value of a technical education. Th experience of nearly all of them had been that they we accepted readily as common and unskilled laborers, a smaller pay, however, and they worked with varyin degrees of patience until, seeing no chance for advanc ment, they quit. One group of five had secured "chance to work up" with a large steel corporation, ar were assigned to the job of straightening steel plat with a 15-lb. sledge, varied occasionally by a turn wit the red paint. At the end of a year there was one the group sticking to the job. According to the cop book maxims he should be chief engineer of the pla by now.

One other had been head of the steam engineerin department of a large engineering corporation, and a such laid out the entire piping system for both pow and heating for what was then the largest woolen mi in the world. His salary was $25 a week, and he left t go into the insurance business.

Facts and Platitudes

It is very easy to give specific reasons in individu cases, why men have not worked themselves up to pos tions of responsibility and trust in their chosen fiel and very easy to deliver a few platitudes about ha work, patience and stick-to-itiveness, but the proble is deeper than that. This country has been a pla where results count, and methods have not been scrut nized. If a man cut a worm in the lathe by trying di ferent gears until it was "near enough," he was ju as good a man as the one who could figure out what the gears should have been. He did the job and that w what was wanted. I do not believe that there is a advantage in having engineers at the head of enginee ing companies, though it is customary to do so in En land and Germany. The writer was employed by t Alien Property Custodian during the war and cons quently saw much of the German-owned and manag industries; in nearly every case the man next in autho ity to the manager was an engineer.

The question of why our technical graduates do n succeed to any considerable extent in technical work too large to settle here; it involves the question of t vital qualities for success in any calling. If it is, ho ever, a fact that the students whom we have trained handle our mechanical problems are not doing it, eith something is the matter with the students as a cla something is the matter with their training, or som thing is lacking in our system of recruiting, traini and selecting executives.



Lack of Standardization of Pneumatic Hammer Chisel Shanks

By A. J. Schwartz

A short time ago it became necessary for a manufacturing firm to procure, by purchase, a large supply of pneumatic hammer chisels. Heretofore this firm had been making its own chisels and had an expert mechanic to fit the shanks of the chisels to one of the hammers in use. With the workman's experience and good judgment the firm was able to get along with a fit of the chisels in the hammers that gave fairly good results. This firm is, however, in the throes of a change, from a "Go" gaging system, to a system requiring "Go" and "No Go" gages. Therefore, a set of "Go" and "No Go" gages were ordered designed for the shank ends of the chisels, so that any person could inspect these tools.

Right here is where trouble developed. How much allowance should be required and how much tolerance should be permitted for these tools? What was the practice of the commercial firms regarding their dimensions? Hand books, periodicals and catalogs were consulted, but none gave, for a given size of hammer, the internal dimension of the socket or nozzle, and while data are given in the catalog for the size of the chisel shanks, there was no uniformity in these dimensions. The policy of the minimum hole basic as a standard has been adopted by this firm, therefore the socket was taken as a standard.

Having decided upon the minimum dimensions for the socket, the next question was to decide upon the

	Round Shank	Hexagon Shank	Differential Shank
Navy Department	0.495" Specification 40-T-2	0.580" 0.680" Specification 40-T-2	Specification 40-R-2 0.580±0.001" 0.680±0.001"
Navy Department	45° 0.495±0.001" Specification 40-B-4	45° 0.580±0.001" 0.680±0.001" Specification 40-B-4	45° 0.580±0.001" 0.680±0.001" Specification 40-B-4
First Manufacture	0.497"	0.597" 0.680"	
Second Manufacturer	0.500	0.590" 0.680"	0.590 0.680
Third Manufacturer		0.580" 0.682"	0.580" 0.682"

COMPARISON OF SPECIFICATIONS FOR PNEUMATIC HAMMER CHISEL SHANKS

maximum size of the chisel shanks and the minimum allowance and then decide the greatest minus tolerance that would permit the proper functioning of the hammers. The sketch shows the result of a search of circulars and catalogs for the shank dimensions. Note how varied the dimensions are for a given size chisel.

It will be seen that only the Navy Department specifications state permissable tolerance. However, exceptions are taken to these tolerances; with an allowance between the maximum shank and the minimum socket of over 0.01 in. the tolerance of only 0.001 in. is considered to be entirely too small. Also as the Navy Department specifications were prepared for the use of the different bureaus in purchasing material, these same specifications would prevent, when "Go" and "No Go" gages were used, any commercial manufacturer supplying the government with chisels taken from stock. It would be necessary for the manufacturers to grind the shanks to meet the special requirements of the government specifications.

A Step Toward Standardization

The appeal is now made to all firms manufacturing pneumatic hammer chisels, to call a meeting for the purpose of standardizing the shanks of chisels and also the internal dimensions of the sockets or nozzles of the hammers, specifying in particular for any given size of hammer the smallest amount of allowance and the largest clearance (allowance and tolerance) that will permit the proper assembling and functioning of a pneumatic hammer, that is, the minimum dimensions with a plus tolerance for the socket and the maximum dimensions with a minus tolerance for the chisel shanks.

The following dimensions should be standardized for any given size hammer: There should be specified a uniform length and tolerance for the total length of the shank whether round, hex or differential; a uniform diameter and tolerance for the large round on the hex and differential shanks; a uniform size and tolerance for the dimensions of the hex; a uniform diameter for the small round on the differential shanks; a uniform dimension for the radius where the shank joins the chisel body. And last but not least the two diameters on each of the differential and hexagon shanks should be co-axial.

Cases are known where it was necessary to make new sockets and ruin a new chisel due entirely to the axes of the two parts of the shank not being exactly co-incident. If it is impossible to keep these parts in perfect alignment then the tolerance on this point should be within the smallest limits possible for commercial production and with the absolute guarantee that the chisels will function properly and not cause any trouble to the purchaser.

Press for Making Paper Tags

By George G. Little

While reading Vol. 49 of the *American Machinist* I saw on page 498 an article illustrating a punch press of unusual design. In the article the statement is made that the maker believes it to be the first instance of operating piercing and blanking dies by pulling the dies down by power applied from beneath.

It is my opinion that the principle of moving the upper head and the punches through the medium of vertical side bars, is old and has been used before though not so common as the overhead crank. In shoe factories I have seen the sole and heel dies forced through a sheet of leather by a press having side rods and an upper head that was pulled down onto the dies.

A Special Press

In 1911 I designed and built a small punch press especially for the purpose of piercing and blanking out the paper tag, shown in Fig. 1, and as far as I know this is the first instance of a press being built to operate pillar dies, having the crank below the platen. It was my intention to develop the design for the market but owing to other more important work it was not carried out. In Fig. 2 is shown a front view, part section, of the press mounted on top of a cabinet. In Fig. 3 is shown a cross section through center of machine and die. The pillar presses are of cast iron 2½ in. square and 2½ in. high, with ½-in. cold rolled steel guide

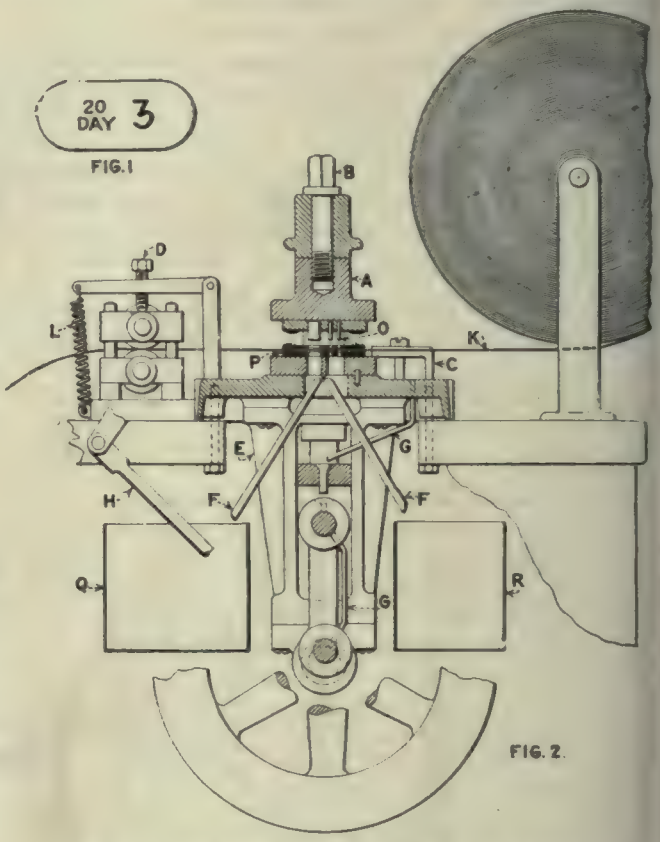


FIG. 1. THE TAG. FIG. 2. FRONT OF PRESS

pins. The cap *A* is secured to the crosshead of the press by the shoulder screw *B* while the base is secured to the press platen by two clamps one of which is shown at *C*. The dies are made of cold rolled steel ⅜ in. thick by 2 in. square, finished and case-hardened. The punches are of drill rod finished and left soft, mounted in punch pads of cold rolled steel ⅝-in. thick by 2 in. square. The dies *P*, together with the stripper plate and guides, are secured to the pillar press base by four screws and dowel pins, as is usual in progressive dies. The pillar press is located on the press platen by two dowel pins before being secured by clamps *C*.

Feed rolls pull the paper strip through the dies and are actuated by a roll-grip clutch (not shown) having six drill rod rolls ¼ in. diameter and ½ in. long, sup-

ported by hard steel plates made by hacksaw blades secured in the rotor. The ring or outer shell of the clutch is of cold-rolled steel not hardened. This clutch has given several years of service without requiring repairs and was still in use one year ago. The spring *L* through adjustment of the screw *D* gives the proper tension for pulling the paper without slip. An eccentric on the crankshaft times the action of the rolls by means of the rod *H*, Figs. 2 and 3. The lower crosshead *I*, shown in Fig. 2, is guided by the side members of the drop frame *E*.

The vertical side rods *S* work in the guides *T* which are a press fit in the platen, the rods being threaded at the upper end to furnish a means of adjustment of the stroke which is secured by setting the collars *M* and the top nuts *V*.

The chutes *F* and *F* in Fig. 3 are for the purpose of carrying the piercings into the box *R* while the finished blanks go into the box *Q*, the separating being entirely automatic. The paper *K* is 1 in. wide and the blank is ¾-in. long, leaving ⅛-in. margin in the scrap with the same amount between the holes. The pitman

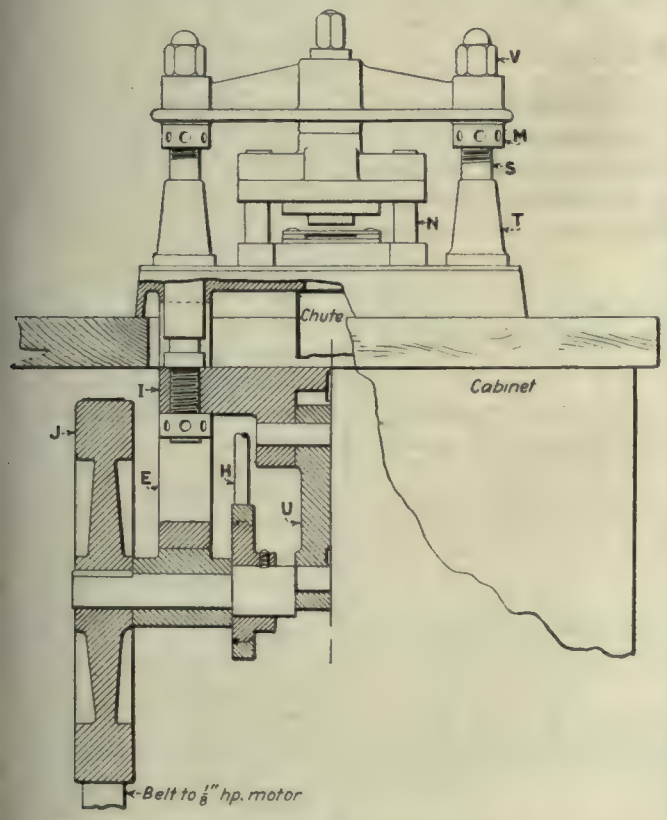


FIG. 3. CROSS-SECTION THROUGH CENTER OF PRESS

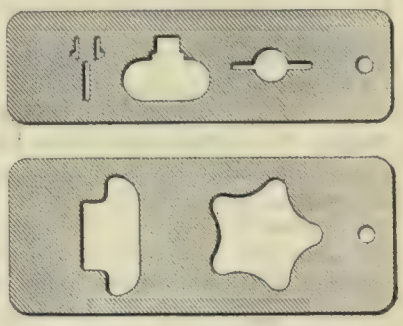
U, Fig. 2, is of cast iron as are the upper and lower crossheads, the drop frames, platen, balance wheel and crankshaft bearings. The balance wheel serves as a pulley being slightly crowned and the belt passes down to a ½-hp. motor. Oil is supplied to the proper points through tubes leading from a row of cups located at one side in the base of the press as indicated by *G*, Fig. 3. The crankpin receives oil from the upper wrist-pin supply. A 12-in. roll of paper makes 27,000 tags and, at six tags per second, takes one and one-quarter hours to cut.

The tags are used for marking surgical ligatures and are inserted in the glass tubes in which ligatures are sealed.

Drawing Room Templets

By John L. Braun

In large drawing rooms where jig and fixture drawings are made, certain standard parts are used, such as knobs and thumbscrews. Sometimes it is desirable to show these parts in the drawing in order to indicate a certain amount of clearance required and the method of clamping. The templets shown are used to draw these parts in place and can be made of celluloid or metal about 0.03 in. thick. If made of brass, and nickel-plated, they will be very durable and probably last longer than if made of some transparent material. The edges are generally beveled to facilitate picking up. These templets cannot fail to save time where finished drawings of jigs and fixtures are made. The illustration shows templets for a ⅜-in. thumbscrew and No. 2 knob.

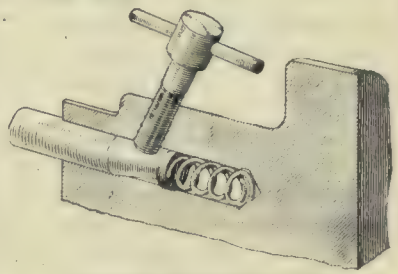


DRAWING ROOM TEMPLETS

A Simple Spring Pin

By Ira Hill

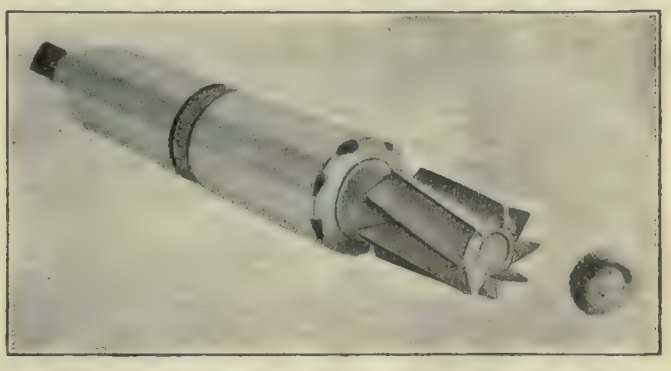
The accompanying sketch shows a spring pin arrangement which I have found works very well and is more easily made than the ordinary design. The spring pin is turned taper, as shown, and the binding-screw hole is tapped perpendicularly to the tapered side of the pin.



A SIMPLE SPRING PIN

Grinding an End Mill with Only One Center Hole

Grits and Grinds shows an interesting kink for holding work on centers for grinding. In grinding an end mill like that shown in the illustration, the common practice is to put one end on the center and use a steadyrest in the middle. If the mill has an opening in the end, like the one illustrated, it can be held rigidly between centers by placing a steel ball between this opening and a female center.



THE END MILL AND THE BALL TO FIT THE FEMALE CENTER

IN THIS ISSUE

"SELLING Machinery in Europe Since the Armistice" is the rather unusual article that opens this issue. It was written by Oliver Field Allen, formerly Major, 24th Engineers, who was on the ground for some time after the armistice was signed and was in a position to get at facts first hand. He has drawn conclusions as to why American manufacturers have not been able to dispose of more machinery in Europe, dealing with the subject from a point of view which takes in sales and advertising methods chiefly, and does not include treatment of the effect of existing rates of exchange. It will be remembered that there was great confidence among American manufacturers as to the possibilities of large sales to the countries which had been devastated and would therefore be compelled to reconstruct to an appreciable extent. Such hopes were founded on logical thought and it is probable that we should have had much more business than we have enjoyed had the countries referred to been possessed of more money, or what would have amounted to the same thing, long-term credit. Mr. Allen's article, therefore, is timely in that it gives some very good information as to necessary methods to be followed in selling machinery once the ability to pay for it is established, because at this time indications are that the Foreign Trade Finance Corporation is started on the way toward solving some of the financial difficulties of our European buyers.

Basset, in his modern production methods article, page 398, takes up the subject of accounting for supplies. He explains how the cost of non-productive materials gets into the final cost of the product and tells of correct and incorrect pricing methods. The sample cards, expense forms and distribution forms included strike us as very valuable indeed. The article as a whole maintains the very high standard set by Mr. Basset in his earlier articles of the series.

Where the nature of the work makes a large shop necessary one of the main factors in cost is inter-shop transportation. When such work consists almost entirely of repairs, and especially when the units are large, the system of conveying every piece on which machine work must be done to the machine proves costly indeed. Traveling cranes have so facilitated the handling of heavy pieces that they may be said to have solved the difficulty for the average production shop. Not so with shops devoted to large repair work, however, more especially those making locomotive repairs. Moving the machine to the work has become an accepted part of the systems of many such shops. In large measure the machines so moved are standard machine tools mounted on wheels. On page 403 Hunter tells of the portable equipment of the Chicago & Alton shops at Bloomington, Ill.

Trade teaching has settled down upon us to stay. Nobody disputes the truth of such a statement. Almost every shop of any size possesses a training department of some kind and many of the smaller shops are finding it profitable to give their newcomers systematic instruction. Where are all the teachers of these many schools coming from? We suppose that the majority of them have just grown. From Ohio, which gave us our President and the World's Champions, has come a contribution on training trade teachers. It tells of the Toledo system, now in its second year. Page 405.

Fred Colvin continues on inspection of automobile parts. His articles this week, page 407, tell of the importance to quality of inspection methods and details some of the methods of inspection in use on Essex and Studebaker pistons and connecting rods.

We must confess to a whole lot of admiration for Sheldon's article on the father of the magnetic chuck. We have read "The Romance of Steel" and "The Romance of the Reaper" and we believe that we have now read the romance of the magnetic chuck, or that at any rate we shall have done so after we have finished the entire series. There are two particularly good features about this week's story—the story itself and the way it is told. Page 412.

Last week you read the first part of the fifth of the DeLeeuw articles on metal cutting tools. You will remember that we said that these articles are better as they go deeper into their subject. You will find that the continuation of part V, page 418, lives up to our advance notices.

Shop Equipment News begins on page 428.

Coming Features

The second of Erwin H. Schell's management articles is scheduled for the issue of March 17. It tells of such things as the distinction between management and capital, the duties of management, the tools of leadership and the value of consistency in discipline.

Stanley will tell of the application to the railroad shop of a very useful machine, the draw-cut shaper.

Hunter has gone into the details of crankshaft turning practice in an article that will appear next week.

Oliver Field Allen's article on selling machinery in Europe since the armistice will be concluded.

Colvin will continue with his articles on the foreman and his job, a series that is proving very popular.

The sixth of DeLeeuw's series on metal cutting tools will be started. It continues the subjects of boring and boring tools.

EDITORIALS

A Rift in the Clouds

PRESIDENT WILSON'S signing of the Winslow partial payment bill making available some $340,000,000 for the railroads shows promise of producing a bright spot in the general gloom which yields so slowly to treatment. Not only will it relieve the strain on the railroads to a certain extent, but it will also provide some business for the machine tool and supply people.

The amount of new business will undoubtedly be much smaller than either the railroad purchasing agents or the manufacturers of tools and supplies would like to have it, but it will be one more item among several that will improve the general situation.

The most serious problem facing the railroads, and the government organizations regulating them, is the so-called "liquidation of labor." When railroad wage rates have been equitably adjusted there should be a pronounced change for the better in railroad equipment and in railroad shops but the process of adjustment is sure to be slow. Consequently this measure affording temporary relief is more welcome than it otherwise would be in a generation that thinks in billions rather than in millions.

Real Patent Progress

THOSE interested in the welfare of our patent system—and who is not so interested—may congratulate themselves that the conferees of the Senate and the House of Representatives have agreed upon the higher salary scale for the staff of the Patent Office. There seems to be no doubt that this legislation will be enacted within the next few weeks and thus provide more adequately than ever before for the technical staff of this institution.

With such a staff as we can now look forward to, we may well anticipate, not only increased facilities in securing a good patent, but increased protection against patents which never should have been granted. This condition existed because the examiners were both under-paid and over-worked and could not give that consideration to the affairs of their office which they knew, as well as others knew, should be given.

Making Business Heard

THE Chamber of Commerce of the United States is taking a distinct step forward in organizing a Department of Resolutions and Referenda. The new department should prove very effective in making the wishes of American business heard before legislative committees and through various public agencies.

The resolutions that have been passed as the result of referendum votes by the members of the National Chamber have proved valuable as indications of the sentiment of American business. Many of these resolutions unfortunately have not carried the weight they were entitled to because of the lack of a suitable organization to insure their proper presentation. As it is a matter of several months to take such a referendum vote in a body as large as the Chamber of Commerce of the United States, the result obtained is anything but a snap judgment and is worth careful consideration, whether its subject be labor, transportation, banking, exports or one of many others of importance.

In the keen economic struggle ahead of us, those in authority will do well to pay careful heed to the composite opinion of the American business man. The business man in his turn will do well to take full advantage of the opportunities offered by the Chamber through its Resolutions Department.

Federated American Engineering Societies Favors Local Section Principle

IT IS encouraging to note that at a recent meeting of the executive council of the Federated American Engineering Societies the sentiment strongly favored the formation of local sections. The local section idea has been well tested by the American Society of Mechanical Engineers and has been very successful.

With the much larger local membership which the Federated Societies will possess, their program of mutual and community service should be easy to carry out. The members of the local section will be residents of the community and directly affected by any improvements their efforts as members of the Federation are successful in accomplishing. Consequently, their interest is likely to be energetic enough to be productive of results that will benefit us all.

Records of the Air Mail Service

AIRPLANE accidents are always given wide publicity, but little attention is paid to the remarkable service records of the veteran planes of the Air Mail Service until they come to grief. Their reputations, like those of many men, are destroyed by one slip after long periods of faithful and honorable service.

A statement recently issued by the Post Office Department tells of the achievements of a few of the older planes. Of the first eight purchased for carrying mail, seven are still in commission. One of them has been in the air for 207 hours, another for 141. As these planes are nearly three years old, their total flying time is nothing remarkable unless we take into account the fact that when they were built airplane mail carrying was an untried venture and they were consequently largely experimental.

Two of the much-criticized DeHaviland planes have records of more than 38,000 miles at an average speed of over ninety miles an hour. Total figures are even more impressive. Up to the end of 1920, Air Mail planes were in the air 18,800 hours and covered 1,572,500 miles, carrying more than 49,000,000 letters. The cost of repair parts and labor was at the rate of 30.5 cents per mile flown.

In the face of such records doesn't it seem a very short-sighted policy to hamper the development of the Air Mail Service in any manner?

SHOP EQUIPMENT NEWS

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and equipment

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs and equipment

Lumsden No. 86 Oscillating Surface-Grinding Machine

Alfred Herbert, Ltd., Coventry, England, and 54 Dey St., New York, N. Y., as sole distributor for the Lumsden line of machine-tools, is placing on the market the oscillating surface-grinding machine shown in Fig. 1. The machine is known as the No. 86 and is said to be especially adapted to locomotive, shipbuilding and general engineering shops, where products such as steel railway buffers, axle boxes and covers, and similar parts having plane surfaces require grinding. It is stated that the output is rapid, surfaces up to 24 x 10 in. being handled.

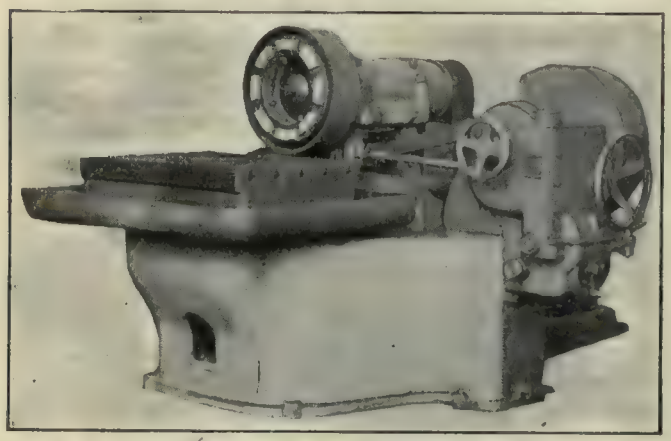


FIG. 1. LUMSDEN NO. 86 OSCILLATING SURFACE-GRINDING MACHINE

Specifications: Capacity, largest surface ground, 24 x 10 in. Face to be ground must be at least 4 in. above surface of table. Working surface of table, 36 x 25½ in. Grinding wheel: diameter, 16 in.; number of segments, 8. Wheel motion: Maximum stroke, 24 in.; hand feed, 3 in.; oscillations per minute, 10.8, 21.6 and 43.2. Wheel-spindle speed, 1,088 r.p.m. Speed of driving pulleys, 775 r.p.m. Width of driving belt, 6 in. Horsepower required, 20. Floor space, 9 ft. 6 in. x 6 ft. 9 in. Approximate net weight, 8,100 lb.

The machine is built on the same principle as the Lumsden oscillating tool-grinding machine, the grinding-wheel head being mounted on a substantial swinging arm whose base consists of two trunnions, which are supported by broad bearings on a shallow box-section bed. The arm is free to oscillate about the center of these bearings, the movement being obtained by means of a connecting rod operated by a crank on a three-speed gear box fixed to the bed of the machine. The construction can be seen in Fig. 2. By adjusting the throw of the crank, the stroke of the oscillating arm on the path of the grinding wheel center can be varied from zero to a maximum of 24 in.

The grinding-wheel head consists of a 16-in. segmental cupped wheel, having eight segments and mounted on a ball-bearing spindle carried in a ram which has an adjustment parallel with the axis of the spindle. This adjustment, which is for feeding the wheel to the work, is controlled by a handwheel on the gear box and can be operated when the arm is in motion. The wheel segments are 6 in. long and can be used down to a length of 2 in., or even 1½ in., if care be taken in chucking them.

The spindle drive is by belt from a self-contained countershaft, situated on the center of oscillation of the swinging arm and supported both by ball bearings in the trunions and also by a bearing on the bed. Facing the grinding-wheel head is a T-slotted work table surrounded by a cast-iron trough. An ample supply of water can be provided by a pump driven from the countershaft. The machine is self-contained.

There are three speeds of oscillation of the wheel suitable for different lengths of wheel stroke, 43 strokes per minute being used for strokes up to approximately 8 in. long, 21½ for strokes from 8 to 16 in., and 10 for strokes from 16 to 24 in. in length. With regard to production, it is stated that on a steel railway buffer ⅞ in. has been ground from a plane surface 13 x 9 in. in 2 minutes; that on steel axle boxes and covers 11 x 5 in. in size a rim ¾ in. wide has been ground in 1½ min-

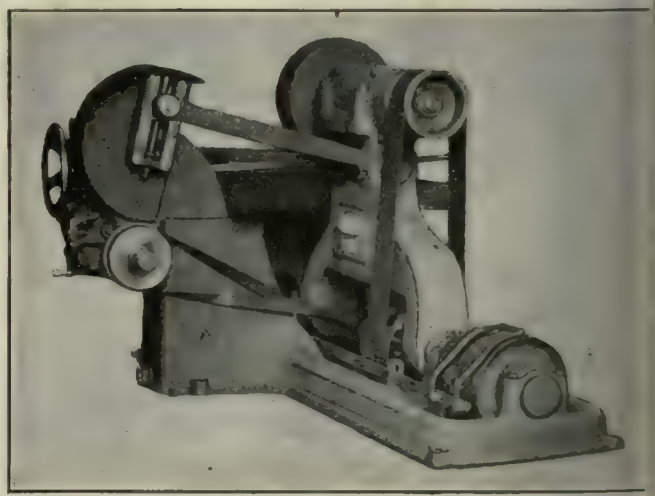
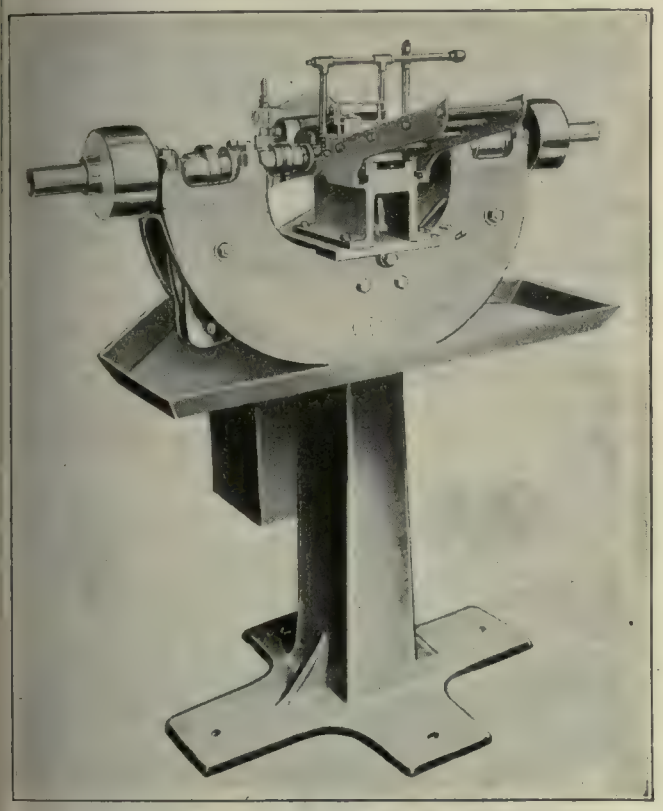


FIG. 2. REAR OF LUMSDEN SURFACE-GRINDING MACHINE

utes, $\frac{1}{16}$ in. of stock being removed; and that $\frac{1}{10}$ in. has been removed in 1½ min. from the 1½-in. rims of 12 x 1 in. cast-iron boxes.

Grant Opposed-Spindle Automatic Chamfering and Threading Machine No. 183

The Grant Manufacturing and Machine Co., Bridgeport, Conn., has recently added to its line of double-spindle automatic chamfering and threading machines



GRANT OPPOSED-SPINDLE AUTOMATIC CHAMFERING AND THREADING MACHINE NO. 183

Specifications: Height from floor to center of spindles, 44 in. Maximum capacity between spindles, 12 in. Diameter of spindles, 1¼ in. Height of spindles above table, 6 in. Size of table, 9 x9 in. Diameter spindle pulleys, 6 in. Driving belt width, 2½ in. Height over all, 48 in. Floor space, 68 x 30 in.

the No. 183 machine shown in the illustration. The principal parts of the machine are two cutter spindles, the magazine, and the work-holding and feeding table. The spindle bushings have a lateral adjustment of approximately 2 in. by means of hardened collars, and are fed to the work by levers situated below them and operated by face cams within the body of the machine.

The automatic movements are controlled by a small hand lever at the front of the machine. The operating mechanism is located at the rear of the machine, the driving pulley being provided with a roller friction clutch. The shaft bearing this pulley passes through to the front of the machine, and is provided with a worm-and-gear drive for the camshaft which operates the levers feeding the spindles. Another worm and gear operates the clamping device through cams mounted on a short shaft.

Ordinarily, the work is placed in the inclined hopper or magazine, from which it is fed by a slide mechanism to the proper machining position, where it is clamped and rigidly held by the clamps at the top and center of the machine while the work is being done. The finished pieces are then automatically ejected. The hopper or magazine and the feeding mechanism may be modified to suit various kinds of work, such as square, hexagon or other irregular shapes, where an operation is to be done on both ends of the piece of work.

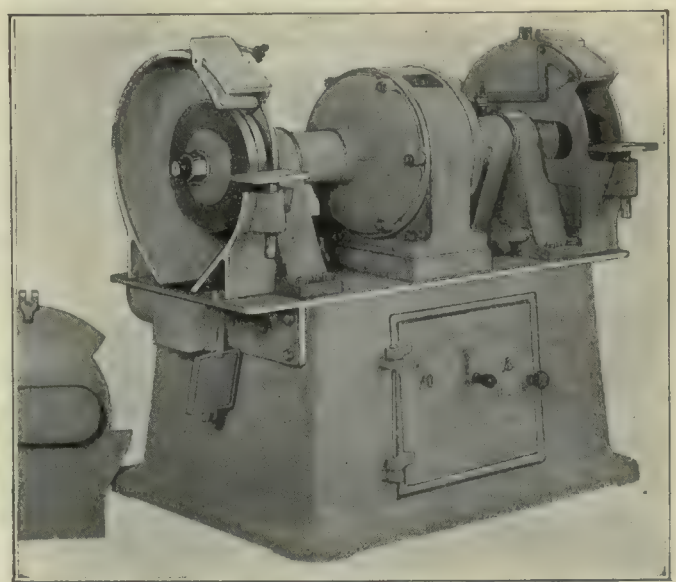
With slight modification the machine, which is shown equipped for double-end chamfering, can be readily adapted for threading both ends of small rods automatically. It can also be equipped with tools to drill and counterbore, or countersink, both ends at one time. An oil tank and gear-driven pump are provided, the cutting lubricant being fed to the tools through pipes. A countershaft is provided.

Marschke No. 18 Floor Grinding Machine

The Marschke Manufacturing Co., Indianapolis, Ind., has added to its line the No. 18 floor-type, motor-driven, dry grinding machine shown in the illustration. This machine will carry 18 x 3-in. grinding wheels on both ends. It is designed for heavy duty and the arbor is mounted on four Hess-Bright ball bearings. The motor starting mechanism is placed in the pedestal, and is controlled by the lever extending through the door at the front.

The wheel hoods are adjustable and can be set so that the wheel is always at the front of the hood. One side cover is removed in the illustration. The spark plate adjusts itself to the wheel as the steadyrest is adjusted. This is done by moving the hood by means of a single handwheel on the side toward the motor. The machine can be furnished with or without an exhaust fan, the illustration showing it equipped with the fan, which is mounted inside the pedestal and is driven by a chain. This drive is enclosed in a housing to keep it free from dust.

The motor starter is mounted on the back of the door of the pedestal and moves with the door, permitting access to the exhaust blower. The hood support acts as a part of the piping for the exhaust. It has an opening directly under the hood to serve as a clean-out. When grinding brass, a container can be placed beneath this opening to catch the particles of metal and thus permit only the dust to pass through the blower.

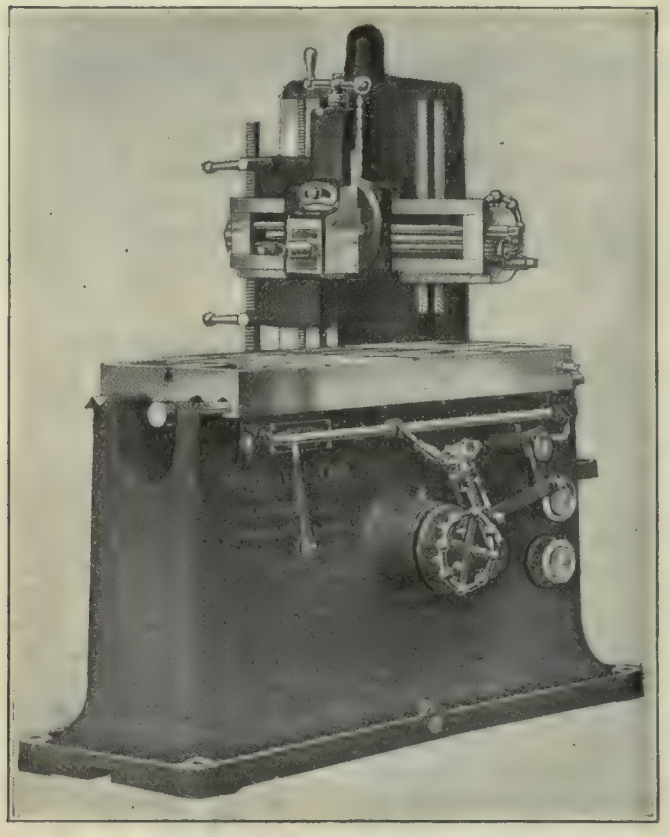


MARSCHKE NO. 18 FLOOR-TYPE DRY GRINDING MACHINE

Specifications: Motor: a.c., 2 or 3 phase, 60 cycle, 220 or 440 volt; d.c., 110 or 220 volt; size, continuous service, 5 hp., intermittent, 7½ hp. Speed: no load, 1,200 r.p.m.; full load, 1,160 r.p.m. Carries two wheels, 18 x 3 in. Arbor: length, 54 in.; diameter in wheel, 1⅞ in.; diameter in armature core, 2⅜ in. Floor to center of arbor, 34 in. Floor space, 32 x 64 in. Weight: with a.c. motor, 2,200 lb.; with d.c. motor, 2,300 lb.

Coulter Open-Side Crank Planer

The latest type of Coulter open-side planer, having a crank drive to the work table and built by the Automatic Machine Co., Bridgeport, Conn., is shown in the



COULTER OPEN-SIDE CRANK PLANER

illustration. The machine is similar to that described on page 819, Vol. 50, of the *American Machinist*, being particularly adapted to toolroom work.

A feature is the combination clutch and brake mechanism, operated from the front of the machine, and by means of which the table can be stopped and started instantly without change of the motion of the motor or countershaft. No countershaft is necessary on the belt-driven model, as it can be belted directly to the main line shaft. An indicator shows the length of stroke, and clamps are provided for locking the down feed while the crossfeed is working, or vice-versa.

The clutch-brake mechanism consists of a raybestos-lined brake and the main driving pulley, made up of two concentric wheels, the inside rim of one and the outside rim of the other being beveled to form a conical clutch. When by movement of the operating handle the clutch is thrown out, the brake is simultaneously applied, but released again when the clutch is thrown in. There is a split nut on the driving shaft, so that the amount of friction in the clutch can be adjusted. From the friction pulley, the power is transmitted through sliding gears of large diameter to a bull wheel and crank which drive the table, similar to the mechanism driving a shaper ram. The transmission shafts of the driving mechanism run on ball bearings. The mechanism is said to be both simple and substantial.

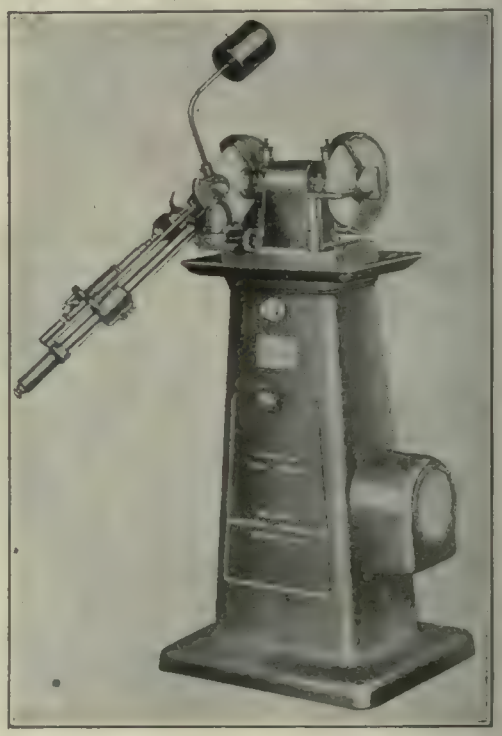
It is stated that the machine contains the advantages found in a shaper, such as the quick return stroke, variable speeds, and the ability to cut to a shoulder, with the accuracy and table capacity of a planer. Th maximum stroke can be taken anywhere on the tab by merely positioning the table under the tool witho disturbing the work, and the maximum stroke can b taken with the same degree of accuracy as a shorter on

Bellevue Semi-Automatic Drill-Grinding Machine

The semi-automatic drill-grinding machine shown i the illustration and designated as No. 20-B has bee placed on the market by the Bellevue Industrial Fu nace Co., Detroit, Mich. It is a self-contained unit wit its driving motor located in its pedestal and part inclosed by the projecting housing on the right of th pedestal. It is equipped with a two-step cone pull for the drive to the spindle. The machine can also b arranged so that it can be driven from a line shaft.

The machine grinds on the periphery of the whe instead of on the side. It can be equipped with a ca riage for grinding left-hand drills, as well as righ Drills with two, three and four or more lips can also b ground. An index is provided for use in setting th drill, for grinding each lip; and a gage for setting th drill in the carriage insures that no more stock is take from the drill than is necessary. The grinding whe can be trued by a diamond or other truing device th can be placed in the chuck, which is brought forwa against the gage, as when grinding a drill. The ca riage is then moved across the face of the wheel by crossfeed, so that the wheel is dressed by the truin tool.

The machine is made in two sizes. The smaller si



BELLEVUE NO. 20-B SEMI-AUTOMATIC DRILL-GRINDING MACHINE

handles drills from $\frac{1}{16}$ to $1\frac{1}{2}$ in. in diameter, the sma r sizes of drills being held in any standard form of chu . The larger machine grinds drills from $\frac{3}{4}$ to 3 in. diameter.

Glow Electric Bench and Floor Grinders

The Glow Electric Co., 219 Walnut St., Cincinnati, Ohio, has added to its products a line of totally inclosed electric grinders and polishing stands. The bench grinder, shown in half-section in Fig. 1, is intended to be used in assembly rooms and where space is limited. It is portable, readily installed and when desirable can be re-located in a short time in proximity to the work to be performed.

The grinder mounted on a pedestal, as shown in Fig. 2, is intended for general shop and toolroom use and a water pocket can be built in the pedestal. The polishing stand is intended to be used on general polishing work. It has comparatively short spindles and large clearances for the work. Due to the contour of the enclosing shell, it can easily be kept clean. The device equipped with scratch brushes, is adapted for brushing and scouring small articles, such as plating ware and musical instruments, being especially intended for the use of manufacturing jewelers.

The machine is built in capacities of ¾, 1, 3, and 5 hp., for either direct or alternating current, and either with or without pedestals. The head is totally

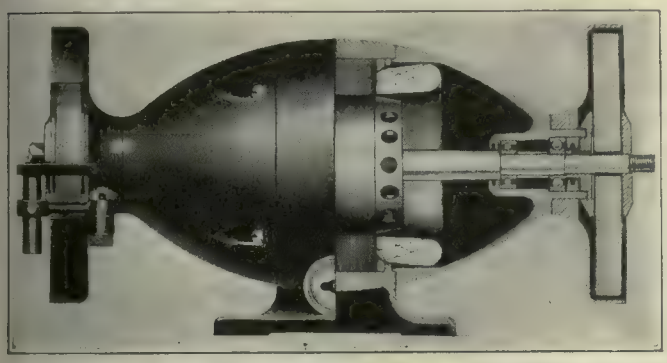


FIG. 1. GLOW ELECTRIC BENCH GRINDER

Specifications: For scratch-brush use, furnished in two sizes, Type BL 8 and BL 10. Hp., ¾ and 1, respectively. Maximum diameter of brush, 6 and 8 in. Weight, 65 and 140 lb. Speed, 3,600 and 1,800 r.p.m. Length of spindle extensions, 4 to 8 in.

Grinders furnished in four types; BG 8, BG 10, BG 14-3 and BG 14-5. Hp., ¾, 1, 3 and 5, respectively. Speed, 3,600, 1,800, 1,200 and 1,800 r.p.m. Wheel size, 8 x ¾, 10 x 1, 14 x 2 and 14 x 2 in. Overall dimensions, 8½ x 18, 11½ x 23, 16½ x 35 and 16½ x 35 in. Weight with pedestal, 170, 290, 560 and 560 lb. Weight without pedestal, 75, 155, 360 and 360 lb.

Polishing stands furnished in four types; PL 8, PL 10, PL 14-3 and PL 14-5. Horsepower, speed and wheel diameter, same as for Type BG. Overall dimensions, 8½ x 23, 11½ x 30, 16½ x 45 and 16½ x 45 in. Spindle extension at each end, 4, 5½, 8½ and 8½ in. Weight: with pedestal, 155, 265, 530 and 530 lb.; without pedestal, 65, 140, 330 and 330 lb.

Grinders and polishing stands furnished standard for 115, 230 and 550 volt d.c., and for 110, 220, 440 and 550 volt, 2 or 3 phase, a.c. Types 14-3 and 14-5 for floor mounting furnished with push-button control.

enclosed and is dustproof. It is said that the oil wells of the machine are filled with a special oil before leaving the factory, so that no further lubrication for a period of at least one year is required.

The motors are of normal rated capacities, and will take care of overload with only a small temperature rise. Two annular ball bearings having a spacing sleeve between them are used on each side. They are said to be of such size as to withstand 100 per cent more load than the capacity of the wheel. The inside flange is keyed to the shaft and has but small clearance, to prevent dust from getting into the bearings or oil from getting out. There is a dust collar between the inside flange and the outer ball bearing.

The grinders are equipped with heavy cast-iron guards and adjustable work rests. The 3- and 5-hp. machines are furnished with push-button controllers that are mounted inside of the pedestal as standard equipment. The bench machine in the smaller sizes is

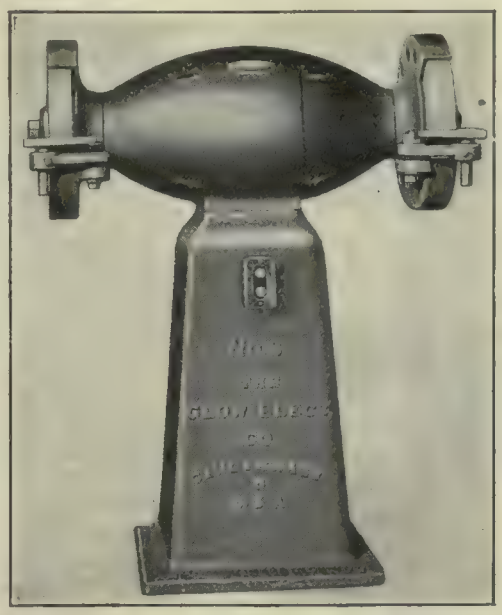


FIG. 2. GLOW ELECTRIC FLOOR GRINDER

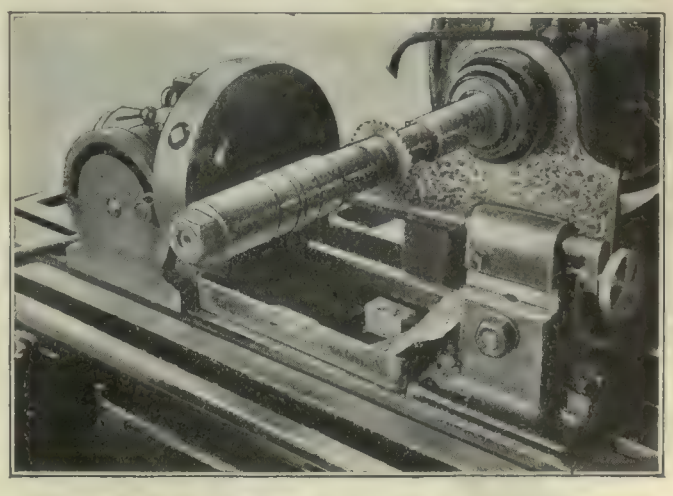
equipped with a snap switch, mounted in the frame of the motor, so as to make the switch convenient for use and to protect it.

The specifications given under Fig. 1 show the different styles in which the machines are made, essentially the same mechanisms being adapted to the different classes of work.

New Britain Adjustable Tail Center

The New Britain Tool & Manufacturing Co., Harvard St., New Britain, Conn., is making an adjustable tail center as a complement to the indexing head made by the same concern and described and illustrated on page 143, Vol. 51, of the *American Machinist*.

The height of the center can be adjusted within rea-

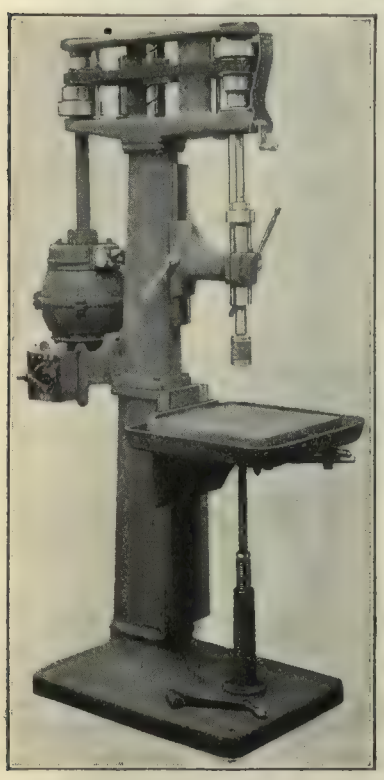


NEW BRITAIN ADJUSTABLE TAIL CENTER

sonable limits, to furnish an outboard support when fluting taper reamers or similar work. The bracket holding the center is secured in place on the base by only one bolt, so that the center can be swivelled to the desired angle and clamped. The device is here shown in position on the table of a milling machine.

"Pecorp" Floor-Type Sensitive Drilling Machine

The illustration shows the Model H floor-type sensitive drilling machine recently placed on the market by the Providence Engineering Corporation, office at 5 Nassau St., New York, N. Y., and plant at Providence, R. I. The machine was formerly known as the Mason-Widmer drilling machine, and is built in two styles, the Model K having a larger table than the Model H. The machine is fully equipped with ball bearings. The spindle is provided with a device for retaining the lubricating oil, a reservoir in the sleeve holding enough oil to lubricate the bearings for a week, it is stated. Because of the fact that the non-rotating sleeve extends below the bearings, oil which has passed through the bearings is thrown against the inside of the sleeve by the spindle and then drops straight downward from the bottom of the sleeve, instead of being thrown outward and upon the operator.



"PECORP" MODEL H FLOOR TYPE SENSITIVE DRILLING MACHINE

The feed handle can be fixed in any position, so as to make it convenient to the operator. The head contains the speed-change and cone pulleys. The belt can be shifted by means of a crank on the front of the head, one complete turn of the crank shifting the belt one step, the shifters then being automatically locked in place. The cone pulleys can be removed without taking out the vertical shaft, through which the head is driven. Two idlers tighten the belt, which is under tension only when the load is applied, thus saving wear on the belt.

The table can be moved by means of a telescopic screw geared to a shaft operated by a removable crank. It has a channel around the edge and is provided with a device for clamping it to the dove-tailed ways on the column. The machine can be driven by means of a belt, the drive shaft being placed horizontally, or by means of either horizontal or vertical motors, the illustration showing the latter type. The machine can be made with any number of spindles up to eight, and a pump and piping can be furnished to handle cutting lubricant. Automatic power feed and tapping attachments can be provided.

Specifications: Maximum distance, table to spindle, 32⅜ in. Spindle: diameter, 1 in.; traverse, 14 in.; taper hole, No. 2 Morse. Traverse of feed rack, 6 in. Speed of driving pulley: carbon drills, 380 r.p.m.; high-speed drills, 525 r.p.m. Spindle speeds: number 4; 400, 800, 1,200, 1,600, for carbon-steel drills; 550, 1,100, 1,650, 2,200, for high-speed drills. Height, 79 in. Net weight with single spindle, 925 lb. Table, for single-spindle machines: Model H, 16 x 16 in.; Model K, 20 x 24 in. Floor space, 22 x 42 in.; and 26 x 46 in., respectively. Multiple-head machines: distance between spindles, 9 in. for Model H, 18 in. for Model K; table size and weight increase correspondingly for machines having any number of spindles up to 8.

Rotary Table for Cleveland Milling Machine

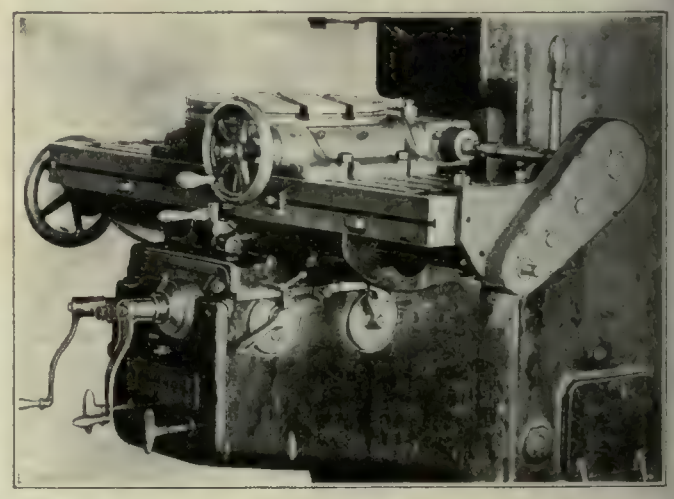
The rotary table shown in the illustration is built by the Clark-Mesker Co., 18511 Euclid Ave., Cleveland, Ohio, for its line of Cleveland milling machines. There are two sizes of the table, which are designated as Nos. 1 and 2, for the corresponding sizes of milling machines. The rotary table can be operated either by hand or by power feed. There are 16 changes of power feed, controlled from the front of the knee by the same mechanism that controls the feed changes for the sliding table. The direction of rotation may also be reversed by the feed-reverse lever, to be seen on the front of the knee.

A set of telescopic sleeves connects the feed drive gear for the milling machine table with the gear case on the end of the table. From this gear case, a shaft provided with two universal joints transmits the feed motion through a pair of bevel gears to the worm drive within the body of the rotary table. Hand feed is obtained by means of the handwheel placed at the front of the table.

The table driving worm is made with coarse pitch and runs in oil. Its end thrust in each direction is taken care of by ball thrust bearings, and means are provided for taking up the wear. The wormwheel is of large diameter, to enable heavy cuts to be taken near the circumference of the table without undue strain on the bearings and teeth of the worm.

The table rests in a taper bearing, which is said to be but little affected by wear. Its surface is slotted, with T-slots of the same size as those in the milling machine table. The table has an automatic trip for releasing the power feed at any desired point. The circumference of the table is graduated in degrees. A taper hole is provided in the center for accommodating a short taper arbor, for use when centering gears and similar work.

The rotating table is surrounded by a coolant-collecting trough that is formed by a rib cast on the base.



ROTARY TABLE APPLIED TO CLEVELAND MILLING MACHINE

Specifications: Made in two sizes for No. 1 and No. 2 milling machines. Respective details: Diameter of table, 14 and 16 in. Diameter over oil pan, 16¾ and 18¾ in. Height, 5¾ in. and 5¾ in. Size of taper hole in center of table, No. 11 B. & S. Weight: net, 315 and 375 lb.; shipping, 365 and 435 lb.

A crank and index plate can be furnished for this attachment, and it can then be used in a manner similar to ordinary dividing centers. When so equipped, it can be used for such work as cutting large gears.

Hill Test Indicator

The illustration shows a test indicator made by M. B. Hill, 10 Eden St., Worcester, Mass. The rectangular shank is carbonized and hardened, and is split so that the tool may be held in the toolpost of a lathe and clamped against turning by the toolpost screw. The stock can be turned easily within the shank, so as to bring the graduated scale into any position convenient for reading. The little bellcrank lever is also adjustable as to position, or may be removed and the implement presented to the work at a right angle. The surface-gage standard is not a part of the tool, but is shown to demonstrate one manner of holding.



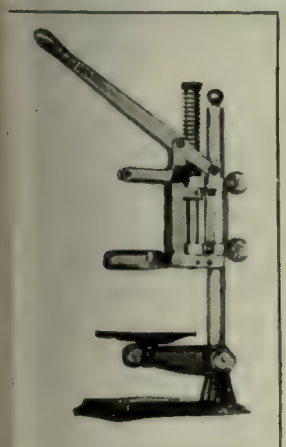
HILL TEST INDICATOR

The bell crank is held in position by a spring clamp, and may be put on and taken off without the aid of tools of any kind. Its use allows the indicator to be presented to the work from different angles. Each graduation on the scale represents a motion of 0.001 in. of the sensitive point.

Arnold Lever-Feed Bench Stand

The Arnold Electric Tool Co., 114 Liberty St., New York, N. Y., has added to its line a lever-feed bench stand, shown in the illustration. It is intended to be used in connection with the company's portable drills and by its use a portable drill can be converted into a lever-feed bench drill.

The column of the stand is made of cold-rolled steel, the base and table of cast iron, and the frame and handle of malleable iron. A coil spring prevents the lever from dropping when the drill is not in contact with the work, or after the point of the drill has cut through. The head holding the drill can be shifted on the column, being clamped by means of thumbscrews. The drill is held in place by means of two straps, it being necessary to remove the handle from the drill before placing it in the frame.



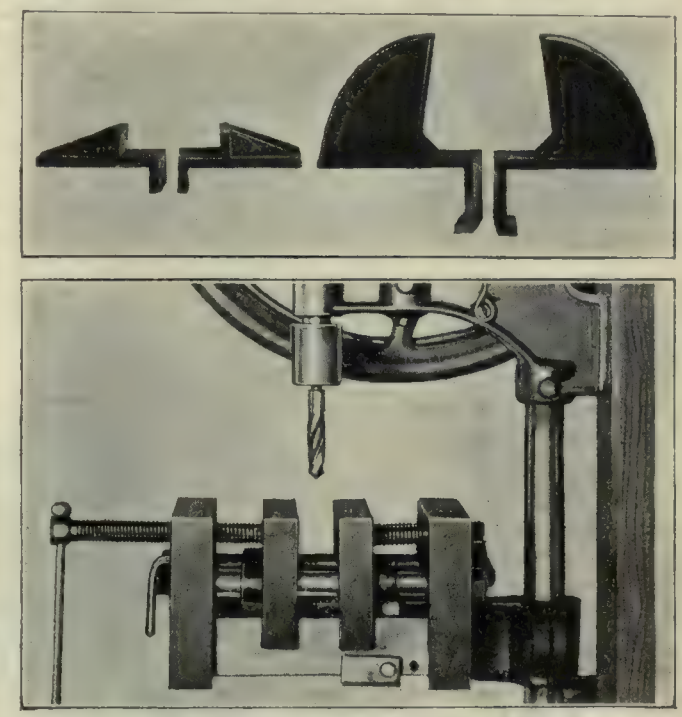
ARNOLD LEVER-FEED BENCH STAND

The table is 6½ in. in diameter, and can be pivoted in the table arm, which swings on the column. The distance from the center of the table to the column is 4⅝ in. The stand is furnished for two types of drills; one for the Type B ⅝-in. drill weighing 40 lb., and the other for the Type C ½-in. drill weighing 55 lb. It is 23 in. high and has a feed travel of 2½ in.

Joyce Drilling Machine Vise

The Joyce Drill Vise Co., P. O. Box 704, Amarillo, Texas, has recently placed on the market a drilling machine vise. The vise is made in two sizes, opening 5½ in. and 11 in., respectively. Both jaws of the vise are movable, which permits different sizes of work to be held without changing the position of the vise on the drilling machine. The rear jaw is moved by means of a thumbscrew. The front jaw is moved and the work is clamped by the screw which is actuated by the vise handle. The jaws are held in alignment by and slid upon two rods. By operating two small cam levers, one at each end of the vise, the half-nuts engaged in their respective screws, are released and the jaws may be pushed by hand to the work, then re-engaged into the screws and tightened.

False jaws, shown at the top of the illustration, are furnished with the 11-in. vise. The false jaws are not fastened to the vise jaws and may be easily lifted off and laid aside when not in use. The set shown at the left has a capacity up to 7 in. in width. The set at the right may be used for holding pipe, pulleys or round articles up to 9 in. in diameter.



JOYCE DRILLING MACHINE VISE

It is stated that the vise saves time, drills and labor, and that it is substantially and durably made. It can be attached to any make of drilling machine. The illustration shows one method of attaching the vise. For fastening it on the table of a drilling machine a set of special clamps is furnished.

Houston, Stanwood & Gamble Plate-Bending Press

The Houston, Stanwood & Gamble Co., Cincinnati, Ohio, has recently placed on the market a plate-bending press, shown in the illustration. It is especially intended for use in boiler or tank shops, or in any plant doing plate or structural-steel work.

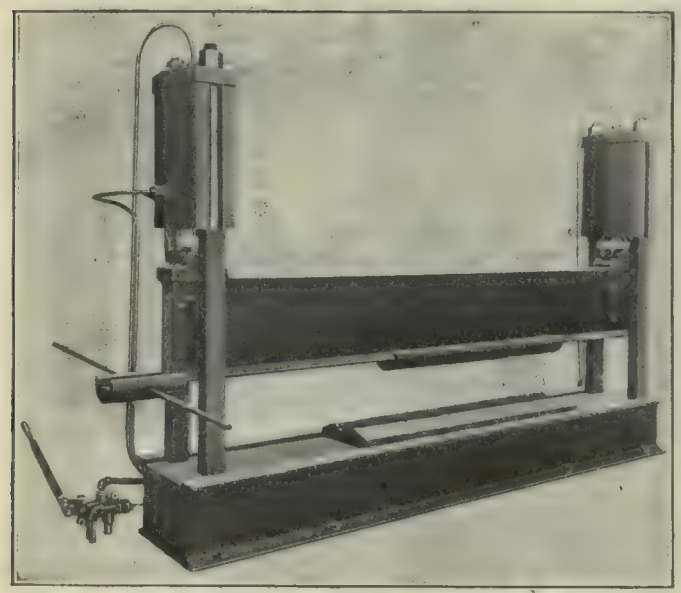
The machine consists of a simple arrangement of a crossbeam, connected to vertical rams at each end by

means of hinged bearings, which give flexibility and allow the beam to adjust itself to any unevenness of the work. The frame consists of four uprights holding large bolts, which pass through the cylinders at the top, and through the heavy reinforced base casting at the bottom. The upper sectional dies are placed on the beam of the machine from the end, as shown at the left, being lifted by means of a bar and then slid into position. The lower sectional dies are placed on the bed of the machine, and aligned with the upper dies by means of the side strips which extend above the base casting for that purpose, and which reinforce the bed.

Either short, long, or sectional dies can be used, flat dies being provided for straightening plates and curved ones for such work as bending boiler plate. It is stated that most bending work can be handled much more quickly than by means of a bending roll, and that a number of plates can be bent to duplicate a particular shape. Angle iron, too, can be bent by means of suitable dies.

The operating lever for controlling both the working and the return strokes is conveniently located at one end of the machine. The entire upper part of the machine is flexible to a necessary degree which takes care of any unequal strains and stresses during the working stroke. The machine does not require an auxiliary ram for returning the crossbeam to its upper position, so as to receive the work.

The machine is built in various sizes and capacities to suit different classes of work, and it can be furnished to operate either on compressed air or on hydraulic

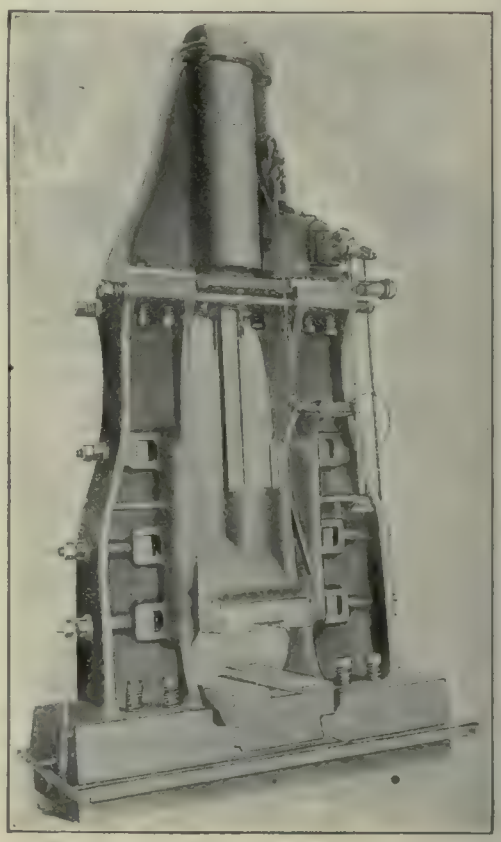


HOUSTON, STANWOOD & GAMBLE PLATE-BENDING PRESS

pressure obtained from city mains or provided by means of a pump, one of which types of pressure is usually available in plants doing work on large plates.

Massillon Steam Drop-Hammer

The Massillon Foundry and Machine Co., Massillon, Ohio, has lately redesigned its line of steam drop-hammers, the recent model being illustrated. The housings are annealed steel castings of I section, machined to fit in deep pockets in the hammer base, which is likewise a steel casting. The cylinder is a semi-steel casting that has been reinforced over the valve. It interlocks in the tops of the housings, so that no tie-plate is required. A safety cylinder is provided to protect the hammer in case the piston rod breaks, it being so made



MASSILLON STEAM DROP-HAMMER

that the piston ascends against a cushion of live steam. Any standard type of valve can be furnished. The valve bracket and the steam-inlet bracket can be removed independently of one another.

The ram guides have been arranged to adjust back into the side frames for the removal of the ram horizontally. The side frames just clear the ram, preventing over-adjustment of the guides, which would cramp the piston rod. A feature of the design is that the guide-adjusting screws are threaded through nuts set in open pockets in the side frame. This arrangement permits damaged screws to be removed by cutting out the nut with an acetylene torch without disturbing the ram or guides.

The ram guides are rectangular in section and of forged steel. Each is held in place by a central pull bolt that draws the guide back against three adjusting screws or push-bolts. These screws bear on hardened tool-steel plugs inserted in the back of the guide. One push-bolt is located above and two push bolts below the pull-bolt; and it is claimed that this arrangement prevents bending at the point of greatest shock, and so reduces the possibility of breaking the guides. The hammers are built in sizes ranging from 800 to 20,000 lb. capacity.

American Gasoline Locomotive

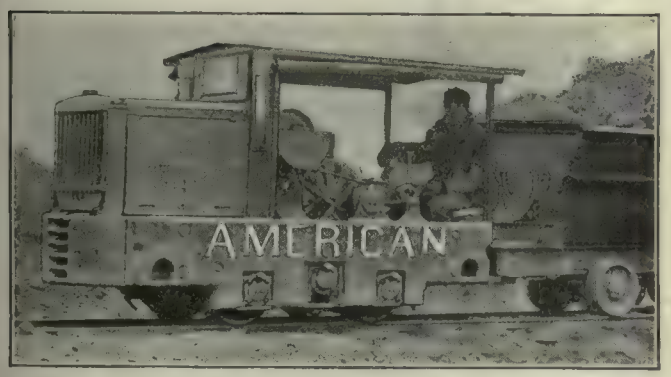
The Hadfield-Penfield Steel Co., Bucyrus, Ohio, has recently placed on the market the American gasoline locomotive. The machine is intended for light haulage purposes where steel rails are provided, being intended

for industrial and construction work, as in steel plants, brick yards, quarries and coal mines, the illustration showing it hauling a train of side-dumping cars. The machine is built in several gages and sizes from 4 to 7 tons, and can be furnished either in the standard or in the low-built design suitable for mine use.

The locomotive is driven by a heavy-duty Hercules, 4-cylinder, 4-cycle, gasoline engine. The engine used for the 4-ton machine has a piston displacement of 226.42 cu.in. and develops 23 hp. at 1,000 r.p.m. It has a 5-bearing crankshaft, and is provided with a force-feed oiling system. A pump is provided to circulate the water in the cooling system and a tubular radiator is used.

The drive from the motor is through friction disks, by means of which the speed can be varied and the direction of travel reversed. The disk shafts are supported on New Departure double-row ball bearings and Hyatt roller bearings, ball thrust bearings being used. The speed can be varied by means of the lever placed directly in front of the operator. The jack shaft is driven by means of a roller chain, and it in turn drives all four wheels. The wheels are 18 in. in diameter, being cast iron with chilled treads, while the axles are 3 in. in diameter. The brakes are applied, of course, upon all four wheels, a pull of 50 lb. upon the lever being sufficient to lock the wheels.

The frame of the machine is built up of four cast-iron sections bolted together. The various units are so placed upon the frame as to make a compact arrangement. The operator's position is covered by means of a cab, which is provided with a small window in the front and can be completely enclosed if desired. The gasoline tank is located at the front of the cab, but is filled from the outside of it. Sand boxes are placed at the end of the gasoline tank, so that the sand can be easily distributed to all four wheels.



AMERICAN GASOLINE LOCOMOTIVE

Specifications of 4-ton locomotive: Length, 122 in. Height: over cab, 72 in.; without cab, 56½ in. Wheel base, 39 in. Gage, 24 to 56½ in. Width, 50 to 63 in. Speed, to 12 m. per hour. Motor: Hp., 23; speed, 1,000 r.p.m.; drawbar pull, 1,600 lb. Weight, 4 tons.

Northwest Crawler-Type Industrial Crane

The Northwest Engineering Works, 28 E. Jackson Blvd., Chicago, Ill., has put on the market the crawler type industrial crane shown in the illustration. The crane is rated at 10-ton capacity with the load at a boom radius of 12 ft. It is self-contained, being driven by a four-cylinder, 60-hp. engine. This engine also drives a generating set for the operation of an electric lift magnet, when the latter is required. One advantage claimed for this type of crane is that it can travel anywhere in a storage yard and is not limited in its field to the points that can be reached from tracks.

The steering is accomplished by a single control lever,



NORTHWEST CRAWLER-TYPE CRANE EQUIPPED WITH ELECTRIC LIFT MAGNET

by means of which the relative speeds of the two crawlers are varied. It is stated that the machine has sufficient tractive strength to effectively handle a string of several railroad cars. The crawlers are made of manganese steel castings. All bearings are either self-aligning ball bearings or bronze bushings.

The crane can also be used to operate a one-cubic-yard, clamshell bucket, a pile-driver hammer or a wood grapple. Its capacity at its maximum radius of 30 ft. is 5,200 lb.

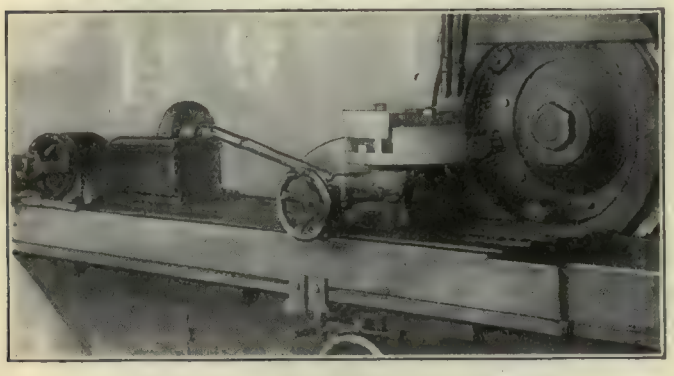
Diamond Rotary Grinding Fixture

The Diamond Machine Co., 9 Codding St., Providence, R. I., has developed a fixture for use on its heavy-duty face-grinding machine. The device is intended for holding circular work while the periphery is being finished, and it can also be used for such work as grinding crowned pulleys. The fixture consists of two units, a plate mounted on a vertical spindle for holding the work, and an electric motor with reduction gearing for revolving it. The spindle is of suitable diameter to fit the hole in the hub of the pulley. A pin inserted between the spokes serves as a driving dog, but with a small change the fixture can be adapted to handling webbed pulleys.

Pulley castings and similar pieces are usually very thin, often chilled, and frequently hard to machine by means of cutting tools, being particularly adapted to grinding. The accompanying illustration shows the fixture used for the grinding of the periphery of a malleable-iron brake shoe, although such things as

rollers for conveyors, wheels for small trucks and pulleys can be finished.

The crowning of pulleys is accomplished at one setting of the work, it being unnecessary to tilt the work to obtain the necessary slant on the face. Referring



DIAMOND ROTARY GRINDING FIXTURE

to the illustration, if the work be positioned directly in front of the face of the wheel, the surface ground will be parallel with the axis of the cylinder being finished. If it be moved away from the center of the wheel so that it makes contact with the outside edge of it, then the surface ground will be hollow or concave, making a shallow-grooved pulley. By moving the work toward the center of the wheel, so that it makes contact with the inside edge of it, a crown is formed on the periphery, the amount of the curvature depending upon the relative positions of the work and the wheel, it being a maximum and having the same curvature as the inside edge of the wheel when the work is actually inside the wheel.

It is necessary that the edges of the work be finished sufficiently to permit of their correct fitting on the fixture. The production is stated to be high, pulleys 12 in. in diameter and having faces 4 in. wide being ground in two or three minutes; and 24 x 8-in. pulleys in about 7 minutes. Widths of face as high as 10 in. can be handled.

Liberty Universal Magnet

The Liberty Engineering Co., Danbury, Conn., has placed on the market a magnet, shown in the illustration, for both magnetizing and demagnetizing. It is stated that the magnet will work equally well on large or small pieces, either a large block of steel or a watch being totally demagnetized by its use. The magnet



LIBERTY UNIVERSAL MAGNET

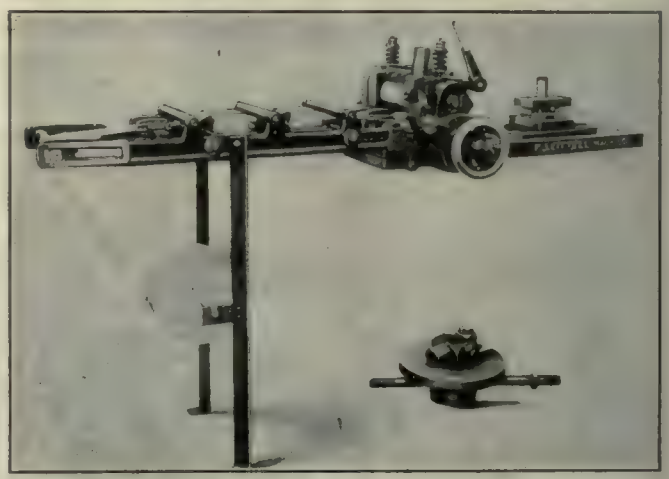
operates on either a 110- or 220- volt alternating current for demagnetizing; and by the use of a quick-acting safety switch, iron and steel may be magnetized to a strong degree by the same current. Should it be desired to make the work a powerful magnet, a direct-current circuit of 110 volts is employed.

It is stated that the apparatus is absolutely fool proof. To operate, the plug is inserted into a light socket, and by pressing the button and passing the piece to be demagnetized over the face of the magnet, the magnetism may be removed from the work. The circuit is automatically broken when the hand releases the button. To magnetize the work, the button is pressed for a period of three seconds, using direct current.

It is stated that the apparatus can be readily adapted to commercial de-magnetizing by placing an inclined brass trough over it, so that the work will slide down over the top plate. As a magnetizer, it may be used in connection with deep-hole drilling, assembling work of various kinds, and to hold screws or articles while inspecting. The magnet is 6 in. in diameter by 1¾ in. high. It weighs 3 lb. The switch and plugs, as well as 5 ft. of cord, are furnished.

Littell Automatic Paper-Feeding Attachment for Punch Presses

The illustration shows an attachment for automatically feeding paper to a punch press, the device being built by the F. J. Littell Machine Co., 4125 Ravenswood



LITTELL ATTACHMENT FOR AUTOMATICALLY FEEDING PAPER TO A PUNCH PRESS

Ave., Chicago, Ill. The feeding rolls are similar to those that were described on page 209 of the *American Machinist*, and the crank for mounting on the end of the press crankshaft, shown lying on the floor, is also similar in construction to the one there described.

The roll of paper stock is mounted on a mandrel supported by brackets on the legs. The strip of paper passes over an adjustable tensioning roller at the extreme left of the attachment and is led through a pair of adjustable angle-iron guides. It then passes under the series of three rollers that are mounted on the top of the extension. These rollers are loose in their trunnions and serve to cause the paper to rest with the necessary pressure on the two blocks of paraffin wax located between the rollers. The arrangement gives to the paper strip a thin coating of paraffin as it passes to the dies, and the paraffin there acts as a lubricant that permits the punching to be drawn into cup-like form without cracking the paper. The automatic feeding rolls can be adjusted for feeding the proper lengths of stock for each stroke of the die.



NEWS SECTION

Senator Edge Speaks on the Future of Our Foreign Trade

The following is an abstract of a statement issued by U. S. Senator Walter E. Edge of New Jersey on the formation of the Foreign Trade Financing Corporation:

"As an ardent advocate of the stimulation of world-wide trade for the United States, and incidentally as the author of the amendment to the Federal Reserve act providing for the formation of corporations to extend long-term credits to foreign purchasers of American goods, I am highly gratified and interested to watch the steps being taken in the formation of the Foreign Trade Financing Corporation.

"The establishment of this corporation is of wide significance to the United States. It offers opportunities for reviving and strengthening American commerce and giving to Europe, China, Australia, Brazil and other foreign countries the raw materials and manufactured articles they need, not by any act of charity or through American Government channels, but as a straight business proposition.

"One of my chief interests is to get the government *out* of business and this corporation will help largely to get the government out of business. Our foreign trade must be financed. There is no question as to whether there shall be foreign trade. There must be, both for the welfare of this country with its raw materials and manufactures now collecting here far in excess of our ability to use them, and for the welfare of the rest of the world which needs our surplus. Our merchant marine must be used to carry our goods to all the ports of the world and bring back goods in return.

"No matter how much money or credit the United States may lend to Europe either through private or government channels, we are not going to encourage or stimulate foreign purchasing if we impose an embargo against imports from other lands. If the American producer needs help, don't let us hand him a pair of broken crutches. And it must be remembered that our imports will help pay for the goods we send abroad, will help to restore foreign exchange to a reasonable basis, and indirectly will help Europe to curtail its indebtedness.

"It has been said when this general subject has been under discussion on the floor of the Senate that the producers were not taking advantage of the export finance act because only two or three corporations had been organized under it. The answer is that up to a very few months ago producers and business men in general did not feel the actual pressing necessity of looking out for trade. We still were living in that fools' paradise of large profits made during and immediately following the war, and there was little inspiration or apparent necessity to provide investment capital for such a purpose; the full pains of readjustment and deflation had not yet been felt. But in the past few months, since conditions have materially changed, orders for goods have fallen off.

"However, as I have frankly stated, this export financing activity will not alone solve the problem. A wise, carefully considered policy on the tariff as it relates to exports and markets may well go side by side with this credit-supporting instrument. The policy though must be most carefully considered, and from every possible angle. Hurried legislation will harm more than help, and just to pass a haphazard "tariff bill," especially in such an emergency and crisis, may give a black eye to the American tariff policy.

"For one thing, we must carefully consider just what retaliatory measures a high protective tariff at this time may invite from most countries which already are buying our goods or are disposed to buy them. We must consider whether the additional income we might receive from an emergency tariff will compensate the American government, American business, and the American people at large for an inevitable falling off of imports. We must consider whether, through this method, we can artificially raise the prices to the producer and still find him a market abroad or even at home, even if we do manage to keep his competitors out of this country. We can not consume all we produce and the surplus must be sold outside our own country, and it is manifest that we cannot sell it at prices established by ourselves if these prices are higher than general world prices."

Australian Trade Outlook Improving

Australia has been forced to curtail its imports for the time being because of the unfavorable position of its exchange on the London market. The charge for remitting Australian funds to London has at times reached 4 per cent owing to the fact that credits held in London for Australian accounts have been depleted by heavy shipments of merchandise to the commonwealth, while exports from Australia have been below normal and payments for these exports have been deferred.

The Australian government figures for the first two months of the present fiscal year, which began July 1, 1920, show that imports exceeded exports by almost £7,000,000, while the exact reverse of this situation was the case during the same period of the previous fiscal year. Figures for New South Wales for the month of September indicate a still greater excess of imports over exports for that month and customs returns for later months show the same trend. During the last six months of 1920 Australia's exports were unusually small, due to the stagnation in the wool and other raw material markets. This situation is now improving rapidly, however, and in addition the commonwealth is now in a position to ship wheat.

A factor in the situation that should not be overlooked is that in the majority of cases shipments now being made are on a 90-day basis and therefore the effect of this merchandise movement has not been apparent on the exchange market. When wheat and wool were under government control payment was made upon shipment.

The commonwealth has just harvested a bumper wheat crop, the demand for its wool and other raw materials is improving steadily. Australia is planning to increase its exports and to cement its commercial relations with the United States in various ways. It needs farm equipment, industrial machinery and manufactures of all kinds and these will be purchased in this country to the same extent that Australian products find a market here.—From the *World's Markets*, published by R. G. Dun & Co.

Business Conditions as the Big Banks of the Country See Them

National City Bank of Chicago Comments on Price Readjustment and Railroad Conditions

Further recessions in prices is enabling the country to do more business with much less money than was required one year ago and systematic liquidation by retailers everywhere is relieving the credit strain. When this movement runs its course, there must be an important revival in business, because there is no unwieldly supply of merchandise overhanging the market at this time. A recent investigation shows that prominent bankers, business men and financial experts are looking for a turn in the business situation during April or May. Under such conditions as exist today no one can call the turn exactly, but the outstanding fact is that the people are doing now the one thing needed to put the country upon its feet and impart new life to general trade. Continuance of war prices for merchandise in peace times was just as impracticable as was the maintenance of $3 wheat or 40c. cotton. The test came and the law of supply and demand was vindicated as usual and now the buyer is in the saddle again which is his normal place.

Readjustments of Prices

General business is being made infinitely safer by the readjustment which is restoring the country's industrial corporations and business firms to their normal position. Sixteen copper companies have passed their dividends and two more have reduced them. Four hundred million pounds of copper have been provided for through a pooling arrangement which will rank among the most ingenious devices of reconstruction finance. It is difficult to see how such a transaction would avail in the case of cotton, wheat, or other commodities, for the production of copper is concentrated largely in the hands of important producers who are well fortified to carry out the engagements which this unique arrangement entails. As compared with one year ago the situation is very much stronger, for then producers and many consumers were living in a fool's Paradise and making themselves believe that a $5 bill was the lowest unit of value worth thinking about. Business improvement is slow as the deflation process usually is, but each day brings some progress, and a recent tabulation shows about sixty-nine recessions in wholesale commodity quotations against twenty-five advances. The present average of steel prices is the lowest since the summer of 1916, for eight of the principal iron and steel products now average $61.72 a ton as against a high quotation last year of $85.03 a ton. Encouraging as this showing is, a comparison shows that the current quotation is still more than 70 per cent above the average level prevailing in August, 1913. There is good basis for the theory that the corner has been turned in some branches and that as compared with conditions existing three or four months ago, the improvement is fairly satisfactory.

Condition of the Railroads

The move made by the railroads to abrogate national wage agreements in the effort to lower operating expenses has directed attention to the status of the wage question in all industries. In a season of vanishing profits, it is clear that labor must contribute its share toward reducing the high cost of living which the people of the entire world will no longer tolerate. Railroad managers have given interesting testimony before the Railroad Labor Board touching the injustice of some of the labor rules which they are working under and representatives of the employees have made strong representations on the other side. This agitation has brought up some interesting problems, and there is no doubt but that the controversy will be threshed out and justice done in the final analysis. It is too early to judge the ultimate effect of this controversy, but it will be helpful in emphasizing the increased labor costs in all industries. The one thing sure is that the railroads cannot further advance passenger and freight rates, for in the judgment of many experts the industry has now as high rates as can prevail without reducing the volume of traffic.

National City Bank of New York Reports Little Change in Business Situation

The general business situation has changed but little during the past month. In the Middle-West the movement of grain to market has continued at a moderate rate, and prices have been stronger. Receipts of live stock at the principal markets have been comparatively light, which has helped to sustain prices and they have recovered slightly. Cotton has been weak and at the close of the month was lower than at any time since 1915, when it was recovering from the great slump that followed the big crop of 1914 and the outbreak of the war. The March delivery in New York has touched 12.25, with the spot price in several Southern markets below 12 cents. This compares with 40 cents a pound one year ago. Naturally the cotton-growing section is not cheerful. Foreign markets are very much depressed, with Liverpool below New York.

Plenty of Retail Trade

The industrial situation is mixed, the news from day to day telling of works that are closing and works that are starting up, the one class of reports apparently about balancing the other. The amount of unemployment unquestionably is very large, but the amount of distress reported is comparatively small, indicating that the wage-earners had laid by something in the day of good earnings. The volume of retail trade in the industrial cities supports this view, but trade in the rural districts is light, bank clearings are down 25 to 30 per cent from a year ago, which, however, is not very bad considering the lower prices. Railroad tonnage is off about 20 per cent from the high point in October. The number of idle cars approaches 400,000. The movement of coal, grain, oil, lumber and all the chief commodities is light. The export business in coal to Europe is dead for the time being and the domestic coal trade is flat, with a good many mines on part time and keen competition among sellers.

Prices Slowly Receding

All commodities are being brought into the movement toward a lower level of prices although as a rule those that have been under pressure longest are fairly well stabilized. Crude oil has declined rapidly since the first of the year and is down about 50 per cent. All of the metals are at the lowest point yet touched. Sugar has recovered about a cent a pound under the influence of an arrangement in Cuba to market the crop through a selling committee representing planters, bankers and the Cuban government. The automobile industry is showing greater activity. Wage reductions are occurring generally and are accepted usually in good spirit.

Reports by cable to this bank from its foreign branches and agencies indicate practically no change in conditions during the past month. In Europe there is much anxiety over the question of reparations.

Guaranty Trust Co. of New York Notes Improvement in Financial and Business Conditions in the United States

The improvement in trade and industry continues, with some evidences of the interaction of recuperative forces. Middle-West wholesale and retail business is gaining conservatively, better prices for wheat, corn and oats being responsible for larger sales of textiles and related commodities at the trade centers. While the buying is of the small-lot variety and indicative of the feeling that prices have not yet reached bottom levels it is sufficient to encourage Eastern manufacturers. In New England shoe, cotton textile, woolen and worsted mills are gradually responding to the renewed demand for their products. Reopenings and extension of working days are accompanied by wage reductions and elimination of bonus payments, these in turn being offset by readjustments in the workers' favor. Decreases in unemployment at the industrial centers are exerting a stabilizing influence.

Employment Increasing

The Bureau of Labor Statistics of the Department of Commerce reports an improvement in the employment situation during January over December. Twelve out of thirteen industries surveyed showed a decrease in the number of unemployed, the decrease being most notable in the boot and shoe industry. There were increases in unemployment in the men's clothing trade and automobile manufacturing. Decreases in wages occurred in the bituminous coal, iron and steel, and carbuilding and repairing industries.

The Chamber of Commerce of the United States declares that the sentiment for a spring revival is growing, but warns that no sudden leap forward should be expected. Farmers are less recalcitrant and while grain and live stock shipments are only fair, the fruit and vegetable movements are heavy. Building continues at a standstill, but there is more work in the industrial sections.

While the improvement from week to week is slow, a comparison with the situation four months ago yields encouragement. Over that period the replenishment of stocks has proceeded steadily and in sufficient volume to prevent widespread distress. No disposition to anticipate future needs is observable, but that would quickly manifest itself, in the opinion of producers, should the way be opened for an influx of foreign orders.

Prices

During the last fortnight price fluctuations have covered a narrow range, the tendency being on the whole downward but with constantly diminishing speed. Wheat, corn and oats have shown a disposition to go up, and beef, pork, copper, tin and steel are without notable change, but other commodities show measurable declines from the high points of the present year as well as from those of the corresponding period of 1920. As for the margin between wholesale and retail prices, a statement by the Department of Labor shows that while wholesale prices of 327 selected commodities fell off 6¼ per cent in January, as compared with December, the retail prices of 43 household commodities in 51 cities showed a decline of 3 per cent. On this same basis a decline of 28½ per cent in wholesale prices has occurred within the year, while the retail price decline for the same period was 14 per cent. Both wholesale and retail prices in January last were about 75 per cent higher than in January, 1913.

Steel Prices Reduced

In an effort to stimulate buying a number of independent steel companies have within the last two weeks quoted prices which, as announced, were at the level of those adhered to by the United States Steel Corporation. It is declared that in a number of instances quotations even lower than the standard prices have been made. The effect has been twofold. Some increases in small orders resulted immediately upon the announcement of reduced prices. The second effect, however, was to deter buyers. The latter seem to have withheld orders on the expectation of a downward movement of U. S. Steel Corporation prices to meet the conditions of such an open market as the independents have precipitated. No announcement of such an intention has come from the U. S. Steel Corporation, however, and apparently for the reason that the stimulating effect upon buyers of price reductions under present conditions is doubted. The lowered price quotations have been followed by wage reductions in a number of instances.

The monthly report of the United States Steel Corporation for January showed unfilled orders amounting to 7,573,164 tons, a decline of 574,958 tons from the December figure. The January total of unfinished business is the lowest since November, 1919.

Foreign Exchange

Pending the expected settlement of the question of German reparations, a dominating factor, the foreign exchange market has been irregular during the last fortnight, with a tendency to dullness. Sterling early last week sold at $3.92¼ to the pound, the highest price obtained since last July, but closed the week below the high of the preceding week. With the exception of Copenhagen and Christiania crowns and Austrian kronen, the last of which showed no change, all European exchanges ranged higher last week than the week before, a situation which in some quarters was interpreted as indicative of a more hopeful feeling regarding Europe's progress toward normal conditions. During the last two weeks Sterling has ranged from 3.83¼ to 3.92¼, as compared with a range of from 3.35¼ to 3.47¼ during the corresponding period a year ago. This market is being observed closely at the present time because of Great Britain's announced intention to pay the interest on her American debt during the current year and the consequent probability that Sterling bills in large quantities will be offered here for the purpose of accumulating dollars.

International C. of C. To Meet in London in June

"The Restoration of the World's Commerce" will be the general subject taken up at the first annual meeting of the International Chamber of Commerce, in London, during the week beginning June 27.

Arrangements are being made for a program of general sessions and group meetings to discuss international economic problems in the fields of finance, ocean and land transportation, communication, production and distribution, and restoration of the devastated areas. All of these topics will be approached with a view to relating them to the central theme.

The International Chamber was organized at Paris last year by representatives from Belgium, France, Great Britain, Italy and the United States. The American Section has been organized for some time with offices at the headquarters of the Chamber of Commerce of the United States in Washington.

The American representatives have proposed a number of amendments to the constitution designed to facilitate operation of the International Chamber, and to expand the organization. These will be considered at the meeting in London.

A part of the London program is the presentation of authoritative statements regarding economic conditions and their international aspects with respect to all countries.

At the annual meeting of the Chamber of Commerce of the United States to be held in Atlantic City, April 27 to 29, a group session will be held at which there will be completed plans for American participation in the London conference, and at which the subjects proposed for the London meeting will be gone over.

American C. of C. in Berlin Opens Office in New York

In order to be prepared for the time when American foreign trade will again approach its pre-war volume and to pave the way for a concentration of efforts in this direction, the American Chamber of Commerce in Berlin established some months ago in New York a branch office and bureau of information which has been of practical aid to exporters and importers in an effort to revive trade with Germany.

This office is situated at 1939 Park Row Building and S. George Fremont is secretary and manager. All communications should be addressed to him.

Decrease in Exports of Metal-Working Machinery

Metal-working machinery to the extent of $44,312,233 was exported during the calendar year of 1920, according to the figures of the Bureau of Foreign and Domestic Commerce. The bureau divides that total as follows: Lathes, $7,575,123; other machine tools, $13,961,243; sharpening and grinding machines, $3,945,490. The total is considerably less than the exports during 1919 when metal-working machinery to the value of $58,507,942 was exported. In 1918 the exports aggregated $51,620,297.

The principal decreases came in the business with the United Kingdom, France, and Japan. Sales to the United Kingdom during 1920 totaled $11,135,567. This is a decrease from $15,221,946 in 1919 and from $19,296,903 in 1918. The exports to France were $7,595,733 in 1920, which compares with $15,785,280 in 1919. In 1920 the sales to Japan totaled 4,250,583 This compares with $5,383,184 in 1919.

There were a few instances in 1920 where exports increased. Exports to Canada in 1920 aggregated $5,815,314. This compares with $4,034,646 in 1919. Exports to Cuba showed a decided gain in 1920. Metal-working machinery sent to that island in 1920 was valued at $1,218,869. In 1919 total sales were $737,238, while in 1918 the exports to Cuba were valued at $309,618. Exports to British India in 1920 were $1,374,068. In 1919 the value of the exports was $900,429. The 1920 exports to countries not mentioned above were valued as follows: Belgium, $1,920,172; Italy, $1,614,818; Norway, $158,200; Spain, $1,144,844; Sweden, $446,787; Mexico, $610,572; Brazil, $455,184; Chile, $443,257; China, $932,351; Australia, $885,490; other countries, $4,310,424.



J. N. Ding in the New York Tribune

Harding Urged to Choose Ministers from Our Diplomatic Service

In an effort to make of the foreign service of our government a career which will attract the services of able and ambitious men the National Foreign Trade Council has written to President-elect Harding urging that a generous portion of the appointments to the rank of ambassador and minister be reserved for well-qualified officials already in the diplomatic and consular services.

The letter, which is signed by James A. Farrell, chairman of the council and president of the U. S. Steel Corporation, states:

"The importance to American foreign trade of able and experienced diplomatic representation is too apparent to require exposition.

"The practice of appointing ambassadors and ministers from the country at large has given this government some of its ablest diplomats.

"As the secretarial grades of the diplomatic service and the entire consular service have for ten years been conducted on the merit system and a large number of well-qualified officials therein desire to make the foreign service their life work the country possesses a resource of experience and ability which should be fully utilized.

"As a means of practically combining the method of general appointment with the principle of a permanent diplomatic service we venture to suggest that in the forthcoming appointments a generous proportion of the embassies and legations be reserved for appointments from the diplomatic and consular services, or those with previous creditable service therein."

This subject of securing the development of a foreign service adequate to the increasing demands and responsibilities of our expanded foreign trade will be considered in detail at the Eighth National Foreign Trade Convention, to be held in Cleveland, Ohio, May 4, 5, 6, 7, 1921.

N. M. T. A. Announces 1921 Convention Features

Announcement has just been made the tentative program for the annu convention of the National Met Trades Association, which will be he at the Hotel Astor, New York, on Ap 18, 19, 20 and 21.

On Monday the 18th there will a meeting of the Executive Committe meeting of local secretaries; and dinner of the secretaries.

On Tuesday the 19th a meeting the Administrative Council will sta the day's proceedings. A joint luncheo of the presidents, secretaries and t council, and an alumni banquet in t evening will constitute the rest of t day's work.

Wednesday and Thursday (the 20 and 21st) will be convention days, wi a theater party for the ladies Wednesday afternoon and the conve tion banquet on the same evening.

Business Items

The Nash Engineering Co., with a plant on Wilson Road, South Norwalk, Conn., has recently been incorporated under the laws of Connecticut, with a capital stock of $500,000, to carry on the machine business of the present company. The incorporators are: E. Kraychie, 326 Crescent St., Astoria, Long Island, N. Y.; H. G. Liese, 1259 Lincoln Place, Brooklyn, N. Y., and Arthur Rothstein, 120 Broadway, New York.

The Viking Specialty Co., of Worcester, Mass., has recently been organized and incorporated under the laws of Massachusetts for the manufacture of hardware, tools, etc. The officials of the company are: President, W. R. Smith, of Auburn, Mass.; treasurer, William E. Gifford, Worcester, and clerk, Frederick A. Nelson, Worcester. The concern is now looking for a suitable building prior to commencing operations.

The combined companies of the Reed-Prentice Co. and the Whitcomb-Blaisdell Machine Tool Co., both of Worcester, Mass., and the Becker Milling Machine Co., of Hyde Park, Boston, have decided to close their sales offices and display room opened last year at 26 North Clinton St., Chicago. Their lines will again be marketed by general dealers in the Chicago territory.

The Stewart Manufacturing Corporation, 4500 Fullerton Ave., Chicago, Ill., manufacturer of die-molded castings and bronze-back bearings, announces the establishment of a permanent Cleveland office at 419 Bangor Building, 942 Prospect Ave. E. P. Grismer, who has been long identified with this industry, will be in charge of the Cleveland territory.

At the annual meeting of the New Britain Tool Manufacturing Co., New Britain, Conn., held recently the following officers were elected: President and treasurer, C. Adrian Carlson; vice-president, Rudolph Sandberg; assistant treasurer, Carl Hammar; secretary, Harold Johnson; assistant secretary, Julie S. Joplowitz.

The Gill Piston Ring Co., of Hartford, Conn., has recently been organized and incorporated under the laws of Connecticut to engage in the manufacture of piston rings, machinery, etc. The incorporators are: L. F. Robinson, 45 Forest St.; Francis W. Cole, 28 Atwood St., and Attorney F. E. Jones, 11 Central Row, all of Hartford, Conn.

Landers, Frary & Clark, of New Britain, Conn., has recently purchased a block of capital stock of the Stanley Insulating Co., of Great Barrington, Mass.

Allen & Co., Inc., of New Haven, Conn., has recently been organized and incorporated to deal in hardware, tools, factory supplies, etc. The capital stock of the new concern is $35,000, and the incorporators are: Ralph Allen, of Shelton, Conn.; William Hargraves, of Derby, Conn., and J. A. Kader, of New Haven.

The Gardner Machine Co., Beloit, Wis., announces that it has discontinued its Chicago branch office and has appointed the Federal Machinery Sales Co., 12 N. Jefferson St., Chicago, to act as its agent for disk grinding and polishing machines.

The Wickwire-Spencer Steel Corporation of Worcester, Mass., has changed the name of its factory paper from the "Triangle Clan" to the "Triangle News." The "News" covers the factories located in Worcester, Mass.; Palmer, Mass., and in Spencer, Mass.

The Acme Wire Co., of New Haven, Conn., has recently issued $500,000 additional preferred stock and $9,700 additional common stock to the present capital of the company. The company has a large plant on Dixwell Ave., New Haven, Conn.

The Smith Engineering Co. announces its organization and the opening of its engineering and designing office at 1 Union Square, New York, for the conducting of a reliable mechanical engineering and contracting service.

The Worcester Stamped Metal Co., 9 Hunt St., Worcester, Mass., has opened a branch office in the Bailey Building, Room 308, Chestnut St., Philadelphia, Pa. The office is in charge of H. L. Hess, agent.

The Worcester Gear Works, Inc., of Worcester, Mass., whose factory was destroyed by fire in January, has opened its new factory in the Osgood Bradley Building in Worcester, where they have a modern equipped plant.

Machinists employed by the United States Cast Iron Pipe and Foundry Company at Chattanooga, Tenn., were replaced within forty-eight hours, officials of the company stated, when a number of them went on strike.

A new plant for the manufacture of welded steel tubing has been placed in operation at Kenilworth, N. J., by the American Circular Loom Co., for many years manufacturers of thin wall steel tubing used for electric wire conduits.

The Bridgeport Hardware Manufacturing Corporation, Bridgeport, Conn., has recently filed with the Secretary of State an increase of capital stock in the amount of $150,000 additional.

The C. J. Root Co., of Bristol, Conn., manufacturers of brass goods and numbering machines, etc., has recently added $75,000 to the capital stock of the concern.

The Empire State Engine Corporation announces the change of its location from 1261 Broadway to 347 Madison Ave., New York.

Personals

A. W. CLARK has resigned his position as manager of the price and products department of the Yale & Towne Manufacturing Co. of Stamford, Conn. Mr. Clark has been with Yale & Towne for the past thirty-one years.

GEORGE F. WRIGHT, vice-president of the Wickwire-Spencer Steel Corporation of Worcester, Mass., has resigned his position to enter private business.

O. R. SPRAGUE has been appointed district sales manager at Portland, Ore., for the Gilbert & Barker Manufacturing Co. of Springfield, Mass., following the transfer of F. R. Burrows to St. Louis.

ERNEST T. CLARY, assistant general manager and assistant treasurer of the Whitcomb-Blaisdell Machine Tool Co. of Worcester, Mass., has resigned his position with that company. He has been with the concern for the past twelve years.

L. ARTHUR BURTON has recently been appointed to the Boston sales force of the Wickwire-Spencer Steel Corporation of Worcester, Mass. Mr. Burton was formerly located at the Wright works of the company in Worcester.

WILLIAM BACON has been chosen superintendent of production of the Reed-Prentice Co. of Worcester, Mass. Mr. Bacon was formerly superintendent of the Prentice Brothers Co. department of the Reed-Prentice Co.

E. J. SLATTERY has resigned as assistant treasurer of the Stanley Insulating Co. of Great Barrington, Mass. Mr. Slattery will resume his former position with the Finance and Trading Corporation of New York.

O. J. SKINNER has been appointed assistant manager of the Pacific Coast sales division of the Gilbert & Barker Manufacturing Co. of West Springfield, Mass. Mr. Skinner was formerly office manager of the San Francisco office of the company. His headquarters will still be in San Francisco.

KENNETH S. EDWARDS, district superintendent of the Los Angeles district for the Gilbert & Barker Manufacturing Co. of West Springfield, Mass., has been promoted to the position of manager of the Pacific Coast sales division, with headquarters at San Francisco.

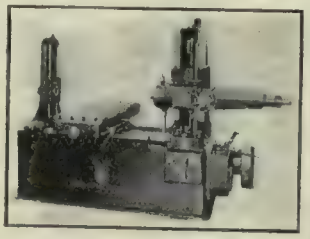
F. E. RHODES of the sales department at the Boston branch office of the combined companies of Reed-Prentice Co. and the Whitcomb-Blaisdell Machine Tool Co., both of Worcester, Mass., and the Becker Milling Machine Co. of Hyde Park, Mass., has resigned his position to take effect at once.

ROBERT C. WELLER has been appointed general sales manager of the Lakewood Engineering Co., with headquarters at Cleveland, Ohio.

Condensed-Clipping Index of Equipment

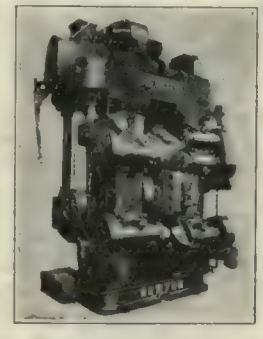
Patented Aug. 20, 1918

Boring, Milling and Drilling Machine, Horizontal, "No. 25"
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
"American Machinist," Feb. 3, 1921



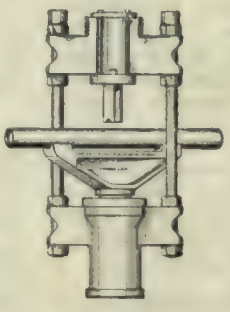
The machine is intended for production work or for toolroom work on jigs and fixtures. All control levers are so arranged as to be easily accessible to the operator. Special equipment can be provided. Specifications: Spindle: diameter of bar, 2⅛ in.; taper hole, No. 4 Morse; longitudinal travel, 13½ in. Vertical adjustment of head on column, 20 in. Maximum distance table to center of spindle, 20 in. Distance from face of spindle to boring-bar support, 48 in. Size of table, 18 x 48 in. Table travel: transverse, 33 in.; longitudinal, 30 in. Spindle speeds: number, 8; range, 12½ to 337½ r.p.m. Feeds in each direction: number, 9; range, 0.0034 to 0.25 in. Driving pulley: size, 16 x 2½ in.; speed, 450 r.p.m. Motor recommended, 3 hp., 1,200 r.p.m., constant-speed. Net weight, 6,300 lb.

Milling Machine, Continuous, Drum Type, "Model O-4"
Newton Machine Tool Works, Inc., 23d and Vine Sts., Philadelphia, Pa.
"American Machinist," Feb. 3, 1921



The machine is intended for finishing two surfaces simultaneously, either on the same or on different castings, being especially adapted to the milling of opposite surfaces of cylinder blocks, parallelism of the surfaces being thus obtained. The bottom of the block is roughed by means of two small face mills and finished by one large one. The roughing cutters are placed at the top, the finishing cutters at the bottom, and the work is removed from and replaced on the rotating drum by an attendant at the rear of the machine, the cutting operation being continuous. Each piece is held by only one clamp, which has a double bearing, thus permitting of speedy operation. It is stated that the average rate of production on the cylinder block shown is 25 pieces per hour.

Press, Hydraulic, "Five-in-One"
The Charles F. Elmes Engineering Works, Morgan and Fulton Sts., Chicago, Ill.
"American Machinist," Feb. 3, 1921



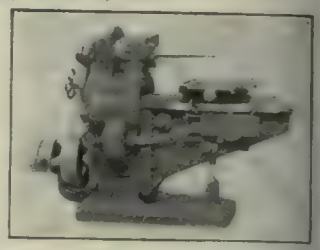
The machine is intended as an all-round press for use in small shops or for repair work. It will handle a large variety of forcing, bending, straightening and broaching work, having a capacity up to 50 tons. On account of its light weight, the machine can be readily handled as a portable press, and used either vertically or horizontally. It can be provided with extension side bars for use when forcing long shafts into or out of gears and pulleys. The press weighs about 500 lb. and has a capacity of 50 tons. The distance between the columns is 18 in., but it may be changed somewhat. The distance from the top-head to the ram lowered is about 20 in.

Broach, Keyway, Staggered-Tooth
Velco Manufacturing Co., Inc., Greenfield, Mass.
"American Machinist," Feb. 3, 1921



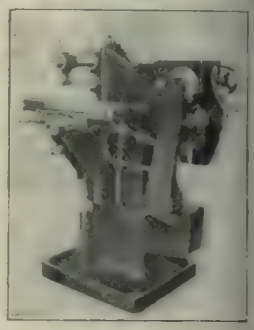
The teeth are milled from solid stock, and are deeply cut to provide chip room, although a strong cross-section is claimed. The depth of the recess makes possible a large radius at the base of the tooth. The tooth faces slant in opposite directions on each side of the bar, thus obtaining a shearing cut, but neutralizing the side thrust on the bar. Because of the shape of the tooth, a large amount of metal can be removed by grinding on the top of it when sharpening, before the rake angle is changed. The broach has a pull shank, which is said to so attach to the broaching machine that it does not pull off-center. The capacity is such that any standard keyway may be cut at a single pass of the broach, which is made in the standard sizes.

Grinding Machine, Cylinder, "No. 55"
Heald Machine Co., Worcester, Mass.
"American Machinist," Feb. 3, 1921



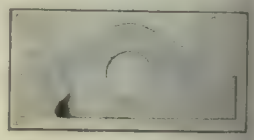
This machine is intended for general repair work, especially the re-grinding of automotive-engine cylinders. It is modeled on the lines of the No. 60 machine, but has been simplified. Specifications: Capacity with standard spindle, to grind holes 2⅜ in. in diameter and larger, by 11 in. long; and 3 in. and larger, by 18 in. long. Standard wheels, 2½, 3 and 3½ in. in diameter. Surface speed of wheels, 4,950 to 5,650 ft. per minute. Vertical adjustment of knee, 2½ in. Transverse adjustment of cross-slide table, 24 in. Cross-slide table: 36 x 18 in.; finished surface, 28 x 14 in. Main table: 55⅝ x 16 in.; finished surface, 24 x 13 in. Distance cross-slide table to center of grinding circle, 7 to 9½ in. Speed of driving pulley, 700 r.p.m. Motor recommended: 5 hp.; 1,000 to 1,200 r.p.m. Floor space, 72 x 110 in. Weight: net, 2,900 lb.; boxed, 3,700 lb.

Milling Machine, Plain "No. 2"
The Standard Engineering Works, Pawtucket, R. I.
"American Machinist," Feb. 3, 1921



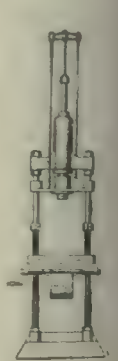
The machine is fitted with positive drive throughout, and is said to be adaptable to all sorts of milling. The table is provided with three T-slots and has oil pockets at each end. The headstock is gibbed to the top of the column, so as to provide for vertical movement, but it can be clamped in any desired position. Twelve spindle speeds are provided, ranging from 80 to 1,950 r.p.m. A power feed attachment can be mounted, thus providing a longitudinal feed for the table of 0.004 to 0.062 in. per revolution of the spindle. Four feed changes, controlled by a single lever, are provided, the gear box being located underneath the speed-change box. The machine is equipped with a Trahern reversible geared pump, having an automatic relief valve. A 1-hp. motor of 1,200 r.p.m. is recommended.

Shim, Laminated, "Fit-All"
The Laminated Shim Co., 47 West 34th St., New York, N. Y.
"American Machinist," Feb. 3, 1921



The shim is made up of thin metal layers, so that by "peeling off" some of them the proper thickness can be obtained. It is called the "Fit-All" because it is adapted to fit nearly all shapes of automotive bearings, it being stated that the shape was decided upon after a study of the shapes of over 1,000 different shims. In some cases it may be necessary to trim the sheet, this being done with a tinner's shears. It is said that this shim combines the advantages of the laminated shim with the universality of the sheet-brass shim. It is made in different thicknesses, and can be furnished punched with holes of two different diameters.

Press, Broaching, Hydraulic, "Rapid"
Charles F. Elmes Engineering Works, Morgan and Fulton Sts., Chicago, Ill.
"American Machinist," Feb. 3, 1921



It is stated that fifteen to twenty-five strokes per minute can be made by this machine. It will take work requiring up to 20 tons pressure. The distance between the columns is 20 in. The platen or table may be raised and lowered quickly by means of the crank at the left of the press, the minimum opening from the ram to the table being 14 in. and the maximum 36 in. A plate set in the platen has an opening through it for the broaches. Below the table is a hopper for receiving the broaches as they pass through the work. The operation of the press is controlled by a single, lever-operated valve, the speed also being regulated by means of a valve.

Clip, paste on 3 x 5-in. cards and file as desired

WALTER G. SCOTT, vice-president of C. E. Knoeppel & Co., industrial engineers, of New York, N. Y., is on a trip through Europe, visiting England, France and Germany. Mr. Scott intends to stay in Europe three months to make himself familiar with the various industrial problems of readjustment and reconstruction occupying this part of the world.

MELVIN W. ELLIS, vice-president and general manager of the Hart-Parr Co., Charles City, Iowa, was elected a director of the Iowa Chamber of Commerce at the recent meeting in Des Moines.

W. W. CLARK, export manager of the Hart-Parr Co., Charles City, Iowa, has just returned from a four months' trip to Sweden, Spain, Denmark, France, Belgium and England in the interests of the Hart-Parr tractor firm.

G. N. JACOBI, SR. has recently been chosen manager of the price bureau department of the Yale & Towne Manufacturing Co. of Stamford, Conn.

Obituary

William D. Forbes

The friends of William Dunderdale Forbes, and they were many, will be deeply grieved to learn of his death, on February 17, at New Orleans, where he has made his home for the past few years. His work as a designer and engineer, as well as a manufacturer of high-grade engines and other products, is well known, his shops in Hoboken, and later in New London, being noted for excellent workmanship.

His career, however, began long before. Born in Perth Amboy, N. J., he went abroad in his youth and living in France at the outbreak of the Franco-Prussian war promptly joined the French colors as a scout. Later he worked with the famous gunsmiths of Switzerland, was on the editorial staff of *Engineering*, of London, under Zerah Colburn, and then returned to this country.

Marine engineering and guns might be said to be his specialties. He did much good work along both lines. But his greatest achievement was his unfailing cheerfulness under difficulties which would have embittered anyone with a smaller spirit. Financial reverses, closely followed by total blindness did not change his attitude toward life and toward his fellow men.

Even when deprived of sight he designed and developed several notable pieces of mechanism, including an automatic rifle which is more simple in construction and in action than any now being made. His wife and daughter were of invaluable assistance in this work, the wife acting as secretary, and the daughter as draftsman. To them he dictated his designs. So accurately was this work done that the machines went together with less difficulty than in many cases where the designer has his vision.

Mr. Forbes soon learned to operate the typewriter, and most of his articles which have appeared in the *American Machinist* during the past three years were typed by him. Of late he had developed a system of making his own drawings, and an article on his method, written by himself, will appear shortly.

To those of us who were privileged to know William D. Forbes, he leaves a lasting impress, and one which cannot fail to be an inspiration as the years go by. Keen, outspoken without being harsh or unkind, courteous and gentlemanly in every way, lending a helping hand to the beginner, giving sound advice freely, his personality will be long remembered. Nor will we forget the faithful and loving care and assistance of his wife and daughter, which filled his years of physical darkness with spiritual sunshine.

FRANK E. LUMMUS, president of the Lummus Gin Co. of Columbus, Ga., operators of foundries and shops which comprise one of the largest gin manufacturing companies in the South, died on Tuesday, Feb. 22, at his Columbus home at the age of 67 years. He had been ill for several months.

LOUIS A. GENDRON, director of the Warren Steam Pump Co. of Warren, Mass., died at St. Vincent's Hospital, Worcester, Mass., Feb. 22, after a short illness. Mr. Gendron had charge of the machine shop of the company and was one of its original organizers in 1897. He was born in Canada in 1849, and came to Warren in 1864.

CHARLES HERBERT TALBOT, purchasing agent of the plants of the General Electric Company in Pittsfield, Mass., since 1904, died at his home in Pittsfield on Feb. 20, after an illness of about four weeks. Mr. Talbot was born in North Dighton, Mass., April 5, 1857. He was well known in industrial circles throughout New England.

Trade Catalogs

Jeffrey Standardized Scraper Conveyors. Jeffrey Manufacturing Co., Columbus, Ohio. Catalog No. 257, eighty-four 8½ x 11-in. pages, describing the latest types of scraper conveyors. The book is profusely illustrated showing the conveyors in action in coal mines, factories and power plants. Several pages of specifications for use of these machines under various conditions are given.

Martell Reamer. Taft-Peirce Manufacturing Co., Woonsocket, R. I. Bulletin No. 112. A book of instruction on how to use the Martell aligning reamer. The various operations are well illustrated and lists of reaming equipment for several auto manufacturing plants are furnished. Bulletin No. 115 is devoted especially to Martell adjustable reamers, their use and special features.

Thread Gages. Taft-Peirce Manufacturing Co., Woonsocket, R. I. Bulletin No. 113, thirty-two 8 x 10-in. pages, containing the important features of the National Screw Threads Commission and their relation to Taft-Peirce Standard gages. Some of the subjects covered are external threads; coarse thread series; fine thread series; S. A. E. and A. S. M. E. standard thread gages; British-Whitworth, International and Lowenherz thread systems; National and American pipe threads. Several valuable tables are included.

Friction Clutches. The Hanson Clutch and Machinery Co., Tiffin, Ohio. Catalog C-3, pp. 80, 6 x 9¼ in. This catalog attempts to show the complete line of Hanson friction clutches, giving its various sizes, weights, dimensions and horsepower.

The Use and Care of the Broach. The Velco Manufacturing Co., Inc., Greenfield, Mass. Booklet, pp. 14, 5 x 7¼ in. The purpose of this booklet is to educate the broaching-machine operator and foreman in the proper use of the broaching machine and broaching tools.

The Cooling of Quenching Oil in the Heat Treatment of Steel. The Griscom-Russell Co., 90 West St., New York. Booklet, pp. 29, 6 x 9 in. This booklet describes the necessity for heat treatment, the various quenching mediums and systems commonly used, the advantages of continuous circulation of the medium and the adaptability of the multi-whirl cooler to the cooling of quenching oil.

Operators' Handbook. The Hendey Machine Co., Torrington, Conn. This company has issued a 68-page booklet giving valuable information to operators using the Hendey lathes. This booklet will be sent free to all who use these lathes.

Bakelite. Boonton Rubber Manufacturing Co., Boonton, N. J. Catalog, pp. 48, 8½ x 11 in. This catalog gives an interesting description of its bakelite which is used for electric insulations; also for mechanical, chemical and other purposes. The various departments of the company and its process of manufacturing is profusely illustrated.

Direct-Current Motors. The Mechanical Appliance Co., Milwaukee, Wis. Bulletin No. 401, pp. 15, 8½ x 11 in. This bulletin describes its direct-current motors and gives information pertinent to the selection of its proper equipment.

Alternating-Current Motors. The Mechanical Appliance Co., Milwaukee, Wis Bulletin No. 401, pp. 14, 8½ x 11 in. This bulletin describes its alternating-current apparatus.

Thread Miller. Taft-Peirce Manufacturing Co., Woonsocket, R. I. Illustrated circular describing two latest types of thread millers—the direct-belt-driven cutter type and the back-gear-driven type.

Line Reaming of Bearings. Bulletin No. 114 issued by the Taft-Peirce Manufacturing Co., Woonsocket, R. I. A well made-up booklet, twelve 8 x 10-in. pages, fully illustrated, describing the Martell system of line reaming bearings. Most of the text is devoted to an explanation of the work of the Martell reamer on airplane motor cylinders.

Forthcoming Meetings

The National Metal Trades Association will hold its annual convention at the Hotel Astor, New York, on April 18, 19, 20, 21. Homer D. Sayre, Peoples Gas Building, Chicago, Ill., is secretary.

The fifth annual convention of the American Gear Manufacturers Association will be held in Cincinnati, Ohio, April 27, 28, 29 and 30.

The annual meeting of the American Welding Society will be held in the Engineering Societies Building, 29 West 39th St., New York, on April 22.

The Society of Industrial Engineers will hold its national convention in Milwaukee, Wis., on April 27, 28 and 29. Geo. C. Dent, 327 So. La Salle St., is business manager.

The National Foreign Trade Council will hold its eighth annual convention in Cleveland, Ohio, on May 4, 5, 6 and 7. J. G. Hammond, care of the Council, 409 Park Bldg., Cleveland, is secretary.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The spring meeting of the American Society of Mechanical Engineers will be held at the Congress Hotel, Chicago, May 23-26. Calvin W. Rice, Engineering Societies Bldg., 239 West 39th St., New York, is secretary.

The Society of Automotive Engineers, 29 West 39th St., New York announces that its summer meeting will be held at West Baden, Ind., on May 24 to 28 inclusive.

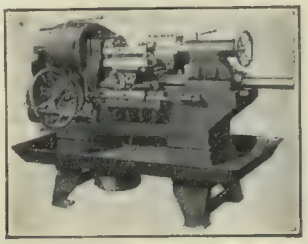
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Lathe, Automatic, Two-Carriage

Rockford Machine Tool Co., Rockford, Ill.

"American Machinist," Feb. 3, 1921

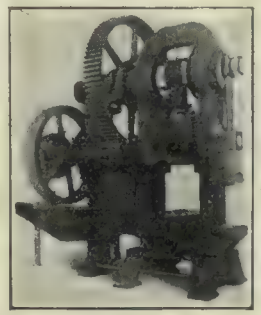


The machine is intended for the rapid production of duplicate parts, especially for the turning of pistons, pulleys, cone pulleys and gear blanks where multiple tools can be used and where the turning and facing operations can be done at the same time. It is said to be built on the lines of a 22-in. heavy-duty lathe. Specifications—Swing: over side carriage bar, 14 in.; over cross carriage, 10⅜ in. Distance between centers, maximum, 18 in. Travel of side carriage, 12 in. Spindle bearing: front, 4⅜ x 6⅜ in.; rear 3½ x 4⅞ in. Hole through spindle, 1¼ in. Taper hole in spindle, No. 5. Spindle nose: diameter, 3⅜ in.; length, 2⅜ in.; threads per inch, 5 U. S. S. Tailstock spindle, 2⅞ in. in diameter. Drive pulley, 14 x 6 in. Weight, 3,500 lb.

Press, Trimming, Straight-Side, "No. 6"

Williams, White & Co., Moline, Ill.

"American Machinist," Feb. 3, 1921

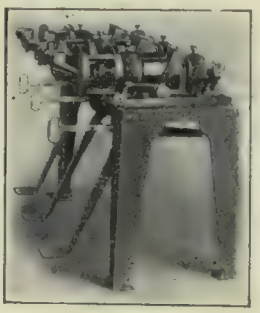


This machine is primarily intended for trimming flashings from drop-hammer forgings, but is also adapted to perforating, blanking, embossing, stamping, etc. The frame is made of semi-steel. The outside slide is of value when auxiliary operations are to be performed. The automatic-stop jaw clutch is said to be of ample dimensions. It has six jaws and is 21 in. in diameter. By means of a screw adjusting mechanism in the pitman the ram can be moved up or down to adjust the die space, as required for the work at hand. When desired the machine can be driven by a motor mounted on the stand at the left. The illustration shows solid frame construction, but the tie-rod construction can be furnished if required or preferred.

Babbitt-Lining Machine, Centrifugal

Ideal Tool and Manufacturing Co., 5825-29 S. Western Ave., Chicago, Ill.

"American Machinist," Feb. 3, 1921



The machine is intended especially for use upon automotive-crankshaft and electric-motor bearings, and is said to have an output of about 700 bearings per day. It is essentially a die-casting machine, but the bushing under treatment is rotated at a speed of 1,800 r.p.m. while the babbitt is cooling. In this way the babbitt is forced against the bronze, the centrifugal force tending to overcome the contracting force due to shrinkage of the babbitt. The machine is provided with three spindles, so that each bearing can be allowed sufficient time to cool before it is removed. The countershaft runs at 600 r.p.m. Floor space, 24 x 28 in.; height, 48 in.; weight, 1,200 lb.

Grinder, Electric, Portable

Forbes & Myers, 172 Union St., Worcester, Mass.

"American Machinist," Feb. 3, 1921



The motor is contained entirely within the spool upon which the wheel is mounted. It is of the three-phase, induction type, the field being rigidly attached to the shaft which, of course, does not rotate. The motor is wound for 110-volt, three-phase current; for higher voltage a simple transformer is provided. The tool is said to be very light in weight in proportion to its capacity. In order to utilize all the weight to the best advantage the wheel flanges and end shields carry magnetic flux, while the end shields are coated with copper and carry electric current also. The wheel is 7 x 2 in. and has safety flanges. The motor gives a maximum output of ¾ hp., the total weight of the grinder being 20 lb.

Drilling Machine, Wheel Rim

The Francis Reed Co., 43 Hammond St., Worcester, Mass.

"American Machinist," Feb. 3, 1921

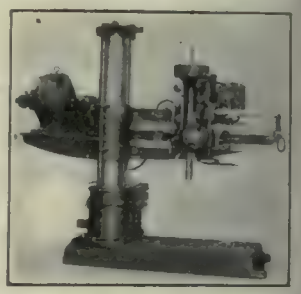


The machine will accommodate any automobile-wheel rim of 20-in. inside diameter or over, but it is adaptable to any regular drilling within its capacity. It will drive drills up to ⅝ in. in diameter. The drive to the spindle is through a 2-in. belt running over idlers on the back of the head. A three-step cone pulley provides for changes of spindle speed. The lower end of the spindle has a No. 2 Morse taper hole. The spindle has a vertical movement of 5 in., and the feed is by rack and pinion operated by a hand lever. The machine will drill to the center of a 24-in. circle. The work table is rectangular, 15 x 17 in., and has a vertical adjustment of 3 in. The machine stands 50 in. high and occupies a floor space of approximately 24 x 80 in. Its weight is 400 lb.

Drilling Machine, Radial, Direct Motor Drive

Fosdick Machine Tool Co., Cincinnati, Ohio

"American Machinist," Feb. 3, 1921



A 5-hp. Robbins & Myers, 3-to-1 variable-speed motor is mounted on an extension of the radial arm on the opposite side of the column from the head. A Cutler-Hammer controller is placed directly on the spindle-head. The drive is adaptable to the 4-, 5- and 6-ft. heavy-duty radial drilling machines made by the concern. A motor of any standard make or speed, but having a 3-to-1 speed ratio, may be used without any change in the mounting. The standard gearing of the machine is used, except in the case of the Bakelite pinion on the motor shaft, the size of which pinion is varied according to the speed of the motor adopted; also it is said that the use of two sets of bevel gears is eliminated, thus saving power. But one motor is used on the machine.

Grinding and Buffing Machine, Combination, Electrical

Cincinnati Electrical Tool Co., 1501 Freeman Ave., Cincinnati, Ohio

"American Machinist," Feb. 3, 1921

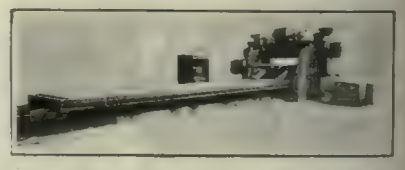


The machine is provided with both grinding and buffing wheels, the grinding wheel being adapted to both tool-grinding and general grinding of all kinds. The motors are made for direct or alternate current in ½, 1, 2 and 3 hp. capacities to carry wheels from 8 to 14 in. in diameter. The motor windings and bearings are fully inclosed. Annular ball bearings are fitted on both ends of the armature spindle, as well as on the outer end of the extension spindle. Dust caps, fitted to the spindle, protect the bearings and windings from abrasive dust and dirt. The machine is fully equipped, including toolboard and water pot, and can be furnished without the floor pedestal if desired.

Planer, 7 x 3 x 42-Ft.

Southwark Foundry and Machine Co., Philadelphia, Pa.

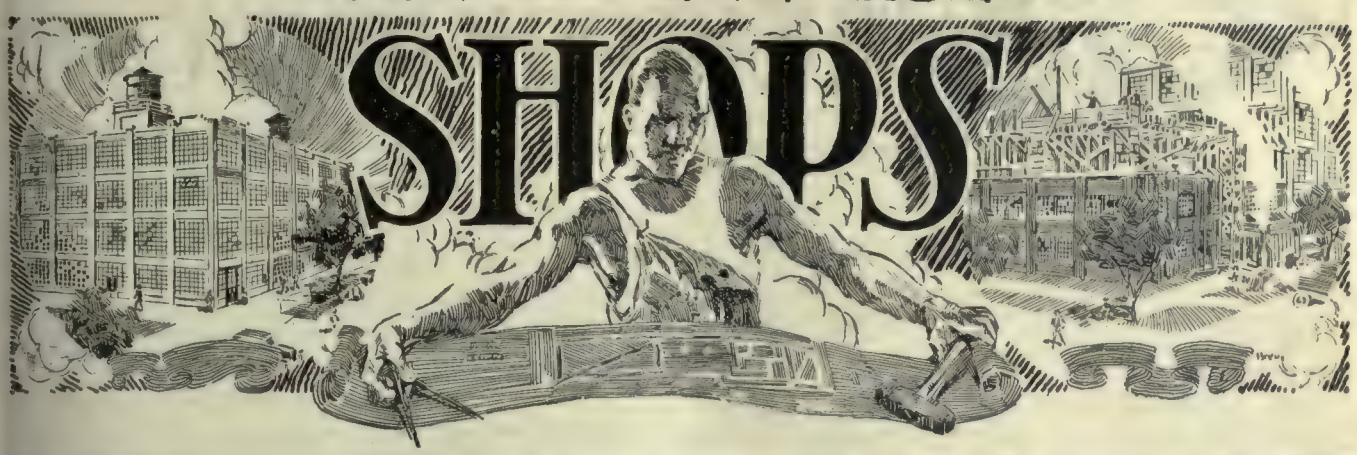
"American Machinist," Feb. 3, 1921



The planer illustrated is one of three that has recently been built for the Baldwin Locomotive Works for heavy-duty service on locomotive frames. It is provided with two heads on the cross-rail, as well as two sideheads fitted to the uprights. Specifications: Capacity: will plane 84 in. in width, 36 in. in height and 42 in. in length. Table: width, 6 ft.; length, 44 ft. Uprights: width of face, 22 in.; depth front to back, 6 ft. 6 in. Cross-rail: face, 26 in.; depth at center, 23 in.; at uprights, 8 in. Table rack: circular pitch, 1¾ in.; face, 14 in. Overall length, 80 ft. Weight, 250,000 lb. Motor, 75 hp.; speed range, 250 to 1,000 r.p.m. Cutting speeds, 20 to 40 ft. per minute.

Clip, paste on 3 x 5-in. cards and file as desired

NEW and ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Conn., Bridgeport—The Bridgeport Auto Repair Shop, 861 Hallett St.—1 small lathe, 1 drill press, 1 small planer.

Mass., Arlington—A-1 Repair Shop, 28 Brooks St., K. Lutz, Purch. Agt.—one 14 or 15 in. screw cutting lathe, 6 ft. bed, compound rest and taper attachment.

N. Y., Buffalo—The Aldrich Mfg. Co., 55 Illinois St., M. Minor, Purch. Agt.—double trussed steel cornice brake 8 ft. long, (used).

N. Y., Rochester—The Alent Machine Tool Co., 467 St. Paul St., N. Alent, Purch. Agt.—old munition lathe any size and grinders, any model.

N. Y., Rochester—Harrison Machine Co., 146 Platt St., J. Harrison, Purch. Agt.—general machine shop equipment.

Pa., Philadelphia—W. S. Haines & Co., 12th and Buttonwood Sts., manufacturer of heating apparatus—small shaper.

Fla., Live Oak—The Live Oak, Perry & Gulf R.R. Co., C. R. Wadsworth, Supt.—
One planer about 24 x 24 x 6 or 8 in. single head.
One pillow shaper about 18 or 20 in. stroke.
One 24 or 26 in. drill press.

N. C., North Wilkesboro—The Superior "Williams" Mill Co., E. V. Williams, Genl. Mgr.—machinery for the manufacture of burr mills, pattern shop equipment and general machine shop equipment.

Ill., Chicago—The Elgin, Joliet & Eastern Ry. Co., 208 South LaSalle St.—one double axle lathe, center drive, to be No. 3 Niles, Bement Pond as described in their catalog of 1920.

Ill., Chicago Heights—The Amer. Manganese Steel Co., 14th and State Sts.—one or two second hand moulding machines.

Mich., Detroit—C. Cummings, 6051 Brush St.—miscellaneous equipment for finishing automobile bodies.

Mich., Marysville—The Wills Lee Motor Car Co.—drill press and equipment.

O., Cincinnati — Harvey Bros. Tank & Welding Co., 315 East 2d St., A. Harvey, Purch. Agt.—punch, capable of punching $\frac{5}{8}$ in. hole in a $\frac{3}{4}$ in plate, 25 in. throat.

Wis., Jackson—The Meehan Mfg. Co., 709 M. & M. Bldg., W. Richter, Purch. Agt.—pneumatic drills, riveting hammers, grinders, bending roll, also small punch to punch sheets.

Wis., Mellen—W. Willoughby—garage repair machinery.

Wis., Milwaukee—A. W. Hardt, 47th and State Sts.—one 20-24 in. lathe and one 12 in. drill press.

Wis., Milwaukee—A. L. Kiefer Co., 433 Milwaukee St., A. L. Kiefer, Purch. Agt.—sheet metal working machinery.

Wis., Milwaukee—The Nash Motors Co., Clement and Oklahoma Aves., E. W. Twyman, Purch. Agt.—sheet metal working machinery for fenders, etc.

Wis., Wausau—H. L. Mumm & Co., manufacturer of spark plugs—wood-turning lathes and automatic saws.

Ia., Dubuque—The A. Y. McDonald Mfg. Co., 12th and Pine Sts.—one No. 2 Landis pipe threading machine to cut up to 2 in. pipe, (used).

Mo., Joplin—The Joplin Steel & Malleable Co., East 3d St.—foundry equipment.

Mo., St. Louis—The Chester Iron & Fdry. Co., 7800 South Vulcan St., F. Schoen, Purch. Agt.—crane, cupolo, molds, ladles and other equipment for a new foundry.

N. S., Trenton—The Nova Scotia Steel & Coal Co.—equipment for its machine shop, etc.

Ont., Tillbury—The Gove Motor Car Co.—metal working machinery and special equipment for the manufacture of autos and trucks.

Ont., Toronto — The Temiskaming & Northern Ry. Comn., 56 Church St.—$57,524 worth of shop machinery.

Que., Hull — W. Cross, Chelsea Rd.—garage equipment.

Que., Montreal—The Supercharge Engine Co., of Canada Ltd., 120 St. James St.—equipment for its proposed plant.

Machinery Wanted

Md., Easton — The Easton Milling Co., manufacturer of flour, meal, feed, etc., G. L. Bartlett, Pres. — sifters, purifiers, dust collectors and cleaning machinery for wheat.

N. Y., Avon—The Valley Sand & Gravel Co., J. Flynn, Purch. Agt.—stone quarry and gravel machinery.

Ky., Broadhead—D. H. Gray—complete equipment for brick plant, canning factory equipment and machinery for broom factory.

S. C., Greenville—The Peerless Folding Ladder Co.—moulders, lathes, multiple boring machines, saws and other wood-working machinery.

Va., Crozet—The Crozet Pin & Bracket Co., W. P. Bickers, Purch. Agt.—woodturning lathes for turning from square to round, circular and tapered shapes, as spools, pillboxes, threaded caps or cobs for steel insulator pins, etc. Especially interested in machine for making the cobs which are $2\frac{1}{2}$ in. in length, $1\frac{1}{2}$ in. in diameter at one end, straight tapered to 1 in. at the other, has $\frac{5}{8}$ in. hole with internal thread extending 2 in. deep from the center of the large end, and a standard insulator thread on the outside, $2\frac{7}{8}$ in. in length beginning at the small end, the threads being $\frac{1}{8}$ in. in width by $\frac{1}{16}$ in. in depth.

Va., Radford—The Radford Ice Corp., W. L. A. Giesen, Genl. Mgr.—complete refrigeration and cold storage equipment.

W. Va., Point Pleasant—Point Pleasant Lumber Co., W. J. Waldie, Mgr.—combination woodworker.

W. Va., Williamson — The Coalton Coal Corp., J. T. Jones, Cambria, Va., Purch. Agt.—mining machines etc.

Mich., Detroit—A. J. Lauhoff, 2445 Seminole Ave.—sheet metal working equipment including brake, shears, roller, all about 30 in. size.

Mich., Detroit—The Michigan Stamping Co., 3171 Bellevue Ave.—equipment for galvanizing department.

O., Columbus—The Franklin Adis Tile Co., Gugle Bldg., J. J. Morgan, Genl. Mgr.—two mixers, conveyors, 2 or 3 molding machines and special machinery.

Wis., Antigo — The Langlade Laundry Co.—laundry machinery, etc.

Wis., Kenosha—The Blommer Ice Cream Co., 1502 North Ave., Milwaukee—ice cream making and refrigerating equipment.

Wis., Kenosha—The Kenosha Woodwork Mfg. Co., 259 Valentine St.—wood-working machinery.

Wis., Milwaukee—The Wisconsin Furniture & Millwork Co., 16 Mack Blk.—planer, mortiser, sticker and other wood-working machinery also portable saw-mill.

Wis., Oshkosh—The Fuller Goodman Co., (wood workers), City Natl. Bank Bldg., F. A. Fuller, Purch. Agt.—rip saw, timber sizer, resaw (7 ft. diameter with 8 in. blade) and matcher.

Wis., Racine—The New York Market Co., 1015 6th St.—special machinery.

Wis., Ripon—C. D. Starck and O. H. Kroll, manufacturers of soft drinks and ice cream — machinery to manufacture ice cream also bottling machinery.

Ont., St. Marys—The St. Marys Milling Co.—chopping mill machinery.

Sask., Maskakee Lake — The Maskakee Lake Development Co.—equipment for its proposed evaporation plant.

Metal Working

NEW ENGLAND STATES

Conn., Norwalk—J. S. Fairbanks, 438 Atlantic Ave., Stamford, has awarded the contract for the construction of a 1 story, 50 x 140 ft. service station on West Ave., here. Estimated cost, $25,000. Noted Nov. 11.

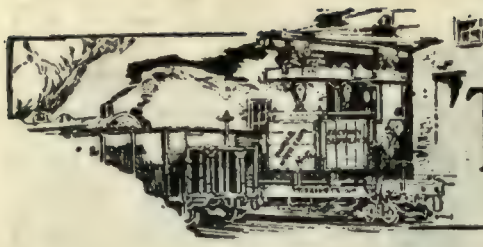
Mass., Boston—T. L. Harkins Machine Co., 44 Farnsworth St., has awarded the contract for the construction of a 2 story, 46 x 91 ft. machine shop at 7-9 Mechanics St. Estimated cost, $30,000.

Mass., Dorchester (Boston P. O.)—H. E. Stevens, 24 Dix St., will soon award the contract for the construction of a 1 story, 60 x 120 ft. garage on Dorchester Ave. Estimated cost, $25,000. Private plans.

N. H., Charlestown—The Bowen Motor Co., will soon award the contract for the construction of a 2 story, 60 x 165 ft. garage. Estimated cost, $100,000. G. W. Griffin, 72 North Main St., Concord, Archt.

N. H., Hanover—H. H. Downing, Littleton, has awarded the contract for the construction of a 2 story, 60 x 80 ft. garage on Cottage St., here. Estimated cost, $30,000. Noted Feb. 3.

R. I., Providence—S. Bomes, 71 Farragut Ave., plans to build a 1 story garage and service station on Warrington St. Estimated cost, $40,000. Private plans.



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Year Ago
CINCINNATI		
No. 2 Southern	$32.00	$44.60
Northern Basic	29.50	42.80
Southern Ohio No. 2	32.00	43.80
NEW YORK—Tidewater Delivery		
2X Virginia (Silicon 2.25 to 2.75)	37.41	47.65
Southern No. 2 (Silicon 2.25 to 2.75)	37.76	47.70
BIRMINGHAM		
No. 2 Foundry	27.50	41.00
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25–2.75 sil.	31.54*	45.35*
Virginia No. 2	35.14*	43.25*
Basic	29.00†	43.00†
Grey Forge	29.75*	42.50*
CHICAGO		
No. 2 Foundry local	30.00	43.25
No. 2 Foundry, Southern	34.16	46.60
PITTSBURGH, including freight charge from Valley		
No. 2 Foundry	29.96	43.65
Basic	26.96	42.90
Bessemer	28.96	43.40

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	*Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.58	$3.58	$3.97	$3.58	$5.50	$3.58	$3.47
Soft steel bars	3.48	3.45	4.12	3.34	5.00	3.48	3.52
Soft steel bar shapes	3.48	3.45	4.12	3.48	....	3.48	3.52
Soft steel bands	4.18	4.18	4.82	6.25	6.25	....	....
Tank plates	3.78	3.78	4.17	3.78	5.00	3.78	4.67

*Add 10c for trucking charge to Jersey City and 15c. to New York and Brooklyn from warehouse.

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$2.25@$2.35	$4.00
Warehouse, New York	3.48	3.52
Warehouse, Cleveland	3.52	3.42
Warehouse, Chicago	4.12	3.52

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York *Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55	4.90	6.80	4.00	4.68
No. 12	3.60	4.55	6.85	4.35	4.73
No. 14	3.65	4.60	6.90	4.40	4.78
No. 16	3.75	4.70	7.00	4.50	4.88
Black					
Nos. 18 and 20	4.20	5.30	7.30	4.95	5.55
Nos. 22 and 24	4.25	5.35	7.35	5.10	5.60
No. 26	4.30	5.40	7.90	5.15	5.65
No. 28	4.35	5.50	8.00	5.25	5.75
Galvanized					
No. 10	4.70	5.40	9.00	5.50	6.10
No. 12	4.80	5.50	9.10	5.60	6.20
No. 14	4.80	5.50	9.10	5.60	6.20
Nos. 18 and 20	5.10	5.90	9.40	5.90	6.50
Nos. 22 and 24	5.25	6.05*	9.55	6.05	6.65
No. 26	5.40	6.20	9.70	6.20	6.80
No. 28	5.70	6.50	10.00	6.90	7.10

*To these prices 10c. must be added for delivery in Jersey City and 15c. for New York and Brooklyn.

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$5.50	$5.25	$4.84
Flats, square and hexagons, per 100 lb.	6.00	5.75	5.34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	50@55
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55
Special Nickel and Alloys			
Malleable nickel ingots	45		
Malleable nickel sheet bars	47		
Hot rolled rods, Grades "A" and "C" (base)	60		
Cold drawn rods, grades "A" and "C" (base)	72		
Copper nickel ingots	42		
Hot rolled copper nickel rods (base)	52		
Manganese nickel hot rolled (base) rods, "D"—low manganese	64		
Manganese nickel hot rolled (base) rods "D"—high manganese	67		

ELECTRIC WELDING WIRE—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 3/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	6.00	8.00	9.00
Spring steel (light)	8.00	7.00	12.00
Coppered bessemer rods	8.50	8.00	7.00
Hoop steel	4.58	4.04	4.18
Cold-rolled strip steel	9.00	8.25	9.25
Floor plates	5.75	4.00	6.03

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Steel Inches	Steel Black	Steel Galvanized	Iron Inches	Iron Black	Iron Galvanized
⅜ to 3	57½%	44%	⅜	15½–16½%	+10½–11½%
			½	19½–20½%	1½– 2½%
			¾ to 1¼	24½–25½%	8½– 9½%

LAP WELD

2	50½%	38%	2	20½–21%	6½– 7%
2½ to 6	53½%	41%	2½ to 6	22½–23%	9½–10%
7 to 12	50½%	37%	7 to 12	19½–20%	6½– 7%
13 to 14	41%	...			
15	38½%	...			

BUTT WELD, EXTRA STRONG PLAIN ENDS

⅜ to 1¼	55½%	43%	⅜ to 1¼	24½–25½%	9½–10½%
2 to 3	56½%	44%			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	48½%	37%	2	21½–22½%	8½– 9%
2½ to 4	51½%	40%	2½ to 4	23½–24%	11½–12%
4½ to 6	50½%	39%	4½ to 6	22½–23%	10½–11%
7 to 8	46½%	33%	7 to 8	14½–15%	2½– 3%
9 to 12	41½%	28%	9 to 12	9½–10%	+2 –2½%

Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅜ to 3 in. steel butt welded	44%	28%	42½%	33½%	57½%	44%
2½ to 6 in. steel lap welded	39%	24%	44½%	29½%	53½%	41%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 6%. Cast iron, standard sizes, 15% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	13.50	14.00	19.00
Tin in 5-ton lots	29.25	32.00	64.00
Lead	4.50	5.50	7.50
Zinc	5.75	6.00	9.50
ST. LOUIS (In carload lots)			
Lead	4.10	5.25	8 87½
Zinc	5.35	6.00	8.50

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	20.75	21.00	29.50	22.50	31.00	24.25	36.00
Copper wire (carload lots)	15.75	16.00	29.25	19.00	29.50	24.00	27.00
Brass sheets	17.75	18.75	26.50	24.00	29.00	26.50	27.00
Brass pipe	21.50	23.50	32.00	24.00	34.00	21.50	35.00
Solder (half and half) (case lots)	19.63	22.50	39.00	26.00	40.50	21.00	38.00

Copper sheets quoted above hot rolled 24 oz., cold rolled 14 oz. and heavier add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill, 1,000 lb. and over, warehouse; net extra:

	Current	One Year Ago
New York	15.75	23.75
Cleveland	20.00	29.00
Chicago	21.25	26.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f.o.b. mill + less 8% for carload lots..... 11.50

	Warehouse			
	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	13.70	15.00	14.30	15.50
New York	12.50	14.00	13.50	14.50
Chicago	14.50	15.00	14.95	15.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	6.00	12.00
Chicago	6.50	12.50
Cleveland	7.50	13.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	10.00	17.00	10.00	10.50
Copper, heavy, and wire	9.50	16.50	9.50	9.00
Copper, light, and bottoms	8.00	15.50	9.00	8.00
Lead, heavy	3.50	7.00	4.00	3.75
Lead, tea	2.2	8.25	3.00	3.00
Brass, heavy	6.50	12.00	7.00	10.00
Brass, light	5.00	8.50	5.00	5.50
No. 1 yellow brass turnings	5.50	14.00	5.50	6.00
Zinc	3.00	6.25	3.00	3.50

ALUMINUM—Cents per pound for spot:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.2@28.1	24.50	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	22.50	33.00
Chicago	24.50	29.00
Cleveland	22.00	32.00

BABBITT METAL—Warehouse price in cents per pound:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	70.00	90.00	46.00	73.00	35.00	70.60
Commercial	30.00	50.00	16.50	21.50	9.00	15.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	List	+$2.00	$1.00	$1.00	+ 1.15	1.25
Hot pressed hexagon	List	+ 2.00	1.00	1.00	+ 1.15	1.25
Cold punched hexagon	List	+ 2.00	1.00	1.00	+ 1.15	.90
Cold punched square	List	+ 2.00	1.00	1.00	+ 1.15	.90

Semi-finished nuts, ⅝ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	60%	60%
Chicago	70%	50%
Cleveland	70%	55%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	45%	60%	50%
1¼ and 1½ in. by 3 in. up to 12 in	25%	50%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York.....$2.00 Cleveland.....$3.50 Chicago.....$2.50

For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:

New York.....$4.50 Cleveland.....$4.00 Chicago.....$4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	40%	50%	40%
Larger and longer up to 1 in. by 30 in	40%	40%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	35%	20%	10%	30%
Chicago	net	10%	net	10%
New York	50%	10%	25%	10%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	45%	50%	45%
Tinned	45%	50%	30%

Structural, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York...$5.08 Cleveland..$5.00 Chicago....$5.08 Pittsburgh..$3.90

Boiler, same sizes:

New York...$5.30 Cleveland..$5.10 Chicago....$5.18 Pittsburgh..$4.00

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.50	24.00	29.00
Brass	21.50	24.00	28.00

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼-2 in. inclusive in rounds, and ¾-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.50 per 100 lb. In Cleveland—$8.50 per 100 lb.; New York price is 8c.

COTTON WASTE—The following prices are in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
White	7.50@13.00	13.00	13.00	14.25
Colored mixed	7.00@11.00	9.00–12.00	10.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.25	$2.00	$2.25
Philadelphia	2.00	2.75	2.00
Cleveland	3.25	4.00	2.50
Chicago	2.50	2.25	2.25

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York (25 bbl.)	$2.50	$2.70	$3.40
Philadelphia (25 bbl.)	2.50	2.70	4.25
Chicago	4.50	4.50	5.00

COKE—The following are prices per net ton at ovens, Connellsville:

	Current	One Month Ago	One Year Ago
Prompt furnace	$5@$5.50	$5.00@$5.50	$6.00
Prompt foundry	6@6.50	6.50@7.00	7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	0.85

LINSEED OIL—These prices are per gallon:

	New York		Cleveland	Chicago	
	Current	One Year Ago	Current	Current	One Year Ago
Raw in barrels, (5 bbl. lots)	$0.73	$1.80	$0.90	$0.75	$1.99
5-gal. cans	0.76	2.00	1.15	0.90	2.23
1-gal. cans (2 to case)	0.76	....	....	....	...

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	15.50	17.00	13.00	13.00
25 and 50-lb. kegs	13.25	4.75	15.75	17.25	13.25	13.25
12½-lb. keg	13.50	5.00	16.00	17.50	13.50	13.50
5-lb. cans	16.00	17.50	18.50	20.00	16.00	15.00
1-lb. cans	18.00	19.50	20.50	22.00	18.00	16.00

500 lb. lots less 10% discount. 2,000 lb. lots less 10-4% discount. 10,000 lb. lots less 10-7½% discount.

R. I., Providence—C. E. Brissette, 685 North Main St., will soon award the contract for the construction of a 1 story garage on Duncan and North Main Sts. Estimated cost, $40,000. Private plans.

R. I., Providence—The Federal Truck Sale Co. of Rhode Island, 276 West Exchange St., will soon award the contract for the construction of a 1 story, 100 x 300 ft. garage and service station on Reservoir and Narragansett Aves. Estimated cost, $100,000. C. H. Lockwood, 171 Westminister St., Archt.

R. I., Providence—S. Wegler, Huntington Ave., plans to build a 1 story garage and service station. Estimated cost, $60,000. Private plans.

MIDDLE ATLANTIC STATES

N. Y., New York (Borough of Bronx)—J. J. Conway, c/o F. J. Shefeick, Archt. and Engr., 4168 Park Ave., will build a 2 story, 50 x 100 ft. addition to his garage on East 172d St. Estimated cost, $35,000.

N. Y., New York (Borough of Bronx)—I. L. Phillips, c/o Dunnigan & Crumley, Archts. and Engrs., 395 East 150th St., will build a 1 story, 85 x 300 ft. garage on Morris Ave. near 174th St. Estimated cost, $75,000.

Y., New York (Borough of Brooklyn)—The Dept. of Plants & Structures, Municipal Bldg., New York City, will soon award the contract for the construction of a housing station, machine and repair shop on Water and New Dock Sts. Estimated cost, $350,000.

N. Y., New York (Borough of Brooklyn)—M. Rich, 253 Throop Ave., will build a 1 story, 100 x 100 ft. garage on 1st Ave. Estimated cost, $65,000.

N. Y., New York (Borough of Manhattan)—J. J. Hearn, 15 West 96th St., will build a 1 story garage on Washington Ave. Estimated cost, $30,000.

N. Y., New York (Borough of Brooklyn)—H. Lindenbaum, 271 East 2d St., New York City, will build a 1 story, 100 x 100 ft. garage on Norman Ave. Estimated cost, $30,000.

N. Y., New York (Borough of Manhattan)—M. J. Martin Sons, c/o S. J. Kessler, Archt. and Engr., 529 Cortlandt Ave., Bronx, will build a 2 story, 110 x 125 ft. garage on 23d St. Estimated cost, $100,000.

Pa., Myerstown—The Myerstown Fdry. Mfg. Co. L. F. Krum, Pres.—new tools.

Pa., Philadelphia—The City Transit, 1211 Chestnut St., has awarded the contract for the construction of a 1 story inspection shop at Bridge St. Yard, for Frankford L. Cost to exceed $100,000. Noted Jan. 13.

MIDDLE WEST STATES

Ill., Chicago—The Amer. Insulated Wire & Cable Co., 954 West 21st St., is having preliminary plans prepared for the reconstruction of a 1 story, 196 x 200 ft. factory on 22d and Fick Sts. Estimated cost, $250,000. D. S. Klafter, 64 West Randolph St., Archt.

Ill., Chicago—The Chicago Blow Pipe Co., 216 North Sacramenta Bl. will soon award the contract for the construction of a 1 story, 75 x 75 ft. factory on West Lake and Clarkson Sts. Estimated cost, $30,000. Z. E. Smith, 305 East 55th St., Archt.

Ill., Chicago—J. D. and E. J. Duffy, 139 West Washington St., have awarded the contract for the construction of a 1 story, 90 x 120 ft. garage at 2906 North Clark St. Estimated cost, $55,000.

Ill., Chicago—The Floyd Mfg. Co., 522 South Clinton St., has awarded the contract for the construction of a 1 story, 35 x 60 ft. power house and a 2 story, 120 x 240 ft. factory for the manufacture of light tools, on Diversey St. and Harding Ave. Estimated cost, $175,000.

Ill., Chicago—The Parmelee Transfer Co., 105 West Adams St., has awarded the contract for the construction of a 1 story, 150 x 190 ft. garage on Monroe St. and Racine Ave. Estimated cost, $110,000.

Ind., Indianapolis—The Indiana Refrigerating Co., 232 South Pennsylvania St., will build a 2 story refrigerating plant. Estimated cost, $50,000.

Mich., Detroit—C. E. Konneker, 502 Moffat Bldg., is having plans prepared for the construction of a 3 story, 132 x 145 ft. automobile sales building, to include a service department, on Cass and Kolburn Aves. Private plans.

Mich., Detroit—The Michigan Stamping Co., 3171 Bellevue Ave., will soon award the contract for the construction of a 1 story, 60 x 480 ft. addition to its sheet metal working plant. A. Kahn, Marquette Bldg., Archt.

O., Cleveland—The Industrial Iron Wks. Co., 16025 Saranac Rd., is having plans prepared for the construction of a 1 story, 60 x 150 ft. factory and warehouse on Saranac Rd. Estimated cost, $50,000. O. Horn, Secy., Allen Osborn Co., Rose Bldg., Archts.

O., Cleveland—A. F. Regyner, 9523 Orleans Ave., has had plans prepared for the construction of a 1 story, 67 x 115 ft. garage on East 93d St. and Orleans Ave. Estimated cost, $50,000. A. E. Skeel, 4500 Euclid Ave., Archt.

O., Cleveland—The Sabin Machine Co., c/o H. B. Sabin Pres., 6536 Carnegie Ave., plans to build a 3 story, 50 x 80 ft. addition to its factory. Estimated cost, $40,000.

O., Columbus—The Ohio Highway Dept., South High St., is having sketches made for the construction of a 1 story, 213 x 460 ft. garage on West Broad St. Estimated cost, $75,000.

O., Youngstown — F. Leish, 224 East Boardman St., plans to build a 2 story, 70 x 140 ft. garage. Estimated cost, $200,000.

Wis., Evansville — Miller & Winn, East Main St., have awarded the contract for the construction of a 1 story, 60 x 130 ft. garage. Estimated cost, $45,000.

STATES WEST OF THE MISSISSIPPI

Kan., Lawrence—The Bd. Educ. is having plans prepared for the construction of a 2 story high school to include shop, etc. Estimated cost, $500,000. I. C. Stevenson, Supt. W. B. Ittner, 915 Locust St., St. Louis, Mo., Archt.

Mo., Joplin—The Joplin Steel & Malleable Co., East 3d St., will build a 1 story foundry and machine shop addition to its plant. Estimated cost, $8,000.

Mo., St. Louis — The Waycleanse Co. plans to build a plant for the manufacture of vacuum street cleaners. Estimated cost, $300,000. M. Smith, Pres.

CANADA

N. S., Trenton—The Nova Scotia Steel & Coal Co. will receive bids until March 15 for the construction of a machine shop, boiler house and forge.

Ont., Belleville—The Ontario School for the Deaf—$18,000 worth of shoe shop machinery and $2,500 worth of carpenter shop machinery.

Ont., Burwash—The Industrial Farm—$4,500 worth of machinery, etc, for workshops.

Ont., Kitchener—J. M. Schneider & Son, 63 Courtland Ave., E., will soon award the contract for the construction of a 1-story, 35 x 85 ft. garage. Estimated cost, $10,000. W. H. E. Schmalz, Frederick St., Archt.

Ont., London—E. Leonard & Sons, York St., have awarded the contract for the construction of a 2 story factory for the manufacture of steam engines and boilers. Estimated cost, $35,000.

Ont., Tilbury—The Gove Motor Car Co. will receive bids about April 1 for the construction of a 2 story, 85 x 200 ft. factory on Main St. Estimated cost, $100,000.

Ont., Toronto—G. Buschlen, R.R. No. 1, Parkway Ave., will soon award the contract for the construction of a 1 story, 40 x 90 ft. garage on Queen St. Estimated cost, $18,000.

Ont., Toronto.— The Temiskaming & Northern Ontario Ry. Comn., 56 Church St., plans to build shops and engine houses. Estimated cost, $78,800.

Ont., Welland—C. E. Nash has awarded the contract for the construction of a 2 story garage. Estimated cost, $18,000.

Que., Hull—W. Cross will receive bids until March 28 for the construction of a 50 x 75 ft. garage, on Chelsea Rd.

Que., Montreal—The Supercharge Engine Co. of Canada Ltd., 120 St. James St., will soon receive bids for the construction of a plant.

General Manufacturing

NEW ENGLAND STATES

Mass., Brookline (Boston P. O.) — The town has had plans prepared for the construction of a 1 story, 95 x 175 ft. addition to its manual training school on Tappen St. Estimated cost, $80,000. F. J. Untersee, 585 Boylston St., Boston, Archt

Mass., Framingham—The Dennison Mfg. Co., 26 Franklin St., Boston, is having plans prepared for the construction of a 4 story 70 x 100 ft. addition to its plant, here, for the manufacture of tags, etc. Monks & Johnson, 99 Chauncey St., Boston, Archts and Engrs.

Mass., Natick—C. W. Dean & Co., North Main St., will soon award contract for the construction of a 3 story, 45 x 170 ft factory for the manufacture of shoes. Estimated cost, $100,000. Private plans.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Phelps Can Co. Lawrence St., has awarded the contract for the construction of a 1 story, 112 x 177 ft. factory. Estimated cost, $32,000.

SOUTHERN STATES

Ala., Birmingham—The Central Ice Co., 2214 Ave. A., plans to construct an ice storage plant. Estimated cost, $10,000.

La., Bastrop—The Bastrop Ice & Storage Co. plans to construct an ice plant. Estimated cost, $25,000. G. M. Boyd, Mgr.

N. C., Ashboro—C. C. Cranford plans to build a 2 story, 40 x 200 ft. chair factory to have a capacity of 1,000 chairs per day.

N. C., Kinston—H. C. Hines will build a 2 story, 30 x 105 ft. ice cream plant. Estimated cost, $50,000.

S. C., Columbia—C. C. Wilson, Archt. Palmetto Bldg., will receive bids until March 14 for the construction of a 2 story, 90 x 118 ft. printing plant on Sumter St., for the R. L. Bryan Co., 1425 Main St.

W. Va., Williamsport—W. H. Miller and G. Steffey plans to organize a company with $25,000 capital stock and establish an ice manufacturing plant.

MIDDLE WEST STATES

Ill., Chicago — The Friedman Kerr Co., 1407 West Jackson Blvd., will soon award the contract for remodeling a 4 story, 75 x 100 ft. store and loft building on Madison and Green Sts., into a candy factory. W. W. Ahlschlager, 65 East Huron St., Archt.

Wis., Antigo—The Langlade Laundry Co. plans to build a 2 story, 40 x 120 ft. laundry

Wis., Kenosha—The Blommer Ice Cream Co., 1502 North Ave., Milwaukee, is having plans prepared for the construction of a 1 story, 50 x 62 ft. ice cream factory and garage. Estimated cost, $30,000. C. H. Stehling Co., 401 4th St., Milwaukee, Archts. and Engrs.

Wis., Milwaukee — The Kuryer Polski Publishing Co., 435 Bway., is having plans prepared for the construction of a 3 story, 60 x 120 ft. newspaper plant on Wisconsin St. Estimated cost, $100,000. L. M. Gurda, 920 2d Ave., Archt.

See "SEARCHLIGHT" for Business Opportunities

American Machinist

Volume 54 NEW YORK, MARCH 17, 1921 Number 11

Pratt & Whitney Toolroom Planer

Intended for High-Speed Operation on Tool Work—Parts Heavily Constructed—Control Made Easy and Accurate—Either Motor or Belt Drive Furnished

SPECIAL CORRESPONDENCE

ACCURATE planing is usually the basis for the accuracy of the finished product. This is especially true in tool and fixture work and in the manufacture of interchangeable parts of all kinds. Precision planing requires more than an accurate machine. It is impossible to produce accurate work with a machine which is not rigid enough to withstand the strains due to clamping and to heavy cuts taken at high speed.

After a careful study of the planer field and of its demands, the Pratt & Whitney Co., Hartford, Conn., has designed and placed on the market the toolroom planer shown in Fig. 1. The machine is distinguished by the rugged construction of the vital parts and by the liberal dimensions of the wearing surfaces, as well as by the accuracy of its working surfaces and tool positions. Exhaustive tests in various plants have shown, it is said, that the machine is capable of taking heavy, accurate cuts at extremely high speeds, and that it possesses a large number of time-saving features which should appeal to the operator and to those in charge of production.

While in general appearance it resembles other planers, the detailed description which follows will serve to emphasize the various features that make it distinctive. The bed is of deep box section, extending to the floor line. Its top is cast closed, with a web below the driving gears in addition to the usual reinforcements, so as to assure accuracy and rigidity. The sketch at the left of Fig. 2 shows the normal section of the bed, with the closed top and the sides extending to the floor. At the right is a section of the bed at the bearings of the bull-gear shaft. The opening at the top allows the bull gear to mesh with the rack, and the closed bottom provides the oil pocket for splash lubrication. The two V-ways are spaced far apart to insure stability. The bed is strongly braced, and the area of its cross section increased at the driving gears.

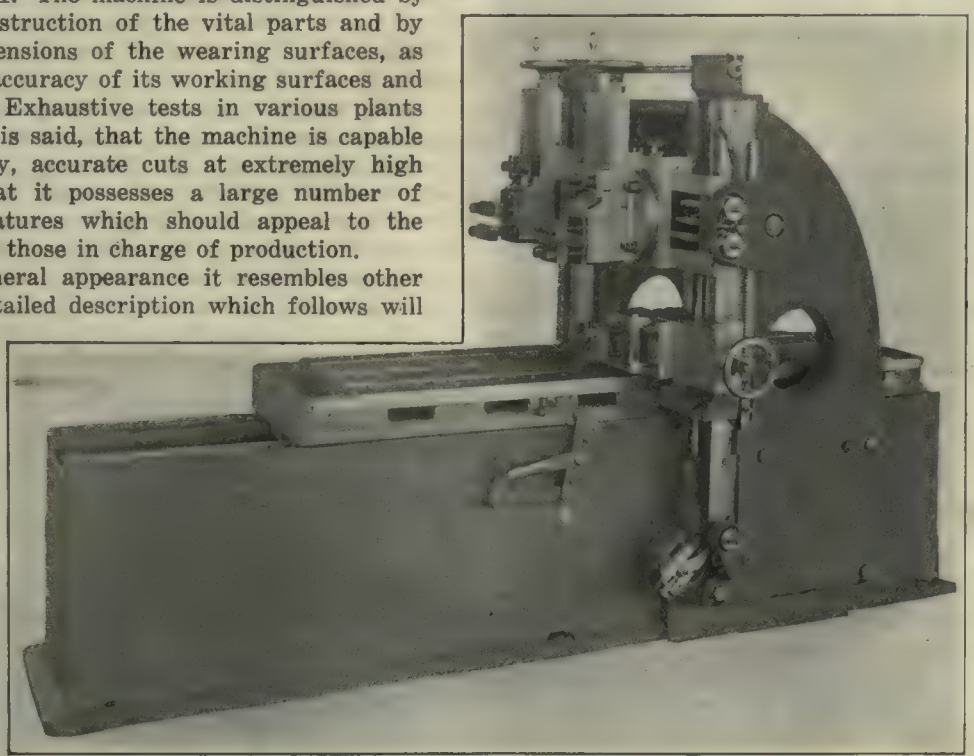


FIG. 1. PRATT & WHITNEY PLANER FOR TOOLROOM USE

The housings are of deep arched box construction, designed in correct proportion to the bed. In addition to being securely bolted, they are tongued, grooved and taper gibbed to the bed, an arrangement that is stated to be an exclusive Pratt & Whitney feature, thereby insuring accurate alignment and maximum rigidity. The rail and side-head bearings are of liberal proportions, and are carefully scraped and fitted.

The rugged box form of table is a heavy cored-out casting, with the bottom completely closed to prevent chips and dirt from falling through the pin holes in the table top and lodging on the ways. The top surface of the table is accurately planed and provided with longitudinal T-slots and numerous holes drilled through the table top for stop pins, thus providing adequate clamping facilities. Cored openings in the side of the table allow of the removal of accumulated chips without endangering the bearing surfaces. The section of the table can be seen at the top of the figure. The table is driven by means of an accurately cut Maag form of rack meshing with a generated gear. The bull gear is driven from the high-speed drive shaft through one intermediate shaft by means of compounded Maag generated gearing, which is said to give to the table a smooth, quiet motion, resulting in accurate, highly finished work, even at extremely high speed.

All driving gears are enclosed and run in oil, both the gears and the racks being made of steel and designed for heavy duty and smooth action. The bull gear is bronze bushed and revolves on its shaft, which is securely fixed in the bed at each end, thereby adding rigidity to this unit. The intermediate shaft, carrying the feed

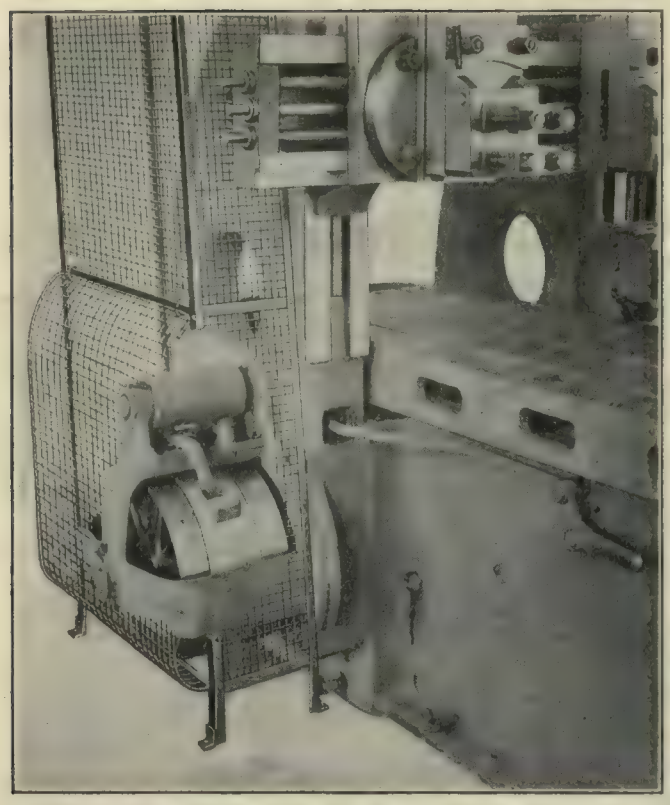


FIG. 3. LEFT-HAND SIDE, SHOWING CONTROL AND BELT GUARD

drum, runs in bronze bearings. Ball bearings are used for the idler pulleys and for the high-speed drive shaft. This shaft runs in perfect balance, and is well supported in a triple ball-bearing mounting. All other bearings are of bronze, lubricated automatically by the splash system.

The table dogs are worthy of attention. Quick adjustments for the length of stroke can be made while the machine is running, without the use of a wrench. The rack-and-pawl action makes these stops positive without danger of slipping. Hardened steel rollers on the rocker arm make the wear negligible and insure smooth action. A handle is provided on each side of the machine to permit hand operation of the rocker arm when desired. Finer adjustment of the table travel, as for planing to a shoulder, is provided for by the micrometer screw on the front dog.

Cross Rail and Heads

Unusual depth and ample bearing surfaces are provided for the cross-rail. Clamping is accomplished by means of a single lever which operates clamps on the inner sides of both housings. This is a decided advantage over the method of going around the machine to tighten the bolts. The clamps are very powerful, the shortened distance between them reducing the length of rail liable to distortion. The clamping lever can be seen above the end of the rail in Fig. 1. The rail is hung on ball thrust bearings for ease of operation.

In addition to their sturdy construction, the heads are provided with adjustable taper gibs throughout. Increased rigidity is obtained by making each saddle in one piece and clamping the swivel by three bolts, one of which is at the top, thus equally distributing the holding power.

The heads are offset right and left, respectively, permitting the tools to be brought close together, and they are provided with automatic feeds in all directions. All feed screws are equipped with graduated dials. The slide screws are mounted on ball thrust bearings. Power feeds are obtained through self-contained removable ratchet pinions, mounted as shown in the illustration, the direction of feed being governed by the conveniently placed ratchet levers. The heads can be locked on the rail and the toolslides clamped by means of convenient screw binders.

The Drive

The countershaft is arranged for two cutting speeds. Aluminum pulleys are provided, which, in conjunction with the quick acting mechanism, makes it possible to run the planer on extremely short strokes without sacrificing speed. The belts are located at the back of the machine out of the way, and are completely guarded, as can be seen in Fig. 3.

On the rear of the machine a hand belt shifter is also provided, thus permitting the machine to be started or stopped from either side. The combination rocker-arm and hand belt shifter on the front of the machine is provided with a spring detent, which materially assists the operator to locate the neutral position, and at the same time keeps the hand lever securely in place. This type of lock is said to be superior to the positive pin in that it is unbreakable and automatic.

An adjustable-speed reversing motor can be connected

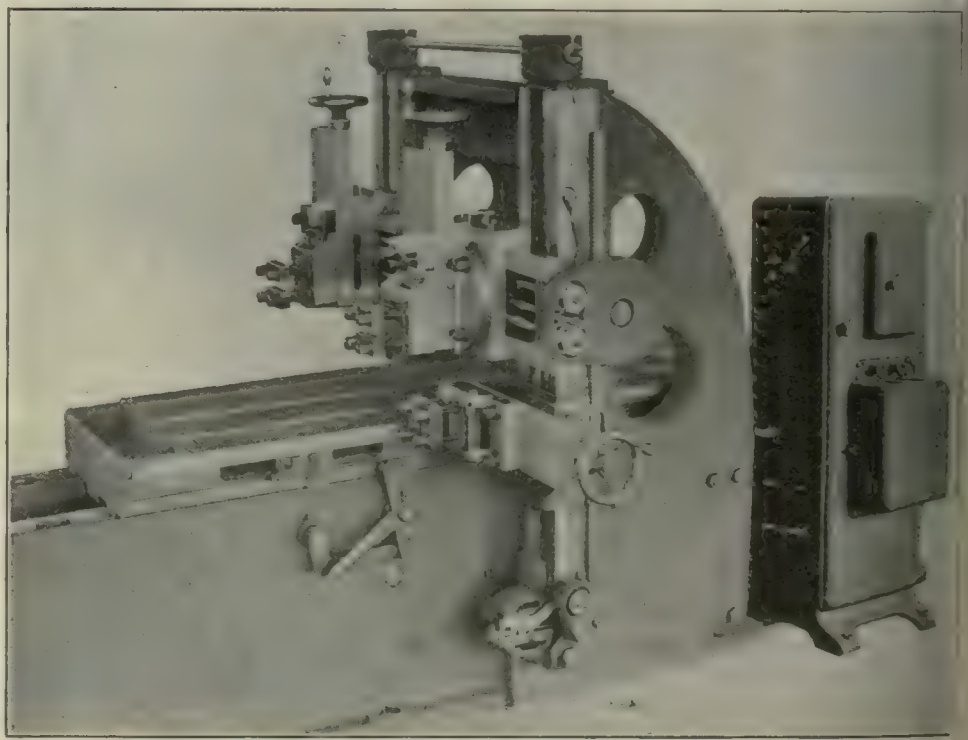


FIG. 4. POSITION OF CONTROL BOX FOR THE REVERSING MOTOR DRIVE

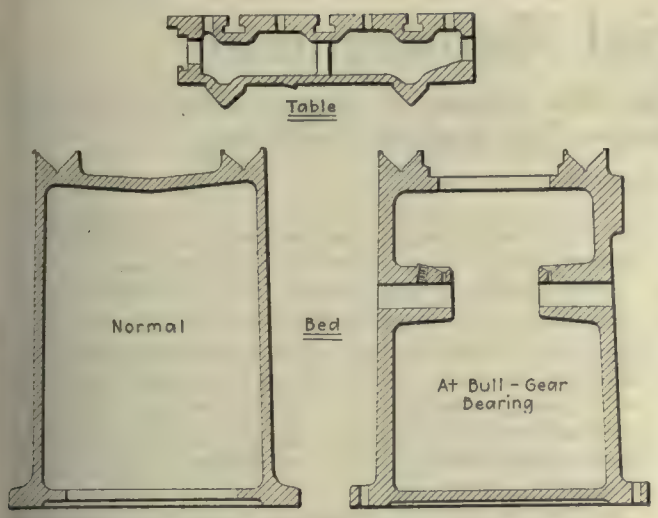


FIG. 2. SECTIONS OF TABLE AND BED

directly to the high-speed shaft through a coupling, the pulleys being removed. The automatic control, which is of the standard Niles-Bement-Pond type, is actuated by the table dogs. The arrangement of the control box can be seen in Fig. 4. This figure shows, also, such features as the control mechanism on the planer, and the oiling rollers in the V-ways.

The machine is made in two lengths, for 6- and 8-ft. strokes, respectively, the maximum width of the work in both cases being 26 in., and the height 20 in. It can be furnished with either one or two heads on the cross-rail, and with or without the side head. The regular equipment includes a two-speed countershaft, a set of wrenches and a screen belt guard.

Specifications: Distance between housings, 26⅛ in. Height under cross-rail, maximum, 20⅛ in. For 6-ft. and 8-ft. stroke, respectively. Length of bed, 9 ft. 7 in. and 12 ft. 6 in.; table, length overall, 7 ft. and 9 ft.; net weight with 1 rail head and counter shaft, 8,995 lb. and 10,195 lb. Table width, 24 in. Minimum stroke, low speed, 4 in. Depth of cross-rail, 11 in. Length of down feed, 10 in. Distance between tools, minimum, 6 in. Tool openings, 2 x 2⅜ in.

Belt drive: Countershaft speeds, 345 and 485 r.p.m. Diameter of driving pulleys on machine, 16 in. Width of belts to machine, 2 in. Cutting speed, 30 and 42.5 ft. per minute. Return speed, 60 and 85 ft. per minute.

Reversing motor drive: Horsepower, 5 or 7½. Cutting speeds: number, 14; range, 30 to 60 ft. per minute. Return speeds: number, 4; range, 60 to 120 ft. per minute.

Comment on Shop Politics

By Cecil K. Perkins

Allow me to comment on L. J. Voorhees' article entitled "Shop Politics," on page 235 of the *American Machinist*. It is somewhat gratifying to have someone open-minded enough to give us his opinion of the adverse conditions in some of our plants. The writer, having spent some twenty years in the shop and offices of several plants, is in a position to bear out his statements.

If some stockholders and directors only knew the inside workings, as well as the men inside, they would not be able to sleep. I have seen many thousands of dollars lost through the inability of higher-ups to place the round pegs in round holes.

A Place for Everyone and Everyone in His Place

I might cite such cases as medical students as industrial engineers; drug-store clerks as managers of tool companies; polishers as industrial-relations heads; newspaper men as chief inspectors. This last case proved a very expensive adventure for the company, the man being a wonderful organizer and speech maker, but his understudies soon got tired of "bunk" and the whole organization was soon broken up with the loss of the good men.

I have sat in production meetings where it was a bore to hear some people pass the "buck" and a shame to see money literally thrown away. It is true that the "bluffer" does not last long, but it is very often the case where he is around just long enough to disrupt the whole organization, at the same time giving labor a chance to criticize, for what man in the shop cares to be dictated to by a mere fashion plate.

We read lots about efficiency, co-operation and co-ordination, but the ideal conditions are impossible while we have so much partiality, making it much harder for the square man to bear.

However, it is hoped that the near future will be more favorable to the honest man, as the competitive period will call for more care to be taken by our directors and managers in their selection of capable executives.

Expanding Aluminum Ware by Hydrostatic Pressure

By Amos Ferber

The article on page 192 of *American Machinist* by J. R. Sheppard, in reference to using water pressure instead of a rubber punch for drawing hollow ware of aluminum, would indicate that he does not quite grasp Mr. Lindgren's objection.

There is no doubt but that aluminum, or any other drawing metal, may be formed by the hydrostatic method, for that method has been in successful use for many years; but it has two faults that must be considered as serious.

If water (or oil) by any chance gets into the die *outside* the shell and is trapped there, the shell will not fill the die, no matter what pressure is applied. As the chances are several to one that the expanding medium *will* get into the die, despite all efforts to keep it out, the loss from imperfect shells is very likely to be large.

The Danger of "Weep" Holes in the Die

The answer would seem to be to put drain or "weep" holes in the die, but, as Mr. Sheppard admits, shells expanded by pressure will show "even the faintest scratches in the die; so it becomes a difficult proposition to put weep holes in a die that will not produce corresponding weep holes in the shell—which would prove highly undesirable if the latter were a tea kettle or some similar utensil.

However, it is possible to overcome this trouble, but there is an even greater difficulty to be encountered. Aluminum is a rather porous metal and its porosity is not diminished to any extent by blowing it up like a balloon.

The spinning process tends to overcome this serious defect in an otherwise almost perfect material for hollow ware. The spinning tool acts upon the metal in much the same manner as the blacksmith's hammer upon a billet of steel: elongating the crystals and kneading them together to produce a homogeneous structure, tolerably free from porosity and capable of taking a fine finish, which the plain drawn shell will not do.

Steps in Industrial Management

Distinction Between Management and Capital—The Duties of Management—The Challenge Presented to Industry Today—The Tools of Leadership

By ERWIN H. SCHELL

THE history of the manufacturing industry has shown a constant refining of the structure of management. Tasks of maintenance have been separated from the work of operation, and specialists have gradually been introduced to shoulder responsibilities hitherto carried by the executives in charge of direct production, making it possible for these executives to focus their entire attention upon the work of labor control—of man-management. As the industrial confusions resulting from the war are gradually eliminated, those who are in search of an effective agency to reduce labor unrest are turning to the administrative organizations, those finely articulated structures of control manned by the production executives, who direct the employees in the operation of converting raw materials into finished product. It is in these organizations that labor management finds its rightful place, and their application of enlightened methods of handling men will prove a powerful factor in the strengthening of our industrial fabric.

The conception of management as an agency apart from labor, from capital and from the public is becoming more clearly defined. While the term "employers" is still in use as comprehending both management and capital, the line of distinction between these two is steadily becoming more plain. It is increasingly evident that management is the rightful arbiter between capital, labor and the public, and, further, that there should be no legitimate need of arbitration between management and any of these three.

It is management's responsibility to be in the right in any points of difference arising between it and labor, capital or the public, and if in the wrong to make frank acknowledgment and immediate rectification. If any of these three be in the wrong, upon management falls the second responsibility of showing them the right and educating them to its acceptance. If management fails in either of these responsibilities, it is not successful management. The industrial plant which finds it necessary to use, or rather, misuse the shop committee plan to avert labor unrest caused by friction between employees and executives, is introducing a substitute for effective labor management. The organization which finds it necessary to appoint the employment manager or other official as arbiter between the production executive and the workmen is introducing a substitute for effective labor management. These policies would be similar to that of the Government had it determined to fight the yellow fever in the Canal Zone through the introduction of vast hospitals, rather than the method which it so effectively pursued by which the *cause* of the yellow fever was eliminated.

Human Education Needed

The challenge which is presented to industry today demands a marked improvement in modern technique of administration. It demands a knowledge of the bases of leadership which may be used in a reasoning way by man-managers. It asks an exposition of the principles and laws governing the organization of the will, so that the long road of experience to executive proficiency can be shortened through training and education.

That this is possible, there can be but little doubt. The military organizations have given the matter objective consideration for some time. The text of Brigadier-General Lincoln C. Andrews' book entitled "Leadership and Military Training," is largely devoted to this subject, and on the cover of the book is printed a quotation from General Sherman, "A knowledge of human nature is half the art of war."

An inaccurate but somewhat useful analogy to the handling of men may be found in the cultivation of the soil. A study of this activity might divide itself into the following parts: (1) The prerequisite characteristics of a good farmer; (2) characteristics and abilities which may be developed through training and experience; (3) the proper tools necessary; (4) the soil; (5) the proper use of the tools by the farmer in the soil; (6) general difficulties of cultivation and means for overcoming them.

In like manner the study of human administration may be approached. The initial characteristics essential to leadership, those which may be developed, and the qualities which are most effective in the organization of the employee, may be considered in turn. The study of the effect which inherent impulses, desires and motives have upon the conduct of the employee yields valuable conclusions. The "one best way" of accomplishing the routine activities involved in the management of men in any one organization is susceptible of determination. Lastly, recurrent problems of administration may be examined and suitable solutions suggested.

It is generally conceded that not every individual is fitted for executive work. Any successful administrator who has had the task of selecting promising candidates for executive work, will undoubtedly recall numerous instances of applicant rejection, perhaps even on sight. The fact that certain insurance companies have for some years made use of a rating scale in the selection of agents, indicates a conviction that certain characteristics are commonly essential to good salesmanship. What then are similar essential characteristics in administrative work?

Qualifications of Administrative Ability

It is obvious that requirements will vary in different industries, will be further influenced by other variables such as the type of work, the sex, nationality or age of the employees, and will, therefore, have to be determined for each establishment. There are certain qualities, however, which may be of almost universal requirement. Physical and mental vigor are perhaps two examples. The executive of tomorrow must have natural capacity for hard work, and ability to think quickly. An inborn honesty with oneself constituting the magic which transforms mistakes and errors into stepping stones toward success is another important prerequisite. An innate capacity for loyalty is of great importance. A natural love of people, an inherent interest in human

ity is unquestionably essential to success in handling men. These suggestions indicate concrete qualifications which may be assembled and verified as the introductory step in the study of man-management.

Contrary to an apparently general opinion, there are numerous characteristics essential to success in administrative work which may be developed through effort and study, and are not necessarily inherent traits of the would-be executive. Many men have learned through bitter experience the administrative value of self-control. Many have been spurred on to success by an ambition which grew more powerful as their ability increased. Not a few of our administrators have entered their vocation, timid, abashed, reticent, but have sensed the resources of self-reliance and have developed courage, aggressiveness and self-confidence. Business judgment, that most precious of industrial assets, is a characteristic which is the fruition of education, training and experience. Vision, foresight, ability to forecast the industrial future is a faculty which results from painstaking care and study. Ultimately every establishment will see the wisdom in carefully determining these qualities and the methods by which they may be fostered in the men who are preparing for future administrative work.

The tools of leadership, the instruments which make for co-operation, with which to obtain discipline and arouse incentive, are also worthy of thoughtful inquiry. The ability to decide is not the least of these agencies, for uncertainty is a great breeder of discontent. The man who is fair finds that he is satisfying one of the most powerful cravings of mankind—the desire for justice. Patience and tolerance are often gilt-edged investments in the development of *esprit*. Enthusiasm is contagious. The power of cheerfulness is so well understood as to hardly require comment. Frankness is a great time-saver. Tact, regard for the personalities of others, has often shown the way around seemingly insurmountable difficulties. Charm or likableness, the regard which comes from a sincere desire to enjoy humanity, will attract followers and beget co-operation when other efforts have failed. These and other similar qualities are of the utmost practical importance to successful administration. They should be brought into the light of reason and analysis, their particular value in the work of management should be defined and understood, and ways of acquiring skill in their use evolved.

Personal Development

The fact that the department of human beings is very largely influenced and motivated by innate impulses which ask expression is common knowledge. There are in every person certain well-defined desires which crave satisfaction in his or her vocational work, and which, when given play, allow for the normal development of a well-rounded personality.

The desire to protect those who are dependent and to better, if possible, their standard of life is common to every individual. The executive who senses the play of this impulse when one of his older employees requests a position for his son at a time when it is evident that no more employees are needed, or when the otherwise amiable girl employee flies into a rage at some slighting remark concerning her sister or brother, is able to cope with the situation far more effectively than when he translates the action in terms of the employee's reasoning, or lack of reasoning. The high feeling which spreads with such rapidity through a group of women workers upon even a rumored partiality or injustice becomes a logical occurrence when viewed with an understanding of the powerful inborn cry for fairness and justice which lies dormant in every person. The commendable spirit or atmosphere of the organization in which the executives are approachable, democratic and frank is at once explained when it is sensed that the employees have been given outlet for self-expression and self-assertiveness. The workman who is assigned a locker which bears his name or who has his machine or bench thus designated, obtains an immediate satisfaction which is perhaps unexplainable to himself. In feeling, if not in fact, these things are his; his wish to possess is gratified. The sight of the first aircraft flying above the factory in which it was constructed, stirs the employees to heights of enthusiasm. They return to their work with an increased desire to improve its quality. They can see the results of their work; their creative impulse has been satisfied. When the solitary workman in the far part of the shop resigns because he "doesn't like the work," the trained executive realizes that his real objection is that he is lonely, not for conversation but for the near presence of others. Man is a social being, he unconsciously asks company.

Executive Democracy

The factory picnic if properly conducted when the boss takes off his coat and plays ball with the boys is a topic of unfailing interest and enjoyment. The organization which sends through the shops half-hourly bulletins of baseball scores during the World's Series, stirs a feeling of real appreciation in the workmen, for there has been indicated a recognition of the fact that "we are human," as the workman puts it, and that recreation, play, and games have a deep-seated place in his make-up. The eagerness of many employees to know their jobs better when the fear of dismissal for ignorance is removed shows the presence of a natural wish to learn, a desire having immense potentialities for good when properly cultivated and fostered. Not the least of these longings is the wish for good leadership. During the early part of the war an official in the Department of Labor was interviewing a structural iron worker who desired to become of service in the building of fabricated ships. When questioned regarding the particular yard in which he preferred employment he answered, "It makes no difference to me, and wherever I go, three hundred workmen will follow. I have just finished a job and when I began it, my boys came several hundred miles to work for me. We were on the job for three weeks before any of us knew how much money we were going to get." Nothing but a great satisfaction in the confidence of good leadership would impel this type of co-operation. If all of our executives measured up to this standard, it seems obvious that our present labor unrest would be materially diminished. Fortunately, there is now to be had literature of a practical sort which is of assistance in the study of this phase of management. The general description of the field of inquiry above presented is sufficient to indicate the extent of the rewards resulting from a working knowledge of these instinctive characteristics of human nature.

The technique of man-managemnt, the actual procedure through which the executive effectively functions is worthy of careful study. Considering first the new employee entering the factory it is entirely possible in

any one industry to determine upon the "one best way" of introducing him to his new environment. At no time is he more sensitive to his surroundings, no later impressions will have the degree of permanence found in those which he gains upon entrance. Is the true "spirit of the shop" then presented to him; is there aroused in him the sense of good-will which is the greatest investment any organization can make in an employee?

Consistency Breeds Discipline

What is the right way to secure a high degree of discipline? It has been said that discipline through emulation is built on the firmest foundation possible. If the executive is prompt in attendance, the employees can more easily be taught the habit. But, it may be argued that discipline is an intangible thing, that it cannot be discussed, that it has no approach through the channels of analysis or experience. The following quotation from Major Bell which deals with the relation of uniformity and severity in discipline is perhaps the most fitting response to this attitude:

"It makes little difference how rigid the discipline—how taut the requirements: if the discipline is consistent it will be a happy institution. Everything is run today as it was yesterday, and will be tomorrow and all hands know what to expect. At all times everybody knows what can and what cannot be done and can adapt himself accordingly. Consistency is more important than strictness or severity. It is the unfairness that hurts rather than the severity."

Is praise or commendation of value in management? If so, how can it most effectively be applied? Should it be given publicly or privately. Should it be presented seriously or jocularly? What are the pitfalls attending its use and how may they be avoided? There are very few individuals who cannot recall personal rebuke or criticism which later proved to be of great benefit to them. How was it administered? Is it essential that to be effective, it must be unpleasant? What is the desired attitude of mind of the employee after rebuke or criticism? How may this attitude be gained? These questions are merely suggestive of the manner in which these considerations may be approached and indicate the entire appropriateness of this method of analytical investigation.

The proper procedure of dismissal or transfer is subject to similar scrutiny. An intimate personal knowledge of the employee on the part of the executive is conducive to satisfying returns. What are these definite items of information which the executive needs in order to deal effectively with his men? Salesmen are equipped by their manager with a questionnaire concerning the habits and hobbies of customers to be filled out before the man is approached. Have the executives given equal thought to their relations with labor? The salesman is taught with great care the technique of selling to the customer the ideals and policies of his concern as exemplified by the product. The executive has an identical task before him in acquainting the employee with the ideals and policies of the company as exemplified by his surroundings and work.

Personal Interest An Incentive

The arousing of interest in the work is always a necessary precedent to the awakening of a desire for its accomplishment. When the workman realizes that the finished product of the organization has a real service to perform and does effectively perform it, his interest is challenged. When the workman senses the presence of a problem, an opportunity which demands skill, cleverness and experience, his interest is challenged. When a workman is given to understand that any suggestions for the improvement of the process will be sincerely appreciated and equitably rewarded, his interest is challenged. These examples suggest the broad field for profitable research which is offered here.

The knowledge of incentives, and their use, whether financial or non-financial is of greatest importance to the administrator. It is largely this resource which enables one individual to attain success in executive work where another of equally good capacity may fail. The leader who understands the value of the "task" as distinguished from "work," who can use the rate increase to its greatest advantage in the stimulation of effort, who can introduce the spirit of the game into his organization, has at hand powerful incentives for production. These and many other similar spurs toward effort are again capable of analysis and formulation. In every industry there is opportunity to determine those which will be of greatest value and to make definite the procedure of application.

Executive Spirit Lacking

The time-honored sign of authority has been the order. Its form, content, manner and time of issuance are subjects which are entitled to the most searching objective consideration. The use of the verbal vs. the written order, the advisability of preceding the written order with the verbal presentation, the policy regarding accompanying explanation, the useful effect of brevity, the attending responsibility for execution, the effect of repetition, vagueness, and frequency upon discipline are illustrative of the many phases of this subject which may receive attention. It is also most important that the safeguarding of the privilege of giving orders be carefully considered. Executive organizations need *esprit* and *morale* as do any group of men working together for a common purpose and perhaps the most sinister thrust at the spirit of these men is made possible through the improper safeguarding of the prerogatives of authority which enables them to maintain rightful control. The giving of orders to labor by functional officials has been a most deadly weapon in the cause of disorganization. The presence of this condition today invites investigation in many American industrial plants.

Many administrative problems of a recurrent nature face the executive. It is logical to view these difficulties in the same light of reasoning as is thrown upon technical obstacles and obtain solutions representing careful thought freed from the confusing environment in which the difficulty occurs. Consider the complaint, for example. Many times submitted when the employee is under the influence of emotion, anger, jealousy, wounded pride or revenge, and sponsored by a complex of motives, it is not an issue to be dealt with without thought or without a background of comprehension. What is the first step in the proper procedure of treatment? One suggestion might be that no direct response to the complaint should be made until the maker has attained mental equilibrium, that is to say, until the pressure of the emotions has been withdrawn. The ability to draw a smile is a test of this condition. A second suggestion might be to allow the complainant

thoroughly express himself, "get it off his chest," to use shop vernacular. The personal attitude and demeanor of the executive is of first importance. It will undoubtedly vary with respect to the particular circumstances and individuals in each case, but there are certain general conclusions possible in each industrial plant which will indicate to the executives a general mode of procedure. How shall the executive deal effectively with a spirit of jealously, of revenge, of hatred, of underhandedness, of conceit, of hostility, of dishonesty, of restlessness, or of uncertainty when it is found to be present in the employee group? These conditions require positive, definite, and consistent remedial action. It should not be essential that all executives learn the remedies from the bitter school of experience. The future administrators should profit from the errors of those who have gone before. Religious differences, neighborhood feuds, political affiliations have been the cause of such so-called "hard feeling" between employees. Many of these troubles are not solved by time but wax more virulent as they proceed, perhaps creating serious consequences. Administrative action is imperative and a technique of the highest order is often essential to remove the difficulty in the most effective manner, with due regard for the retention of *esprit* and *morale*.

Possibilities of Man-Management

The field of investigation in the art of handling men has been sketched in a very brief way. The need of knowledge, and the formulation of laws and principles which govern successful administrative procedure is great. There is, however, one feature of great encouragement. There is today, in the experiences of successful leaders, a vast and satisfying fund of data which, if properly viewed and considered, will yield the desired facts.

There are successful leaders in every industry. There are men in every organization who, as the result of years of experience intuitively decide and act rightly in the performance of their duties as man-managers. If the technique of each industrial plant can be raised to the level of the best executive talent in the organization, a great deal will have been accomplished. To attain this result seems entirely possible. It will call for the development of a new form of investigation—an industrial research in the art of man-management.

What Is a First-Class Machinist?

By John Mark May

A man having the qualifications enumerated here should be listed as a first-class machinist: First, he must be a square dealer and an honest man. If otherwise, he cannot be depended upon to give first-class service, even though his ability does fit him for it. He would sacrifice whatever he could cover up, whether it be time, workmanship, tools, or what not. He should have a natural liking for things mechanical, and have some native ability in machinery lines. He must have a sense of feeling for machinery that would make him feel uncomfortable when around a machine that was loose and pounding, or groaning from lack of oil, and he always will be entertained by seeing or handling a well-made and well-kept machine, whatever kind it may be. The machine or tools he operates and the work he turns out will be treated as his friends, which indeed they are. Such a machinist will not put a center in a lathe, an arbor in a milling machine, or a drill in a socket without knowing that the parts are free from dirt and burrs. Neither will he slam the lathe tools or files down on the ways of a lathe, nor slide files over one another when putting them in a drawer. Acts like these would be too nerve racking for him.

He must have a good stock of common sense, for emergencies are ever arising that no set rules can cover, and the machinist, to be a success, must act on his own initiative. He must have experience. The amount of time required to gain this depends very much on how quick he is to absorb from his surroundings—probably from two years upward.

Machinists Need a Good Education

He should have a fairly good education and be good in mathematics. The degree of education he has and uses to good advantage—other things being equal—determines very largely where he will be rated in proportion to other men, but the first-class machinists with what is termed today a meager education are—not a few.

Thus far I have not said a word about the experience and knowledge he should have on machine tools, for I do not know yet just what position this first-class machinist is to occupy. He may be wanted to take care of a wood-sawing outfit consisting of a boiler, a steam engine, and a saw mill, that is so isolated from other machinery that he is obliged to get along without the aid of machine tools. He who fills that position satisfactorily is a first-class machinist, even though his experience and knowledge of machining has all been gathered at this place. There was a time when any man who successfully ran and repaired any one of the lines of equipment that are classed as machines was listed as such. What may be expected from a first-class machinist today is often very much different from what was expected ten years ago and the requirements are constantly undergoing a change due to new machinery, tools, and methods that are brought out each year. In view of this fact it would seem that the question of what is a first-class machinist is a very pertinent one and well worthy of discussion. Employers are puzzled as to how they can make their wants understood and workmen are puzzled when they try to classify themselves.

Specialization and the Machinist

Has not the range of things that a machinist may or may not be able to do become so great that it is not enough to say that he is a machinist of either first or second class? But that it should be stated in just what lines he is especially skilled, for instance: A machinist skilled in the use of all ordinary machine tools such as lathes, planers, boring mills, milling machines, slotters, cylindrical and surface grinding machines, drilling machines, etc., as well as the laying out of work, filing, hand fitting and erecting—such a description ought to convey to the inquirer the man's capacity and place him in the grade determined by the requirements of that particular position. This grade would from the varying nature of the work in some localities differ to a considerable extent.

The many and varied duties that are enumerated by J. A. Raught, on page 42, Vol. 54, of the *American Machinist*, as being done by many men of his acquaintance lead me to think that both soil and climate must be favorable for the growth and maturity of machinists in his locality.

The Draw-Cut Shaper in the Railroad Shop

A Tool With a Wide Range of Usefulness—Easy Handling of Irregular Parts—Examples of Machining of Brasses and Cylinder Castings

By FRANK A. STANLEY

THE draw-cut shaper is a tool of so many purposes in the railroad shop that it is well worthy of a special article describing a few of its various applications in regular engine shop and roundhouse operations. Although known as a shaper this machine is adapted for many classes of operations outside the province of the conventional design of tools in the shaper group. For example, on cylinder work, it not only serves as a shaper and travelling head planer, but also may be used as a boring mill, and a milling machine as well. Thus it may be seen in operation in the railroad shop, planing a cylinder, boring the valve chambers and milling the ports all at one setting; and further, it can be applied to the planing of the smoke box fit after the two cylinders are bolted together.

The accompanying engravings are reproduced from photographic views of typical operations performed upon various sizes of draw-cut shapers.

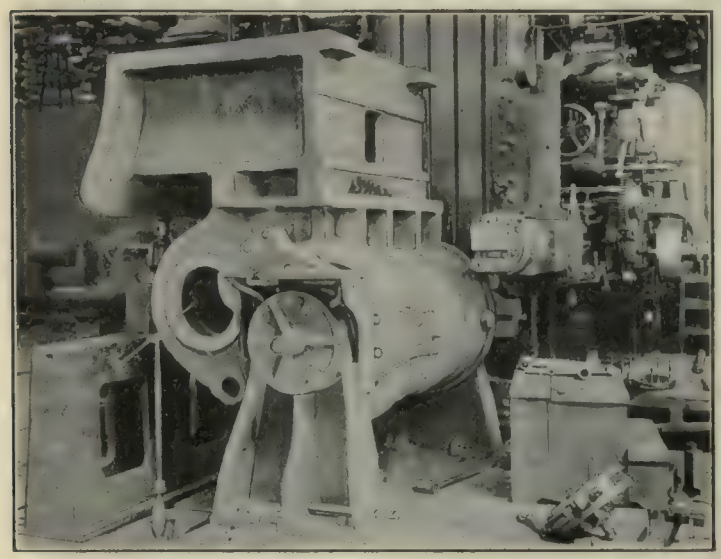


FIG. 1. METHOD OF SETTING CYLINDER BY SURFACE GAGE FOR MACHINING

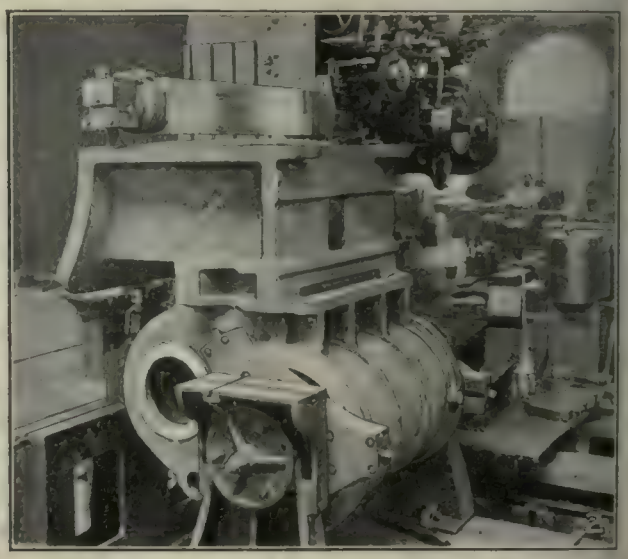


FIG. 2. PLANING THE JOINT FACE OF THE CYLINDER

Machining Big Locomotive Cylinders

The application of the surface gage to the setting up of the cylinder casting on the draw-cut shaper is illustrated by Fig. 1. The casting is located by its cylinder proper on a trunnion fixture forming a part of the machine and then adjusted to bring the steam chest opening to correct position and the joint face in horizontal position for the planing of the face as in Fig. 2. Jacks are placed under the outer edge of the casting as shown to the left in Figs. 1 and 2. The jack rests upon a frame or outboard support which is represented in the different views. This casting is in the form of a large parallel with accurately finished top and bottom surfaces and a T-slot is planed along the top as indicated. The top is finished to the same height as the center line of the trunnion fixture and by means of height blocks, scale, and surface gage it is an easy matter to bring the cylinder casting to proper adjustment for the machining operation. As a further aid in this direction, a narrow parallel or straight edge can be used in the slot in the top of the supporting block (as shown in Fig. 4). This view shows also a high jack screw used on certain jobs to support work from the outer corner which may overhang the main supporting block.

Referring again to Fig. 2, this engraving illustrates the method of planing the joint surface which is at the top of the casting when set in the present position. The long ram of the shaper extends forward sufficiently to operate over the entire area of this surface and the advantages of the draw-cut principle are well exhibited in the performance of the tool on a job of this character, as the tool ram, being in tension when under the cut, is relieved from vibration and chatter.

A still more interesting display of the peculiar features of this machine is exhibited by Fig. 3, which illustrates the method of planing out the cylinder frame fit where a long, offset cutting tool is necessary in order to reach down in between the cylindrical valve chest and saddle to machine the narrow, nearly enclosed surfaces.

The shape of the planing tool, the offset and the overhang, and the length of cut and narrow operating space for the toolhead, form a combination of conditions under which the advantages of the draw-cut principle show up most effectively.

In reference to various other planing operations, it will be evident that they may be attended to with equal facility. As the saddle with the tool ram and head can be operated up and down on the main column of the machine, the planing of vertical surfaces such as

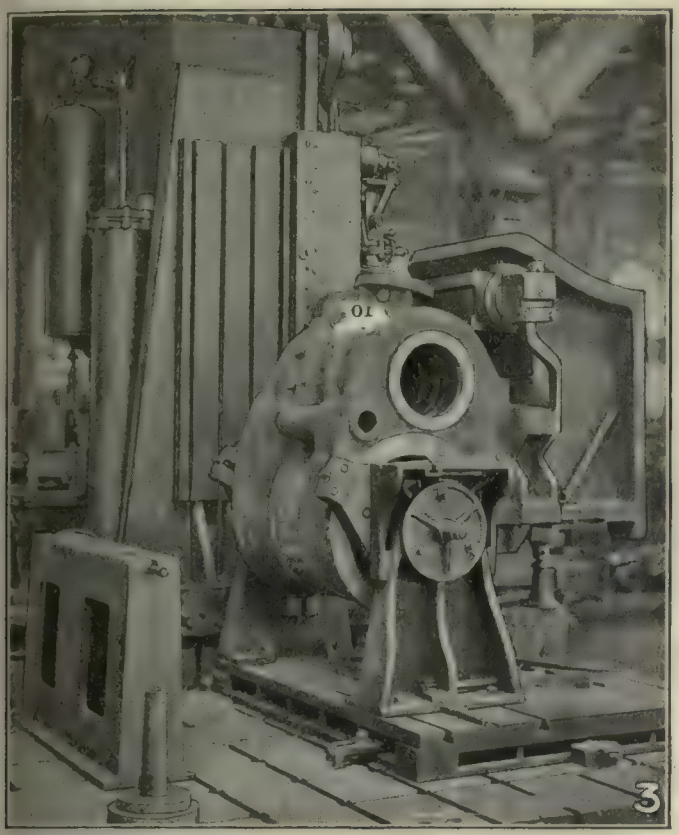


FIG. 3. PLANING THE CYLINDER FRAME SEAT, SHOWING THE ADVANTAGES OF THE DRAW-CUT SHAPER IN AWKWARD PLACES



FIG. 4. SHOWING BORING HEAD, ALSO WORK SUPPORT AND SURFACE GAGE ON FLOOR PLATE

that at the right-hand side of the cylinder casting in Fig. 2 can be accomplished without difficulty.

Turning now to Fig. 4, the machine is here shown set up for boring the valve chamber. For this operation a cutter head is used which is carried upon a spindle driven through suitable gearing at the end of the ram. The cutter consists of a solid ring-shaped body with four inserted tools of high-speed steel. The four boring tools are placed in radial seats in the head and are secured by setscrews from the front of the body.

In Fig. 5 a handy sling is shown as used for handling brasses in and out of the rotary feeding fixture for machining the outside of the brass in the draw-cut shaper. The view, Fig. 6, illustrates the actual shaping of the brass. In this instance the shaper ram is operated at the rate of 20 or more cutting strokes per minute, with a feed of $\frac{1}{4}$ in. and a depth of cut ranging from $\frac{1}{4}$ in. to $\frac{3}{8}$ in. The character of the arbor on which the work is carried is well shown by the illustration; and it will be understood that the intermittent rotation of the arbor and work which gives the brass the circular feed for each ram stroke is brought about automatically by mechanism at the side and rear of the machine. Here it will be noticed that the pull of the cut is taken by the back bearing on the

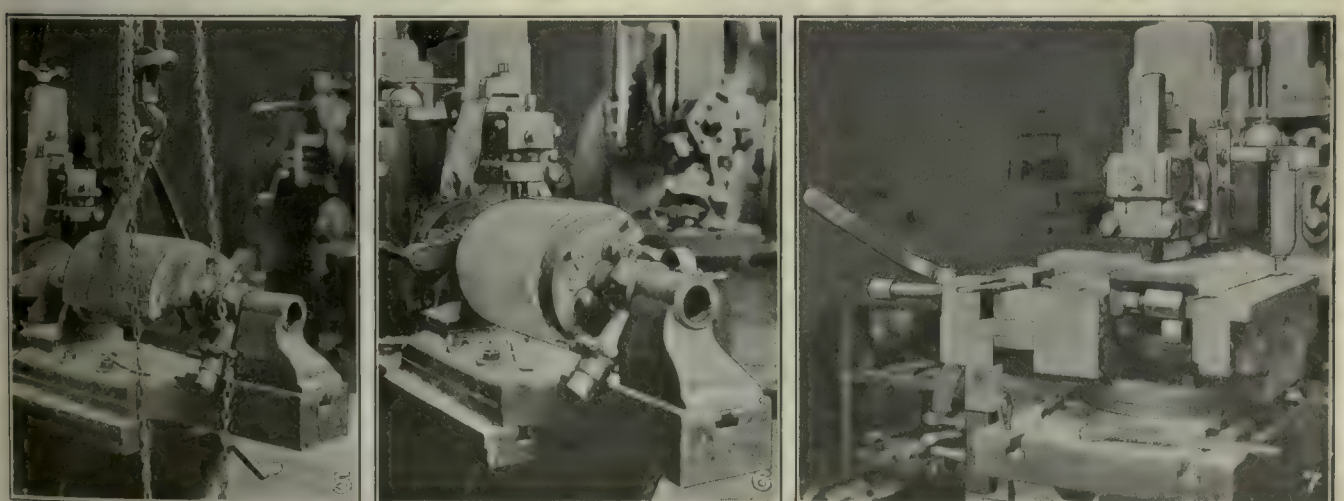


FIG. 5. SHOWING THE USE OF A HANDY SLING TO SWING BRASSES IN AND OUT OF THE ROTARY FEEDING FIXTURE FOR PLANING THE OUTSIDE. FIG. 6. PLANING THE OUTSIDE OF THE BRASS. FIG. 7. SHOWING WEDGES HELD IN VISE LINED UP BY PINS RESTING UPON VISE JAWS. ALSO SHOWS FRONT JACK USED TO BRACE CASTING INTERNALLY AGAINST SIDE STRESSES

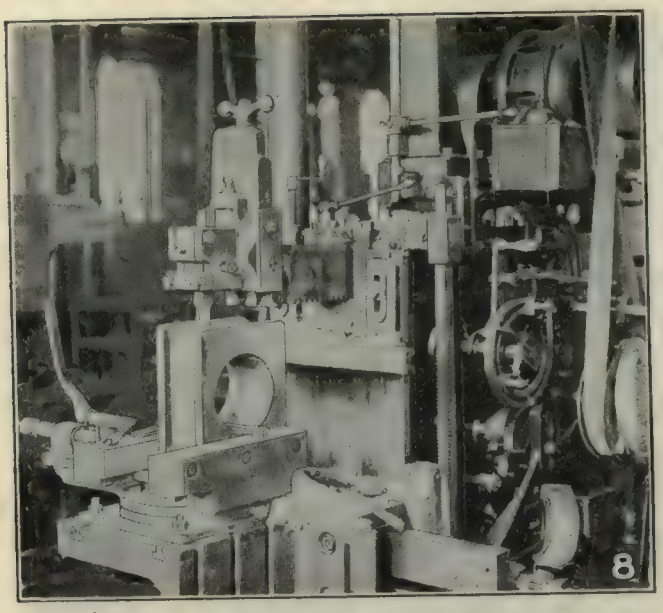


FIG. 8. FINISHING ROD BRASS EDGES AND FLANGES

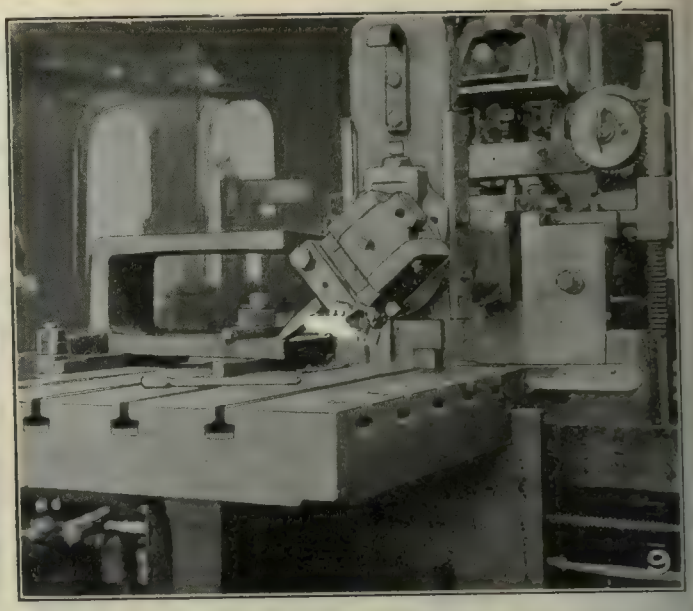


FIG. 9. SQUARING AND PLANING ENDS OF SPRING SADDLES

column through jacks which are tapped into the rear end of the work holding fixture.

The method of handling shoes and wedges in the draw-cut shaper is shown by Fig. 7, which illustrates the manner in which a wedge is held in the shaper vise for the machining of the flat surface. The shoes and wedges are planed here after laying off on the engine and very quick time is made in handling in this manner. After laying off the center lines on the sides the center punched marks are drilled for small short pins and these pins resting upon the vise jaws as shown in Fig. 7 give the wedge the correct position for planing the outside.

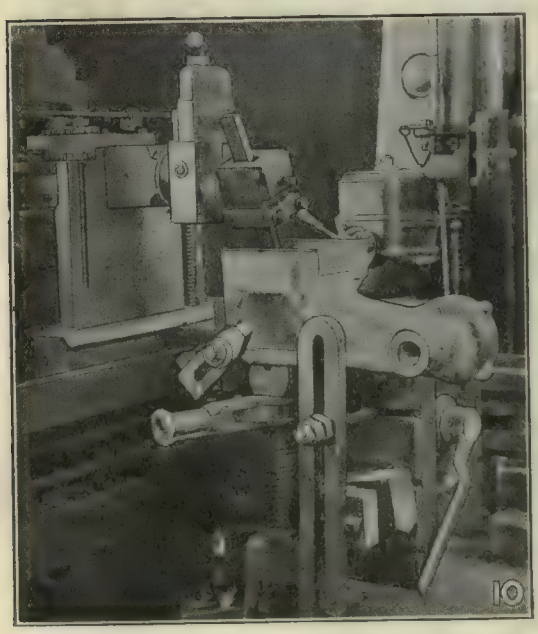
To enable the work to be gripped securely in the shaper vise jaws without danger of springing in of the side walls, short jacks are used at the ends to brace the casting internally against side stresses. The jack at the front is shown clearly in the engraving.

With the shoe or wedge thus secured the metal is removed in heavy cuts. Thus the roughing out is done with a feed of $\frac{1}{8}$ in. and a depth of chip of $\frac{1}{4}$ in. Two or more cuts are taken according to the total amount of stock to come off. In either case $\frac{1}{64}$ in. is left for the finish cut to remove.

The methods of holding the work for finishing the other surfaces will be understood without special explanation.

Finishing Rod Brass Edges and Flanges

The finishing of rod brass edges and flanges is illustrated by Fig. 8. The brasses are first faced on the sides in the shaper by gripping the edges in the vise and this is followed by the operation shown where the brasses are placed on edge in the vise jaws and machined for the strap fit. Following this they are placed in a strap and are then bored out either on the lathe faceplate or on the table of the vertical boring mill.



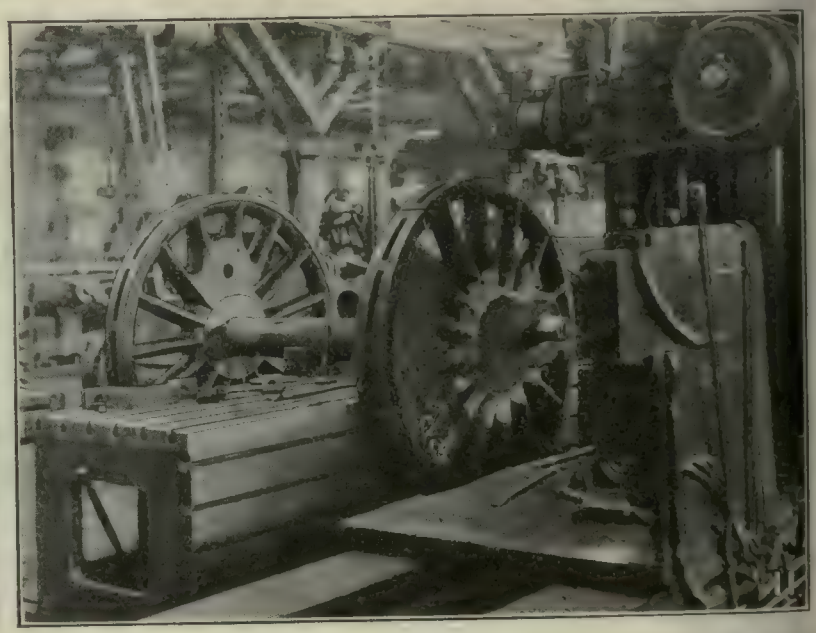


FIG. 10. CASTING CLAMPED AGAINST THE VERTICAL SIDE OF THE SHAPER SUPPORTED BY A JACK AND END THRUST AGAINST THE MACHINE INSURING RIGIDITY UNDER CUT. FIG. 11. SLOTTING RIM OF DRIVING WHEEL TO BE USED AS EXPANSION MANDREL

Spring saddles are handled in the shaper as illustrated in Fig. 9. The operation here is to square up the ends and plane out the ends of the jaws to a distance of, say, 1½ in. to allow the saddle to hang up on the frame and fit properly in place. The operation is of course a simple one and the method of securing the work on the shaper table is quite apparent without detailed description. It is another case, however, where considerable overhang of the tool is required and where in consequence the draw-cut action is of value in permitting rigidity of operation under the cut.

The casting in Fig. 10 is shown supported by means of a jack at the side of the table and two heavy straps and bolts are applied to clamp the casting securely against the vertical face of the table. The rear end of the work thrusts against the back bearing and during the shaping out of the fit along the top surface the job is stiffly held and the pull of the cut is against the frame of the machine without tendency to force the work away from its points of support.

It is the practice in some shops to turn driving wheel tires on mandrels made of old drivers with slots in the rims in which wedges are used to expand the driver rim into the work. A method of slotting the rim of a driving wheel is shown in Fig. 11. The draw-cut shaper is employed for this purpose, the

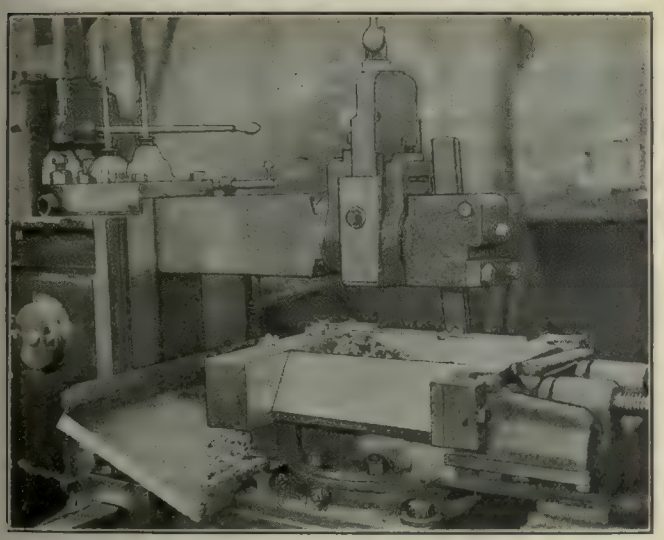


FIG. 12. DIE JOB WHERE LAYOUT LINES CAN BE FOLLOWED EASILY

driving axle being mounted in V-blocks on the work table at the front of the machine. The head and ram are elevated and the ram stroke adjusted; the slotting operation is then a simple matter.

The draw-cut shaper is used in railroad toolroom operations as well as on locomotive work itself.

Thus the die job in the shaper vise in Fig. 12 is a characteristic toolroom job. The tool cutting back from the front edge of the work enables layout lines to be followed to the best advantage.

The operations illustrated in this article are typical of a great variety of draw-cut shaper work as carried on at the Southern Pacific shops at Sacramento, Cal.

Should Jigs and Fixtures Be Designed?

By John Homewood

Should jigs and fixtures be designed in the drafting room? In answer to this question asked by Mr. Fredericks on page 26 of the *American Machinist*, I say that they should be; but there are many things to be taken into consideration before laying down any rules.

We know that a really up-to-date firm, with the most modern ideas of procedure, uses the design and production method when building its tools. Whether it gets the best for the effort in all that is turned out is very questionable. Its most efficient system is very inefficient in many ways; but this cannot be helped until the great trouble is eliminated by further effort to build up the tool-designing element. There are some firms that go too far with the paper instructions, and the result is that the toolmaker increases the cost of the tool by his adherence to the instructions given to him.

If a drawing of a jig or fixture goes to the shop with the details carried out to extremes in the way of decimal dimensions, the cost of that tool is going to exceed what it would if the chief essentials were given and the rest left to the judgment of the workman. A toolmaker capable of turning out jigs and the like should not be asked to turn a bushing down to 0.501 in. and ream out to 0.500 in. the hole that the bushing is to go into. Instructions calling for ½ in. are good enough. If he should happen to make the hole slightly smaller or larger he could compensate with the other part.

There are not enough first-class tool designers to fill the chairs awaiting them. At present the wages paid for tool designing are small, and should be increased in order that the men now at the bench will aim for the design work. There are thousands of men at the bench today that do not feel it worth their effort to put a lot of valuable time at study and practice to gain something that will reap them no great benefit. Again, good conscientious tool designers do not live to be very old, as their job is not the best for a man's physical being.

The world seems blind to the folly of handing out to the tool designer a few more crumbs than the toolmaker gets. I was looking at a display given by the I. C. S., where there was a mechanically actuated dummy with a pick, and at his side sitting down at a drawing board was a man swinging his drawing pen around an irregular curve. A draftsman asked, "Which way is he supposed to have advanced?"

Could we but see the real value underlying some of the thinking caps of the men that are easily strolling around in white aprons, contented with their lot because they are on a pinnacle that is comfortable to them. Do you blame them for not putting forth the effort needed to reach the top of the next pinnacle, that seems no higher and affords no better view of life? All men at the bench would not make what I want to call first-class tool designers, no matter how hard they tried, although there are a few that have the right stuff in them—but, do you blame them?

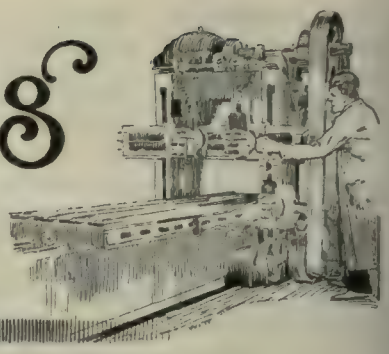
In one shop that I know of they resorted to the "dope-it-out" method of designing tools. The foreman, who was either too busy on other details or else didn't care a rap, would approach his man with a big block of iron and a sample part to be machined. He would lay the block down with a bang, then he would give him a little spiel about the thing that was wanted, and with a sweeping gesture, he would tell him to "dope-it-out" and leave him to his pleasures. The tool was doped out and "so were the hours."

Get the proper stuff behind the pencil by making the conditions better for a man to strive for. Don't leave him contented at the bench, and ignore a very valuable asset to manufacturing. Yes, tools should be designed in the drafting room—but.



Metal Cutting Tools.

By A.L.DeLeeuw



VI. Boring Tools Continued*

The Boring Head, Multiple Boring and Taper Boring Tools—Their Construction and Use—A Word About Reamers and Floating Reamers

FOR the boring out of large holes such as, for instance, the bore of cylinders for steam engines, air compressors, etc., it is customary to use a boring head with two or more tools. Such a boring head is roughly sketched in Fig. 86. The boring head, as shown, slides on a bar. This construction is preferably used for very large work. With this arrangement the bar is driven from a headstock and is guided at its other end in a tailstock. The space required between headstock and tailstock is equal to the length of the hole to be bored, plus the length of the boring head on the bar, plus a certain amount for clearance. If the boring head were fastened to the bar and the work should feed, then the amount of room required between the headstock and tailstock would be twice the length of the hole to be bored, plus the length of the boring head on the bar, plus some clearance. In the first case the boring head assumes different positions along the bar so that the deflection of the bar will vary according to the position of the head. As the bar and head revolve in such work (at least, as a rule), the hole generated will have a curved axis. With the second arrangement, that is, with the head stationary on the bar, the deflection will be more, but constant, so that the axis of the hole will be a straight line. The first arrangement is more commonly used, nothwithstanding that the second arrangement promises better results. With the arrangement shown in Fig. 86 the head feeds along the bar by means of a nut fastened to the head, and a screw laid in the groove of the bar. It is common practice to make the nut bear against the sides of the groove, in order to make it act as a key as well as a nut. In addition, another key is added so as to reduce the oscillation of the head on the bar to a minimum. With the second arrangement, that is, when the work feeds, the head is fastened to the bar in some substantial manner. In a good construction of such a boring head each tool is made individually adjustable, both for depth and for diameter, for, in order to get the best results, all tools should be set to the same diameter and to the same depth. As a rule, three cuts are taken for a bore, a first and a second roughing cut, and a final finishing cut. Notwithstanding all precautions it is not possible to adjust a number of tools so accurately to the same diameter that they would produce a smooth hole, and it is therefore good practice to remove all but one tool for the finishing cut. This finishing cut should remove only a very small amount of metal and a wide feed should be given to the head. If, for instance, it were necessary to bore out a cylinder 8 ft. in diameter and 10 ft. long, and if we should use a 0.010 in. feed, which is a customary feed for fine boring work, the tool would have to make $10 \times 12 \times 100 = 12{,}000$ revolutions to finish the work, and as the circumference of the hole is, practically speaking, 25 ft., the tool would have to travel a linear distance of $12{,}000 \times 25 = 300{,}000$ ft. Of course, the tool would have worn away before travelling so far so that it would be necessary to remove it, sharpen it and reset it to exactly the same diameter as before. This would be exceedingly difficult, for, even if the tool is set so as to touch the finished part of the hole, the spring of the bar would make the second part of the hole slightly smaller in diameter. For these reasons, it is good practice to give the finishing tool as wide a feed as possible.

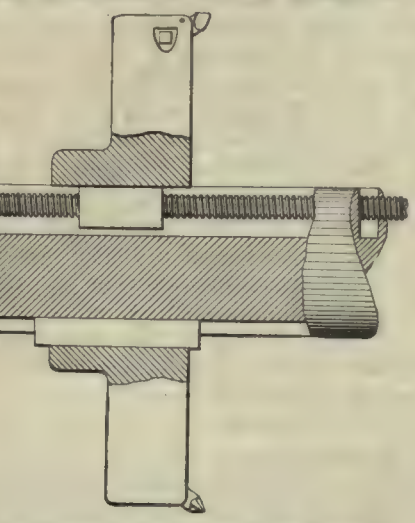


FIG. 86. BORING HEAD FOR LARGE CYLINDERS

Another method which has been successfully followed,



FIG. 87. THREE-FLUTED DRILL

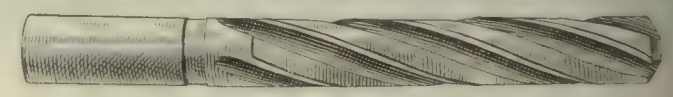


FIG. 88. FOUR-FLUTED DRILL

*For the author's forthcoming book. All rights reserved.

but which requires great care, is to have, say, four roughing tools and one finishing tool in the head. The four roughing tools are evenly spaced, so that each will take the same amount of feed and cause the same increase in diameter. The fifth or finishing tool is set slightly back of the roughing tools and to a slightly greater diameter. This method can be followed if the first roughing cut has left the hole round and straight, so that the boring head has no tendency to move sideways or up and down due to the uneven distribution of metal to be bored out. If the hole is crooked to any considerable extent, then the boring head will follow the hole and, as the finishing tool goes with the boring head, the finishing tool also will follow the hole. This objection is of greater or less value according to the condition

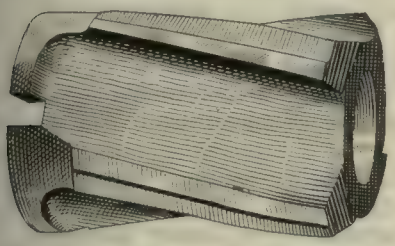


FIG. 89. FOUR-FLUTED SHELL DRILL

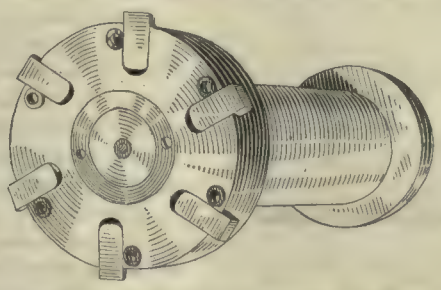


FIG. 92. SIX-TOOL BORING HEAD

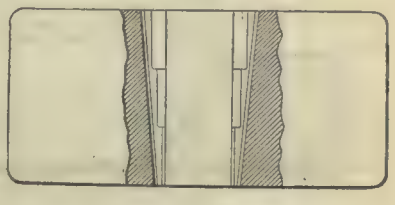


FIG. 93. METHOD OF BORING TAPER HOLE



FIG. 90. COUNTERBORE WITH INTERCHANGEABLE PILOT

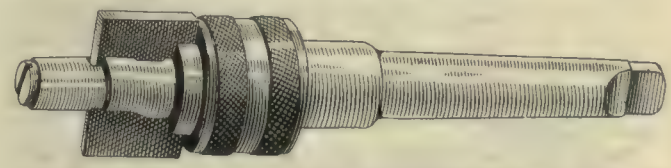


FIG. 91. COUNTERBORE WITH INTERCHANGEABLE BLADE

in which the castings are turned over to the machine shop and also according to the diameter and length of hole to be bored.

It is common practice to face a cylinder at the same time as it is bored, by mounting a facing head on the spindle of the headstock or on a sleeve in the tailstock (which sleeve is driven by the bar), or by mounting it directly on the bar. Mounting the facing head on the spindle causes no other effect on the boring of the hole than that there may be a sudden halt in the movement of the boring bar when the facing tool strikes a heavy amount of metal; but when the facing head is mounted directly on the bar, this striking of heavy resistance will cause considerable deflection in the bar and may cause a bad hole. Such a flaw would not be of much importance if the hole is not yet finished, but it is absolutely non-permissible to do heavy facing with a facing head mounted on the bar while taking a finishing cut in the bore. There are machines in existence specially constructed for boring Corliss engine cylinders. They will bore and face the main cylinder as well as the port holes. These port holes are interrupted, so that there are times when the boring tool in the port holes meets metal only for a fraction of a revolution. This shock on the boring bar for the port holes is transmitted to the saddle, column and bed of the port boring attachment and on to the bed, headstock, spindle, boring bar and boring head of the main machine. It would seem natural that the effect of this shock of boring a relatively small hole would be entirely lost by the time it reaches the large hole. But such is not the case. It has been found that it is not practical to rough bore a port hole while finish boring the main hole.

There are many other tools which should properly be considered as multiple boring tools, though they are known under other names. Three-, four- and five-lipped drills, and counterbores are, properly speaking, multiple boring tools. They are not drills in the sense in which we have used the word before; that is, a tool capable of making a hole in a solid piece. They are used for enlarging holes which may be either rough, such as bored holes, or semi-finished. In shape they are similar to drills, with the exception of the number of flutes. As there are three or more grooves in the drill, it is not possible to bring the cutting lips sufficiently close together in the center to expect the central web or core of the drill to crush the metal of the piece to be drilled. In all other respects their action is similar to the action of a twist drill. The greater the number of lips, the more difficult it becomes to grind all lips to the same depth. If we should want to bore with a three lipped drill and use 0.015-in. feed per revolution, each of the three lips would have to take 0.005 inch. If one of the lips should project beyond the other 0.003 in., this one lip would have to take a cut of 0.003 in. plus one-third of the remaining 0.012 in., or 0.007 in. altogether. If we should have found that 0.015-in. feed is all the drill will stand, this means that each lip cannot stand more than 0.005 in., and as one of the lips has to take 0.003 in. before the other lips cut, the amount of feed for each of the other two lips will be 0.002 in., or a total of 0.009 in. for the three lips. This shows how necessary it is to use great care and possibly some special means to secure an even grinding of all the lips of this type of drill. In Fig. 87 is shown a three-fluted, and in Fig. 88 a four-fluted drill. Fig. 89 shows a four-fluted shell drill.

The Counterbore

Another type of multiple boring tool is the well-known counterbore. As a rule, counterbores are used to provide a place for the head of a screw, and as these holes are made with clearance, the operation for which a counterbore is used does not require great accuracy. A counterbore resembles a short twist drill with a blunt piece of shaft between the drill portion and the shank, and a pilot at the front end. The pilot guides the counterbore in the previously drilled hole and secures a fair degree of concentricity. Most counterbores have four lips, which requires a somewhat different way of grinding from that used for two-lipped twist drills. Each lip has to be ground separately and, as the pilot is more or less in the way, it is very difficult to grind all four lips to the same depth. However, as most counter-

boring operations are done with hand feed, this lack of uniform depth of the teeth is not very important. Where counterbores are used in automatic machines, such as screw machines, the depth to which they have to bore is generally only a fraction of the total length of the piece, so that it is possible to give the counterbore a relatively fine feed without retarding the operation to any great extent.

Counterbores are often made with interchangeable blades. Fig. 90 shows such a tool, and Fig. 91 another construction of the counterbore for the same purpose. There are a great many ways in which interchangeable counterbores are made. Some have a fixed pilot with an interchangeable blade for the size of the counterbore,

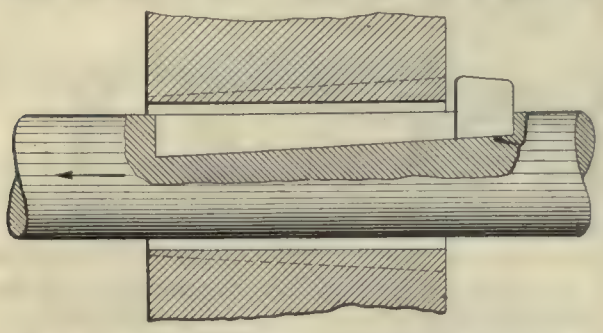


FIG. 94. BORING BAR FOR LARGE TAPER HOLES

others have fixed counterbore size with interchangeable pilot. In still others both pilot and blade are made interchangeable.

With the exception of the multiple boring tool mentioned in the previous paragraphs, it was not customary to use multiple boring heads until quite recently. The progress made in manufacturing methods, and especially the development of the automobile industry, has brought other multiple boring tools into the machine shop. It is now quite common to use such tools on horizontal and vertical boring mills, on turret lathes, drill presses and the automatics. Tools of this description, and of many varied styles, are now available as a standard product.

Fig. 92 shows a multiple boring head with six tools, as manufactured by the Kelly Reamer Co. Such a toolhead is too small to permit of individual adjustment of the blades in two planes, so that it is necessary to grind the blades in position in order to have the boring head divide the feed properly among the various tools. The clearance can be given either by straight grinding or by eccentric grinding. The latter method is preferable, as it permits of a very small amount of clearance without danger of the heel of the tool interfering with the bore. However, it requires a great deal of skill to grind a tool of this description so that all blades will take the same amount of cut, and well-equipped shops have special grinding devices to overcome this difficulty.

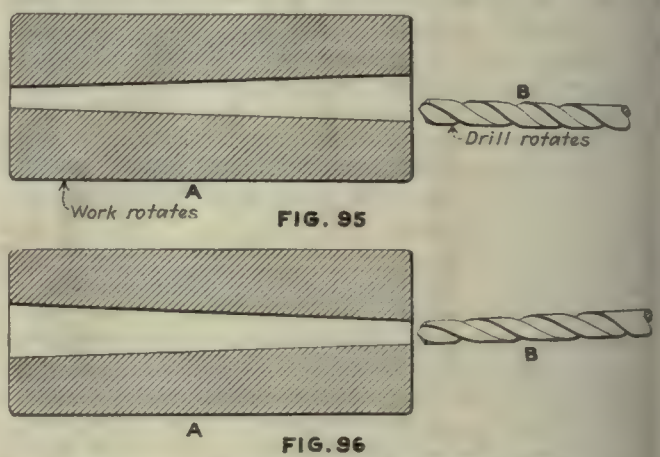
Multiple boring heads are made not only for the purpose of dividing up the cut between a number of blades and thereby permitting the taking of much heavier feeds than would be possible with a single-pointed tool or with a double-end cutter, but also for the purpose of combining various operations such as rough and finish boring and reaming and facing in one toolhead. Some of these tools will be taken up later in connection with the remarks about reaming.

The boring of a correct taper hole has always been considered a difficult matter. Fig. 93 represents a piece of work in which a taper hole is being bored, and shows a method frequently employed. First a straight hole is drilled, indicated in the sketch by *1*. Then part of the remaining metal is taken out by a stepped cutter, producing a hole indicated by *2*. The remaining amount of metal is then removed by a taper blade, generally a taper reamer, as indicated in *3*; and finally the finshing cut is taken by a taper reamer, as indicated by *4*. The chief difficulty lies in the reaming, for a reamer working in a taper hole must necessarily take a chip the length of which is equal to the length of the hole. Such a broad cut, as we have seen before, has a great tendency to cause chatter. The main problem is to make the semi-finished hole so true that the final reaming cut shall have but a small and even amount of metal to remove from the hole. In that case, the reaming cut is more in the nature of a scraping operation than of a true cut.

Sometimes a specially constructed reamer is used instead of the stepped reamer. In case large taper holes have to be bored, a boring bar is provided with a tool which moves along the boring bar in a taper path (see Fig. 94), or which moves with the boring bar, so far as the axial feed is concerned, but which has at the same time a movement in a radial direction so that the resulting movements produce the proper taper. Such arrangements are necessarily special and unless the relation between the two movements is closely controlled and without back-lash the resulting hole will not be smooth nor of the correct shape.

Very large holes which can be bored on the boring mill do not require any special arrangement, as it is possible to set the boring bar, which in this case is part of the machine, to the correct angle and bore to the proper taper. All that is then necessary is to take a sufficient number of cuts to insure a smooth hole and the correct size.

Most difficult of all is the boring of a taper hole of small diameter and great depth. Holes intended to receive taper pins or studs of small size are generally drilled and reamed. But where a hole is used to receive some important machine part, this simple set of operations is not sufficient. The following method will produce a hole of small diameter and of relatively great depth which will meet all practical requirements. Fig. 95 indicates this method. *A* is the piece of work in which the hole is to be drilled. It is held in a chuck or clamped to the faceplate in such a way that the location of the axis of the hole to be bored coincides with the axis of the spindle of the machine. *B* is a drill somewhat smaller than the small end of the hole and preferably, though not necessarily, somewhat larger than half



FIGS. 95 AND 96. TWO WAYS OF BORING SMALL TAPER HOLES

the diameter of the large end of the hole. This drill is set at an angle corresponding to the angle of the side of the hole. Both the piece and the drill revolve, in opposite directions. The fact that *A* revolves insures that the axis of the hole will be in the correct location and direction. *B* acts both as a drill and as a boring tool, and will generate a hole of which the angle is correct, but of which the size is somewhat uncertain so that a final reaming cut must be taken for size and finish. However, though we are still depending on a reamer for the final size, the direction of the hole is not altered by the reaming, as the reamer removes the same amount of metal all around the hole. The writer has employed this method a number of times under very difficult conditions and has obtained very good results. Employing this method it is possible to bore a taper hole starting at the small end as shown in Fig. 96. This may be of advantage where this boring operation must be combined with other operations, such as turning or facing, and where a second setting can be avoided by turning the small end of the hole toward the tool.

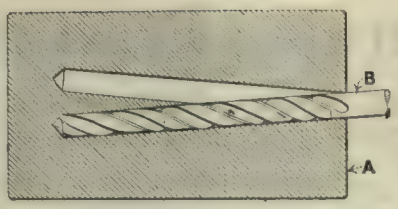


FIG. 97. TAPER BORING A BLIND HOLE

This method is also useful for recessing the bottom of a blind hole where this is desired for the purpose of reaming or tapping. The extent to which this method may be employed is indicated by a little experiment which anyone can carry out. In Fig. 97 *A* is again the piece of work, and *B* is the drill which is set at such an angle that the size of the bottom of the hole is more than twice the diameter of the drill. The illustration shows how a little cone is left at the bottom of the hole. Such a hole might be useful for clinching a stud or stem into another piece. Splitting the stem in three or four parts will allow it to be driven into the piece of work, and the cone which is left at the bottom of the hole will spread out the three or four pieces of the stem, preventing it from being withdrawn.

When speaking of the drilling of deep holes, mention was made of the fact that it was possible to drill a hole through a long piece by starting at each end and having both work and drill revolving. The two holes would then have a common axis and would meet. The only error would be that the holes would not be of equal size at the meeting point. The reason why this is so is that the drill has worked as a boring tool. Any little deflection given to the drill point, or any cause whatsoever, would give the same results as if the drill were set at an angle with the axis of the spindle and would, from there on, produce a taper hole but the axis would not be disturbed. This method was tested out on a large scale with a manufacturer of the recuperators or recoil mechanisms of the 75-mm. French guns, and proved to be eminently satisfactory. Of course, if one starts drilling from either end, and one wishes the two axes of the two half-holes to coincide, it is absolutely necessary to have the two starting points in line with the axis of the spindle. In order to obtain this result the piece of work was laid in a cradle which was turned up at both ends, one end resting in a bored out fixture fastened to the faceplate, and the other end resting in a steadyrest, which was also carefully bored out and in line with the spindle. A bushing in the cradle permitted the centering of one end of the work by a heavy, short drill, after which the deep hole drill was set to work. When this drill had reached the halfway position, work and table together were reversed and centering and drilling started at the other end. The chief advantage of this method was found in the fact that the subsequent boring tools had the tendency to follow the hole, and as this hole had already a straight axis and was in the proper direction, the final boring also was bound to produce such an axis. And as, furthermore, the original drilled hole was of a true round section, there was no tendency to deflect the subsequent boring tools.

(To be continued next week.)

The Selection of Apprentices

By A. W. Forbes

A number of articles have appeared recently in the *American Machinist* on training apprentices, but the question of the selection of boys for apprentices has been largely ignored, although it is an important item.

The example of the colleges is well worth attention in this respect. In the first place, the colleges do not pay anything to the boys, and in many cases charge quite a considerable sum. This eliminates those who are looking for immediate returns; and most of us will agree that one of the greatest troubles with the boys in our shops is that they are looking too much for the dollar this week, and not enough for the future. Next, they require an amount of study that the ordinary boy would be unwilling to do. As study is one of the most important things toward success, this eliminates a large proportion of those destined to be average workmen, or less.

The entrance examinations, while not difficult to those with ambition and intellect, are sufficiently difficult that the majority of those who leave school at the lowest legal age could never pass them, no matter how much they studied. Thus are eliminated those intellectually below the average. Who are left to go to college? A superior group, the best from all classes of society, mixed with a considerable proportion of inferior persons, whose faults do not come within the arbitrary principles of selection.

A factory is not judged by the improvement that is made in the raw materials. It is judged by the quality of the finished product. The purchaser does not care whether the results are due to materials or workmanship. With schools or apprenticeship courses the aim is to improve the raw material, that is, the students.

I have often wondered what would be the result if we should imitate the colleges in their methods to the following extent. An apprentice should work for four years without pay. He should be required to pass strict intellectual tests comparable with those in the colleges, both for entrance and for what he was learning afterward. It would be advertised widely that the boy was getting a great benefit, and that the company was doing one of the greatest possible services to the country by allowing him to work.

It would be hard on the boys that lacked ability if they could neither go to the shop nor to the school. The system will, of course, never be put into practice universally, and I havn't the nerve to try it in my own shop; but as long as the factories extend opportunities to the boys who have not the ability nor character to amount to much, they will be condemned for doing so. If these boys were discharged and supported by public charity, the factories would have a much better name than they do.

Crankshaft Turning Practice

Cheeks, Pins and Bearings Turned in Special Lathes—Shafts Driven from Both Ends by Pot-Chucks—Special Tooling Methods Employed

By J. V. HUNTER
Western Editor, *American Machinist*

SPECIAL lathes have been developed to turn rapidly the cheeks, pins and bearings of automotive engine crankshafts. Among them are the crankshaft-turning machines built by Wickes Brothers, Saginaw, Mich., which are equipped with tooling of considerable interest. Crankshaft lathes are usually built with double-end drive to avoid the torsional deflection or "lag" which may occur in any shaft driven from the end opposite that upon which the cut is taken.

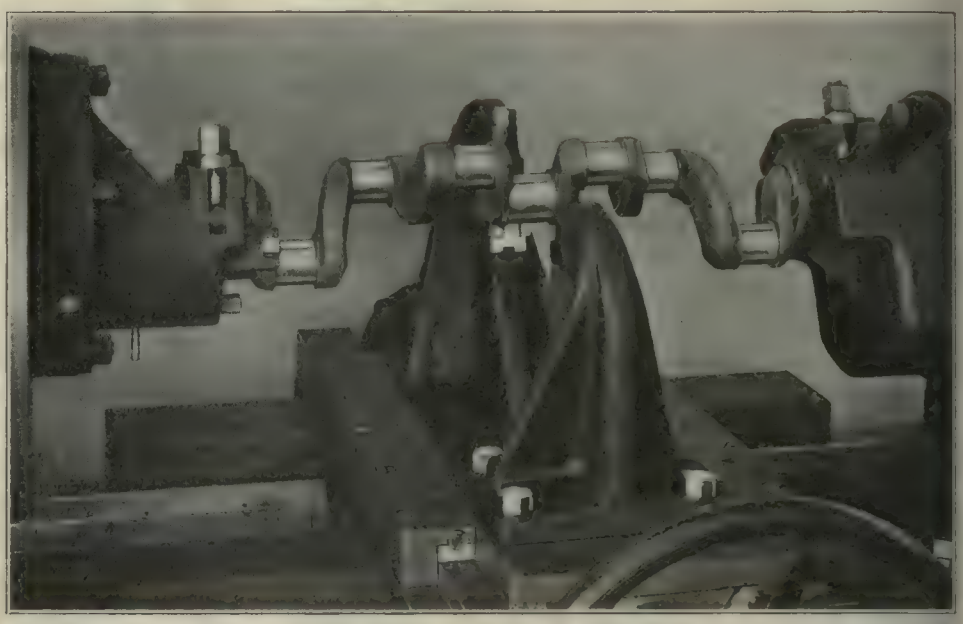


FIG. 2. TURNING CRANKPINS ON A UNIVERSAL TYPE MACHINE

Due to the variations in stiffness of different heat-treated shafts, no previous correction can be made in chucking to provide for the eccentricities of "lag," and this may result in some pins being $\frac{1}{32}$ in. or more displaced from their true position. When distorted shafts are finish-ground this eccentricity has a destructive, pounding effect on the wheel, causing excessive wheel wear and retarding that operation. In addition to driving from both ends, to lessen the "lag," the crankshaft is stiffened by holding it in heavy pot-chucks, Fig. 1, which extend from the faceplates to positions as close as possible to the cuts being taken, thus reducing to a minimum the length of shaft through which the torsional strain occurs.

Turning the Pins

The turning of the pins is performed by pairs of tools mounted on the tool carriage. A pair of tools consists of front tool *A* and back tool *B*, spaced from 6 to 7 in. apart to permit ready removal of the work. The cut on the pin is made by a tool of sufficient width to finish all except $\frac{1}{4}$ in. of the pin at each end, and for this cut it is fed directly back into the work. The rear toolpost carries a single or double tool for cutting the fillets at the ends of the pin.

The average amount of stock left on the pins and bearings of a drop-forged crankshaft for turning will run about $\frac{1}{16}$ in., although in places it will amount to $\frac{3}{8}$ in. or more. The scleroscope hardness of this steel will run between 30 and 40. The turning operation leaves from 0.020 to 0.030 in. on the diameter for grinding. The long pot-chucks shown in the illustration give a clear idea of the practical method used to support the shaft close to the cut. This job is a single-throw crankshaft that is used in the internal combustion engine which drives one of the new types of farm-lighting units.

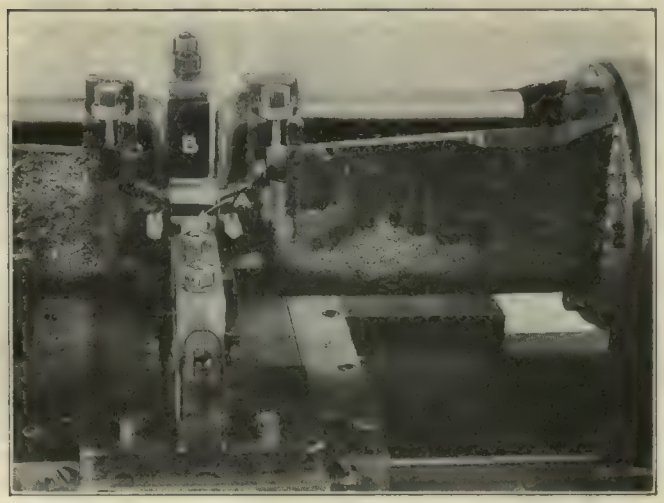


FIG. 1. POT-CHUCKS AND TOOLING FOR SINGLE-THROW CRANKSHAFT PIN

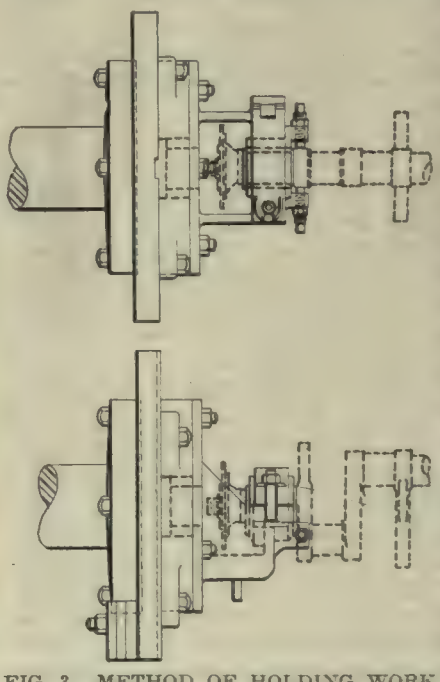


FIG. 3. METHOD OF HOLDING WORK IN UNIVERSAL TYPE POT-CHUCKS

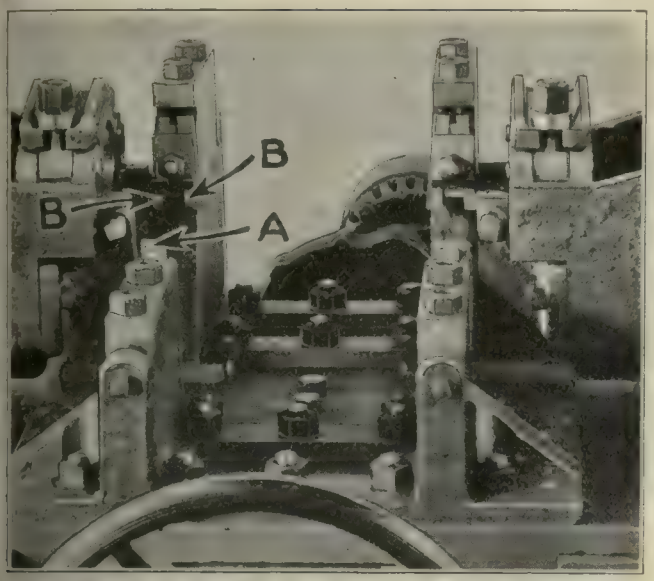


FIG. 4. DUPLEX PIN LATHE WITH ADJUSTABLE TOOL-HOLDERS AND EXTENSION TO POT-CHUCK

The same idea in tooling is embodied in the set-up shown in Fig. 2, although this set-up serves a far more complicated operation than that previously described, being employed on what the maker terms a "universal" crankshaft machine, adapted for turning all the throws on a crankshaft in a single setting of the work. Clearance between the tool carriages and the shaft is secured by using exceptionally high toolpost brackets. The tools lie in a horizontal plane. The pot-chuck, Fig. 3, is arranged with an indexing device that permits adjustment to bring the two pairs of pins successively in line with the centers without necessitating removal of the work.

The complete operation of turning a pin requires about 1.3 min.; a production of sixty-eight six-throw crankshafts in a day of 9 hours is attained.

Duplex Pin-Turning Lathes

The duplex crankshaft lathe, Fig. 4, turns at the same time the two pins that are in line. For each pin there is a pair of tools on the carriage. The design of the tools is similar to that of the tools described for turning single-throw cranks. The horizontal tool has been almost entirely displaced by the vertical tool, similar to those shown in Fig. 1. The cutting bits *A* are sections of high-speed steel about 5 in. long, dove-tailed into the toolpost, and clamped in place by adjusting screws. This type of tool need be ground only across the top; the clearance angle is provided by the position in which it is set in the toolholder. The tools for filleting, *B*, are small bits which are clamped in an inverted position in the rear toolpost. They are backed up by hollow-head setscrews.

The tooling is varied on some machines by the use of a single narrow tool in the front holder, in which case the cut is started at one end of the pin and the carriage fed lengthwise to a stop. When against this stop the carriage is in position for the cut of the rear tools. In other cases two narrow tools with about half the length of the bearing between them are used in the front holder. One tool starts its cut at the end of the pin while the other starts near the middle, thus reducing the carriage travel and cutting time to about one-half.

When machining a six-throw crank with a duplex machine it is customary to turn bearings Nos. 1 and 6, Fig. 5, and locate the remaining bearings for angular alignment from No. 1. The pot-chucks are made of cast crucible steel and are designed to afford the maximum convenience to the operator. They grip the shafts, without the use of centers, by brackets which hold the previously machined line-bearings between hardened-steel cheeks. In the first operation the angular position is determined from a spot which was placed on the side of the cheek of the first throw by the inspector at the time the shaft was straightened. This "spot" is held against a pin-stop on one side of the pot-chuck by a form of vise jaw *A*.

All succeeding pins are located from the first pair turned and the pot-chucks are arranged with the necessary clamping brackets, as shown in Fig. 6. After alignment is made further stiffness is obtained by tightening the setscrews *A* and *B*.



FIG. 6. METHOD OF HOLDING FOR TURNING INSIDE PINS

A different system for the turning operations has

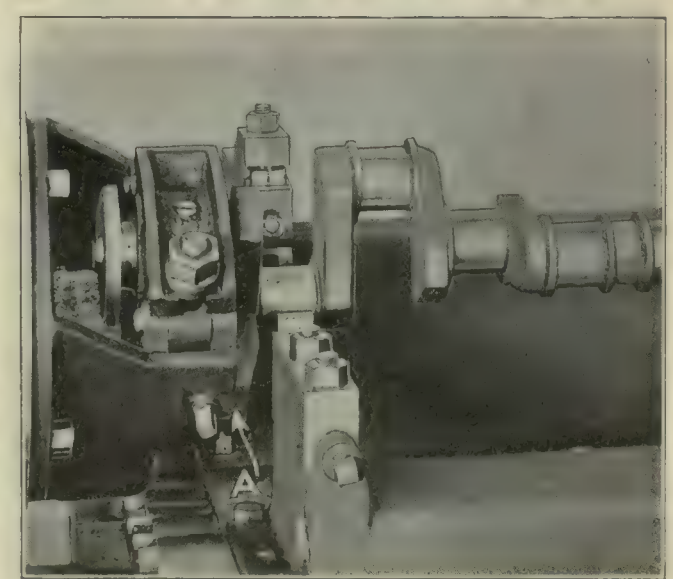


FIG. 5. TURNING END-PINS ON SIX-THROW CRANKSHAFT

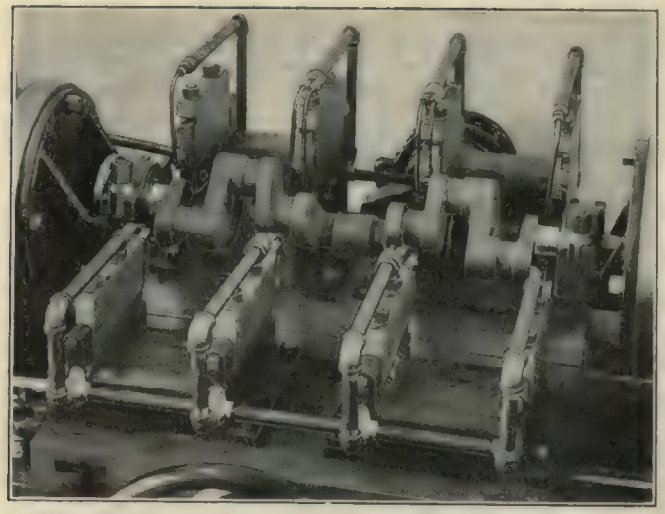


FIG. 8. ROUGH AND FINISH CHEEKING CUTS ON A SIX-THROW SHAFT

been adopted by one large automobile manufacturer who has had special pot-chucks built, so that all pins are located for turning from the inspector's "spot" on the side of the first throw. The shop turns the Nos. 3 and 4 pins at the center of the shaft first, following with Nos. 2 and 5 and finishing with Nos. 1 and 6.

Using Duplex Lathes for Small Production

It has been customary practice with duplex lathes to have one of these set up for each set of throws. This practice can be varied by using special pot-chucks adapted for turning different throws. For example, the chucks on the lathe in Fig. 4 can have their short extensions replaced by longer ones, and the toolposts can be adjusted on the carriage. The cutting speed for crankshaft turning is between 50 and 60 ft. per min. When working on 2¼ x 2¼-in. pins a duplex machine should finish a pair in slightly under two minutes, which includes time for chucking and removing the shaft and allows one minute or less as sufficient for cutting time. The operators usually employ hand feed, since by so doing they can better compensate for the irregularities of the forging. For filleting the rear tools are brought to cutting position by an electrically operated rapid traverse and then fed in by hand.

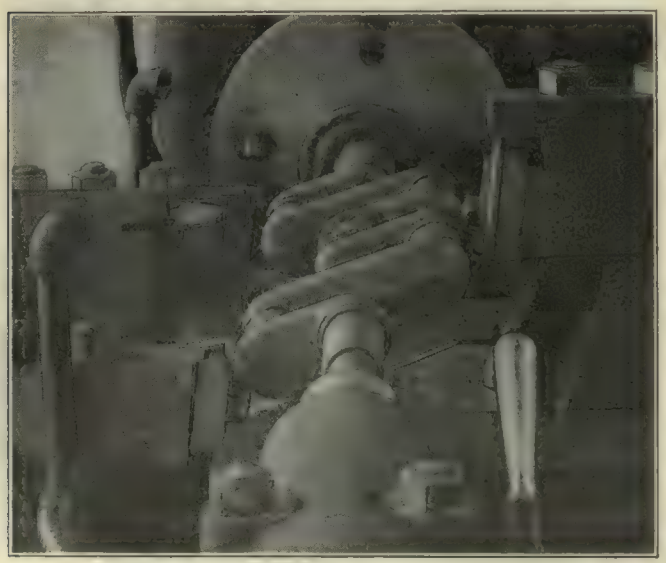


FIG. 7. CHEEKING CUTS AS AN INDIVIDUAL OPERATION

A further operation beyond that of turning and filleting the pins is provided by the introduction of cheeking tools in connection with the filleting tools carried by the rear toolholder, the cheeks being faced and the fillets finished when the rear tools are brought forward.

Cheeking Operations

For carrying through the cheeking cuts as an individual operation the tooling is frequently arranged as shown in Fig. 7. The toolbits are dovetailed into the sides of the toolposts. This machine is arranged with telescopic slides operated by right- and left-feed screws so that both the front and rear tools are fed in simultaneously.

The cheeking operations on a six-throw crankshaft are shown in Fig. 8. The tools are designed to make both rough and finish cuts on the cheeks of these throws. A telescopic cross-slide is used and the roughing tools are carried in the front and the finishing tools in the rear toolholders. Both sets of tools are fed in at the same time, with the roughing tools slightly in advance, until near the bottom of the cut, where their feed is automatically tripped while the finishing tools complete the operation.

Want Ads

By Joe Gilbert

The article on page 103 of the *American Machinist*, by Charles F. Smith, somewhat describes the case of many hundreds of applicants who are perfectly capable and honorable men able to handle the positions for which they apply. The general impression would be from the way advertisers reply to applicants that so many replies were received they could not spare time to answer them all. At any rate it seems to be the general custom to absolutely ignore many likely applicants.

There may of course be several reasons for this. The advertiser may desire to remain unknown to any but the most desirable applicants. The writer has known of several cases where desirable positions have been secured through the "Want Ads," usually when business was booming. On the other hand he knows a few men who have wasted their last postage stamp on blind ads. One man in particular, who has worked through all the grades from machinist to superintendent, an expert on production of accurate work from the finest to medium heavy class, an expert designer of labor saving tools and equipment, has used up lots of his spare time since the war closed in trying to locate something really worth while. He tells me he has written thirty to forty letters endeavoring to answer all questions and received only three of four replies to the lot. Now this man left a good position to get into the war industry in an endeavor to help Uncle Sam. He had full charge of a plant engaged in important government work and "he made good," naturally, as the work was far easier than the work he was trained to handle. Many of the piece workers whom he took from stores, farms, stables and the streets drew more money than he. He is also a member of the A. S. M. E. Through gradual shutting down of industries he dropped back to working on tool and experimental work at the bench. But he says he prefers doing that to constantly repeating his life history to unappreciative employment managers, who think it as easy to make machinists of the real kind as it was to make the war variety.



The Foreman and His Job

Suggestions for live foremen who wish to go up the ladder, and for firms who want better shop executives

By FRED H. COLVIN
Editor, American Machinist

CUTTING speeds and feeds as well as the different shapes of tools for various metals are very important to the foreman. When a hard casting interferes with cutting at schedule speeds he should know how to get over the difficulty, either by reducing speed, or feed, or perhaps by changing the shape of the cutting tool. A good general knowledge of the various metals and other materials which enter into machine-shop work, together with information as to cutting them, will always be of great assistance. A general knowledge of steel and its treatment; of the effect of different alloys and of the significance of both the Brinell and the scleroscope tests cannot fail to be helpful to the modern foreman.

The construction of machine tools, the advantages of different types, when to use one type and when another to secure the best results, are all right in his line and directly useful. Perhaps the best opportunity of study along these lines is by reading and studying the technical papers, including both the reading and advertising pages. This should be supplemented by catalogs and instruction books issued by many of the leading builders of machine tools so that a general working knowledge of the different machines should be easy to get at when needed. And this foundation should be laid in advance.

It is also a good thing to get a general knowledge of the prices of machine tools and other shop equipment. It not only helps in selecting equipment intelligently but is also useful in many other ways. It helps in estimating the cost of overhead, or burden, and is



. . . A GENERAL KNOWLEDGE OF THE PRICES OF MACHINE TOOLS AND EQUIPMENT

very useful in discussing methods and products with the men themselves, but this is another story.



. . . BY READING AND STUDYING TECHNICAL PAPERS

Lost Time Between Jobs

In some organizations the foreman gives out the work to the men while in others the work is scheduled from a central planning office and does not come directly under the foreman. In such cases the job tickets are placed in racks so as to be readily accessible to the men who, when they finish a job, turn in one ticket and take the next one. These tickets may be placed under the name or number of the man or of the machine which he runs. In either case, however, the foreman needs to keep a close watch on the progress of the work so as to avoid lost time between the jobs, as well as to see that everything moves along smoothly.

Someone has said that the foreman's job is to keep

the men busy. But it must not be overlooked that it is far more important to keep the *machines* busy, as idle machines mean a much greater loss than idle men. When one knows and appreciates the cost of machine tools and their equipment, especially those of large size, the necessity of keeping machines at work and of avoiding lay-offs of men, becomes very apparent. It is well for the foreman, and the men, too, for that matter, to realize the cost of holding machines idle. The interest on the investment and the proportion of the total shop expense which must be charged to each machine should be known to every foreman. It is one of the facts of management which he should study and apply at all times.

With this in mind he should have a constant incentive to find ways and means of reducing the idle time of all machines, especially those which have a large overhead charge against them. Anything which will reduce this idle time is well worth considering. Hoisting apparatus to cut down the time of handling pieces on and off the machine table; quick-acting fixtures which will save time in setting up, both help to reduce the total cost of production on such a machine even without increasing the cutting speeds or feeds. The cost of the new devices must be balanced against the saving and the decision made as to whether it will pay or not.

Cost of Supervision and Overhead

The question of overhead is one which will bear considerable investigation as it should be thoroughly understood. Roughly speaking, overhead is all the expenses of doing business which do not come under the head of direct labor or materials. It includes the cost of supervision and is well worth careful consideration at this point. In this connection I can probably do no better than to include an extract of an article published over a year ago on this subject:

In order to get something of an idea of the many items which go to make up the expenses of a manufacturing business, perhaps the outline submitted by a well-known machine tool company of the Middle West gives the most complete and at the same time most concise list. This divides the expenses into a number of headings as shown, and shows very clearly how the various expenses are distributed. By this method they figure the burden or factory expense as being equal to the total of the material and labor cost on a complete machine; in other words, 100 per cent.

Factory expense is divided into two parts, as shown under the heading of Supervision and Shop Management. The first division includes that of supervision and other items which are quite different in character from those in the second group under the same head. This second group includes what might be called the material things which go into the machines being built.

Fixed Charges

Taxes, buildings and real estate, material and equipment, corporation tax, capital stock, street and sewer.
Insurance.
Depreciation on equipment.
Depreciation on buildings.
Interest on investment.

Office Expense

Executive and clerical.
Depreciation on furniture and fixtures.
Heat and light.
Bonus and wage distribution.
Interest on borrowed money.
Discount charges on customers' notes.
Interest paid on notes to creditors.
Supplies—printing, stationery, etc.
Donations—charity.

Supervision and Shop Management

Factory Expense

Executive: Superintendent, production department, cost and factory clerks.
Purchasing department.
Watchmen.
Hospital.
Garage and trucks.
Discarded parts—old style.
Toolroom—manufacturing special tools and jigs; storing and distributing same.
Castings storage; receiving, storing and issuing to factory.
Blacksmith, dressing and hardening tools.
Stockroom—storing finished parts and issuing same to factory.
Steel stock storage; receiving, storing and issuing to factory.
Shipping and boxing.
Drawing room.
Pattern shop.
Inspection department.
Millwrights and carpenters.

The foregoing departments each include the following expense items:

Fixed charges.
Power, heat and light.
Labor.
Charges by other departments.
Defective workmanship.
Repairs.
Bonus and wage distribution.

The monthly total of the entire general expense is distributed on a productive-hour basis and charged as such to each productive department.

The productive departments are classified as follows:

Boring and chucking.
Lathes.
Grinding.
Polishing.
Large erecting.
Drilling.
Milling.
Planing.
Painting.
Small lathe erecting.
Milling-machine erecting.
Automatic screw machines.
Rack-cutting and keyseating.
Cutter grinder assembling.
Countershaft assembling.
Boring mills.
Gear cutters.
Repair department.
Unit assembling.

The above include the following expense items:

Fixed charges.
Power, heat and light.
Nonproductive labor—foreman and assistants.
Charges by other departments.
Defective workmanship.
Supplies.
Repairs.
Bonus and wage distribution.

Total department expense is distributed on a departmental productive-hour basis, and by adding the general factory expense hourly rate we have the complete hourly burden rate.

Selling Expense

Fixed charges.
Executive and clerical.
Bonus and wage distribution.
Discount allowed customers.
Collection charges on discounted notes and checks.
Entertaining.
Club dues.
Traveling expense.
Publications.
Catalogs and circulars.
Freight and drayage.

Selling expense is added to the total cost. The burden or factory expense) on a complete machine is equal to ne total material and labor cost on same.

In addition, the manufacturer paid last year an excess-rofits tax which in large concerns is about 75 per cent.

Taxes Make Overhead 200 Per Cent

The second concern reports, according to figures recently ompiled for 1918 operations, "Our overhead was almost ouble the average hourly rate of shop employees. This, f course, was largely due to the tremendous income tax hich the form of our organization imposed on us last ear."

Firm No. 3 writes as follows: "We figure the cost of upervision in shop management as two separate burdens; ne called the manufacturing expense and the other the ommercial and sales burden. The kind of accounts that re carried under each of these heads would be those natu-ally suggested by the titles.

"The total manufacturing expense for the month is ivided by the total number of productive hours for a onth and the results given as a productive hourly burden ate.

"We do not consider this necessarily the best or most ccurate method, inasmuch as it throws the cost of han-ing of raw material into the productive operation. It , however, the method which was instituted here some me ago and we continue it for the sake of comparisons ith past records, and it works out very satisfactorily. he sales and commercial burden is estimated as a per-ntage of the cost of sales. Both of these burdens are ubject to considerable fluctuation and for the sake of btaining more practical comparisons, we are in the habit establishing a fixed burden for a period of six months nd then adjusting it to take care of an excess or de-iency which may have accrued."

leeting the Present Emergency—Discussion

By G. R. Richards

In a very able article under the above title on page 04 of the *American Machinist*, an Eastern machine tool anager discussed the means that should be taken to eet the present depression in business.

There is one very important work that should be un-rtaken at this time, however, that he does not mention detail, although it is quite probable that he had it in ind. It is a work that is not as directly productive making spare parts, repair parts, units, etc., and this probably why it was not mentioned. The work re-rred to is the general overhauling and bringing up to ate and, if necessary, the further development of the op system and production control methods.

Where Efficiency Is Needed

Under this heading would come the systems of the afting room and engineering department, the plan-ng department, the production office, the raw and fin-hed stores, and the linking of all these with the cost, rchasing, and sales departments. This sounds like job for one of our efficiency engineers or systematizers.

To digress a moment: "Why" is an efficiency engineer systematizer? Why does any concern have to go out-de its own organization for assistance of this char-ter? The principal reason for this is to be found in e methods—the standard methods—that any good stematizer uses in his work.

We will omit the expression "efficiency engineer," as is term pertains largely to manufacturing methods. ny good systematizer first finds out the character of e present system in force and then tries to improve it. To do this he collects data, generally having some e to help him, that is, to do the clerical and cheaper work. Then he sits down, digests this data, and makes his recommendations. And right here is the secret of the whole thing. He has nothing else to do except this one thing and can concentrate on it. Production and research will not mix and no one can attend to both successfully, whether the research concerns purely inventive and design problems or matters of system and shop control. Investigations of the latter generally lead to as much of a saving as those along the purely technical lines of manufacturing methods.

A Place and an Opportunity for Home Talent

Any well-educated executive in an organization, if given the equivalent backing and the time, and if not bothered with production or routine matters, could achieve results which would average just as high as those obtained by an outside systematizer. This statement might not hold true for very large concerns, but in making it, a concern employing up to 1,000 men was in mind. In other words, in the average concern, there are executives with the imagination and experience necessary to carry on this work, and more important, an intimate knowledge of the business and its requirements which offsets the greater experience generally possessed by the outsider.

But to come back to the subject, there are very few systems that require a complete overturn. What is usually necessary is a review of where the time and money go and the refinement of present methods to take care of these two items. We all know that during the last few years, no one has hardly had the time to look around, and particularly is this true of the system and control end. Everything has been production.

As a matter of fact, when production is at its height, we have not time for anything but production; and when business gets slack, we fire everybody and have no force to do work of this kind.

Co-operation of Foremen and Executives Will Reduce Overhead

This is dead wrong. It is at this time that the executives and foremen are less busy and more open for consultation. Why not then get together under a leader selected from within the organization and take account of stock, so to speak? We could in this way take care of some of the excess overhead expense, which was mentioned by the writer of the article previously referred to. And while this expense would not be reduced, it would be taken out of the routine channels and made more productive. In other words, in addition to going over the production equipment and its design, we should go over the system for taking care of and recording this production.

Consider what we have done in the rush of war conditions and see if this will not stand improvement. Consider the means we possess for securing the co-operation of shop and office which is so essential. Consider what lists and reports it would be desirable to have in the future. Consider the duties of each person in the organization. Consider the forms and stationery. Consider, in a word, all the thousand and one things of which the foregoing are some of the essentials, make the decisions after a full and free consultation with all concerned, and then put this data in a standard practice or system book and we'll be prepared for taking care of any future business efficiency, whether it happens to be large or small.

Selling Machinery in Europe Since the Armistice

By OLIVER FIELD ALLEN

(Continued from last week's issue)

UNLESS one has seen France and Belgium outside of the show places, studied Paris away from the grand boulevards, been where the workmen are early in the morning and watched them at work, both in shops and in the open, it is impossible to realize how earnestly the French and Belgians are working and what wonders they are accomplishing, not only in reconstruction, but in production both on the soil and in factories.



FIG. 8. OLIVIER WORKS, FRANCE

Showing a machine shop as wrecked and stripped by the Germans. This picture was taken in February, 1919, when some of the reconstruction had been done. It is only illustrations of this sort that can convey an idea of the vast quantity of machinery taken away by the Germans.

The accompanying illustrations show typical examples of industrial reconstruction accomplished in a year.

In the ten devastated departments of France the resumption of work in the industrial establishments has steadily progressed. Out of 4,241 plants listed, a year after the armistice about 1,300 had resumed operations completely or partially. In April, 1920, about 2,400 and on Oct. 1, 1920, 3,239. These same establishments employed in 1914, 773,639 workers. A year after the armistice about 25 per cent had returned; in April, 1920, 35 per cent, and on Oct. 1, 44.6 per cent or 345,664.

The metallurgical industries showed on Oct. 1, 1920, 37 establishments operating out of 50 destroyed, and employing 13,766 workers compared with 36,751 in 1914. There were also over 7,000 employed in their reconstruction. Of the ordinary metal-working plants 844 were destroyed and 736 have partially or wholly resumed operations with 64,344 workers out of 128,455 in 1914. About 15,000 more workers are engaged in their reconstruction. Iron foundries, wire works and structural steel plants had recovered 45 to 50 per cent and brass foundries 62½ per cent on Oct. 1. The resumption in the metallurgical plants was greatest, 57 per cent in the department of the Meurthe and Moselle; in the ordinary metal-working plants the Ardannes led with 85 to 90 per cent.

Industrial Renaissance

The leading French Industrials working with the Government started their program of reconstruction during 1915, and by the beginning of 1917 had a well developed scheme and fine organization, which enabled them to be ready for instant action as soon as the armistice was signed. Their program has been carried out with remarkable efficiency. Both there and in Belgium it has been an intensive, rapid rebuilding and expansion in their own way by their own people. As some of the accompanying illustrations show, the reconstructed plant is frequently better and bigger than the one the boches destroyed.

In machinery lines the extensive use of the best shop equipment from England and the United States, plus the forced development of their own tools and fixtures to meet the unprecedented demands for war production, has given them the chance to select the best for each class of output, and for each operation. In many cases they will be in the same strong position as a company whose factory burned to the ground, but which was rich enough to build a new, better and more efficient plant and re-enter the field with the best possible manu-



FIG. 9. THE SAME SHOP AS SHOWN IN FIG. 8

Actually in operation in July, 1920. Note the good lighting in spite of the extensive use of belt



FIG. 10. CANOREL & BROS. METAL WORKS NEAR ARRAS, FRANCE
This is a typical view of war destruction of industrial plants by shell fire.

facturing facilities. Such a concern is the most dangerous competitor.

As with individual plants so with the complete nation. This renaissance of French and Belgian industry can only mean that they are going into the world markets to sell their goods in order to pay their debts. Not only are they going, they are there now. They have sold large orders of machinery to such countries as Turkey, Spain, China and the Argentine.

We Must Become Exporters

There are many things they would buy, so that they may utilize their limited plant and labor capacity to the best advantage for their most profitable lines and we should fit ourselves to encourage this and to be the ones they buy from. We should foster reciprocal trade with them. We must buy from them so that they can pay not only what they now owe us, but pay for future purchases in goods that we can use. This must not be in gold, which is of little use as clothing and none at all as food and is an expense to guard instead of being productive of more wealth by its use. Exchange of commodities is essential to satisfactory commercial relations.

Let us put ourselves in the position where the manufacturers of western Europe will want to buy from us. How? By really becoming exporters. In the past the average American business man has looked upon exporting as a separate business. He has not done it himself. Last spring an American asked his London banker for a list of the manufacturers in England doing an export business. The reply was to the point: "Had you asked me for a list of those *not* doing an export business, I might have been able to get it for you. What you ask is practically a directory of English manufacturers."

How can we overcome such handicaps as have been mentioned? First find keen, alert young men, preferably college graduates, and have them learn both the foreign language and the domestic product. Select fellows who have tact and some knowledge of the country where they are to go. They must know the language idiomatically so they can talk it freely and write it correctly. They must study the product thoroughly as to design, construction and use. Not catchy selling phrases nor trade camouflage, but its real merit, how it is made, what it will do, and how it compares with competitive products. They must know it from all angles and not be permitted to become specialists on a few features, unless the product is important enough to justify sending both general representatives and specialists abroad. Then send these men abroad as business men to study the problem of the sale and use of their products—and not as tourists. They cannot be expected to open new trade channels and get orders in two or three months. It takes months and years for a salesman to win the confidence of his customers here, where his firm and its product are known. In a strange land it takes longer and requires a better man. Getting "under the skin" with the foreign engineers is most important, and that is where tact and a broad gaged way of looking at things and knowledge of the language and the people count.

Honesty, Service and Efficiency

Above all he and the people he represents must be absolutely frank and honest. They must tell the real advantages and capabilities of their goods, but admit their limitations. If samples are shown and used as the basis of orders the goods furnished must be exactly like the samples. No change should be made without the full prior approval of the purchaser.

Quick service is vital. Inquiries must be answered promptly. Quotations and specifications must be sent at the earliest possible moment. Remember that it takes as many weeks to get a letter from you to the foreign representative or customer as it does days for your foreign competitor's proposition to get there. Do not forget that our type and descriptive abbreviations and idiomatic trade expressions are frequently unknown abroad, so write your proposals in plain, lucid English so that it may be easily understood and translated. You are writing to trained engineers, but your words must be expressed and understood in another language. Your expressions should have almost kindergarten simplicity.

Shipping promises should be conservative and due consideration should be given to time required to get the goods from the point of manufacture onto the steamer. Then the promise should be kept.

So far as possible all technical data should be furnished in the system of measures used by the purchaser. The preferable arrangement is to have at your service a local company, really native to the country at least as to a large part of its capital and most of its personnel, whose engineers and salesmen can translate and submit proposals according to the customs of the country. When

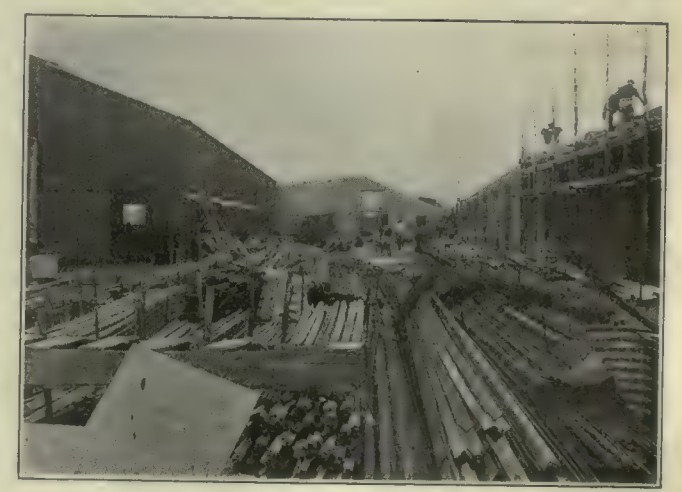


FIG. 11. THE SAME VIEW AS FIG. 10
Taken one year later, showing reconstruction and enlargement of the plant and accumulation of stock.



FIG. 12. MACHINE SHOP OF VERLINDE AT LILLE

Taken in June, 1919, showing a temporary protection of machines which had not been stolen and foundations of the machines taken away by the Germans. In some cases the foundations were left intact and in other cases the bolts were torn off.

that is not practicable the American representative must do it himself. In any case the project should be presented to the purchaser in his own language, conforming to the customs of his trade and it goes without saying that the product offered must really be competitive when applied to that particular customer's business. This may sound like a prohibitive program on account of cost and time involved, but it is what the English have done; what the Germans did long before the war; what the French are doing now; and what a few of our American manufacturers are doing very successfully. The start seems difficult, but it is really worth while when the benefits to Americans, individually and collectively, are considered. It does pay when well and faithfully done.

Many manufacturers would like to know how to create the little internal organization which would enable them to get export orders, but they do not know how to go about it. Broadly constructive criticism and general plans are all right in their place, but the small manufacturer wants to know in detail how he can adapt his own existing organization to the requirements of export trade. It is frequently difficult for a regular commission house to handle a new line adequately. It may be competitive with some of their existing clients' product, or be something that they lack the technical staff to exploit with sufficient attention to details of construction and performance. Their correspondents or representatives in the foreign country may not be in touch with the class of purchasers involved. The manufacturer is generally not in a position to select a foreign concern to represent him, and such a firm might have the same limitations as the American export house. On the other hand, all the export houses will benefit by his getting into the field, because the more avenues of trade that are opened the more profitable it will be for all engaged in exporting.

If the size of the American manufacturer's business or the proportion of its output available for export is too small to justify the expense of training new men or adding competent specialists to the existing organization, the problem is somewhat more difficult under existing conditions. There seems to be need for a branch of engineering work which is being talked of a little but which has not yet developed beyond the embryonic stage. The consulting engineer now helps his client by constructive planning, advantageous purchasing and economical and efficient construction.

Export Specialists

There are plenty of specialists who study and co-operate in increasing the efficiency of domestic manufacturing and merchandising, but engineers who have made a careful and intelligent study of export conditions and are prepared to give the manufacturer sound advice as to how he can apply a portion of his output to the export market are not generally available. Let us have specialists who will go to a manufacturer and study the possibilities of his export trade. Show him how to develop it. Help him meet the peculiar requirements of technical and commercial data and aid him in selecting and training men. Or, if he already has orders, help him to understand clearly what is required. Tell him how to prepare the goods for shipment, and get out the proper drawings and instructions to go with them, perhaps doing the necessary translation not only of dimensions but of language. The growing interest in export business and the call for more extended markets which is now manifesting itself in this country should create sufficient demand for such service to make it attractive to competent, experienced engineers. This would be a service entirely separated from direct selling. Orders would come from the man sent abroad or through some carefully selected commission house or representative in the foreign country. The functions of the consulting export expert might include assisting in the selection of that sales organization, as well as in preparing adequate data for it. After the order is placed such an engineer would be of great service in saving waste of time and energy in preparing information to be sent abroad, and in such humdrum but important details as intelligent instructions about boxing and arranging for ocean transportation, including loading at the American dock and unloading at the foreign dock.

Having the order, what next? Good faith in meeting the specifications and matching the samples is not only fundamental, but must be exercised liberally without taking any advantage of the purchaser's ignorance of our trade customs or terms. Of course there will be times when our ignorance or theirs may work hardships, but it can generally be charged off as part of the cost of our learning the art of exporting.

The goods completed, they must be properly prepared for shipment. After preparing for shipment they

should be routed so as to arrive at seaport not only promptly, but at the time when a vessel will be able to take them on immediately. Arrangements should be made for securing not only a low freight rate, but the best service in the matter of properly handling the boxes both in loading and unloading.

In the case of small packages of medium weight it is a question of adequate packing. In the case of very heavy or very bulky pieces the question of how far disassembly should be carried must be carefully investigated. It is now feasible to ship single packages to Europe weighing as much as 100 tons, and at least one line has vessels available with very large hatches and open holds so that even crated locomotives can be carried below decks. To the manufacturer whose shipping department lacks experience in export shipments, or who has not the personnel trained to carry on the necessary correspondence and prepare adequate instructions regarding these matters, the consulting export expert would be a blessing. Where machinery has been sold boxed for export, f.a.s. New York, the manufacturer's natural tendency is to do a minimum amount of disassembling and to ship in large packages with ordinary crating or skidding such as has proved satisfactory for domestic shipments. In many cases where this has been done great expense for repacking has been incurred at the seaport because it was impossible for the steamship to receive the material as delivered by the railroad company. Much distrust of American manufacturers has resulted from the poor condition in which shipments have reached their destination.

After finding out the weights and dimensions permissible on the boats of the steamship company, and the limitations of height and measurement imposed by the unloading equipment and the regulations of the railroad over which the cases must be transported from the point of landing to the ultimate user, provision must be made for disassembling and boxing in conformity with those limitations. In view of the unavoidable exposure and methods of handling on docks and in holds machinery must be protected against moisture and other exposure by waterproof slushing compounds which do not easily rub off, melt from warm exposure nor chip off from freezing, but which can be cheaply removed by kerosene or something of the sort. Crates or boxes should be designed by engineers so as to not only protect the machinery under all conditions and in all positions but to provide for lifting it up by slings or dragging it up and down gang planks without submitting it to any dangerous strains. This may involve detailed working drawings and the same care as is given to the manufacture of the machinery itself.

As the packages will generally be opened by people unfamiliar with the apparatus, not only the packages themselves but every separate part should be positively and clearly identified with marks which will not be destroyed in the unpacking and cleaning process, or if this is impracticable, by cloth tags wired on. There should be memoranda naming each part clearly and using the same identification marks as are on the parts themselves, inside of every package. Each package should contain only things which would be used immediately after opening. It should not be necessary to open an extra crate to get a few parts required at the time and be forced to leave the majority of the contents exposed, perhaps for several weeks pending either the arrival of a later shipment or the progress of assembly so as to require the other parts. This especially applies to large apparatus assembled in the open or in partially finished buildings.

In every case copies of all the shipping memoranda with complete instruction for unboxing, assembling, installing, starting and operating should be forwarded by the first mail after the boxing is completed so as to arrive considerably in advance of the merchandise. This will enable the foreign purchaser to familiarize himself with the equipment and prepare a program for handling it. The instructions and accompanying diagrams should be very complete, it always being borne in mind in preparing them that the person who is going to use them is frequently not only unfamiliar with the particular apparatus in question but with the methods and practice which it represents. Whenever possible this data regarding shipment and installation should be in the language of the user and the measurements conform to the standards of his country. Do not forget that while some of the leading engineers of the purchaser may be familiar with our language the actual installing and operating must be carried on by workmen who rarely know more than one language, and to whom a diagram in feet, inches and pounds is about as intelligible as a Chinese laundryman's slip is to us. Such service while in no sense sales representation, if faithfully and patiently done, could be of great benefit to scores of our manufacturers who have goods for which



FIG. 13. A VIEW OF THE SAME CORNER OF THE SHOP SHOWN IN FIG. 12
Taken in February, 1920, showing the considerable number of tools recovered and put back on their original foundations. The plant has otherwise been renovated and reconstructed.

there is a foreign market, but lack the liaison, as we called it in the army, or the proper connections as we might say in trade, to provide a smooth and effective channel from their factories to foreign customers and back to their bank accounts with resultant swelling of profits.

Foreign Business a Good Balance Wheel

Finally, the American manufacturer must have low cost production and be willing to take moderate profits, getting his return on quantity output rather than attempting big gains on a few small sales. He must realize that the foreign business is a good balance wheel for domestic business, but he must not make the fatal mistake of neglecting the foreign market when domestic business is good and expecting to be able to jump into it profitably the minute there is a slump in his home sales. He must take as good care of his foreign as of his domestic customers. He has more severe competition in the foreign field. The English took good care of their foreign customers throughout the war.

After the goods are shipped and paid for (payments, like exchange, are beyond the scope of this article but it must not be forgotten that our German and English competitors have found the giving of long credits for at least a part of the purchase price worth while), all practicable assistance must be given the purchaser to enable him to utilize them effectively and profitably—for it is from repeat and spare-part orders that most profit comes.

What the United States Can Do

As a result of our part in the war, we now have the opportunity to think and act in a big, international way. It is a chance to get into the world's markets which will not come again for a long time, certainly not while we are alive. If we all, big industrials, little industrials, individuals, go at it right, we will not only establish the United States as a great and powerful international merchandising group, but we will greatly benefit ourselves, especially our workmen, by stabilizing our industries and more justly equalizing the purchasing power of earnings.

Queries on Spindles and Bearings

The following queries concerning lathe spindles and their bearings have been received from different sources. They are all pertinent to the problems of machine design and should prove fruitful topics for discussion. The last query, regarding the carbon content of shafts for bearings of various kinds, is particularly interesting. What has been your experience?

1. Among the forms of bearings for lathe spindles we have: Both bearings straight; front bearing tapered and rear straight; both bearings tapered; straight journals in tapered bearing shells. Which is best?

2. Do hardened and ground spindles wear longer than soft spindles not ground?

3. How do babbitted bearings stand up on lathe spindles?

4. What is the best bearing mixture and what is the best way of applying it?

5. What is the best method of machining babbitt bearings for lathe spindles?

6. What effect has the carbon content of a steel shaft on its running qualities in a bronze bearing?

The Testing of High-Speed Steels

By Thomas Fish
President, The Ready Tool Co.

The writer's attention has been called a number of times to the fact that there seem to be no facilities in this country for testing in a scientific way the merits of the various makes of high-speed steel. The writer has in mind some place where it would be possible to continue the work as laid out by the late Frederick W. Taylor, at the Midvale Steel Co. If some good technical school, like the Massachusetts Institute, would take hold of this, or the American Society of Mechanical Engineers could in some way provide facilities for the proper testing of high-speed steel, I believe it would be invaluable to the users of steel in this country.

We, of course, as manufacturers of tool-holders and sellers of large quantities of extra cutters, toolbits and threading tools, are interested in determining the best steel. We have the representatives of the large steel companies calling on us continually, stating the tests they have made in various plants, and how their steel, "did more work than any of the other twelve or twenty-four brands." But when you come to examine the report of the test, you find that no attempt was made to analyze the piece of work that was being machined, that no stated form of tool was used or maintained, and that various ways of determining the value of the steels being tested are used by different manufacturers.

One man will take a sample piece of high-speed steel, and run it just as long as he can at a very high speed, which speed may be entirely impracticable, as far as its use is concerned. The theory is that, if he can show on one grade of work that a tool ran for two inches, where another steel ran only one inch at this high speed, then the one that ran two inches is double in value to the one that ran only one inch. Another manufacturer will run steel for days at a time without sharpening, and if one specimen will run three days, and another will run six, then, it is his opinion that the one that runs six days, is worth twice as much as the one that runs three.

In other words, there is not only no place for properly testing high-speed steel, but also there is no standard being used for determining the results. Taylor gave us an accurate report of his tests, showing that the average economical time that a tool should be used before breaking down was an hour and twenty minutes; but that a twenty minute run was nearly enough correct for determining the value of high-speed steel.

There is, in addition to this, another very important factor, the heat treatment of high-speed steel. In my travels I ran across some peculiar methods of treating high-speed steel. There is no standard, and even the manufacturers vary considerably in their instructions for the heat treatment of their own particular brand.

It would seem to the writer, that if the American Society or some technical school could take advantage of this opportunity, the benefits derived would be very valuable. A proper sized lathe should be used, and properly annealed and analyzed cast iron and steel could be furnished for the purpose of the test. Then, correctly formed, hardened and ground tools made from various makes of high-speed steel could be run at predetermined feeds and speeds, and compared with other makes of steel, giving an accurate report. It would be understood that each manufacturer having steel tested would hold for his own use the name of the steel.

Hydraulic Forge Press Operations

Recording Instrument Developed—Graphs Indicate Proper Treatment for Strange Forgings—Information on the Forging of Thirty Types of Shells and Tubes

A PAPER, very important to engineers responsible for forging operations, was presented by Eugene Schneider before the autumn (1920) meeting of the British Iron and Steel Institute, entitled "An Investigation of Various Forging Operations Carried Out Under Hydraulic Presses." In it the author describes a recording instrument developed at the Creusot works, gives an illustration of the autographic and derived curves for a heavy forging job, and finally a diagram summarizing information on stamping thirty calibers and designs of shells. By means of such graphs it is possible to predict confidently the proper treatment for strange forgings; hitherto, only a "cut-and-try" process has been the guide.

Fig. 1 shows a photograph of the recorder. A strip of paper is wound around drum *A* by means of wire *B* connected to the ram and wound in turn about the drum-end *C*, made slightly conical to compensate for the thickness of the overlapping paper. A pipe, as large and short as possible, connects the press cylinder to manometer *D*; pressure moves the pointer, and through the agency of a light sheave and silken cord, drives a tiny counterweighted pen carriage *E* at right angles to the paper-travel. Such a curve as that shown on the drum



FIG. 1. RECORDING INSTRUMENT FOR FORGING PRESSES

evidently records the position of the ram and the pressure in the cylinder at any instant. Times corresponding to these movements are recorded in a unique manner. A constant speed motor *F* drives an endless chain at right angles to the paper-edge. To this chain are attached pencils *G*, one of which is always making a mark on the paper. Since the transverse speed of the pencil is uniform, the slope of its trace is a measure of the speed with which the paper (that is, the ram) moves.

In order to record both up and down ram-movements on paper constantly moving in the same direction, wire *B* is pulled by a second drum, mounted on the same shaft as a fine-toothed ratchet wheel. To right and left of the latter and loose on the same shaft are mounted

SYNOPSIS OF PUNCHING

No.	Type of Forging	Weight in Kg.	Nature of Blank Employed—Diam. in mm.	Lgth. in mm.	Thickness of Bottom in mm.	Depth of Punching in mm.
1	75 mm. shrapnel	5.6	Round, 82	138	22	116
2	H.E. 75 mm. shell	7.8	Round, 82	190	30	160
3	Howitzer shell 58 mm	4.8	Round, 82	117	20	97
4	105 mm. shrapnel	13.3	Round, 115	165	30	135
5	155 mm. cartridge	17	Round, 172	95	22	73
6	H.E. howitzer shell, 120 mm.	28	Round, 138	240	30	210
7	H.E. howitzer shell, 105 mm.	23	Round, 115	285	40	245
8	H.E. howitzer shell, 155 mm.	56.5	Square, 145; diag., 186.	360	35	325
9	H.E. howitzer shell, 145 mm.	50	Round, 162	310	35	285
10	H.E. howitzer shell, 155 mm.	63	Round, 180	317	35	282
11	H.E. howitzer shell, 190 mm.	110	Round, 230	340	70	270
12	H.E. howitzer shell, 149 mm.	59	Round, 178	305	45	260
13	H.E. howitzer shell, 279 mm.	270	Square, 265; diag., 320.	540	70	470
14	Hydrogen gas shell	82	Square, 230; diag., 280.	210	20	190
15	H.E. shell, 293.4 mm.	345	Round, 320	545	80	465
16	H.E. shell, 279.4 mm.	270	Square, 270; diag., 365	480	70	410
17	H.E. shell 240 mm.	210	Square, 230; diag., 280	550	70	480
18	H.E. shell, 270 mm.	195	Square, 250; diag., 335.	410	70	340
19	Example of punching					
20	H.E. shell, 279.4 mm.	290	Square 280; diag., 350.	475	70	405
21	H.E. shell, 274.4 mm.	305	Square, 265; diag., 320.	595	70	525
22	H.E. shell, 320 mm.	485	Square, 280; diag., 350	820	80	740
23	H.E. shell, 370 mm.	650	Square, 368; diag., 430	665	75	590
24	H.E. shell, 370 mm.	530	Square, 268; diag., 430.	555	75	480
25	H.E. shell, 340 mm.	630	Square, 320; diag., 430.	795	90	705
26	H.E. shell, 400 mm.	800	Square, 368; diag., 430.	820	110	710
27	Torpedo tube	1,510	Octagon, diam., 480.	1,015	130	885
28	H.E. 520 mm.	1,250	Square, 465; diag., 550.	790	130	660
29	H.E., 520 mm.	1,800	Square 465; diag., 550.	1,130	130	1,000
30	H.E.	1,400	Octagon, diam., 580.	970	130	840

sprockets carrying counterweighted link chains fixed to the ram, but reeved oppositely. Thus when the ram is going down, the right sprocket ratchets the drum forward, and when the ram is being raised, the left sprocket ratchets the drum forward, the right sprocket then idling.

Calibration is effected by attaching a hand pump to *H*, holding a certain pressure, indicated by the standardized manometer *J*, and drawing the paper forward slightly. The time is checked by measuring with a stop watch the time necessary for, say, twenty complete circuits of the first pencil *G*, and computing its speed.

The diagram in Fig. 2 assembles information on forging of thirty different types of shells and tubes listed in the table. Many different factors affect the work of forging *T* (defined as the necessary pressure in kg. per sq.mm. of the greatest diameter of the punch). After temperature—which is held constant at 1,050 deg. C.—the greatest influence is exerted by the thickness of the walls *e* (Fig. 3) and the diameter of the punch. The ratio between the area of the side wall (an annulus with thickness *e* and inner diameter *d*) and the area of the punch is noted by *Y* and is called the coefficient of spread.

$$Y = \frac{4e\ (d + e)}{d^2} \text{ and } Y \propto \frac{1}{T}$$

If the diameter of the punch *d* is constant, the work of forging *T* evidently decreases with increase in wall thickness *e*. If the wall thickness *e* is constant, the work of forging decreases with the diameter of the punch. Therefore, *Y* has been computed for each forging and plotted below the horizontal axis. Three general classes have been distinguished, the dotted lines referring to thin walled forgings ($Y = 0.76 \pm$),

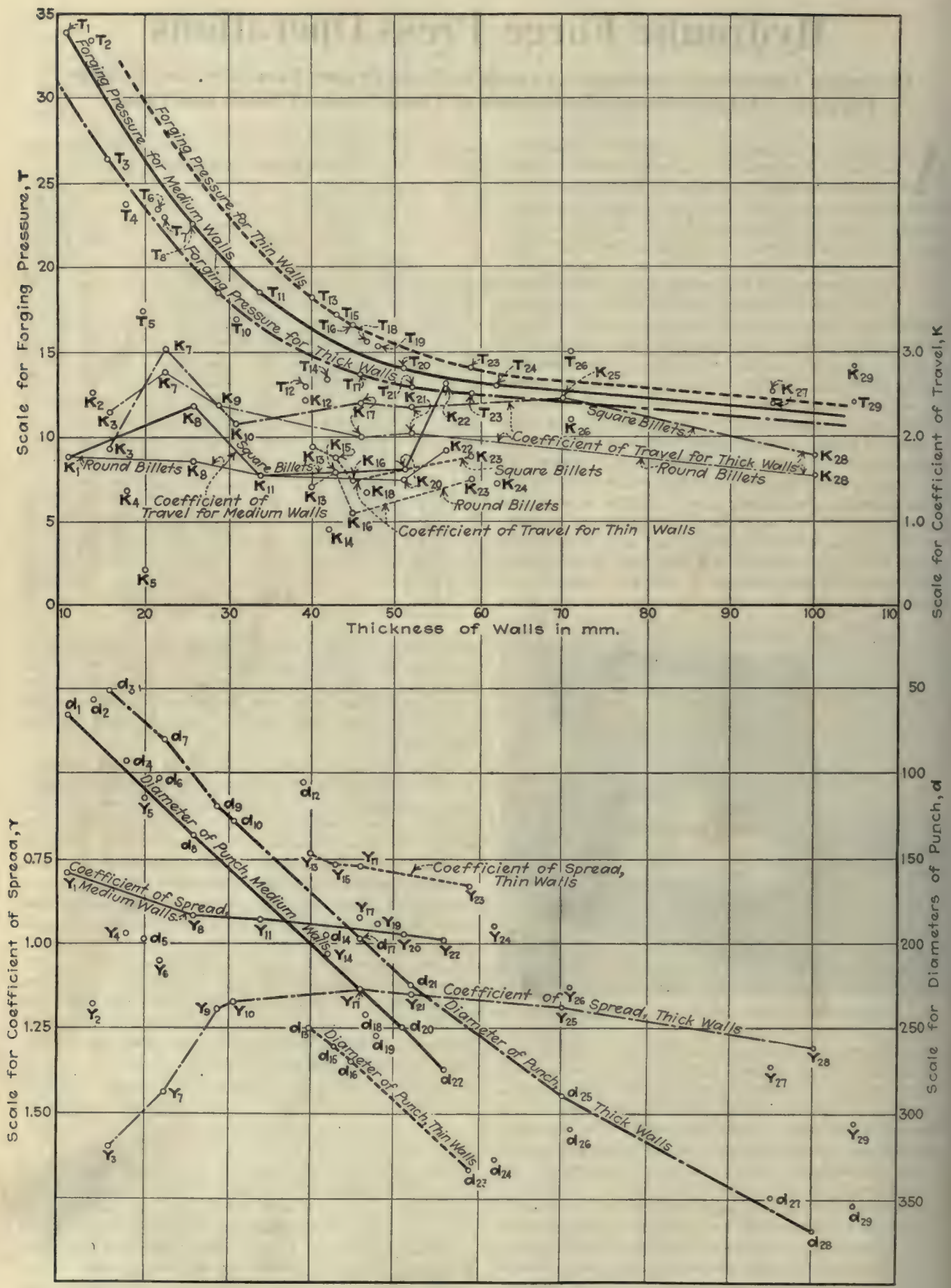


FIG. 2. DATA ON WORK REQUIRED FOR A PUNCHING OPERATION

Relationship between forging pressure in kilograms per square millimeter, diameter of punch, coefficient of spread and coefficient of travel for various operations, grouped in three classes.

the continuous lines to medium-walled forgings ($Y = 0.95 \pm$), and the dot-and-dash line to thick forgings ($Y = 1.2 \pm$). Heavy lines below the axis also connect corresponding punch-diameters. Values of Y and d not falling near the curves such as for forging 24 present in general no anomalies.

The length of the stroke is of influence chiefly on account of the time the metal is pressed and cooled against the die. The coefficient of travel K is defined as the ratio of length of stroke to diameter of punch, and is plotted above the horizontal axis, both for round and square billets, the latter being the higher. Other variables which have been eliminated are the shape and surface condition of punch and die, the speed of the press, the "spread" (or $e \div E$, see Fig. 3), the temperature of the tools, and the lubrication. Finally, the graph contains what is doubtless the most important information, viz., the work of forging, each point T being an integration of all these factors for a particular job, as determined with the aid of the recorder described above.

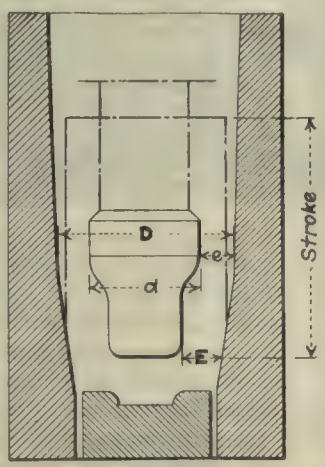


FIG. 3. SKETCH OF PUNCH AND DIE

As examples of the service to which this graph may be put, take the following:

(*a*) What pressure will be required to make a forging with $d = 255$ mm. and $e = 48$ mm.? Y is figured to be 0.89, consequently the work would be between that required for thin and for medium forgings. Running up ordinate 48, the required pressure is found to be about 15 kg. per sq.mm.

(*b*) Suppose a forging with $d = 255$ mm. is required and only a 650-ton press is available (a press which gives a maximum pressure of 12.8 kg. per sq.mm.). Running across abcissa 12.8 to its intersection with the curve T for thick forgings shows that a wall thickness of at least 60 mm. must be provided, and the die must evidently have a diameter not less than 375 mm. Y figures 1.16, consequently our assumption that the forging would lie in the "heavy" class is justified.

Other instruments may evidently be substituted for the manometer D (Fig. 1) and the working of a pump, machine tool or other machine can be studied. When applied to presses, it has furnished data for proper conversion of steam-driven pumps into electrically-driven pumps, and, as remarked above, for the solution of all forging problems connected with the scientific management of that department, enabling the production to be largely increased.

The Value of Books to the Mechanic

By G. G. Weaver

Daily we meet people who have not had the advantage of an education, but who are keenly ambitious to make a success of their work. Many times all avenues of future progress seem to be blocked to them, and no one appears to take any personal interest in extending friendly advice or assistance. Such individuals have a feeling of, "What's the use?"

There is one democratic friend we may all enjoy, a friend who shows no partiality to creed, color, sex or social standing. That one universal friend is "Books." Although we may be poverty stricken, socially an outcast and unable to enjoy the society of the educated or the environments of the wealthy, it is possible to share in all the world's best thought, education and pleasure by reading and studying from books.

In these unusual days of industrial progress, invention, breaking down of traditions, abdication of kings, new ideas on religion and politics, it is necessary that we keep posted on the world's events if we hope to make personal progress. The newspaper has been the chief source through which we have acquainted ourselves with the great world-wide movements of modern times. The newspaper, however, gives only the tid-bits and not the ideas or instruction we need in personal advancement.

One reliable medium through which we may obtain authentic facts, personal encouragement, self-satisfaction and new ideas about our work is the reading of various books along our lines of interest. There are in print, books on every conceivable subject of interest to human beings, whether it be things we see, materials we use, thoughts we think, or religion we believe. Regardless of what job you hold or position you fill, you cannot afford to do without some form of instruction on your work through reading. Instead of brooding over your unsatisfactory employment, get busy with books on your chosen line of work. Look beyond your job and let "Preparedness" be your slogan.

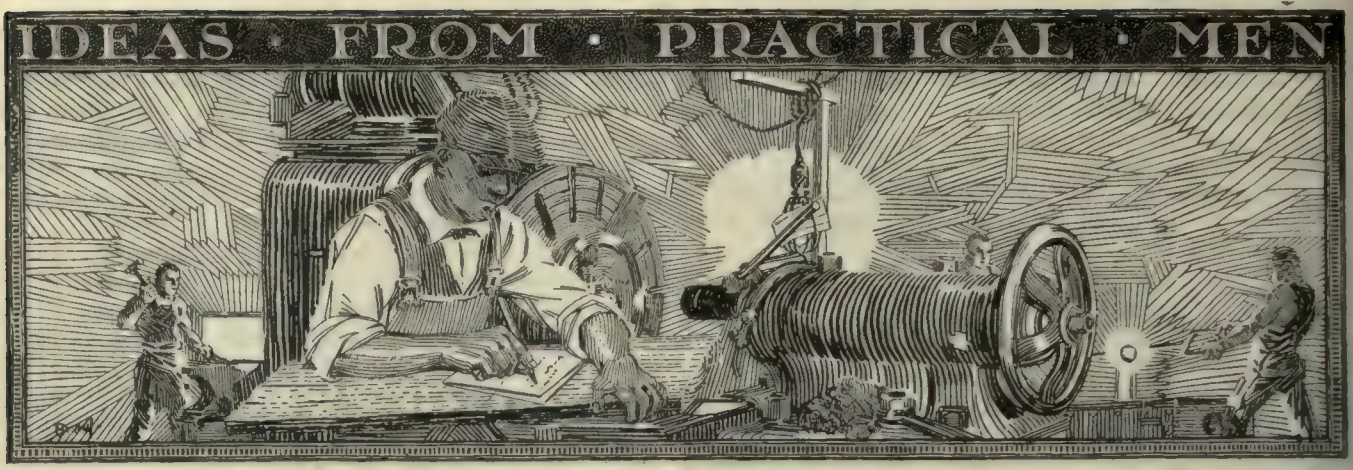
All of us possess latent powers and faculties for work and ambitions for progress, but it is very necessary to stimulate these hidden energies from without, as they possess no self-starter. If we make use of instructive books, rich in information, good in style, sound in reason and keen in insight, our own minds will acquire and develop these same characteristics, which are forerunners of advancement and success.

In days gone by, many mechanics and so-called practical men have promoted the idea that things can not be learned from books. That old idea has been exploded and now-a-days, every progressive apprentice, mechanic and executive is familiar with the best printed matter in his particular line. There are books for all, regardless of whether you are a machinist, toolmaker, patternmaker, millwright, automatic screw-machine operator, blacksmith, polisher, tool designer, office clerk, purchasing agent, superintendent or manager.

Experience in Words

We must bear in mind that books on practical subjects are nothing more than the long and varied experiences of some one put into words. Is there any reason why each one of us should go through the same long-drawn-out experimental stages, if it is possible to obtain the same amount of knowledge from a book in a comparatively short length of time? Let us display our debt of gratitude to the writers by taking advantage of their spirit of generosity to pass the valuable information to us. The libraries throughout the country possess a very extensive list of good books on hundreds of subjects. Nothing would be more gratifying than to have them worn out by continued usage. Those in charge of the libraries will be glad to volunteer every assistance possible to you.

Let us therefore, supplement our mechanical skill with mechanical knowledge, as mechanical success is due to the combination of mechanical skill plus mechanical knowledge and mechanical intelligence.



Special Bench-Lathe Tools to Avoid Resetting

By Henry F. Colvin

In machining the aluminum case of a special gasoline gage for airplane use, the shop superintendent of the Pioneer Instrument Co., Brooklyn, N. Y., devised a lathe tool which did the complete job without moving the tool in the holder or without changing the piece of work in the chuck. As ten operations were required on the case, including facing, boring, threading, counterboring and beveling, the fact that the whole job was done so simply and quickly made it unusual.

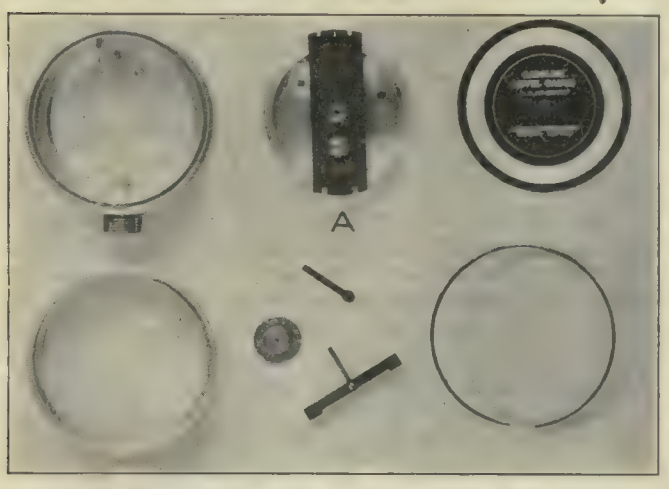


FIG. 1. PARTS OF THE GASOLINE GAGE

The case was an aluminum casting which had to be machined with great accuracy as it was to be air-tight when completed and the bezel ring screwed on. The mechanism, shown assembled at *A* in Fig. 1, fitted the case within very close limits and special attention was given to making the depth dimensions accurate, as the air-tightness of the case depended largely on this feature.

The outside of the case was left in the rough except for such finish as was necessary for concentricity when chucking up for the inside machine work.

The tool, Fig. 2, which was designed for the inside work, was mounted in the toolholder at right-angles to the work, that is, parallel to the ways of the lathe. In order to make the depth dimensions uniform on all castings, stops to limit the forward movement of the carriage at the desired points were devised to be used on the ways of the lathe.

The main stop was provided for by clamping a small parallel clamp to the ways of the lathe at the "zero point," that is at the point which was the depth of the deepest cut and which was the point from which all other measurements were taken. Additional stops for the other cuts were made by placing small blocks of steel of the desired thickness on the ways of the lathe in front of the parallel clamp so that the carriage would stop at any desired distance from the "zero point."

When the casting was placed in the lathe and trued up, the first cut was made with the front edge of the tool, Fig. 3, operation 1. This was a facing operation and the cut was made as an index point, so that the carriage was run to the clamp on the ways as a stop while making it. With the carriage in the same position the second cut was made, Fig. 3, operation 2, the crossfeed being determined by the usual micrometer reading.

With these two operations completed, a block of steel ½-in. thick was placed on the ways behind the clamp and the third cut was taken, Fig. 3, operation 3. This was another facing operation and the front face of the tool was again used.

With the same stop in use the fourth cut, a boring operation, was made and the stop on the crossfeed was determined as in the second operation, Fig. 3, operation 4. In the fifth cut a 1-in. block of steel was substituted for the smaller one on the ways of the lathe and the facing operation, Fig. 3, operation 5, was made. In order to turn the casting for the threads (which was the sixth operation, Fig. 3, operation 6), the tool-rest was run to the back of the cross-slide and the lathe was then run backwards. In this manner no change of tool or toolholder was made necessary. This operation, and the next, which was facing, Fig. 3, operation 7, were both made with the lathe running backwards and with a $\frac{33}{32}$-in. stop substituted for the one used in the

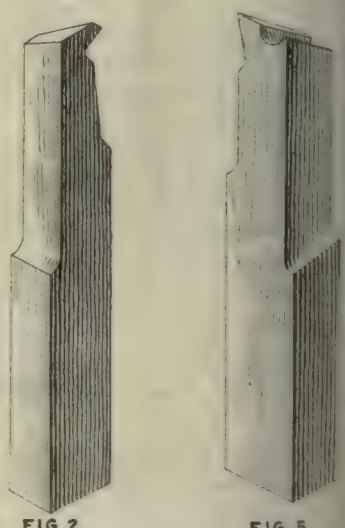


FIG. 2. THE TOOL USED ON THE CASE

FIG. 5. ONE OF THE TOOLS USED ON THE BEZEL

previous operation. The eighth operation, Fig. 3, operation 8, was the cutting of a relief for the thread chasing. This relief was cut with the V-point of the lathe tool which was used in the next operation, Fig. 3, operation 9, for chasing the threads. The last operation on the case was the bevelling off of the threads, Fig. 3, operation 10, this being done by merely using the front edge of the thread cutting tool.

In this way a job which ordinarily would require numerous changes of tools and settings was accomplished with a minimum amount of effort, in a minimum space of time and, the writer believes, with greater accuracy than could be assured by any other method.

Interesting Operations on a Bezel Ring

A bezel ring which was a part of this same gasoline gage and which fitted directly to the part just described, presented an interesting problem also and was made to a large extent with the same tool which was used on the case, and with the same tool setting.

These rings, one of which is shown in the lower left-hand corner of Fig. 1, were machined from "drum" castings. The drum was machined outside to size and the rings were then cut off from it. The inside machining was done in a similar manner to that employed on the cases.

Each ring was chucked in a lathe and stops were used on the ways of the lathe as before. The first cut, Fig. 4, operation 1, was facing a surface $\frac{1}{32}$ in. from the finished edge. The same tool (shown in Fig. 2), was

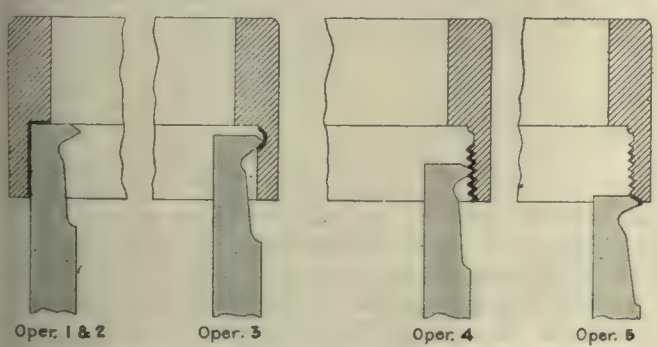


FIG. 4. OPERATIONS ON THREADED SIDE OF BEZEL

used here that was used in machining the case and it was held in the same manner. This operation was followed by a boring cut to the same depth, Fig. 4, operation 2. The carriage was then run across to the far side of the lathe and a relief for the threads was cut, Fig. 4, operation 3, the same as was done on the case, by running the lathe backwards. Threads were then chased, Fig. 4, operation 4, and the outer bevel cut, which completed the machining necessary on this end of the ring.

The rings were then screwed on a special plug which was chucked in the lathe. The machining operations were completed with another lathe tool which, while not as universal as the first, was equally ingenious. It is shown in Fig. 5.

The first operation with the work screwed on the plug was boring the inner surface to size, Fig. 6, operation 1. This was done with the broad cutting edge of the side of the tool.

Stops were set for the next cut, Fig. 6, operation 2, so as to insure accuracy at this point, and this same stop was used for the boring operation which came next, Fig. 6, operation 3. An additional stop of 0.040 in. was then placed on the ways and the point of the form tool

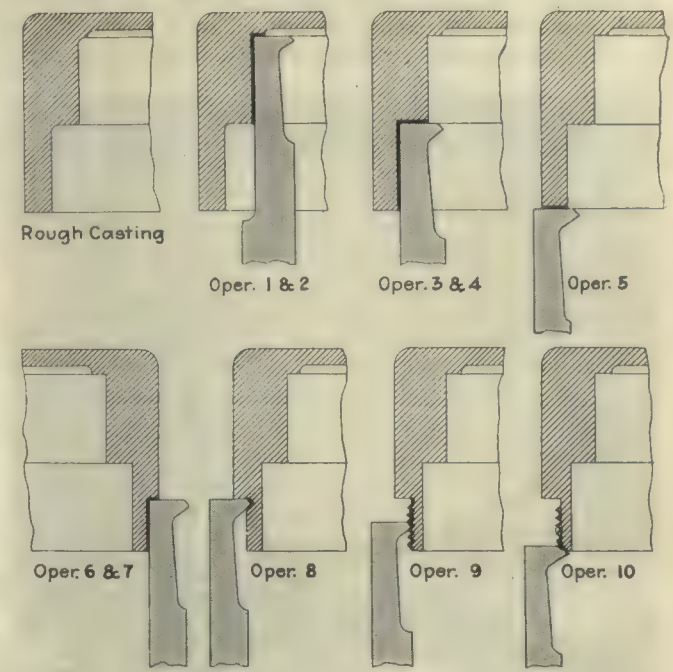


FIG. 3. OPERATIONS ON THE CASE

was run into the side of the ring making the groove, shown in Fig. 6, operation 4. The final operation on the ring consisted of forming the rounded front edge of the ring and this was done with the half-round groove which had been ground into the front edge of the tool.

The Value of Simplicity

In this manner a job which under usual circumstances would require the time of a highly skilled instrument maker was simplified to such an extent that it was done by an apprentice in the shop who had had a limited amount of practical experience. All that was required of the operator was that he place the proper stops on the ways of the lathe and that he read his crossfeed dial correctly, for aside from these things the job was not different from the usual run of work that comes into any shop. The gasoline gages were for the U. S. Air Service and turned out remarkably well. Although it

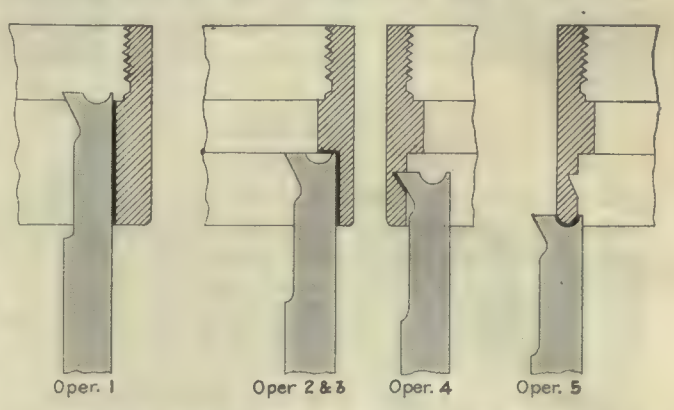


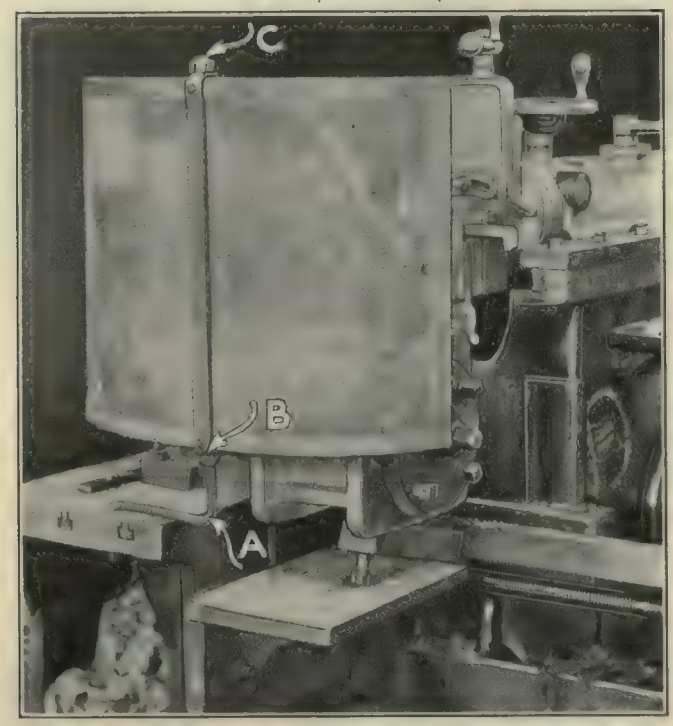
FIG. 6. OPERATIONS ON PLAIN SIDE OF BEZEL

was a comparatively small order, it was produced on a quantity production basis yet without undue waste of money in elaborate tooling.

Chip Guard for a Shaper

By J. H. Vincent

When machining a hard bearing bronze the chips fly freely and are a danger to all workmen in the vicinity. The illustration shows a chip guard that has been put on



CHIP GUARD USED IN A LOCOMOTIVE REPAIR SHOP

a shaper in the locomotive shop of the Wabash Railway at Decatur, Ill. This shaper is used on locomotive driving rod boxes.

The ease with which the screen can be swung to one side while replacing work or setting the tools is its especially valuable feature. The frame is covered with a light perforated metal sheet and is curved so that it partially surrounds the sides of the work. It is carried by the standard *A* which is a piece of $\frac{5}{8}$-in. diameter steel rod. The rod is offset so that it reaches the table at the side of the work. The end is bent down to slip through a hole drilled through the table, and, as the rod is not fastened, the whole contrivance can be lifted off when its use is not desired. The frame is pivoted on the rod which passes through a loop in the frame with nuts at *B* and *C* to hold it in place. The pivot gives the frame additional adjustability to meet varying conditions of the work.

A Data File

By E. Wilmont La Rue

Many draftsmen and men of the machine shop and toolroom have some sort of system for keeping notes and data that pertain to their special line of work. I believe that in most cases the data, if kept in systematic order, are filed according to subject matter and the data under each main heading or sub-heading are kept in separate folders.

A container for these folders is seldom provided. In most cases the folders are stored on a bookshelf with a rubber band around them and may be kept in order. In this condition they are exposed to dust and often become mixed or placed in improper order. I have found that a cardboard folder 9½ x 11½ in. is a convenient size to accommodate full pages from most of the technical magazines and other data that might be collected. A folder of this size will fit nicely into a letter file or box file, and can be bought at any stationary store. They are also called transfer cases. The cases are made of thin slabs of wood and form a closed box with a snap catch at the front. A file kept in these boxes is well protected and is in a compact form. In many instances one box may serve to hold an entire file. If the volume of data is large enough a separate case may be used for each main subject.

A High-Speed Milling Attachment

By E. A. Dixie

We have recently had a lot of *small* milling cuts to be taken on fairly *large* work. Our milling department is well equipped with both large and small milling machines but none of our equipment was suitable for taking the milling cuts demanded by the work referred to. The parts were too large and heavy for the small machines which had the speed to handle the small milling cutters suited to the work, and the large machines which were husky enough to support the heavy castings were too slow to drive the small cutters at correct cutting speeds.

The works manager decided that the simplest way out of the dilemma was to build the high-speed milling attachment shown in Fig. 1, and apply it to one of our heavy machines.

The taper shank of the attachment fits the tapered hole in the spindle of the No. 3 Milwaukee milling machine on which it is used.

The high-speed spindle runs in a ball bearing at the front and in a bronze bearing at the rear, as shown in Fig. 2. The pulley on the attachment is driven from a countershaft overhead.

When in use the spindle of the milling machine is run in order to drive the feeds. The spindle of the attachment runs in the same direction as the spindle of the milling machine, with the result that the speed of the spindle of the attachment with relation to the milling machine spindle is considerably less than its rotations per minute. In other words, suppose that the spindle of the attachment runs at 200 r.p.m. and that

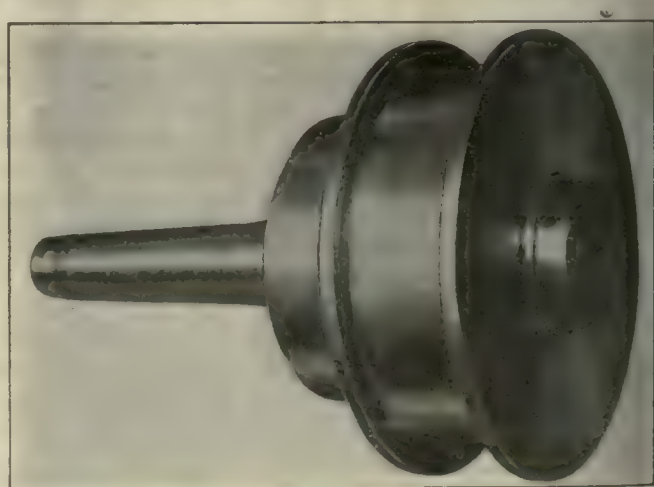


FIG. 1. THE HIGH-SPEED MILLING ATTACHMENT

the spindle of the milling machine turns in the same direction at the rate of 100 r.p.m., then while the spindle of the attachment makes 200 r.p.m. with relation to the

work, it only makes 100 r.p.m. with relation to the milling machine spindle. This results in a considerable saving of wear to the bearings of the attachment.

This attachment has saved its cost many times over on the first lot of machines on which it was used.

The countershaft which drives it is driven from the

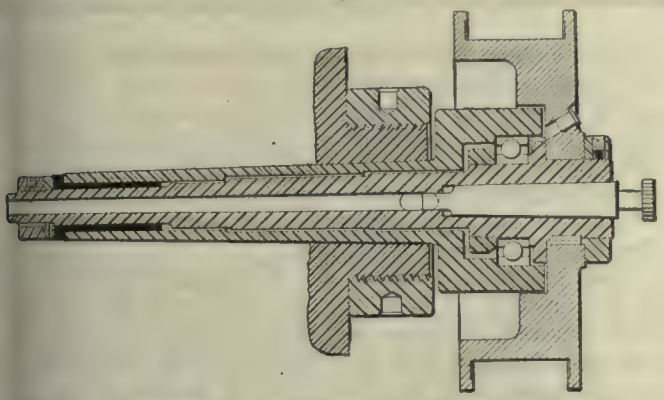


FIG. 2. ASSEMBLY DRAWING OF THE ATTACHMENT

main-line shaft. Four changes of speeds are provided by means of a pair of four-stepped cone pulleys, one on the line- and one on the countershaft.

An Automatic Stop for Punch Press Work

By Louis Meszaros

The accompanying illustration shows an automatic stop for punch press work. It works surely and is equal to the finger stop used in many shops. It can

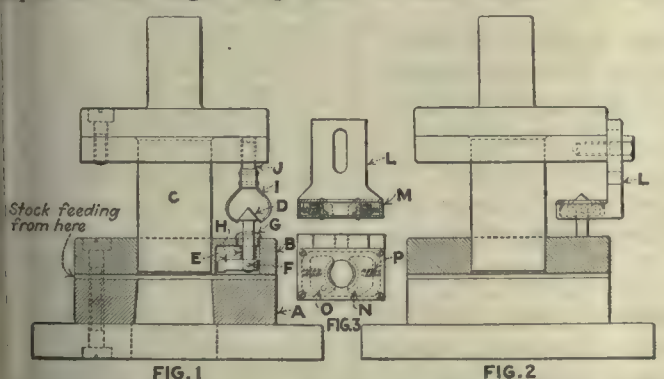


FIG. 1. AUTOMATIC STOP WITH ADJUSTING SCREW AND FLAT SPRING LIFTING DEVICE
FIG. 2. AUTOMATIC STOP WITH SLOT FOR ADJUSTING, AND COIL SPRING LIFTING DEVICE
FIG. 3. DETAILS OF AUTOMATIC STOP SHOWN IN FIG. 2

be used on almost any die where an automatic stop is required.

In Fig. 1, *A* shows the die and *B* the stripper plate which is a close fit on punch *C*. The stripper plate is milled out in order to give finger *E*, which is connected with pin *D* by the dowel pin *F*, sufficient movement and also space for the coil spring *H*. Bushing *G* gives pin *D* more guide. The two flat springs *I* are riveted to the adjusting screw *J* and lift the pin *D* when the punch is going up in order to allow the stock to be pushed forward. When the pin *D* is lifted the spring *H* becomes stronger than the two springs *I* and pushes the stop *E* back again. Fig. 2 shows another lifting attachment that can be adjusted and used universally for more dies. Fig. 3 shows the details, consisting of the body *L*, cover *M*, two jaws *N* which are pivoted on pins *O* and two coil springs *P*.

Efficient Multiple Grooving Tool

By A. A. Karcher

A long-lived, multiple grooving, lathe tool for piston work was made by mounting three new high-speed milling cutters on a special holder equipped with a short cutter arbor. Spacing collars were used between the cutters which were kept from shifting on the arbor by a strip fastened to the holder engaging between two teeth on each cutter.

When the edges of the three respective cutters became dull, the cutters were advanced to the next tooth and so on until all were dull. The cutters were then dismounted and sharpened. The construction of the tool is so simple that an ordinary operator can reset the tools.

Drill Jig for Small Pin Holes

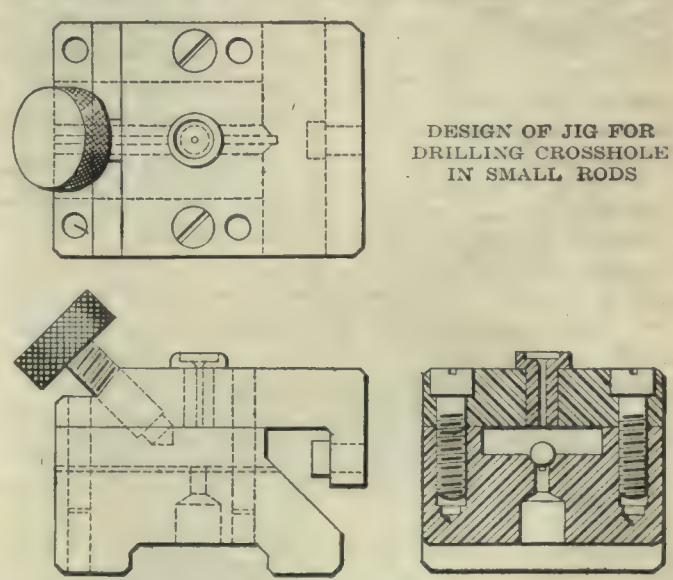
By F. W. Shumard

Drilling small holes in round shafts may be done in several different types of jigs, but the writer believes the design shown has several features of more than usual interest.

The part to be drilled is a drill-rod valve-stem $\frac{3}{16}$ in. in diameter in which a No. 51 (0.067 in.) hole is drilled. This hole must be held within what are generally conceded to be close limits from the end and exactly in the center of the valve-stem.

The body and bridge of the jig are cold rolled steel, pack hardened and ground, and from the design it will be noted that the work rests in a V and is positioned by the shouldered pad. The work is held by a knurled screw, located on a 45-deg. angle, having a 90-deg. pointed end which insures positioning the work against the stop pad and in the V when the screw is tightened. The operator can see if the work is against the stop and can easily clean the jig between loadings by dipping same in small pan of drilling compound. There is no reason for the work ever sticking and the packing of chips is never encountered.

The tool steel bushing is of the ordinary type, with the exception that the flange is made thicker and has



DESIGN OF JIG FOR DRILLING CROSSHOLE IN SMALL RODS

a counterbore in the top. This counterbore acts as a reservoir into which the drilling compound is fed and is of further advantage in that it allows a full volume of compound to enter the bushing.

IN THIS ISSUE

A TOOLROOM planer recently placed on the market is the subject of the leading article. The machine was designed for high-speed operation on tool work, particular attention being given to supplying heavy construction and easy and accurate control.

The second of Erwin H. Schell's articles on "Industrial Management" begins on page 444. It takes up the distinction between management and capital, the duties of management, the tools of leadership and other similar subjects. To get you into the swing of Schell's article and the arguments he advances, if they may be called such, permit us to quote a paragraph:

"The knowledge of incentives, and their use, whether financial or non-financial, is of greatest importance to the administrator. It is largely this resource which enables one individual to attain success in executive work where another of equally good capacity may fail. The leader who understands the value of the 'task' as distinguished from 'work,' who can use the rate increase to its greatest advantage in the stimulation of effort, who can introduce the spirit of the game into his organization, has at hand powerful incentives for production. These and many other similar spurs toward effort are again capable of analysis and formulation. In every industry there is opportunity to determine those which will be of greatest value and to make definite the procedure of application."

What is a first-class machinist? It seems to be a question hard to answer. Several have tried it within the past few weeks. We now have the opinion of John Mark May in a short article on page 447.

Stanley has prepared a very good article on the draw-cut shaper in the railroad shop, using his camera quite extensively to help him get his message over. We have allotted the necessary three-and-a-half pages, beginning with 448.

DeLeeuw's article on boring tools starts on page 452. It is the sixth of his series on metal cutting tools, a series that is receiving much favorable comment, deservedly so, we think. The current article takes up the construction and use of the boring head and multiple boring and taper boring tools. It also has some paragraphs on reamers and floating reamers. The subject is big, so that we are unable to run the entire article this week. The remainder will be in our next issue.

Western Editor Hunter, aided by his camera, gives us a three-page treatise on crankshaft turning practice. He explains how the cheeks, pins and bearings of automotive engine crankshafts are turned in special lathes, describes some of the lathes used and explains much of the special tooling. Page 456.

This week's installment on the foreman and his job is quite meaty. It deals for one thing with idle time of both men and machines, an important theme indeed. It also gives some advice as to how foremen and prospective foremen may learn about such things as cutting speeds and feeds and shapes of tools. There is a word as to the advisability of having a knowledge of the prices of machine tools. In connection with the matter of overhead, there is given an outline that comprises a complete and concise list of the items that go to make up the expenses of a manufacturing business. The article begins on page 459.

Beginning on page 462 we have the conclusion of Oliver Field Allen's article on selling machinery in Europe since the armistice. It will be remembered that the author was on the ground for some time after the armistice was signed and was in a position to get at facts first hand. He deals with the subject from a viewpoint which takes in sales and advertising methods chiefly.

On page 467 there is an abstract of a paper on hydraulic forge press operations, which describes a recording instrument developed at the Creusot Works, England. By means of the graphs produced by the instrument, it is possible to predict confidently the proper treatment for strange forgings, instead of depending upon cut-and-try processes. Data on forging thirty calibers and design of shells are given.

Space this week seems to permit us to do something that we have had in mind for several weeks, namely, to call attention to our large "Shop Equipment News" section. Less pressing business has given many shops the long-wished-for opportunity to work on development and we have been almost swamped with the descriptions of the many machines which have resulted. Last week we ran nine pages, this week we have nine, and we shall probably have nine next week. Page 476.

Coming Features

There will be a Basset article next week on "Getting Executive Leadership." It's a "brass tack" article that treats of the danger of over-organization, the desirability of free play for initiative and one-man and committee forms of control.

Morris will describe the employee training departments of the Goodyear Tire and Rubber Company. The systems of the Goodyear plant have been evolved after a good many years of experiment and experience. There are some unusual features connected with these systems and we suspect that many of our readers will receive some useful hints.

Sheldon's fourth magnetic chuck article, title "The Walker Chuck," will appear. After you read this article you will know quite a number of things about a chuck's "insides."

Associate Editor Hand will be with us again next week and will furnish an article on fast gear cutting.

EDITORIALS

The Sun Breaks Through Again

LAST week we took pleasure in commenting on the rift in the business depression clouds made by the signing of the Winslow bill. Although the funds thus made available to the railroads are so small that they will have to be spread very thinly indeed, their release marks a change for the better.

But now the sun breaks through the clouds and lights up an entirely different part of the industrial landscape. Word has reached us that automobile parts makers are getting releases on orders that have been held back for months and, more than that, they are getting some new business. The stimulus of renewed retail buying is reacting on the various links of the production chain and will get back to the source inevitably.

Another bright spot is the statement by Henry Ford that his main plant will be running at 75 per cent of its maximum capacity by the end of this month. Some people blame Mr. Ford for precipitating the present troubles by his famous price reduction. If he can get things moving again perhaps they will think less harshly of him.

Engineers in the Cabinet

THE appointment of Mr. Hoover to a post in the new cabinet will be hailed with satisfaction by engineers the country over. The Secretary of Commerce in the new administration is going to have a job that will call for the maximum of human ability. President Harding has displayed sound judgment in his choice.

There has been a feeling among engineers for some years that members of the profession were peculiarly fitted for service in high government positions. Encouraged perhaps by the choice of an engineer for a cabinet portfolio, this sentiment has crystallized in two communications from the American Engineering Council of the Federated American Engineering Societies to Mr. Harding. One letter urges the appointment of an engineer as Assistant Secretary of War; the other asks a similar choice for the vacancy on the Interstate Commerce Commission.

To us it seems to be not only advisable but vitally necessary to have an engineer with large manufacturing experience near the top of the War Department. It has been proved that industrial preparedness is the controlling factor in our defensive program, and consequently the need for a man thoroughly versed in industrial matters on the War Department staff is obvious.

A Move To Make Contracts Safe

AT THE present time contract cancellations are not so dreaded by machinery builders as they were a few months back. Not that cancellations are any more pleasant than they were before, but for the simple reason that almost everything cancelable has been canceled.

There are cases where cancellation is the only solution of a difficult situation and where such action may be the best move for buyer and seller both. But in the vast majority of instances cancellation of contracts has been one degree worse than burglary, for it is possible to insure against theft but not against cancellation of contract.

The war left many evils behind it but none worse than the very evident lowering of the moral tone of the country, both in business and in social life. Just why the contemptuous reference of a former emperor to a treaty as a scrap of paper, should be taken as a guide to business ethics by some presumably responsible business men is beyond comprehension, but such seems to have been the case.

Up to the present time nothing much has been done to remedy the condition other than vituperation which has had the usual lack of results.

On another page we have a brief notice of the movement undertaken by the National Association of Purchasing Agents to arrive at a form of standardized contract. It is their praiseworthy intention to reach a solution of the whole problem by gradual steps of which this is the first. Perhaps it is no more than just that they should be the ones to take the initiative in overcoming cancellation evils for some people hold them largely responsible for the trouble.

Failure of the Patent Office Bill

THE Patent Office bill failed of passage by Congress largely because of the persistent effort to have the salary bill include also the regulation for the assignment of patents of Government employees to the Federal Trade Commission. Unfortunately Senator Norris, although doubtless recognizing clearly this cause of difficulty, refused to urge the bill in the Senate without this complicated appendage.

No matter how much one may feel that we should provide for the utilization of the patentable developments of Government employees, he can hardly claim that the need for provision for this class of patents was any justification whatsoever for delaying the Patent Office reorganization bill.

One can scarcely condemn strongly enough those who backed this particular clause of the bill despite its detrimental effect on the main legislation. Such a legislative stand is indefensible on general principles and merits the careful consideration of the offending legislators' constituents.

As matters now rest we can only hope that the next session of Congress will promptly take up and pass the legislation as agreed upon by the conference committee of the last Congress providing for increased salaries of the Patent Office force. This may seem like a matter of minor importance in contrast with our making of peace, internal readjustment, taxation, transportation and coal legislation; but patent matters are so vital to all business that this provision for the Patent Office organization is of unusual importance. We trust that it may receive the attention it deserves at an early date.

SHOP EQUIPMENT NEWS

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and equipment

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs and equipment

Bertschy Heavy-Duty Shaper

The Bertschy Engineering Co., Cedar Rapids, Iowa, has announced a high-speed, heavy-duty shaper, made in five sizes. The shaper is built both with a cone-pulley-drive, as shown in Fig. 1, and with a single-pulley, gear-box drive, as shown in Fig. 2. The standard sizes include 12, 16, 20, 24 and 32 in. shapers. The base of the machine has been extended beyond the sides of the table and around the column, in order to obtain ample foundation surface. It is stated that the column has been made heavy and deep, to absorb the shocks of operation. The column is aligned to the base by a tongue and groove.

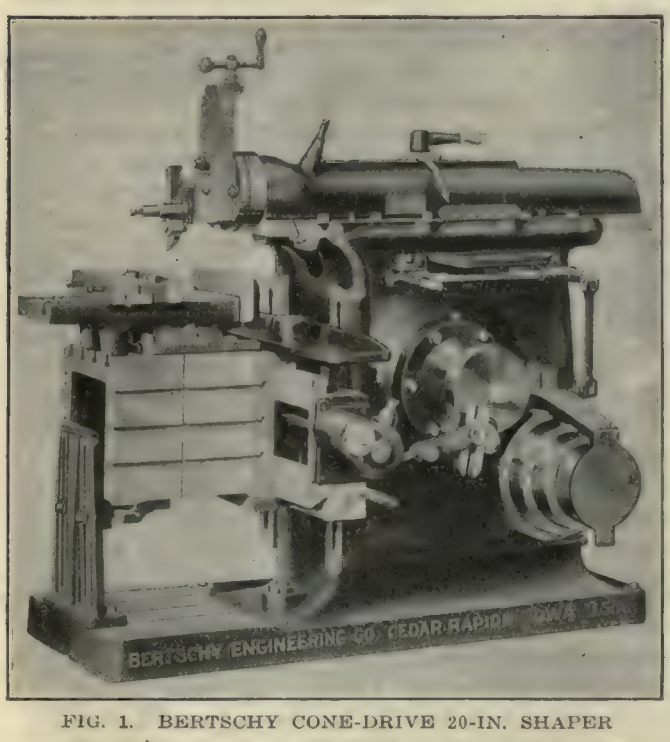


FIG. 1. BERTSCHY CONE-DRIVE 20-IN. SHAPER

Specifications: Built in 5 sizes: 12, 16, 20, 24 and 32 in. Dimensions for only 3 sizes given, 16, 20 and 24 in., respectively. Actual length of stroke, 16¾, 21 and 24¾ in. Horizontal travel of table, 22, 24 and 29 in. Vertical travel of table, 16, 15 and 15 in. Maximum distance table to ram, 19¾, 18¾ and 18¾ in. Maximum distance base to ram, 38, 38 and 38 in. Top of table, 14 x 15, 16 x 17 and 16 x 20 in. Down feed of head, 7, 7 and 8 in. Vise: jaw size, 2 x 12, 2¾ x 12 and 2¾ x 14 in.; opening, 10½, 12¾ and 14 in. Cone pulley: 8 to 14 in. in diameter, 4-step: face, 2¾, 3½ and 3½ in. Countershaft, 350 r.p.m. Speeds of ram, 8. Range of strokes per minute, 9 to 120, 8 to 100, and 8 to 100. Power required, 5, 5 and 7½ hp. Floor space, 45 x 78, 48 x 92 and 53 x 104 in. Shipping weight; domestic, 4,000, 4,750 and 5,300 lb.; foreign, 4,700, 5,500 and 6,200 lb..

The semi-steel bull-gear is provided with a hub bearing that is supported by a flanged bushing secured to the column. The rocker arm is mounted on a counterweight, which is supported in the column and extends into the base. It is claimed that this construction permits the use of a heavy driving arm without putting undue weight on the ram, and that the weight aids in absorbing vibration. The ram is mounted in V-ways of 45-deg. angle, only one adjusting gib being required. The ways are guarded from dust and dirt by suitable oil wipers, which also provide lubrication. An adjusting screw is incorporated for positioning the ram while it is running. The swivel head is secured to the ram by a tongue and by T-bolts fitting in machined slots. Its weight is carried by a large plug bearing in the center of the ram head. For swiveling, the toolbox is similarly mounted. Dials for micrometer adjustment are provided on all cross and down feed screws.

The cross-rail is bolted to the face of the column, and is self-aligning when locked in place. Tension bolts are used to prevent the cross-rail from dropping away from the angular ways of the column when the locking bolts are loosened. The elevating screw is held by a bushing in the base and a key prevents it from turning. The screw is operated through a train of bevel gears, consisting of bronze and steel gears mounted with ball-thrust bearings. The saddle is carried on the cross-rail by the square projection fitted with gib adjustment on the top of the rail, together with a V-slide with adjustable gibs on the lower side. A screw with thrust bearings is provided for its movement. It is said that the

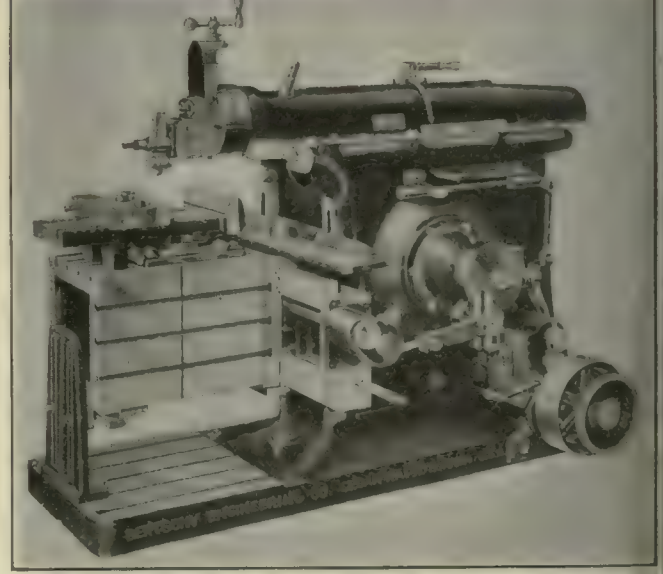


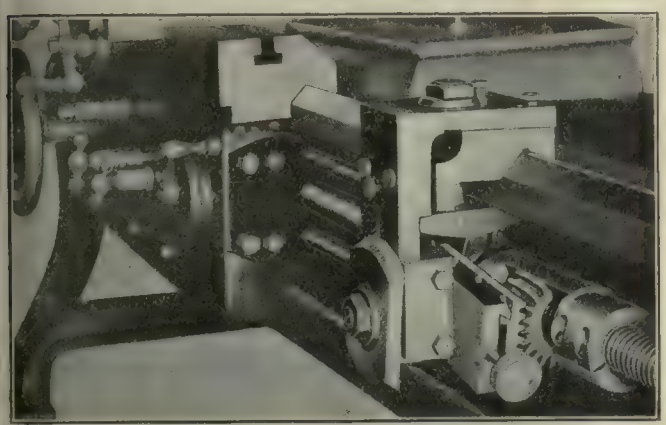
FIG. 2. BERTSCHY SINGLE-PULLEY-DRIVE SHAPER WITH GEAR-BOX

table is unusually large and heavy and has its T-slots cut from the solid metal. It is held in alignment by a tongue and groove. The table can be supported at its outer end by braces from the end of the long base. The power crossfeed is fitted with a friction safety device, to prevent damage due to feeding beyond the limits.

On the cone-pulley-driven machine, the pulley runs on a large sleeve mounted on the column, thus eliminating the need of an outer bearing and taking the belt strain. The gear box on the single-pulley-driven shaper contains a train of gears cut from alloy steel and heat-treated. It provides four changes of speed, thus, together with the two ratios in the bull-gear train, giving a total of eight speeds. This machine can be provided with a motor, driving through a high-speed, silent-chain V-belt.

Precision and Thread Lead-Screw Variator

The Precision and Thread Grinder Manufacturing Co., 1 South 21st St., Philadelphia, Pa., is manufacturing a lead-screw variator for lathe attachment. The



PRECISION AND THREAD LEAD-SCREW VARIATOR

device is intended for elongating or diminishing the normal lead on lathes, and also for correcting errors in the lead of the screw. It facilitates the use of an ordinary lathe for precision thread cutting. Metric threads can be cut without the use of translating gears. The variator is built in two sizes, Model A being adjustable to fit lathes having swings up to 12 in. and Model B to fit lathes of from 13 to 20 in. swing. The normal length of travel for the carriage is 6 in., but greater lengths can be provided.

The stationary part of the device consists of a bracket, clamped on the ways of the lathe. This bracket is composed of two pieces, the outer frame and the ways adaptor. The outer frame is adjustable horizontally sufficiently to make the proper connection between the bracket and the mechanism carried on the lead screw. The bracket carries a swiveling rack and provision is made for vertical adjustment to bring the center of the rack pivot in line with the center of the lead screw. The adjustment can be locked, and subsequent tilting of the rack does not disturb it. A dial is provided, to show the degree of inclination of the rack.

The mechanism on the lead screw consists of a nut adjustable for size and having an extension carrying a half gear, that is free to swivel in line with the rack. The variation in the lead is obtained by the rotation of this half gear, in accordance with the angle at which the rack is set, as the nut is traversed by the action of the lead screw. The lead-screw nut in the lathe carriage is not employed, but the connection is made between the variator nut and the carriage by the two rods and plate. The variator nut moves the lathe carriage only during the machining operation. The return of the carriage to its initial position is obtained by a second nut, keyed in the frame of the variator nut to permit longitudinal movements independent of those making variations in the lead.

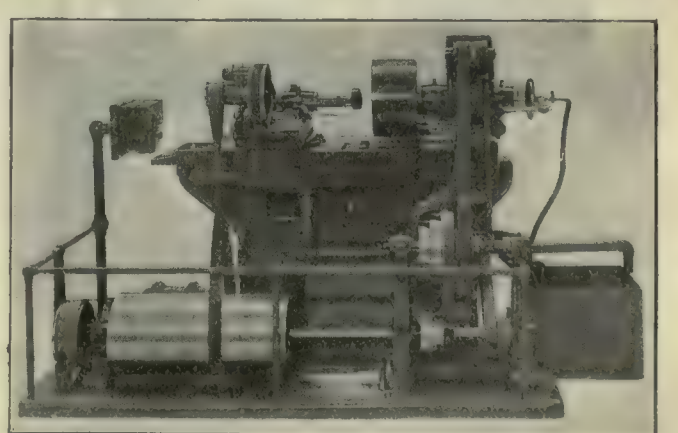
A dust guard is furnished to protect the lead screw from abrasive dust when performing grinding operations. It is recommended that the variator be positioned near the tailstock end of the lathe, as that part of the lead screw is generally but little used.

In order to aid in setting the lead variator for either the normal lead of the screw or for a change of lead, a gage block is provided. The block is used by clamping it directly upon the threaded work, it fitting all diameters up to 3 in. The block is 1 in. thick, so that by turning the work through the same number of turns as threads per inch required and measuring the travel of the carriage by a dial indicator on it adjusted to fit the block, the variation of the pitch of the lead screw can be determined. The desired pitch can be obtained by varying the angle of the swiveling rack to suit the conditions, and then locking it in place.

It is stated that the device is particularly useful in the manufacture of taps and thread gages, as the necessary correction in the lead can be made while machining, in order to compensate for changes of size during heat treatment, thus reducing the amount of grinding required after hardening. Of course, a sample is first made up from the stock to be used, so as to ascertain the correction necessary.

Motor Drive for Heald Internal Grinding Machines

The Heald Machine Co., Worcester, Mass., has changed the style of the motor drive attachment used on its internal grinding machines Nos. 70 and 75. The illustration shows a rear view of a machine equipped with the drive, the motor being at the front and left. The so-called "bass fiddle" casting used with the former No. 70 motor-drive attachment is not employed. Instead of using the solid idler for the wheelhead, a flexible idler gives the proper tension to the wheelhead



REAR VIEW OF HEALD INTERNAL GRINDING MACHINE SHOWING MOTOR DRIVE

belt, as well as to the vertical belt between the drum and the idler.

The drive is somewhat changed at the workhead end. Instead of the casting coming up over the head and carrying the two idler pulleys for driving the workhead, a swinging arm is furnished, which swivels on a bracket holding the driving cones for varying the speed to the workhead. This arm can be used on the regular machine or when the 2-in. raising blocks are employed. When the 4,- 6,- and 8-in. raising blocks are used, a longer swinging arm is furnished.

The swinging arm is connected to the workhead by a rod so fastened that it will allow the swiveling of the head either way and still keep the belt tight. The rod acts as a distance piece in locating the swinging arm, having a spring to give the proper tension to the belt. A nut on this rod may be adjusted so as to obtain the desired belt tension. Attaching the motor-drive arrangement is said to be very simple, requiring only the removal of the standard guard over the workhead pulley, and putting in its place a box containing the idler-pulleys.

Changes in "New Shepard" and "Sterling" Lathes

The Shepard Lathe Co., Rising Sun, Ind., formerly of Cincinnati, Ohio, has recently made some changes of design in its lines of "Sterling" and "New Shepard" lathes.

The "New Shepard" 12-in. lathe, shown in Fig. 1, is now made in a gap-bed style, in addition to the other models, previously described in the *American Machinist* on page 917, Vol. 47, and on pages 90 and 136, Vol. 49. The swing is thus increased to 19 in. for a length of 5 in. in front of the faceplate. The section of the bed is reinforced at the gap, and is said to be stronger there than at any other point of the bed. The carriage can over-run the gap without any lowering.

The "Sterling" lathe, previously described on page 1061, Vol. 50, of the *American Machinist*, is now made with a completely inclosed, geared head and with a single-pulley drive. It can be driven from a countershaft or furnished with a foot-power drive. In the illustration, Fig. 2, it is shown equipped with an individual motor mounted on top of the headstock and belted to the pulley. The motor is small enough to be

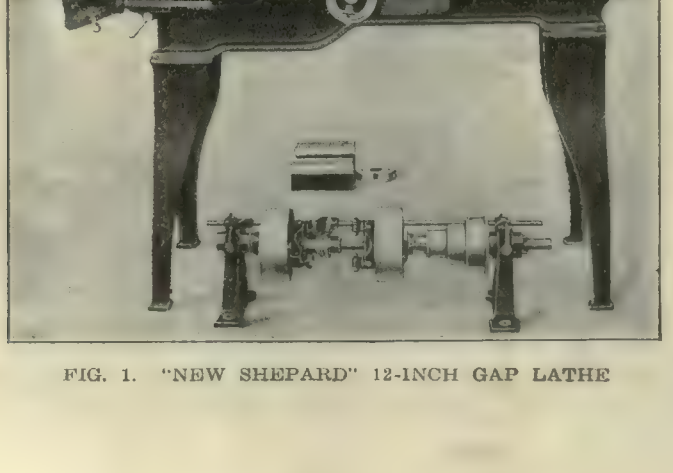


FIG. 1. "NEW SHEPARD" 12-INCH GAP LATHE



FIG. 2. "STERLING" GEARED-HEAD, MOTOR-DRIVEN LATHE

driven by current from an ordinary lighting circuit without additional power wiring or control.

The lathe can be furnished with either a plain or gap bed, and with standard or bench legs. The machine is said to be especially adapted for use in garages, training schools and repair shops, and for experimental work and light manufacturing. Two of its features are stated to be the facts that there are no shifting belt nor shifting gears.

Cutler-Hammer Auto-Transformer Starter

The Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has devised an auto-transformer starter for standard squirrel-cage induction motors. It is stated that the simple steel construction, using no wood nor castings, the absence of flexible moving leads, and the ease of inspection of the contacts and of adjustment of the relays, enable the starter to give continuous service at a low upkeep cost. The device, shown in the illustration, consists of two auto-transformers, commutating mechanism, low-voltage release and duplex overload relay, all enclosed in a sheet-metal case with the operating lever outside. The case is reinforced with angle iron, and has a hinged cover which can be lifted, as shown, to expose the transformers and relay. The transformers and case are carried directly on the supporting brackets and may be mounted on the wall or switch board.

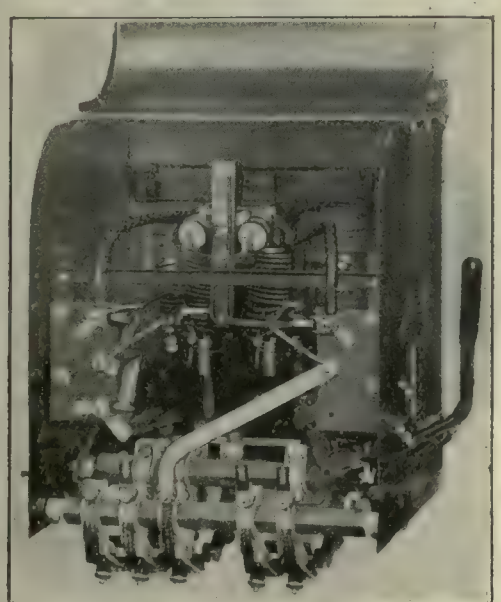
The starter is operated by moving the operating lever forward to the starting position and then backward to the running position, where it is held in place by the low voltage mechanism. Interlocks prevent the movement of the lever directly to the running position. It may be locked in the neutral position to prevent unauthorized operation Two auto-transformers connected in open delta are used for both two- and three-phase service. The construction of the transformer core allows either coil to be easily replaced. Each coil is provided with three accessible taps, which give 50, 65 and 80 per cent of full line voltage, respectively.

The oil-immersed commutating mechanism is placed at the bottom of the case and may be exposed for in

spection, as in the illustration, by the removal of the oil pan, which can be effected by one man. Breaking the circuit horizontally confines the arcs between the copper contacts and prevents burning of parts not designed for that service. The sliding action of the contacts keeps them clean and breaks the film of oil which might form between them and produce destructive arcing. The contacts are carried on steel supports clamped on insulated square steel bars. The stationary contacts are drop-forged pieces of copper carried on fingers of the non-stubbing type, which may be easily adjusted and renewed. The moving contacts or segments are short copper strips, reversible so as to give double the normal amount of service.

The low-voltage mechanism is mounted on the right-hand side. A wire from the armature of the release coil extends through the case near the operating handle and is bent to form a hook, a slight pull on which releases the starter and returns the handle to neutral. Remote control for stopping may be obtained by inserting one or more normally closed push-button switches in the low-voltage coil circuit, so that pressing one of the buttons releases the starter mechanism.

A duplex overload relay with an inverse time-limit movement is so mounted on the transformer assembly that adjustments for time and current values can be readily made. This duplex relay is equivalent to two overload relays, each in series with one of two phases. The Underwriters' rules do not require installing a disconnecting knife switch or circuit breaker ahead of this starter when thus equipped, because the starter completely disconnects the motor from the supply line



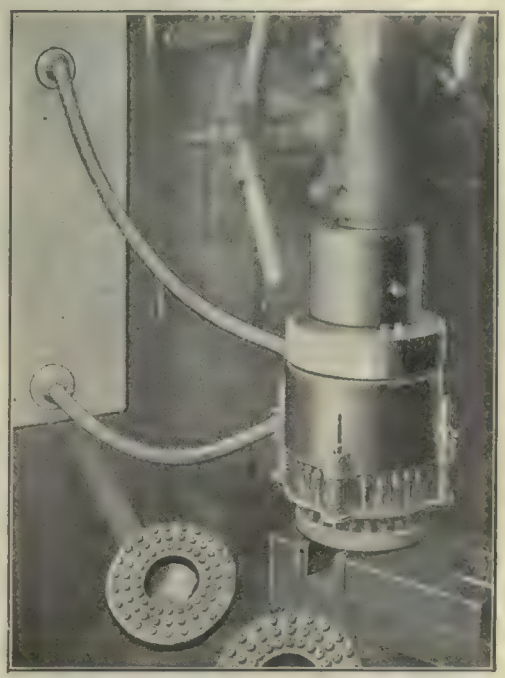
CUTLER-HAMMER AUTO-TRANSFORMER STARTER FOR INDUCTION MOTORS

when released by an overload. Rigid copper leads are used throughout, with the exception of four flexible stationary leads to the transformer taps and low-voltage coil, the flexible leads being out of the way of the moving parts, so as to lessen the danger due to broken and grounded leads.

The starters are made in various sizes for the operation of two- or three-phase induction motors rated between 5 and 100 hp., on standard commercial voltages between 110 and 2,200 and at frequencies of 60, 50, 40, 33 and 25 cycles per second.

Newmanco Multiple-Spindle Drilling Head

The Newman Manufacturing Co., 717 Sycamore St., Cincinnati, Ohio, has placed upon the market the multiple-spindle drilling head shown in the illustration, and



"NEWMANCO" MULTIPLE-SPINDLE DRILLING HEAD

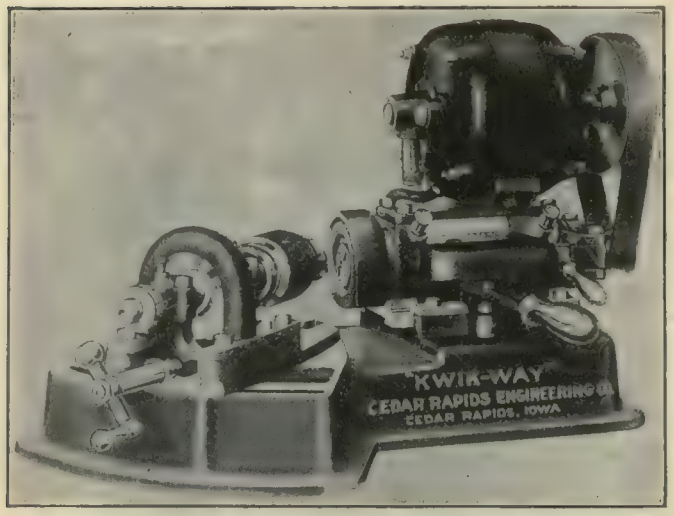
known as the "Newmanco." The device is intended for the drilling simultaneously of a large number of small holes, the head shown drilling 69 holes in a gas-burner casting. It is provided with a water jacket, through which water is circulated in order to cool the head and to keep both it and the drill from overheating. The device is intended for use upon a standard drilling machine, but can be built to suit any particular machine and also to meet the individual requirements of the work.

It should be noted that the lower ends of the drills are steadied by means of a plate provided with hardened bushings, the plate being so fastened in position that it can be pushed close to the head as the drills advance into the work. In this way the drills are supported, so that they start into the work properly. It is stated that a very high rate of production is obtainable by means of the device, since the head can be operated continuously without overheating.

Cedar Rapids "Kwik-Way" Valve-Facing Machine

The Cedar Rapids Engineering Co., 902 North 17th St., Cedar Rapids, Iowa, has recently placed on the market the "Kwik-Way" valve-facing machine, shown in the illustration. The device is intended for the purpose of refacing automotive valves, preparatory to grinding them with a grinding compound in place in the motor, as is the usual practice. It is claimed that by this method, but very little fine grinding with compound need be done with the valves in place, since the grinding wheel on the machine very quickly trues up the valve.

The valve is held by means of a chuck, and is rotated while in contact with the abrasive wheel. The apparatus is mounted upon a heavy casting, which is in-



CEDAR RAPIDS "KWIK-WAY" VALVE-FACING MACHINE

tended to be set on a bench, and which serves to absorb vibration. The spindle of the grinding wheel runs in ball bearings, inclosed in dust-proof covers.

It is stated that the chuck which holds the valve is capable of centering it, even though the stem be worn. It really consists of two universal three-jaw chucks, working independently of each other and bearing at two points 2¼ in. apart on that section of the stem that works in the valve guide. The chuck and chuck shaft are made in one unit. The chuck shaft runs in reamed bearings, adjustable for wear, being driven at a speed of 200 r.p.m. by a set of worm gears from the grinding wheel shaft, which has a speed of 6,000 r.p.m.

Both the grinding wheel shaft and the chuck shaft are mounted on sliding carriages, the ways of which are gibbed to compensate for wear. The grinding wheel can be moved across the face of the valve by means of a hand lever on the front of the carriage. The adjustment of the valve relative to the face of the wheel is accomplished by turning the small crank at the left end of the chuck carriage.

The angle of the face ground upon the valve can be varied from 25 to 65 deg., a graduated dial being provided for reading the angle of cutting. The machine is driven by a motor mounted above the spindle and connected to it by means of a belt running on a friction clutch pulley on the spindle. The machine can accommodate valves having heads up to 3 in. and stems up to ½ in. in diameter. It is stated that the valves can be trued at the rate of one per minute, thus enabling the grinding of valves upon a production basis.

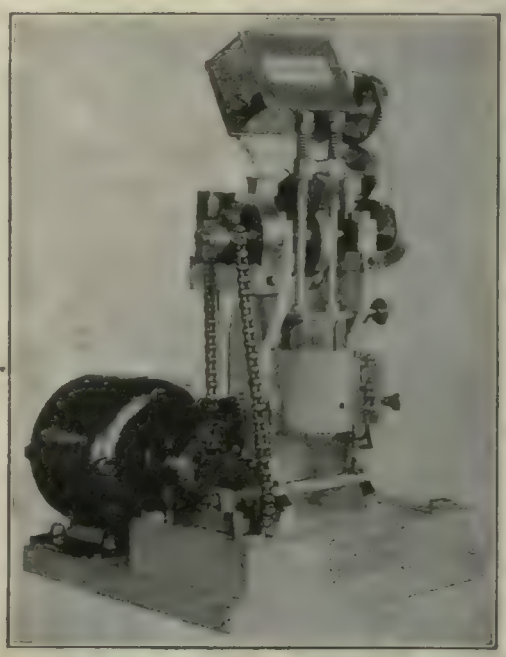
Pittsburg Continuous and Alternating Impact Testing Machine

The machine shown in the illustration has recently been placed on the market by the Pittsburg Instrument and Machine Co., 40 Water St., Pittsburgh, Pa. It is intended for the testing of metals for fatigue and impact fatigue, the action conforming closely to the actual working conditions of metals subjected to repeated shocks and stresses. The test piece is not broken at one blow, but is subjected to a number of blows, this number depending upon the kind of metal, its homogeneity and its resistance to shock.

The test piece should be turned to a diameter of ½ in. with a notch at its center, leaving the bar $\frac{7}{16}$ in. in diameter at that point. The piece rests on two bearings, so that the point of the ram is central with the notched part. A feeding attachment, run by the motor, turns the specimen either halfway around between each blow, for the so-called "alternating" test, or, by means of a special attachment, through its diameter for the "continuous" test. Alternating tests are used for such parts as eccentric shafts, railroad and automobile axles and airplane material, while continuous tests are used especially on building material.

The machine is set to deliver about 85 to 100 blows per minute. The ram is raised by a cam and then allowed to fall on the test piece. An electric motor, driving through a worm and gear, furnishes the necessary power. The ram carries two rods connected by a roller crosspiece, against which the lifting cam operates. The main body casting holding the bearings for the camshaft and test piece has a vertical slide, guiding the ram in its movement. The ram has a hardened anvil which strikes the center of the test piece, the latter being prevented from moving away by the arrangement of its bearings.

As soon as the test piece breaks, the machine stops, because the ram will then drop lower and break the



PITTSBURG CONTINUOUS AND ALTERNATING IMPACT TESTING MACHINE

electric circuit by means of a suitable switch. The number of blows can be noted from the counter at the top of the machine.

Robbins Combination Milling and Grinding Attachment for Bench Lathes

The combination adjustable milling and grinding attachment here shown has recently been placed on the market by the A. F. Robbins Co., 85 Moody St., Waltham, Mass. It is intended for use on bench or other small lathes for the purpose of performing small milling or grinding operations without removing the work from its mounting on the faceplate or in the spindle of the lathe.

The stationary base attaches to the toolblock of the lathe by means of two flush-head screws passing through it into a double nut of T-section in the toolpost slot.



ROBBINS ADJUSTABLE MILLING AND GRINDING ATTACHMENT ON A BENCH LATHE

The device swivels upon a central stud rising from the stationary base, being held and secured thereto by a quick-acting clamp. The upper part of the base is graduated over the complete circumference to facilitate setting to any desired angle.

The spindle-carrying member is arranged to slide vertically upon two pillars set into the swivelling base and tied together at the top by a rigid crossbar. The elevating screw carries a dial, graduated to read in thousandths of an inch of vertical adjustment. The spindle can be quickly removed and another substituted. Spindles for carrying various kinds of milling cutters and grinding wheels are provided, as well as a spindle which will take standard spring collets up to ⅝ in. in diameter. This latter spindle is provided with an index plate and locking pawl, and is intended to carry work which is operated upon by tools held in the lathe spindle or between centers. A high-speed traversing spindle is also provided for internal grinding, where the holes to be ground are very small in diameter or unusually deep.

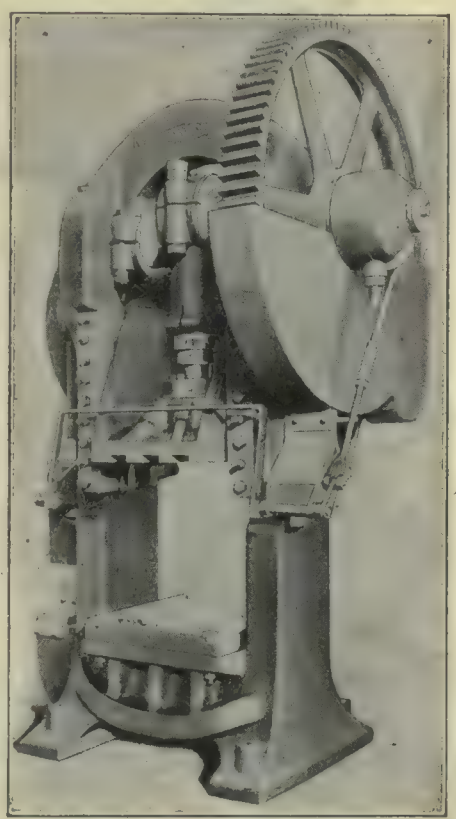
Provision is made in the vertically sliding member to insert an overarm, by which the outer end of the cutter spindle can be held rigid. As this overarm is carried by the same member that carries the spindle itself, it does not interfere in any way with the freedom of movement. As a complement to the attachment, the maker can furnish a spring-suspended extension countershaft which is adapted to be held in the brackets supporting the regular bench lathe countershaft, supplementing the latter and doing away with the necessity for idlers or belt adjustment for different positions of the device.

Massillon Trimming Press

The trimming press shown in the illustration is a late product of the Massillon Foundry and Machine Co., Massillon, Ohio. It is claimed that the press incorporates some new and desirable features in the clutch control. All clutch parts are inclosed and run in an oil bath. The main gear is placed next to the main bearing with the clutch on the outboard side, this arrangement making the clutch more accessible. The clutch jaws are hardened steel and can be replaced without removing the gear. The clutch body has a square hole that slides on a squared portion of the shaft, thus eliminating the use of keys.

The clutch pin has roller contact with and always remains in the cam groove to its full depth. The clutch is engaged by revolving the clutch case slightly by means of the tripping lever. This action shifts the pin off the high spot on the cam, allowing the clutch to engage and make one complete revolution, whereupon the pin is automatically and positively drawn out. The clutch can not repeat and a second stroke requires a full series of motions of the tripping lever. The construction is such that there is no end wear on the pin.

The main frame is made of semi-steel castings with legs cast integral. All main gears and pinions are of open-hearth steel with cut gear teeth. The press is made in suitable sizes, to trim forgings up to the maximum capacity of any drop hammer. A small outboard shear is provided at the flywheel side of the machine. It is made either for belt drive, or with a platform for mounting the motor at the top of the frame and in the rear, so that the motor can be belted directly to the flywheel.



MASSILLON TRIMMING PRESS

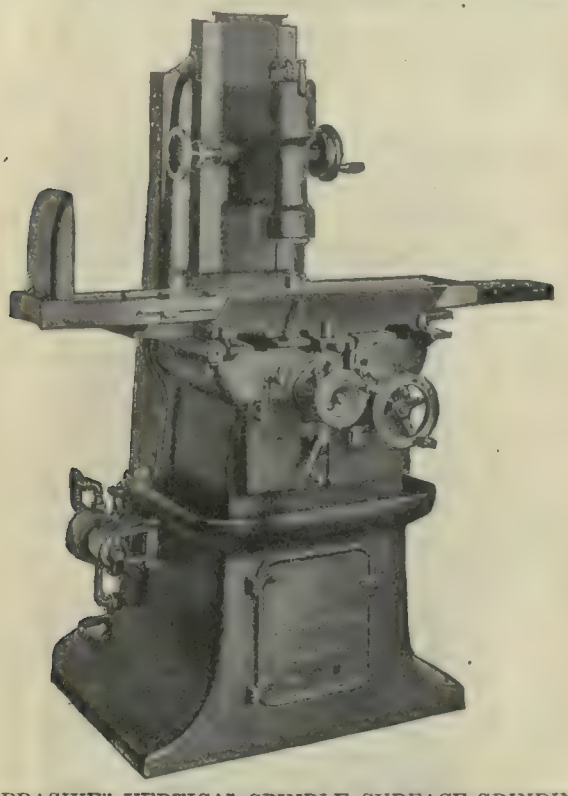
"Abrasive" Vertical-Spindle Surface-Grinding Machine

The Abrasive Machine Tool Co., East Providence, R. I., has placed on the market the No. 3 vertical-spindle surface-grinding machine. The tool is intended for small work, both in the toolroom and on regular production, being adapted to the squaring of the ends of shafts held on centers, the surfacing of small pieces held on magnetic chucks, and for the resharpening of pilot dies. It is stated that on the last-named work the machine is

particularly useful, since the cupped wheel leaves the cutting edges on the die sharper than does a disk wheel.

The machine has a capacity of 22 in. longitudinal feed, 8 in. transverse feed, both automatic, and 10 in. hand vertical adjustment. The wheel spindle is heavy and carried on radio-thrust ball bearings. All of the high-speed shafts run on ball bearings. Wheels up to 5 in. in diameter can be used. The adjustment of the wheelhead is by means of a screw actuated by a worm and wheel. Two handwheels are provided, one for fine feed, being graduated to 0.00025 in., and one for rapid movements.

The gear case for operating the table and crossfeed is a self-contained unit, in which the gears and clutches run in a bath of oil. All belts are enclosed, also the moving parts, where possible, so that the safety of the operator is promoted. All bearings are guarded against



"ABRASIVE" VERTICAL-SPINDLE SURFACE-GRINDING MACHINE

the admission of dust or water. The machine can be equipped with either a countershaft or a concealed motor drive. Provision is made for the use of water, so that wet grinding can be done.

Johnson Electric Heavy-Duty Buffer

The U. S. Electrical Manufacturing Co., Central Ave., at Third St., Los Angeles, Cal., has recently developed and placed on the market a heavy-duty, electric-driven buffer, shown in the illustration. The machine, known as the Johnson buffer, has an overall shaft length of approximately 5 ft., so that two men can work at the same time without interfering with each other. The machine was developed for use on pneumatic truck tires, but is adaptable to heavy-duty buffing of all sorts.

The large, ground shaft of 40-point-carbon spindle steel is supported by a double set of ball bearings. One set of the bearings is placed at each end of the machine next to the wheels, with the other set at the center to prevent periodic vibration of the rotor. A sturdy rotor construction is obtained by brazing the end rings to the bars. A heavy pedestal supports the motor, guards being provided for the wheels, which can be up to 12 x 2 in. in size.

The buffer is entirely inclosed, and can be furnished in various sizes for use on two- or three-phase alternat-



JOHNSON ELECTRIC HEAVY-DUTY BUFFER

ing current. It is stated that ample power is provided, so that there should be no trouble due to stalling; and that the 5-hp. size, running at 3,600 r.p.m., is the most popular size of the buffer.

Thor Rotary Wire Brush

The Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill., has recently placed on the market the Thor rotary wire brush, for use on either the No. 71 portable pneumatic grinder or the No. 6 electric grinder made by the same concern. The brush shown in the illustration attached to the No. 71 pneumatic grinder is 5 in. in diameter; but the brush intended for use on the No. 6 electric grinder is only 4 in. in diameter, because of the fact that the electric grinder runs at a higher rate of speed than the pneumatic tool. The device is intended particularly for the removal of paint, rust, scale, grit, dirt or sand, being adapted to such work as the cleaning of steel cars, automobile bodies, castings and sheet metal.

The wires of the brush are 3 in. in length, being made of heat-treated steel and tapered at the end attached to the brush, so as to give greater strength at that point. The wires are held in a concave wooden back, which is fitted in a metal cover. It is stated that the method of securing the wires is such as to permit of a great deal of wear before the brushes are destroyed, the wires being easily replaceable with new ones when worn out.

The brushes can be furnished either separately or fitted to the grinders. The electric grinder can be



THOR ROTARY WIRE BRUSH

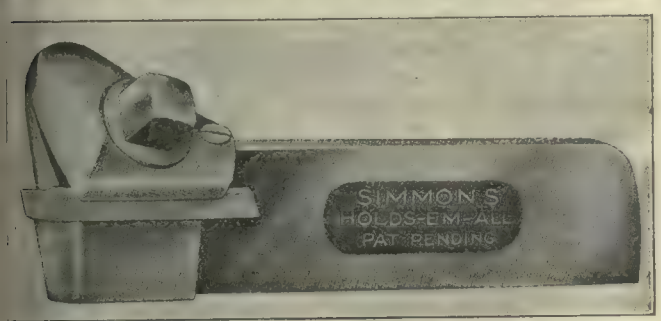
equipped with a Universal motor operating on either d.c. or a.c. current, or it can be furnished for d exclusively, for either 110 or 220 volts.

Simmons "Holds-Em-All" Toolholder

The Simmons Economy Tool Corporation, Albany, N. Y., has recently placed on the market the "Holds-Em-All" toolholder, shown in the illustration. The toolbit rests in a right-angle groove, and is held in place by means of a clamping plate placed at an angle. The plate bears at its upper edge on the end of the shank, and is secured by means of a setscrew having a spherical bearing. A second small screw is provided, so as to furnish a third point of support for the clamping plate in case that the toolbit is very short.

On account of the position of the clamping plate and the long bearing provided, toolbits or stock of any shape, as round, square, or hexagon, can be securely held, it is stated. Drills, reamers, taps, boring tools, shanks for dial indicators and other devices can be clamped, thus giving the holder a wide range of usefulness. Each holder is capable of holding several different sizes of bits, since it can be easily adjusted to the size of the stock to be gripped. Tools having taper shanks, as well as straight shanks, can be held.

One of the principal advantages claimed for the holder is that it is capable of securing very small lengths of stock or toolbits. Bits as short as $\frac{7}{16}$ in. can be firmly held, it is stated, so that a considerable



SIMMONS HOLDS-EM-ALL TOOLHOLDER

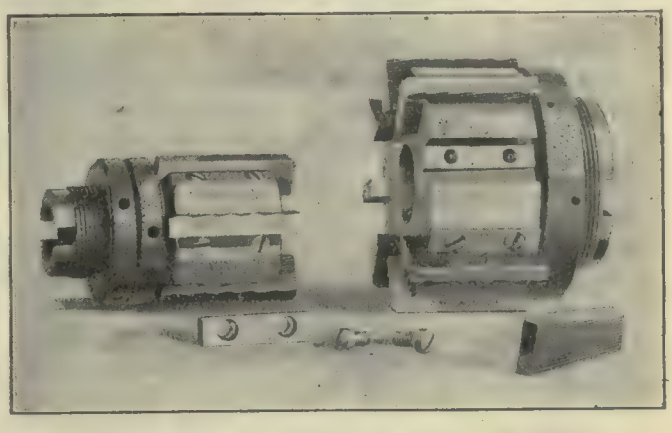
saving of tool stock can be effected. The lower lip of the holder is under-shot, so that the cutting end of the toolbit is supported.

The holder is drop-forged. It is stated that all parts are heavily made, so that the strength of the device is more than sufficient to meet the loads encountered in practice. The tool is made in either straight, right-hand or left-hand style, and in eleven different sizes. The smallest holds bits from $\frac{1}{16}$ to $\frac{3}{16}$ in. in size, and its dimensions are $\frac{7}{16}$ by $\frac{3}{4}$ by $4\frac{1}{2}$ in. The largest holder is for bits from $\frac{1}{2}$ to $1\frac{1}{4}$ in., and is itself $1\frac{3}{4}$ by 3 by 20 in. in size. Besides emphasizing the fact of the strength and universality of the holder, the manufacturer states that it is well adapted to the holding of stellite bits, because of the long bearing surface that is provided.

Cleveland Adjustable Shell Reamer

The Cleveland Cutter and Reamer Co., 1619 Merwin Ave., Cleveland, Ohio, has placed on the market an inserted-tooth adjustable shell reamer of the type shown in the illustration. The backs of the blades are provided with corrugations placed at an angle and fitting corresponding grooves in the slots in the body. The reamer has a double adjustment. By screwing back the locknuts in the rear of the blades $\frac{1}{16}$ in., a diameter adjustment of 0.083 in. can be obtained. Placing the blades up one step in the corrugations adds another 0.083 in. to the diameter of the reamers, so that the locknuts can be moved forward. This action can be continued until the blades are worn out, when they can be replaced.

The reamers are regularly made with the blades set straight in the body, as shown; but reamers with helical



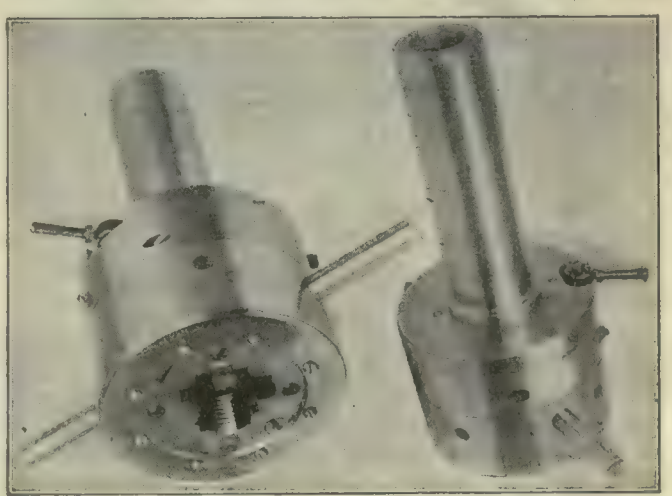
CLEVELAND ADJUSTABLE SHELL REAMER

blades can be furnished. The tool can be furnished in any style to suit special requirements, and it can also be equipped with a float. The standard sizes range from 1 to 6 in. in diameter. The overall length varies from $2\frac{1}{4}$ to $3\frac{1}{2}$ in. and the diameter of the hole in the large end from $\frac{3}{8}$ to 2 in.

Modern Style-H Self-Opening Die-Head

The Modern Tool Co., Erie, Pa., has added to its line the Style-H, self-opening die-head that is shown in the illustration. This tool has supplanted the Style-B head in all sizes from Nos. 1 to 6, inclusive. The head is intended for general threading work, and can be used on the turrets of hand or automatic screw machines. It can be fitted with a closing device, so that it may be used on a drill press or other revolving-spindle machine.

The head can be so fitted with chasers that it can be used for any form or pitch of either right- or left-hand thread, having a diameter within its capacity. The chasers are supported at their outer edge by a cam ring which, it is claimed, makes it impossible for the



MODERN STYLE-H SELF-OPENING DIE-HEAD

chasers to change position while working. The die heads are made of hammered tool steel and all parts are interchangeable. The chasers are made by the hob-

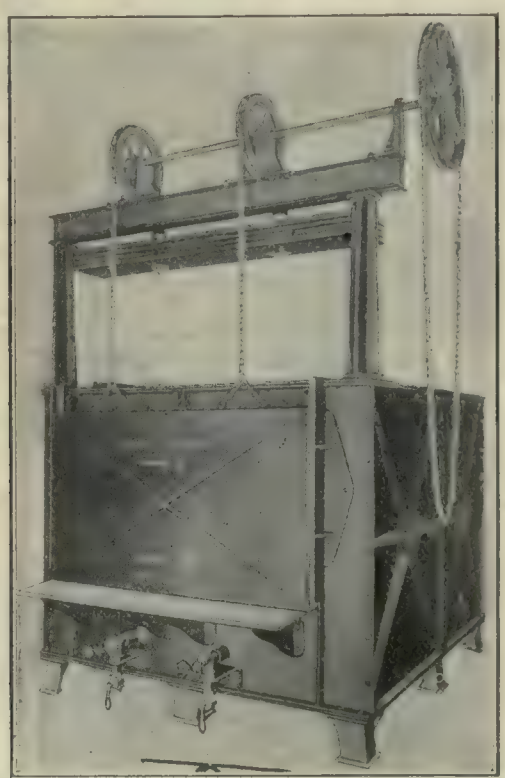
bing method and are interchangeable only by sets. Depending upon the size of the die-head, three to six chasers constitute a set. A floating device is incorporated between the body and shank of the die-head to compensate for inaccurate adjustment of the turret.

A feature of the die-head is the roughing and finishing attachment that is furnished as standard equipment. The small lever at the shank end is used for changing from the roughing to the finishing size, and vice versa. The view on the right shows the screws and micrometer graduations on the side of the head for the adjustment of all of the chasers, so that either tight- or loose-fitting threads can be cut.

The die-head is mounted on a shank, to serve for holding it in a turret or spindle, and the one shown is hollow, to provide for threading long pieces. The dies may be closed by the handles on the side and opened automatically when the turret travel ends. An internal trip can be installed when desired.

Bellevue Annealing Furnace

The illustration shows a late type of annealing furnace made by the Bellevue Industrial Furnace Co., Detroit, Mich. The furnace is of the semi-muffle type



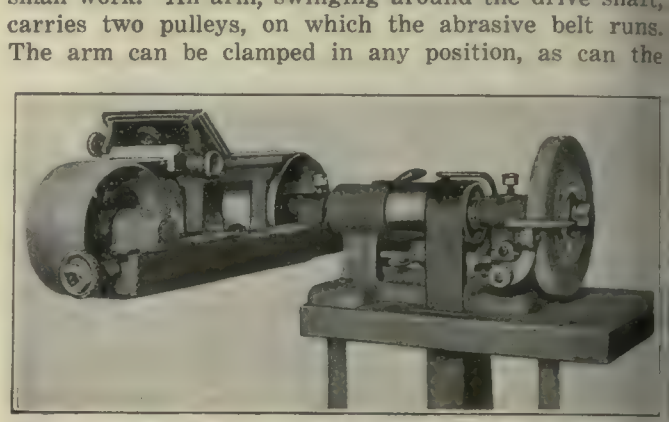
BELLEVUE SEMI-MUFFLE TYPE ANNEALING FURNACE

and can be heated by either oil or gas. It is equipped with a hand-operated chain mechanism for raising or lowering the door, the weight of the door being suitably counter-balanced. Two of the company's standard oil-burners are ordinarily used for heating the furnace and are located at the front, where they are easily available for adjustment. The gas burners can be substituted if desired.

The furnace is built in six sizes, the muffles being from 56 to 78 in. wide, 60 to 120 in. deep, and 8 to 24 in. high, the dimensions of the minimum and maximum sizes being given.

Peerless "Junior" Surfacing Machine

The Peerless Surfacing Machine Co., Inc., Troy, N. Y., has recently placed on the market the "Junior" surfacing machine, shown in the illustration. The machine is small and compact and intended for the surfacing of small work. An arm, swinging around the drive shaft, carries two pulleys, on which the abrasive belt runs. The arm can be clamped in any position, as can the



PEERLESS "JUNIOR" SURFACING MACHINE

small rest for holding the work on the belt, thus making it possible to grind the work at any angle desired.

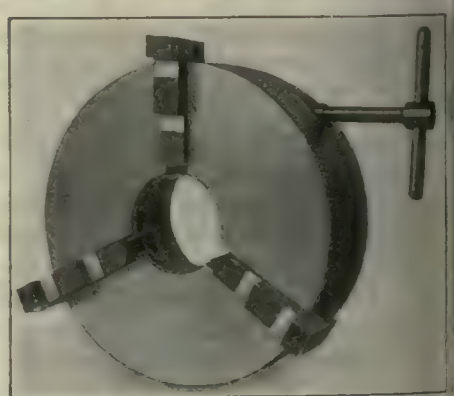
The machine is of the bench style, so that it can be mounted in a number of different ways. When attached to a small table it can readily be moved around the shop from one job to another. It can be driven from a countershaft or by a separate motor, either belted to it or connected directly to the end of the shaft. Tight and loose pulleys with a belt shifter are provided.

A grinding wheel or disk plate up to 11 in. in diameter can be carried on the shaft, a work rest being provided. It is stated that a wide range of work can be handled by the machine, such things as piano parts, small castings, switch bases and metal stampings being finished with ease.

Spillman Self-Centering Chuck

The lathe chuck shown in the accompanying illustration has been brought out by H. Spillman, Zurich, Switzerland.

This chuck is operated by worm gearing in connection with a scroll plate which differs from the usual construction of such members, inasmuch as the scroll proper is not an integral part of the plate. The scroll has slightly more than one convolution, so that but one tooth in any chuck-jaw is engaged at one time except when it is in position where the ends of the scroll overlap. This construction makes it possible to have all the teeth in the jaws of such shape as will insure a good bearing on the scroll. In addition, the scroll is very heavy; is let into a groove in the plate and is hardened and ground. The jaws are made of steel and are hardened and ground.



SPILLMAN SELF-CENTERING CHUCK



NEWS SECTION

Unemployment Insurance To Stimulate Steady Work

To bring about steady work, as the ermanent cure for unemployment, industry itself must put into effect wellested plans for regularizing production, and unemployment insurance, with esulting accumulation of information, ill furnish a new incentive to employers to keep the wheels of industry oving.

This is the conclusion set forth by mployers, labor representatives and ndustrial relations experts in a bulletin on unemployment which will be ssued this month from the national eadquarters by the American Association for Labor Legislation.

Other measures advanced as necesary in effectively combatting unemployment include the creation of an dequate national-state system of labor xchanges and the intelligent planning f public works.

A Success in Two Instances

Two American employers, Dearing, Tilliken & Co., operating bleachery lants in New York and the South, and he Dennison Manufacturing Co., paperox manufacturers in Massachusetts, in detailed explanation of their systems f unemployment insurance and reglarization of production, declare the heasures have been a success in avertng suffering and the breaking up of orking forces during the existing industrial depression.

Continuous production throughout the ear is insured by the Massachusetts oncern through plans for getting adance orders from their customers, increasing the proportion of non-seasonal rders with a long delivery time, planing stock items and inter-departmental eeds well in advance and building up out of season" items and varying the ines of stock so as to balance one demand against another.

Both employers, after several years' xperience with voluntary unemployment insurance funds, regard the genral adoption of social insurance against nemployment as an effective means of roviding a financial stimulus to industry generally to prevent unemployment as well as to relieve distress among workers and their families due o unavoidable idleness.

N. I. Stone, labor manager of Hicky-Freeman Co., Rochester, N. Y., and a well-known economist, reports that several firms have made significant progress toward bringing about continuity of production in the clothing industry, but declares that only the government can provide the necessary incentive to universal efforts of this kind, just as workmen's accident insurance laws have stimulated safety first campaigns. "Such an incentive," he says, "can be furnished by a system of unemployment insurance. By grading the insurance premium in proportion to the continuity of production carried on by each concern, it would be made to the interest of each house to maintain production as steadily as possible. Once this incentive were provided, the ingenuity of every manufacturer would be exercised to the utmost in this direction."

Whiting Williams, formerly vice-president of the Hydraulic Pressed Steel Co., who worked as a common laborer in America and England in order to get an insight into the workers' attitude, said that their real Utopia is security in the job. "When we regularize industrial processes," he declares, "and when we make it possible for men to get out of their daily jobs the same sort of satisfaction that keeps you and me going on ours, then we are going to find men desiring less and less of these strange Utopias that worry us and trouble us and make us wonder what kind of minds these men can have."

Urges Legislation

In urging legislation to establish on an adequate basis a national-state public employment service, Professor Henry R. Seager, of Columbia University, says: "All other measures in a comprehensive program for combatting unemployment must be co-ordinated with well organized machinery for labor placement." Meyer Bloomfield, editor of *Industrial Relations*, declares that the conservation division of the War Industrial Board demonstrated the economic benefits of industrial planning, including regularity of work, which should be carried on in peace time and Otto T. Mallery, of Pennsylvania, asserts that intelligent planning of public work is effective.

Hoover to Begin National Assay of Industrial Waste

Herbert Hoover has recently outlined the purpose of the American Engineering Council, of which he is president, to conduct a national assay of waste. A complete organization known as the Committee on the the Elimination of Waste in Industry has been set up, and results of the preliminary survey started by Mr. Hoover are already beginning to come in.

Mr. Hoover, through the council is interesting himself actively in work that is closely linked in character and purpose to the kind of task he will be called upon to perform as Secretary of Commerce. Industrial waste is a matter that has engaged the attention of Mr. Harding and Mr. Hoover's latest activity as an engineer may have been in Mr. Harding's mind when he decided upon Mr. Hoover for the Commerce portfolio.

In co-operation with L. W. Wallace, J. Parke Channing and other prominent engineers, Mr. Hoover is now directing a preliminary survey of industries east and west to ascertain at first hand facts upon which the Committee on Elimination of Waste in Industry can act.

This survey is being conducted by a special staff of trained field workers, principally in New York, New England and Pennsylvania, and is designed to furnish results which shall be the working basis of the most exhaustive investigation into the causes of labor unrest and industrial defects ever made in this country.

As one of the investigators said, "We are going to find out why 3,000,000 idle men are walking the streets. If Mr. Hoover can be of greater service in the Cabinet, then that is the place for him. It is doubtful though, whether he can find a job much bigger than the one he has tackled as an engineer. His associates on the American Engineering Council regard his work as president of that body as even more important in its potentialities than even his work as Food Administrator. Under Mr. Hoover the engineer is becoming an enormously powerful force for constructive and disinterested public service. There will be published in next week's *American Machinist* an analysis of the plans for the assay, prepared by Mr. Wallace.

Business Conditions as the Big Banks of the Country See Them

People's National Bank of Pittsburgh Reports Quieting of Business, but Stabilizing of General Trade Conditions

On the whole, industrial affairs were quieter in February than in January. The total volume of business in iron, steel and fuel was smaller, and this caused a decrease in railroad freight traffic, necessitating further retrenchments by the railroads. The number of idle cars in the country today is larger than at any previous time in many years. Bank clearings reflect a shrinkage, an interesting feature of the weekly returns being the uniformity of the contraction. Thus in one week last month 47 out of 50 cities in the country reported a decrease, the average of all being about 30 per cent compared with the corresponding period a year ago. Of all the great industrial centers, however, Pittsburgh continues fortunate in the matter of unemployment, the latter being proportionately smaller here than elsewhere. Nevertheless there has been a considerable decline in industrial payrolls which, of course, impairs buying power.

During the month just closed there was a further decline in iron and steel prices, in numerous instances below the level of March, 1919, but the concessions quoted have thus far failed to stimulate a buying movement. In other words, business is on a hand-to-mouth basis. There seems to be a disposition on the part of consumers to await any action which may be taken by the largest producer in the matter of reducing costs by the reduction of wages, the effect of which will be passed on to the user of steel products. Many of the smaller producers have already reduced such costs in order to be in a position to underbid stronger competitors, and with respect to some of them it is claimed that on the existing basis of cost and price, the execution of new orders merely involves the exchange of a new dollar for an old one.

Mercantile Trade Good

Despite increased unemployment and decreased buying power, local mercantile trade is fairly well maintained up to the recent average. In some lines, business has been stimulated by special "sales," a factor in the latter being probably the unusually mild winter which adversely affected the movement of seasonable goods. In some staple lines there has been noticeable increase in purchases to replenish stocks, and in a few instances the earliest deliveries run into April and May, indicating that supplies in first hands are low. Incidentally, it may be said that similar conditions are developing in supply houses which carry diversified stocks of staple iron and steel products.

The most important price development of February was the further sharp reductions in crude petroleum. Since December, the decline in the Pennsylvania grade is no less than 50 per cent and the product of other fields has suffered even to a greater degree. The daily average output of all fields in the United States is about 1,260,000 barrels, and the decline in price during the past two months has ranged from $1.50 to $3.10 a barrel. The loss to the producer, therefore, is running close to $2,500,000 a day as compared with December. In the mid-continent field, which is the most prolific, the refining business is relatively as depressed as the producing business. This state of the oil trade affects an important department of the steel trade which furnishes pipe, tankage and oil well supplies.

The easing of money rates which developed in January disappeared in February and the money market is again firm at the average rate quoted during the last quarter of 1920. The only change in official discounts was a slight rise in rates quoted at the Federal Reserve Bank of Cleveland, bringing the market rates in the Fourth District to a parity with those in other districts.

Guaranty Trust Co. of New York Warns Against Unwise Tariff Legislation Which Might Impair Our Position as Creditor Nation of World

A complete understanding of today's world trade situation, uninfluenced by any provincial or political views, must guide the course of the tariff legislation now pending before Congress if the United States is to benefit in full measure from her position as creditor nation of the world, according to the current issue of *American Goods and Foreign Markets*, the international trade survey of the Guaranty Trust Co. of New York. The bank emphasizes the dangers of plans which imply commercial isolation, and of temporizing devices which propose to hamper the free world-wide movement of the great staple raw materials and food products.

The Emergency Tariff Act that has passed both the House and the Senate at the present session, but seems not likely to become a law, cannot be said to reflect any clear appreciation of the present world situation and the new relations which the United States now holds in international trade and finance.

At a time when vast debts are owed by foreign countries to the United States—debts that are so great that the possibility of payment in gold is out of the question—it is a matter of concern that it should be seriously proposed to erect additional heavy barriers to such payment as might be made through the importation of foreign raw materials, food products and manufactured commodities.

More to Be Lost Than Gained

While the unfortunate position of holders of agricultural products, in whose behalf this legislation is chiefly urged, may be fully recognized, it is still difficult to see in what respect the imposition of tariffs can help them materially; while it is certain that the effect upon the welfare of the nation as a whole cannot fail to be seriously adverse. There is no certainty whatever that domestic markets can be stimulated by tariff exclusion of foreign goods, nor that domestic prices will thereby be appreciably enhanced. If Canadian and Argentine wheat, for example, are excluded from the United States, it is clear that this surplus will then compete in foreign markets with our own wheat exports, with a resulting disadvantage to that trade which would probably offset any supposed advantages gained in the domestic market. The chilling effect of the loss of foreign markets upon our domestic industries will certainly be reflected in a lessened demand for our raw materials here, and this in turn will tend further to depress the prices received for such materials. Our farmers and cotton growers, especially, should remember that only as Europe's purchasing power is restored will she be able to buy the surplus products of our fields, and that there is more to be lost in retarding the restoration of Europe's purchasing power than is to be gained by tariff differentials.

World Commerce Must Balance

The United States, with exports of $8,000,000,000 in 1920, and with an aggregate favorable trade balance exceeding 17 billion dollars for the last seven years, now has a heavy stake in foreign trade, too heavy to ignore or to risk by uneconomic or ill-considered legislation. There was never a greater need for a widespread recognition by the people of the United States of the broad basic principles of trade. It is axiomatic that, in the long view, nations must prosper commercially with other nations, and not at their expense. Buying in international commerce must approximately balance selling, either through exchange of goods or services, or trade soon lags and in fact finally ceases.

The United States has a wealth and producing capacity so much greater

than any rival that the disclosure that is being made in some quarters of a timorous attitude toward foreign competition is to be seriously regretted. The adjustments that must be borne in the United States due to falling prices and renewed foreign competition may be painful for a time, but they are really inevitable. They may perhaps be postponed a little, but in the end it is certain that they must be endured. Any attempt to delay such readjustments by political nostrums must finally fail of its purpose.

The inexorable operation of the laws of supply and demand cannot long be artificially forestalled. Very materially lessened demand in European countries due to the reduced consumption that has been forced upon them by circumstances, a condition which has now lasted for a long time, has affected all countries producing raw materials, and new crops and supplies coming along add to the previously unconsumed stocks that have accumulated. Time alone can bring about the absorption of this accumulation, and it seems beyond argument that the freest movement of these commodities between the nations is necessary to facilitate such absorption.

Of course, the industries of the United States must be protected from unrestricted floods of imports arising from the inequalities of wages and depreciated exchanges. Security from these cheap foreign costs cannot be derived from any single, all-inclusive tariff; it might be found in a more flexible arrangement, by treaty or otherwise, which would equalize the selling prices of varied foreign goods in our markets.

With all the wonderful advantages possessed by the United States as compared with any other country, there is little excuse for reliance upon such temporizing devices as are often proposed in plans to hamper the free world-wide movement of the great staple raw materials and food products. With thrift and energy applied to the situation today the present difficulties can readily be overcome within a reasonable period of time. We should surely hesitate before arousing the resentment of the entire world by adopting plans which imply commercial isolation, and which must eventually react to our decided disadvantage. If wisdom and foresight characterize our action toward foregin nations in the next few years, there is nothing that can dislodge us from a position of leadership, both in trade and in finance. It will be unfortunate if we risk this great opportunity by a shortsighted and provincial outlook upon the present situation.

Industrial Conditions in Middle West Show Gradual Improvement—Iron and Steel Business Dormant —Cotton and Wheat Expect Spring Revival

The National Bank of the Republic of Chicago reports an optimistic outlook for business in the Middle West territory.

Gradual relaxtion of credit stringency and the steady decrease in the volume of goods in manufacturing and trade channels warrant the conclusion that business is well established on the road to recovery and that the possibility of a relapse is remote. At the same time there is little in the present situation to prompt the belief that everything is now clear sailing and that another boom is in the making. A repetition of the conditions of business exaltation, speculation and excesses, as witnessed in 1919, is not to be expected or, indeed, desired. Likewise, hopes based on the restoration of prices to the general level of that period are doomed to disappointment, at least within this generation. The return of business to even a normal plane of activity, or a state of balance between producing facilities and consumption, is contingent upon the solution of problems which lie largely without our own boundaries. These heritages from the war comprise the settlement of the question of German reparations, the readjustment of the enormous debts between nations, the stabilizing of the immense paper currencies of European countries in fixed relationship to gold, and the like. Not until these things are solved can our industries—now expanded beyond the needs of domestic consumption alone—resume full and continuous operation.

Business Conditions Improving

The unevenness of industrial activity still continues, but less markedly so than a month ago. Many concerns which had curtailed drastically during the latter part of 1920 have increased operations due to the accumulation of orders. These are principally textile, shoe and allied manufacturers who were the first to experience a falling off in demand. The orders, however, appear to be small individually, but fairly large in the aggregate, and represent principally buying to fill out depleted lines, rather than extensive future commitments. Cotton mills are now operating at nearly 40 per cent of capacity as compared with a little over 25 per cent a short time ago. In the woolen industry something like 60 per cent of machinery is estimated to be in operation, as contrasted with 30 per cent at the bottom of the recent depression. In broad silk manufacturing an indeterminate, but noteworthy, improvement has taken place largely as the result of the stimulation of the recent silk exposition in New York City. The manufacture of clothing has likewise expanded with the reductions in producing costs made possible by the return to the piece-work system. Although the mild winter has not helped the shoe trade, depletion of retail stocks and the growing belief that the leather market has completed its readjustment have conspired to stimulate shoe manufacturing, particularly the manufacture of novelty footwear.

Metal Working Industries Suffer

On the other hand, manufacturers of iron and steel, machinery and tools, who for the large part were not obliged to curtail extensively because of the large amount of old orders, have since narrowed their operations more in conformity with the small volume of incoming business. In fact the principal industrial development of the moment is the readjustment to a lower price basis in the iron and steel industry which is usually one of the last to feel the effects of depression. The first stage in the readjustment was achieved when the smaller manufacturers revised their prices to the level set by the Industrial Board and since adhered to by the Steel Corporation. As that action had little practical result beyond the placing of pressing orders which could not have been postponed in any event, the second step has been taken by the independent steel manufacturers in cutting prices, or in accepting orders at concessions, in order to keep operating. To some extent this has been made possible by the reductions in wages which have very generally been made among the independents, by the decline in the cost of coal and by the drastic deflation of coke prices. It is believed that sooner or later the shading of steel quotations must become general in the industry since it is a well understood fact that in a period of industrial depression the revival of steel buying does not get under way until after a severe cut in prices has taken place.

Conditions in Agricultural Communities

The general business situation is dependent as never before upon conditions in the agricultural sections of the country. Few farm products escaped the general decline in prices, and then only because of strong marketing organizations among the producers themselves, or because of early maturity which permitted marketing before prices had fallen appreciably. Relatively the greatest depression in farming regions is to be found in the northern part of the cotton belt and in the upper half of the spring wheat section. Until recently farmers have not marketed anything they could possibly avoid. In view of the large size of most of last year's crops, however, the impendence of the new season has already started the movement of grain from the interior which movement is expected to reach record proportions during the next few months. This will undoubtedly have a very beneficial effect on the country districts in question, both by easing the banking situation and by stimulating local trade, although no genuine revival in business is probable until the spread between the prices of farm products and of manufactured goods is narrowed, either by a rise in the former or by a substantial decline in the latter.

National Federation of Export Managers Organized at New York Meeting

At the behest of the Export Managers Club of New York 350 export managers from all over the country met at the Hotel Pennsylvania, New York, on Feb. 17, and took the first steps in the formation of an organization to be known as the National Federation of Export Managers. Oren D. Gallup, of the Simond Manufacturing Co., Fitchburg, Mass., was elected chairman of the meeting. He will appoint a committee to draft a constitution and set of by-laws for the new federation, which is designed to "elevate the profession of export managers and to establish a clearing house for information on foreign markets, credits, sales methods, etc."

Much of the time was given to a discussion of our present foreign trade conditions and the causes and effects. The opinion was generally expressed that there is little immediate hope for a stabilization of foreign exchange rates, which are hampering our export trade, but gradual improvement is anticipated. It was stated by one of the speakers that good foreign markets still exist, particularly in China and the Far East, Mexico and South America.

On account of the lower manufacturing costs in Europe exports to this country can be sold for prices below our rates, which are kept high by wage rates and prices of raw materials. Several of the speakers urged a higher tariff to protect American manufacturers, saying that unless it is granted many factories cannot continue in existence beyond the present year.

The selection of Herbert Hoover as Secretary of Commerce met with the approval of the convention and a telegram was sent to Mr. Hoover pledging the support and co-operation of the federation.

The delegates also discussed and approved the New Foreign Trade Financing Corporation.

The convention closed with a banquet at which former Secretary of Commerce William C. Redfield was the principal speaker.

Chicago to Have Progress Exposition This Summer

Millions of visitors are expected to be attracted to Chicago this summer as a result of the interest already displayed in the "Pageant of Progress Exposition," to be held on Chicago's $5,000,000 municipal pier July 30 to Aug. 14. It is expected to be the greatest event in Chicago since the World's Columbian Exposition of 1893.

At first it was contemplated to hold an exposition of the products manufactured and distributed in Chicago, with the aim of stimulating business, advertising Chicago as a world market.

This idea was submitted to a group of representative Chicago business men. Their response was instantaneous and enthusiastic. It was given publicity. The response from business men in general was as enthusiastic as that of the first small group.

Governors of twenty states were invited to send representatives to a dinner given at the Hotel La Salle by the Hotel Men's Association a week ago. A dozen were represented and promised to co-operate. All lines of industry were invited to be represented. More than 600 business and professional men responded.

It was then decided to expand again and take in the whole country, and that is now being done. Inquiries have already been received from every large city in America, and the Pageant of Progress Exposition will present exhibits showing the progress made in every important industry and business for many decades.

For exhibition purposes the Municipal Pier, extending into the lake more than 3,000 feet, has been divided into sixteen sections, allotted to various industries. A chairman of each section has been named, and is now busy distributing the space among exhibitors.

Clothing manufacturers will exhibit the style developments of a century; a transportation exhibit will trace progress from the days of the two-wheeled ox cart to the modern motor car and aëroplane, and machinery, leather, furniture and other manufacturers, the packers, the dairy interests, and hundreds of other lines will be represented.

Purchasing Agents Take Steps to Correct Cancellation Evil

The National Association of Purchasing Agents, through its representative, Harry Botsford, has announced a tentative program for the working out of a suitable form of standardized contract.

One of the most disturbing factors that business has to contend with in this day of getting back to normal conditions is the making of contracts. The contractual breakdown is directly allied to the cancellation evil and while business men, as a rule, fume and fret over the deplorable situation, apparently little or nothing, aside from a few strictly temporary emergency measures, has been adopted or tried out with a view of eliminating the present evil.

The National Association of Purchasing Agents has long realized that a solution to the problem must be found and that such a solution must be arrived at by a calm getting-together of both sides affected by the issue and trying to reach some equitable, practical and inviolate form of contract which will not place any unfair burden on any of the parties concerned.

In its effort to make contracts safe the National Association of Purchasing Agents is co-operating with various trade, manufacturing and professional associations in the United States and Canada in an attempt to arrive at a co-operative contract form which will be possible to standardize. The N. A. P. A. intends to reach a contract form, which, when universally accepted and established, will result in a crystallization of business opinion toward living up to contractual obligations.

The working plan is simplicity itself. Each of the national commodity committees will work out a contract form meeting with their specific needs. This, in turn, will be presented to particular trade, manufacturing or professional organizations interested, and suggestions and revisions requested on the form. If necessary joint conferences will meet and arrive at mutual agreements.

When the various commodity contracts are worked out they will be turned over to the Standardization Committee which will then draw up a basic standard form of contract, which will meet the need of every industry, and, in conjunction with the commodity committees, make provisions for each special commodity requirement.

This, briefly, is the definite program worked out by the association. It is the organization's wish that every business firm and association co-operate in this matter. It is not the purpose to inaugurate a contract-form that will merely satisfy the buyer, but rather a contract-form that is mutually fair in every phase to buyer and seller alike.

The N. A. P. A. has taken the initiative in the solution of this tremendously important problem and in the immense amount of work involved they must have the confidence and co-operation of the entire business and industrial world. Any suggestion as to the proposed form will be welcomed at the national headquarters of the association, 19 Park Place, New York City.

Canada Plans Extensive Trade Program with United States

The following is from the *Financial Post*, one of Canada's leading business newspapers:

"Whatever can be said against the scheme of advancing government credits for the extension of foreign trade—and there has been a good deal said against it in parliament and elsewhere; in fact, its critics are still hot on the trail, judging from questions now on the order paper—trade returns show very plainly that it has been with those countries to which credits were granted that the bulk of our trade, outside the United States, has been done since the war ended.

"It is very unlikely that anything further will be undertaken in that line by the government alone; but in both the United States and Great Britain projects are in force or under way for the promotion of export trade. In the United States, acting on the report that the buying power of Europe can only be restored if long-time credits can be supplied, two great trade financing corporations have been formed.

"In the meantime there is being urged upon the government the development of trade extension in a quarter where no credits are required,

and which lies right at our doors. During the week Colonel Cooper, who is in charge of the Canadian Bureau of Information, has been in Ottawa endeavoring to further the idea of appointing trade commissioners to the United States, and it is believed the idea is looked on with favor by the government.

"During the year ending January our exports to the United States amounted to $551,522,444, or considerably over one-third of our total export trade. Nearly 40 per cent of this was for manufactured articles. At a time like this, when exchange rates make it easier to sell in the United States and harder to sell in Europe, the advisability of the extension of our trade there would seem to require no argument.

"The extent to which the United States consular service, wherever it is established, is responsible for the extension of American trade is well known. It is so in Canada. It keeps American manufacturers and selling agencies constantly informed with the most up-to-date commercial information. It is so close to its home producers that the latter are able to avail themselves almost immediately of the information furnished. In the case of our trade representatives abroad such a long time must necessarily elapse before the information they furnish is received and disseminated that it is liable to be too late to be of much benefit. The case for the establishing of trade agents across the line is a strong one and merits the support of both countries.

Southern Metal Trades Association Growing

A report that has just been issued by W. E. Dunn, Jr., secretary of the Southern Metal Trades Association, shows that this association has expanded from sixteen members three years ago to about 150 members at the present time. Originally only iron foundries were included in the membership but the scope of the association has been broadened to include machine shops, of which there are several now in the organization. The field extends from Virginia to Texas, including ten of the Southern states. Each state is regarded as a separate division and has a vice-president in charge of that territory. Divisional meetings are to be held several times during the year in addition to the annual and semi-annual meetings of the whole organization.

The next divisional meeting will be held in Texas, the date and exact location to be announced later. All foundry and machine shop operators west of the Mississippi River will be invited to this meeting, whether or not they are members of the association.

William T. Harding, president of the Raleigh Iron Works, of Raleigh, N. C., is president of the Southern Metal Trades Association.

Cincinnati Metal Trades Association Elects Officers

At the annual meeting of the Cincinnati Branch of the National Metal Trades Association, held in that city on March 3, J. B. Doan, of the American Tool Works Co., was re-elected president for the ensuing year. Other officers elected were: J. W. Carrel, Lodge & Shipley Machine Tool Co., vice-president; D. C. Jones, Lunkenheimer Co., secretary; E. A. Mueller, King Machine Tool Co., treasurer.

In his address President Doan reviewed the activities of the year, showing what the association had accomplished. He laid particular stress on the necessity for educating and training the foreman in the shop with a view to establishing better relations between workman and executive. Other speakers were George P. Carrel, Congressman Charles L. Underhill of Massachusetts, George J. Foran and Homer Sayre.

Defiance Machine Works Celebrates 50th Anniversary

Celebrating the fiftieth anniversary of the management of the Kettenring family the Defiance Machine Works, Defiance, Ohio, recently celebrated a half century of notable achievement in the industrial world.

Beginning in 1870 with one small building of 800 ft. floor space providing employment for only fifteen men, the organization has developed to a plant covering three entire city blocks in which 200,000 ft. of floor space provide production facilities for 700 employees.

From a localized business in woodworking machinery there has been built up in this city a factory which designs and constructs both wood and metal working machines for almost every known requirement, sending these tools into all parts of the world.

This achievement is an enduring monument to the name of Kettenring—to Peter Kettenring, under whose leadership the company was organized in 1870; to his son, William A. Kettenring, active head of the organization from 1890 until 1912, and to Charles Henry and Ransom P. Kettenring, now president and vice-president respectively.

Prior to the incorporation of the company in its present form, Peter Kettenring was a member of the partnership which had done business on the site of the present office building since 1850. Hence the Defiance Machine Works is really able to date its history back more than 70 years, and rightfully takes pride in its standing as one of the pioneer enterprises in the machinery business.

Improvement in Iron and Steel Conditions

Iron and steel conditions have taken a turn for the better in the Birmingham district and the improvement has been so steady within the past few weeks that men of the industry are confident that normalcy will have been reached again within a few weeks.

In and near Birmingham the subsidiary plants of the Tennessee Coal, Iron and Railroad Co. are now operating at about 80 per cent of normal. So far as this company is concerned no cessation of activity has been noted in the iron production end of the business. All of the six mammoth furnaces at Ensley are now making basic iron. The furnace at Alice is making ingot mold iron and one furnace is operating at Bessemer making ferro-manganese for the steel works; another furnace at Bessemer is making foundry iron. In all eight of the active stacks are producing for the finishing steel mills, and iron production is fully up to the best times of 1920.

This condition is due to the fact that there is considerable activity in the steel mills. At Ensley, Fairfield and Bessemer the plants are running on five-day schedules, and enough new business is being received to point to full time schedules in the near future. Operations of the steel corporation's auxiliaries in Alabama are thought to lead those of any other section.

Ex-Manager of Ford Co. to Make New Car

Formation of a new motor company is announced by Frank L. Klingensmith, former vice-president and general manager of the Ford Motor Co., who will be president. The company will be known as the Gray Motors Corporation.

F. F. Beall, former vice-president in charge of manufacturing of the Packard Motor Co., is associated with Mr. Klingensmith as vice-president and general manager. The company expects to get into production this summer or early in the fall. Mr. Beall since last summer has been perfecting a four-cylinder motor which has run 27 miles on a gallon of gasoline. The car will have a 112-in. wheel base and sell around $1,500.

Pennsylvania Engineers Form Steel Works Section

A steel works section of the Engineers' Society of Western Pennsylvania was organized recently in the William Penn Hotel, Pittsburgh, by the election of T. P. Davis, Pittsburgh, chairman, and Strickland Kneass, Jr., Youngstown, Ohio, vice-chairman. K. F. Treschow, secretary of the society, is also secretary of each of its sections. More than 100 members belong to the new section and it is expected to have in a short time the largest membership of any of the society's sections.

F. KARL SCHNEIDER has severed his connection with the Krebs Pigment and Chemical Co., of Newport, Del., and has purchased the plant and equipment of the Albion Engineering Co., of Philadelphia, operating it as a general engineering and machine shop.

Business Items

The Surface Combustion Co., Inc., 366 Gerard Ave., New York, N. Y., manufacturer of industrial furnaces has acquired the entire right and interests of the Ratiometer Corporation, Rochester, N. Y., and has established a separate manufacturing and sales organization in its own plant in New York City where it will continue this business under the name of the Ratiometer Corporation. The Ratiometer is a mechanical device invented by Ivar Lundgaard for the automatic proportioning of gaseous fuels and the air used for their combustion. Other patent rights recently acquired by the Surface Combustion Co., Inc., are the Clark principle of intermittent firing for enameling furnaces and the Langenberg-Fetterly furnace for heat-treating armor piercing shells.

At the annual meeting of the Superior Iron Works, Superior, Wis., directors and officers were elected for the year 1921. E. H. Williamson, Frank R. Zimmerman and P. G. Stratton were chosen as directors, and the officers elected were: E. H. Williamson, president; Frank R. Zimmerman, vice-president; Charles Gray, secretary and treasurer. Mr. Zimmerman recently moved from Duluth to Superior. For the last eight years he has been with the National Iron Works, of Duluth, as general superintendent and chief engineer and before that time he was mechanical engineer in charge of construction of mining machinery and equipment of mines at Butte, Mont., and Baraboo, Wis.

At the annual meeting of the stockholders of the Louisville Machine Manufacturing Co., Canton, O., A. L. Keim was elected president; E. L. Menegay, vice-president; Paul F. Loichot, treasurer and general manager, and A. Rodgers, secretary and sales manager. The directors include Arthur L. Keim, Paul F. Loichot, E. L. Menegay, and N. L. Menegay of Louisville and A. Rodgers of Canton. Generally dull business throughout the country did not affect the Louisville plant according to stockholders who reported a gain in 1920 of 45 per cent over 1919 in sales volume. The company manufactures clay working specialties, dies, screens.

Reductions in freight rates have been announced on cast-iron pipe, coal and coke from Mobile, Ala., to various points on the Pacific coast. The coast, for several months, has been taking large quantities of water, gas and sanitary pipe manufactured in the foundries and shops in the Birmingham district. The reduction in rates on pipe is from 80 cents to 65 cents for pipe more than 12 in. in diameter, and from 75 to 60 cents for pipe under 12 in. Coal and coke rates are reduced from $12 to $10 per ton. The companies that have been participating in this movement of pipe to the coast are mainly the United States Cast, the National, the American, the Central Foundry, Stockham Pipe and Fittings, Birmingham Pipe and Fittings and Hammond-Byrd Iron companies.

The American Gas Furnace Co. announces that its entire personnel will henceforth be concentrated in the main office in Elizabeth, N. J., where its two plants are located; also that it has discontinued selling operations through its former sole agents, E. P. Reichhelm & Co., Inc. This action will give more thorough co-operation of the various departments and will place at the disposal of patrons the entire organization of the American Gas furnace Co.

The Georgia workmen's compensation law, one the most important and far reaching laws ever enacted in Georgia, became effective March 1. It was enacted by the state legislature at its 1920 session and virtually will serve to revolutionize the payment of claims for personal injuries. Its greatest importance is in industrial circles throughout the state. The law is to be administered by a board of four members, composed of H. M. Stanley, Georgia commissioner of commerce and labor; R. A. Denny, attorney general; Sam J. Slate and W. G. Raoul.

Following a tour of inspection of the various foundries and plants operated by the General Fire Extinguisher Co. directors and officers of that organization met recently in Columbus, Ga., and after declaring the usual dividend re-elected the following officers: Frank H. Maynard, of New York, president; Russell Grinnell, of Providence, vice-president and general manager; W. A. Neracher, of Warren, O., second vice-president; L. W. Jones, of Providence, treasurer; Edgar W. Shaw, of Providence, secretary.

Dwight P. Robinson & Co., Inc., engineers and constructors of New York, has recently opened branch offices in Montreal in the Dominion Express Building. Alexander C. Barker, vice-president, is in charge of the office. The company is a consolidation of Westinghouse, Church, Kerr & Co., Inc., and Dwight P. Robinson & Co., Inc., and has done extensive construction and engineering work in Canada for the Canadian Pacific Railway, Canadian Salt Co., Canadian Crocker-Wheeler Co., Dominion Government, Aetna Explosives Co., Grand Trunk Railway, and others.

At the annual meeting of the stockholders of the Canton Rim Co., Canton, O., F. G. Graber was elected president; Isaac Ulman, vice-president; William Bernhardt, secretary and treasurer and Charles Doershuck, general manager. The directors are the above named officers and Frank Leslie. This company commenced March 1, to operate its new factory at Louisville. It will manufacture a demountable automobile rim.

The Newton Steel Co., Youngstown, O., at its recent meeting of stockholders re-elected retiring directors who organized as follows: President, Edward F. Clark; vice-president and general manager, H. M. Steele; secretary, R. A. Kenworthy; and treasurer, J. H. Fitch, Jr. Finished steel shipments in 1920 were about 30,000 tons of full finished and full black sheets.

At the annual stockholders' meeting of the Massillon Rolling Mill Co., Massillon, Ohio, R. E. Bebb was elected president; F. J. Griffiths, vice-president; Charles C. Chase, general manager; Joseph Immler, secretary, and I. M. Taggart, treasurer. The directorate includes R. E. Bebb, Charles G. Chase, Fred H. Snyder, W. A. Dielhenn, Joseph Immler, I. M. Taggart Peter Beninghoffen, H. M. Geiger Maurice Bissel and F. J. Griffiths.

The Liberty Stamping and Manufacturing Co., 401-402 Book Bldg., Detroit, Mich., has been incorporated with a capital stock of $20,000. The incorporators are William P. Neville president; Curtis H. Longsdorf, vice-president and treasurer; Walter S Scott, secretary. The new concern will do stampings of all descriptions.

Butterfield & Co., Derby Line, Vt. will carry in the future a complete stock of tools at 62 Reade St., New York, N. Y., together with the stocks of the two other divisions of the organization, the Union Twist Drill Co and the S. W. Card Manufacturing Co

The Stewart-Warner Speedometer Corporation, Chicago, Ill., has purchased the major part of the merchandise and fixtures, other goods and chattels of the Van Sicklen Speedometer Co., Elgin, Ill.

The Lincoln Institute for Vocational Education is now located at 694 Broadway, New York, N. Y. J. Edward Mayman is the director.

Personals

JONATHAN WARNER, president of the Trumbull Steel Co., of Warren, O. was elected a member of the board of directors of the Truscon Steel Co Youngstown, O., at its annual meeting The new directorate includes: President, Julius Kahn; vice-president, T. H Kanel; secretary, Henry M. Butzell treasurer, Day Krolick. Jonathan Warner, Albert Kahn and Joseph Krolick are the other members of the board At the meeting it was decided to increase the capital stock of the company from $2,000,000 to $4,000,000.

CHARLES EISLER, consulting engineer 159 Clifton Ave., Newark, N. J., has purchased the assets of the National Machine and Tool Co., of Newark, N. J The firm's name has been changed t

the Charles Eisler Engineering Co., who will manufacture the gear testing machines as well as incandescent lamp machinery, in addition to its regular consulting engineering and machine designing. The factory and offices are located at 15 Kirk Place, Newark, N. J.

THOMAS K. GLENN, president of the Atlantic Steel Co., left Atlanta on Wednesday, Feb. 23, for South America, where he will spend several months in the interests of the steel company. He will spend a large part of the time in Buenos Aires in the Argentine. The Atlantic Steel Co. has had a sustained trade with Latin-American countries for a number of years.

LEWIS E. HARPER, who has been superintendent of the Reed plant of the Reed-Prentice Co. of Worcester, Mass., has been promoted to superintendent of buildings and equipment of the Reed-Prentice Co.

CARLTON R. DODGE has been appointed Western sales manager of the Lakewood Engineering Co., with headquarters at 1215 Lumber Exchange Bldg., Chicago, Ill.

GEORGE B. HADESTY has been appointed general manager of the Philadelphia & Reading Coal and Iron Co., of Pottsville, Pa.

Obituary

W. H. Van Dervoort

W. H. VAN DERVOORT, president of the Root & Van Dervoort Engineering Co., of Moline, Ill., died at his home in that city on Feb. 25. He had been ill for some time.

Mr. Van Dervoort was a well-known mechanical engineer and manufacturer. He was at one time president of the National Metal Trades Association and also a member of the American Motor Car Manufacturers Association and the Society of Automobile Engineers. He served on the faculties of Michigan State Agricultural College and the University of Illinois, as professor of mechanical engineering. During the late war he was a member of the munitions standards board, Council of National Defense, and rendered excellent service to the country. As an author his best known work is "Machine Shop Tools and Shop Practice."

PROF. WILLIAM E. NINDE, M. E., who held the chair of associate mechanical engineer in the College of Applied Science, Syracuse University, died recently in Syracuse, N. Y. Professor Ninde was a member of the American Society of Mechanical Engineers and the author of "Design and Construction of Heat Engines."

WILLIAM C. LORING, vice-president of A. F. Way Co., Inc., Hartford, Conn., died at Burnside, Conn., recently.

New Publications

The "Mechanical World" Electrical Pocket Book. Emmott & Co., London and Manchester. Cloth, 306 4 x 6 pp. 108 illustrations.

This little book contains a great amount of electrical information, from the definition of electrical terms and units to the principles of generators of different types together with their care and use. Short chapters are devoted to: Transformation of Current, Converters; Rectifiers; Starters and Controllers; Conductors and Cables; Insulation; Wiring; Switchboard; Measuring and Testing Instruments; Lamps; Lighting, Welding; The Use of electricity in mines and on shipboard; Heating, etc.

Immigration and the Future. By Frances Kellor. 276 pp. Published by George H. Doran Co., New York City.

This is a book that should be read by every employer of labor, manager and engineer in the United States. Although showing indications of haste and marred by poor proofreading, it nevertheless discloses conditions and discusses problems relating to immigration and assimilation that are unknown to most Americans.

The author formulates the following questions and presents the facts connected with each of them in a manner calculated to make the most casual reader pause and consider:

(1) Is immigration essential to our economic development? (2) Is America a necessary asylum for the foreign born? (3) Shall America adopt a national system of assimilation? (4) Shall the bas's for assimilation be Anglo-Saxon? (5) Shall American citizenship be compulsory? (6) Shall aliens be registered? (7) Shall America have inspectors abroad and a national distribution system? (8) Shall the troubles of Europe be solved in America?

If the attention of the country can be focused on the immigration problem with sufficient accuracy to force the formulation of a logical and equitable immigation policy by the United States, the book will have more than served its purpose.

National Safety Code for the Protection of the Heads and Eyes of Industrial Workers—No. 2. Department of Commerce, Bureau of Standards. Sold by the Superintendent of Documents, Government Printing Office. Washington, D. C. Sixty-four 5 x 7½-in. pages.

This is a set of rules designed to give mechanical and optical protection to the eyes of workers in certain occupations which involve eye hazard. The rules have been worked up in co-operation with outside conferees representing all points of view and especially with the assistance of an advisory committee which has approved the draft of the rules.

The rules are accompanied by a discussion intended to assist in their interpretation and application and to show the reasons for including some of them in the text.

Thirteenth Conference on Weights and Measures. Department of Commerce, Bureau of Standards. Sold by the Superintendent of Documents, Government Printing Office, Washington, D. C. Two hundred 7 x 10-in. pages.

This book gives all the details of the thirteenth annual conference on weights and measures held at the Bureau of Standards, Washington, D. C., on May 24, 25, 26 and 27, 1920. The reports of delegates, papers, sessions and discussions are thoroughly covered. A list of persons who attended the conference is included.

The Welding Encyclopedia—1921. Three hundred twenty-six 6 x 9-in. pages, numerous illustrations, tables and charts. Bound in dark green cloth boards. Published by the Welding Engineer Publishing Co., Chicago.

This is a very complete reference and instruction book covering the fields of electric, gas-torch, and Thermit welding. About one-third of the subject matter consists of an illustrated dictionary section devoted to definitions of the numerous words, terms and trade names peculiar to autogenous welding. Oxy-acetylene, electric arc, electric resistance and Thermit processes are treated in separate chapters which give instructions for welding all metals by each of these methods. Following these chapters is one on the use and care of equipment. The rules and regulations of the various states, departments and organizations are also given in detail. A special chapter is devoted to boiler welding and another to heat treatment. An important feature of the book is a catalog section devoted to advertisements of the leading manufacturers of welding supplies and equipment. The buyer's index enables the reader to easily locate makers of any desired apparatus.

The Slide Rule. By Charles N. Pickworth. Emmott & Co., Ltd., London and Manchester. D. Van Nostrand, New York. Seventeenth Edition. Cloth. 132, 4¾ x 7 in. pp.; 39 illustrations.

A practical manual covering slide rules of all kinds with full instructions for their use, including the solving of such problems as are met with by the engineer in his everyday practice. The mathematical and mechanical principles of the slide rule are explained. An appendix contains a description of some of the newer forms of slide rules and attachments together with various tables and data.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Mercantile companies in Argentina are interested in securing agencies for the sale of machinery suitable for bakeries. Correspondence should be in Spanish. No. 34,453.

A merchant in Germany desires to be placed in touch with manufacturers for the importation of machine tools, especially lathes, shapers, drill presses, etc. No reference offered No. 34,454.

A firm in Mexico, which is about to establish a cement manufacturing plant desires to purchase full equipment in the United States. No. 34,461.

Forthcoming Meetings

The National Metal Trades Association will hold its annual convention at the Hotel Astor, New York, on April 18, 19, 20, 21. Homer D. Sayre, Peoples Gas Building, Chicago, Ill., is secretary.

The fifth annual convention of the American Gear Manufacturers Association will be held in Cincinnati, Ohio, April 27, 28, 29 and 30.

The annual meeting of the American Welding Society will be held in the Engineering Societies Building, 29 West 39th St., New York, on April 28.

The Society of Industrial Engineers will hold its national convention in Milwaukee, Wis., on April 27, 28 and 29. Geo. C. Dent, 327 So. La Salle St., is business manager.

The National Foreign Trade Council will hold its eighth annual convention in Cleveland, Ohio, on May 4, 5, 6 and 7. J. G. Hammond, care of the Council, 409 Park Bldg., Cleveland, is secretary.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

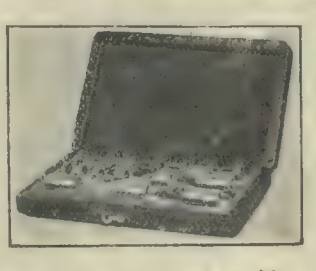
The spring meeting of the American Society of Mechanical Engineers will be held at the Congress Hotel, Chicago, May 23-26. Calvin W. Rice, Engineering Societies Bldg., 239 West 39th St., New York, is secretary.

The Society of Automotive Engineers, 29 West 39th St., New York announces that its summer meeting will be held at West Baden, Ind., on May 24 to 28 inclusive.

Condensed-Clipping Index of Equipment

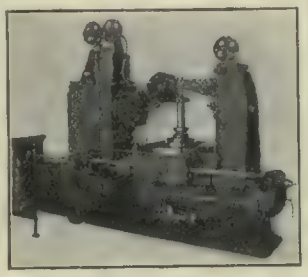
Patented Aug. 20, 1918

Gage Set, Combination, "Micro."
Van Keuren Co., 361 Cambridge St., Allston, Boston, Mass.
"American Machinist," Feb. 3, 1921.



This set gives every thousandth of an inch from 0.4 to over 5 in. It is intended for production departments, small shops, or for individual workmen, being adapted to such purposes as setting sine bars, checking instruments, snap gages and tools, and for measuring dimensions on pieces being machined. Only 16 separate gages are used. The sizes provided are: In the thousandth series, 0.101, 0.102, 0.103, 0.106 in.; in the hundredth series, 0.110, 0.120, 0.130, 0.160 in.; in the tenth series, 0.100, 0.200, 0.300, 0.500 in.; and four 1-in. blocks. When making combinations, it is necessary in some cases to use two gages to secure the desired thousandth. The blocks are standardized by light-wave measurements.

Hobbing Machine, Gear, Automatic, "No. 5"
Newark Gear Cutting Machine Co., Newark, N. J.
"American Machinist," Jan. 27, 1921.



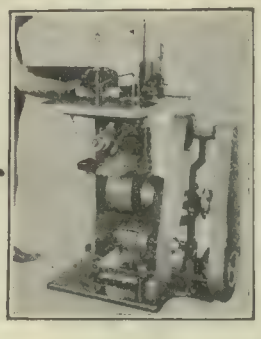
The machine is stated to be intended primarily for the rapid production of accurate helical gears, being fitted for cutting street-railway and electric-locomotive gearing, herringbone gears for mill drives, and a large range of general industrial gearing. Wormwheels and straight-tooth spur gears can, of course, also be hobbed by the machine. Specifications: Face capacity, 18 in. Diameter capacity, 28 in. with outside arbor support in place. Minimum centers between work and cutter arbors, 2½ in. Hob capacity, 7⅜ in. in diameter by 9 in. long. Cutter arbor, 1¼ or 1½ in. in diameter. Work arbor, 2¼ in. in diameter. Motor drive, when furnished, requires constant-speed, 7½- to 10 hp., 1,100- to 1,200-r.p.m. motor. Weight, 14,000 lb.

Feeding Devices, Punch-Press, Automatic, Chute and Slide
F. J. Littell Machine Co., Chicago, Ill.
"American Machinist," Feb. 10, 1921.



The operator feeds the pieces into the chute *A* that extends down to the die-feeding mechanism. The automatic feeding mechanism is contained in the block *B* and consists of a spring-actuated slide that moves toward the die and pushes a fresh piece in place above the die as the punch rises. As the press slide descends, the feeding slide is pushed away from the punch by means of a bracket with a roller *C*. This roller presses against a bevel cam *D* standing up from the top of the feeding slide. A hopper feed mechanism for automatically feeding small parts into the chute is made, so as to eleminate hand feeding. A No. 0 dial type of feeding device is also manufactured by this company.

Die-Filling Machine, No. 6
W. D. Rearwin, 716 Monroe Ave., Grand Rapids, Mich.
"American Machinist," Feb. 10, 1921.



The machine is provided with a 20 x 24-in. table, 30 in. high. The head can handle files up to 14 in. in length. It has a stroke adjustable up to 7 in. The machine is intended for work of a rather heavy nature, and can handle various sorts of filing and sawing jobs. The capacity of the machine from the back of the file to the front of the slide is 9 in. Also, it is 9 in. from the top of the table to the under side of the file arm. Arms are provided for holding hacksaws, as shown, and for the filing of dies or patterns where the under side is closed or has a shoulder. The machine can be furnished with an individual motor, with a countershaft, or be driven directly from a lineshaft. The weight crated is 650 lb.

Welding Machines, Seam, Electric, Intermittent Action
Gesellschaft für Elektrotechnische Industrie, Berlin, Germany
"American Machinist," Jan. 27, 1921.



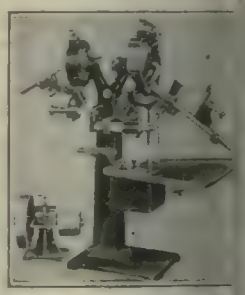
This company manufactures several electric seam-welding machines, both for circular and longitudial seams, and for welding bottoms in iron drums and small containers. The rollers of the machines all have an intermittent action, the current being automatically turned off when the motion stops, to prevent oxidation at the welding point. The machine shown, which is typical of the others, has a consumption of 12 kw., is intended for the welding of round or straight seams of any length, and has electrodes about 13⅜ in. in diameter. A foot lever, adjustable in a longitudinal as well as transverse direction, is used to control pressure between the electrodes.

Feeding Devices, Punch-Press, Flat Stock, Automatic
F. J. Littell Machine Co., Chicago, Ill.
"American Machinist," Feb. 10, 1921.



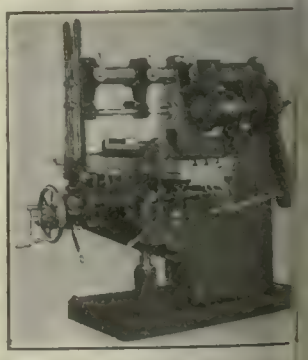
The roll-feed device shown is the No. 5 size and is equipped with a scrap-cutter and with straightening rolls. The straightening rolls at the right-hand end consist of five rolls, three stationary ones below and two adjustable above. A bracket at the extreme right carries a set of adjustable angle irons for guiding the stock into the attachment. The device will handle stock of any width up to in. The bolster is a steel casting. The weight of the complet device is about 3,000 lb. No. 2 and No. 3 single-roll and double roll feeding devices are also made, being similar to the No. 5 but with smaller capacities. The company makes a reel stand fo holding the coiled stock for use with the feeding attachmen and a power-driven winding device for again coiling the stoc after it comes from the machine.

Grinding Machine, Twist-Drill, "Improved New Yankee"
Wilmarth & Morman Co., 1187 Monroe Ave., N. W., Grand Rapids, Mich.
"American Machinist," Feb. 10, 1921.



This machine will grind either straight, taper or collared-shank drills without the adjustment formerly required. For grinding straight-shank drills, the center attachment is not used. For short straight-shank drills the sliding V-support is swung out of the way. For grinding taper and collared-shank drills the center is used to support the drill. Nine belt and eight motor-driven styles of machine are offered. These styles can be made up in different combinations from four holders having the following capacities: No. 52 to ⅝ in.; ⅛ in. to 1⅛ in.; ¼ in. to 2⅛ in.; and ½ in. to 4 in. Each machine is equipped with means for obtaining different clearance angles. A built-in wheel-truing device is also provided.

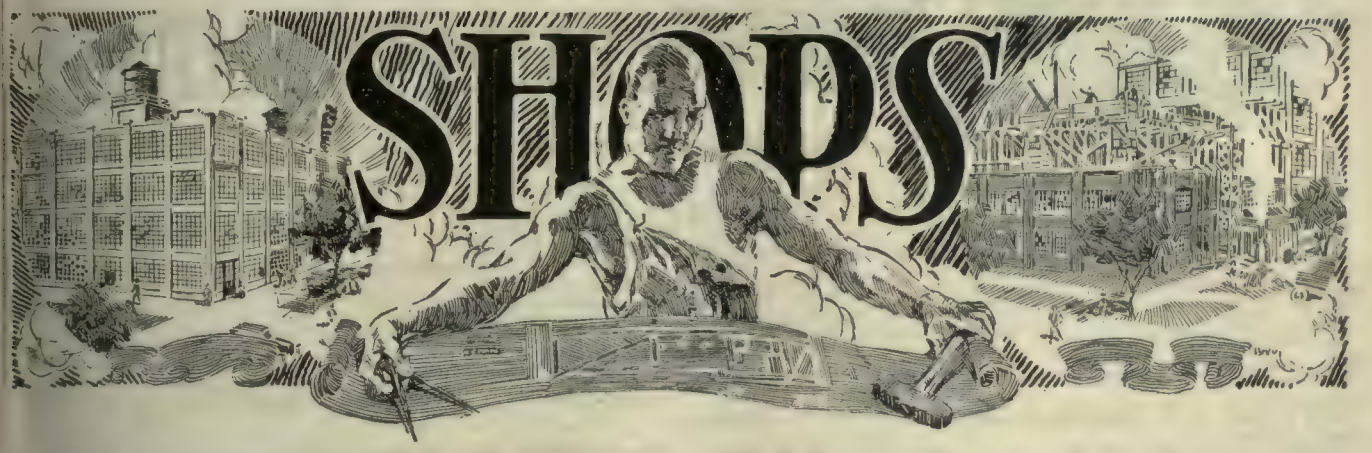
Milling Machine Plain, No. 4.
Ford-Smith Machine Co., Ltd., Hamilton, Ont., Can.
"American Machinist," Feb. 10, 1921.



Specifications: Table: working surface, 71 x 14½ in.; T-slots, ⅝ in.; traverse, 42 in. Saddle transverse movement, 12 in. Knee vertical travel, 20 in. Face of column to brace, 30 in. Center of arbor to underside of overarm, 7½ in. Spindle; diameter at front bearing, 3⅛ in.; taper hole, No. 11 B. & S.; hole through, 1⅛ in.; speeds, 18 from 14 to 415 r.p.m. Back gear ratios, 3 to 1 and 10.8 to 1. Overarm, diameter, 4¾ in. Belt width, 3½ in. Diameter of large cone, 13 in. Feeds; number, 36; range, per rev. of spindle, 0.002 to 0.390 in. for transverse and vertical, 0.006 to 1.56 in. for longitudinal. Rapid power traverse in in. per min.; table, 130; transverse, 33; vertical, 11. Countershaft: pulley, 16 x 5 in.; speed, 180 and 220 r.p.m. Floor space, 11 ft. 3 in. x 7 ft. Net weight, 6,500

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Conn., Bridgeport—The Bridgeport Auto Repair Shop, 861 Hallett St.—1 shaper (used).

Conn., Bridgeport—The Garrison Co., Inc., Merriam St., manufacturing engineers—one Universal milling machine with a dividing head.

N. Y., Troy—The Mill Supply Co., 226 Hill St.—5 or 6 ft. radial drill with tapping attachment, arranged for motor drive.

Fla., Daytona—H. E. "Gene" Johnson, manufacturer of bicycles, etc.—lathe power drill, emery grinder, etc.

Fla., Jacksonville—The Jones Furniture & Storage Co., 639 West Forsythe St., R. T. Jones, Purch. Agt.—punching machines for use in the manufacture of bed springs.

La., Baton Rouge—W. D. Boyd, R. F. D. No. 1—automobile tools and boring tools for reboring cylinders.

La., Baton Rouge — The Capital City Plumbing Co., 236 Laurel St.—electric pipe cutting machinery, dynamo and machine from 2 to 8 in.

La., Baton Rouge — Crawford, Jenkins, Booth Motor Co., Inc., 213-215 Crockett St. —planers, hoists, drills, etc.

La., Baton Rouge—Doyles Repair Wks., 247 Main St.—1 lathe with 16 in. swing and 12 ft. bed, also machine shop tools of all kinds.

La., Baton Rouge — D. Souter, 647 St. Mary St., manufacturer of metal specialties —special wire forming machinery, automatic stamping machines for making sheet metal stampings and die cast parts for light work.

La., New Orleans — The Globe Boiler Wks. Co. Inc., 1014 Tchoupitoulas St.— small drill presses, also small hand punch and shear machine (preferably used).

La., New Orleans — H. M. Jannett, 712 Hennen Bldg.—1 four side small planer (good condition).

La., New Orleans — The Liberty Machinery & Welding Co., Inc., 1025 Tchoupitoulas St.—1 in. cap, 1¼ in. screw machine with drawing chuck attachment (new or in good condition) and a 30 in. drill press (new or used).

La., New Orleans — The Orleans Steel Products Co. Inc., 1021-25 Bienville St.— One Universal shear and bar cutter on style of Pells make (new or used).

One power punch with architectural jaw to cut ½ in., 4 x 4 angles, 8 in. throat; Bagger type (new or used).

One double end punch and shear to cut angles ⅝, 4 x 4.

One No. 2 Acme bolt threading machine complete with countershaft (new or used).

S. C., Columbia—The Tozer Engine Wks. will increase its capital stock to $100,000 and install additional equipment.

Ill., Belleville—The Unit Stove & Furnace Co., H. A. Langfelder, Purch. Agt.—planers, lathes and sand blast machines (new or used).

Ill., Chicago — The International Filter Mfg. Co., 1226-38 South Dearborn St., P. N. Engel, Purch. Agt.—radial drill with 2½ in. tapping attachment.

Mich., Detroit—The Amer. Machine Products Co., 18th and Howard Sts.—general machine shop equipment.

Mich., Detroit — Neumann & Co., 3527 Greenwood Ave., R. Neumann, Purch. Agt. —miscellaneous sheet metal working equipment.

O., Springfield—The Yost Gearless Motor Co.—1 wire cutting and straightening machine for ⅜ in. wire up to 5 ft. lengths (new).

Wis., Appleton — The A. Brandt Power Co., 987 College Ave.—machine tools.

Wis., Kewaskum—The Kewaskum Auto Service Co., C. Schaefer, Purch. Agt.—machinery for repairing cars.

Wis., Milwaukee—J. Maus, Port Washington Rd.—lathe and drill press for garage.

Wis., Milwaukee—W. Salmon, 836½ 15th St.—polishing mills, carborundum machines and power saws for marble works.

Wis., Sheboygan—The Jenkins Machine Co., c/o A. Studeman, 318 North 8th St.— machine tools, including lathes, grinders and power machinery.

Ark., Stuttgart—The Starley Whites Machine Wks.—1 No. 60 Heald cylinder grinder (used).

Mo., St. Louis—The Christopher & Simpson Iron Wks. Co., 9th St. and Park Ave. —one No. 1 or No. 2 Universal milling machine (used).

Mo., St. Louis — The Steiner Mfg. Co., 4100 North 21st St. (machinists), J. C. Steiner, Purch. Agt.—surface grinder, drill press and lathe.

Machinery Wanted

Mass., Pittsfield — The Pittsfield Milk Exch., 125 Dawes St., K. B. Mills, Pres.— dairy equipment.

D. C. Washington — A. L. Flint, Genl. Purch. Officer of the Panama Canal, Washington, will receive bids until April 11 for furnishing power and refrigerating equipment.

La., Baton Rouge—Kean Bros., 3d St.— washing and laundry machines, tools, wrenches, cold chisels.

La., New Orleans—The Southern Mattress Co., 1109 Annunciation St., manufacturer of felt, moss, hair, excelsior mattresses and pillows—one tuffing machine, one roll edge machine, garnet machines, etc.

N. C., Ashboro—C. C. Cranford—complete line of machinery for the manufacture of chairs.

N. C., Wilmington—The Carters Production Wks., 210 South Water St., manufacturers of machinery, etc., O. Carter, Purch. Agt.—complete foundry equipment for making sash weights and grate bars.

S. C. Charleston—The Southern Beverage Corp., 5 Charlotte St.—cane crushing machinery, equipment for sirup plant, canning equipment, etc.

S. C., Columbia — The Bingham Hogan Co., 1540 Main St., T. W. Bingham, Vice-Pres. and Mgr., will be in market Aug. 1 for one Chandler Price or other make printing press, size up to 20 in.; 1 embossing and cutting machine for making up mounts for art calendars, 1 turning machine, hand or motor driven, for turning roll calendars up to 30 in.; 1 stapling machine for calendar pads and fan handles.

Ill., Chicago — The Mickelberrys Food Products Co., 641 West 47th St.—meat handling machinery.

Ill., Chicago—E. O. Reed, Inc., 2956 North Leavitt St.—candy making machinery.

Ind., Terre Haute—The Hoosier Rolling Mill Co.—1 traveling crane, 45 to 50 ft. span, 5 to 7 ton lift (used).

Mich., Ishpeming—H. W. Elson, 325 Cedar St., manufacturer of soft drinks—bottling machinery.

Wis., Ephraim—A. Ohman—woodworking machinery.

Wis., Kenosha—The Star Cleaners and Dyers, 265 Park St.—dry cleaning and dyeing equipment.

Wis., Kenosha—The Whitcomb Tool & Machine Co., 761 Strong St., J. Whitcomb, Purch. Agt.—foundry equipment including furnaces.

Wis., Kilbourn—W. R. Weir—ice cream making machinery.

Wis., Manitowoc—The American Seating Co., 16th and Wollmer Sts.—wood-working machinery.

Wis., Racine — The Bd. of Industrial Educ., City Hall—wood-working machinery, lathes, etc., for machine shop.

Wis., Racine—The New York Market Co., 1310 Washington Ave.—machinery (new).

Wis., Waukesha — The Waukesha Ice Cream Co., c/o D. A. Williams, 208 Charles St.—ice cream and refrigerating machinery.

Ark., West Helena—(Helena P. O.) The Helena Spinning Co., C. J. Rhodes, Secy.-Treas.—one 40 in. breaker lapper with automatic feeder attached, one 40 in. intermediate lapper and one 40 in. finisher lapper. (Kitson make preferred.)

Mo., Joplin—The Union Iron Wks., 623-629 Kentucky Ave.—oil drilling tools and machinery for heavy forging.

Mo., Kirksville — The Automatic Self Leveling Clock Co., Inc., J. F. Janisch, Mgr.—machinery and other equipment for the manufacture of clocks of various kinds.

Mo., St. Louis—The Bon Ton Mfg. Co., 211 South Bway—1 brush block boring machine, motor drive, and 1 bench trimming shear for fiber brooms.

Okla., Oklahoma City—The Dinks Parrish Laundry, 2 Bway Circle — laundry machinery, etc.

Ont., Connaught Station—T. Woolings & Co., Englehart—Rossers and Barkers, saws.

Ont., Dundalk — The Dundalk Woolen Mills, W. Heimbecher, Mgr. — machinery and equipment.

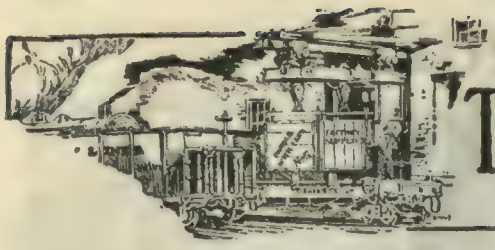
Ont., Windsor — The Neal Baking Co., Salter Ave., H. Neal, Mgr.—modern machinery and equipment.

Que., St. Anne de Bellevue—The Garden City Press, Ltd. — printing machinery equipment.

Metal Working

NEW ENGLAND STATES

Conn., Hartford—The Connecticut Blower Co., Inc., 135 Sheldon St., plans to build a 1 story, 50 x 175 ft. addition to its factory. Estimated cost, $50,000. Private plans.



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current
CINCINNATI	
No. 2 Southern	$30 75
Northern Basic	28 52
Southern Ohio No. 2	30 50
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	33.16@34.16
BIRMINGHAM	
No. 2 Foundry	26 50
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75 sil	*27.80@28 25
Virginia No. 2	*34.75@35 75
Basic	†27 25
Grey Forge	*27 75
CHICAGO	
No. 2 Foundry local	26.00@27 00
No. 2 Foundry, Southern	35 40
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26.00
Basic	25.00
Bessemer	27.00

*F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from hobbers' warehouses at the cities named:

	New York *Current	Cleveland Current	Chicago Current
Structural shapes	$3.58	$3.58	$3.58
Soft steel bars	3.48	3.34	3.48
Soft steel bar shapes	3.48	3.48	3.48
Soft steel bands	4.18	6.25	...
Tank plates	3.78	3.78	3.78

*Add 10c. for trucking charge to Jersey City and 15c. to New York and Brooklyn from warehouse.

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current
Mill, Pittsburgh	$2.25@$2.35
Warehouse, New York	3.48
Warehouse, Cleveland	3.52
Warehouse, Chicago	4.12

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York, *Current	Cleveland	Chicago
No. 10	3.20@3.55	4.50	4.00	4.68
No. 12	3.25@3.60	4.55	4.35	4.73
No. 14	3.30@3.65	4.60	4.40	4.78
No. 16	3.40@3.75	4.70	4.50	4.88
Black				
Nos. 17 and 21	3.75@4.15	5.30	4.95	5.55
Nos. 22 and 24	3.85@4.20	5.35	5.10	5.60
No. 25 and 26	3.90@4.25	5.40	5.15	5.65
No. 28	4.00@4.35	5.50	5.25	5.75
Galvanized				
No. 10 and 11	4.25@4.70	5.40	5.50	6.10
No. 12 to 14	4.35@4.80	5.50	5.60	6.20
Nos. 17 and 21	4.65@5.15	5.90	5.90	6.50
Nos. 22 and 24	4.80@5.25	6.05	6.05	6.65
No. 26	4.95@5.40	6.20	6.20	6.80
No. 28	5.25@5.70	6.50	6.50	7.10

*To these prices 10c. must be added for delivery in Jersey City and 15c. for New York and Brooklyn.

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$5.50	$5.25	$4.84
Flats, squares and hexagons, per 100 lb	6.00	5.75	5.34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45
Monel Metal	
Shot and blocks	35
Ingots	38
Sheet bars	40
Hot rolled rods (base)	42
Cold rolled rods (base)	56
Hot rolled sheets (base)	55
Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	42
Hot rolled copper nickel rods (base)	52
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 5/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7¾c. Domestic iron sells at 12c. per lb

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	6.00	8.00	9.00
Spring steel (light)	8.00	7.00	12.00
Coppered Bessemer rods	8.50	8.00	7.00
Hoop steel	4 58	4.04	4.18
Cold rolled strip steel	9.00	8.25	9.25
Floor plates	5.75	4.00	6.03

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

Inches	Steel Black	Galvanized	Inches	Iron Black	Galvanized
BUTT WELD					
⅜ to 3	57½%	44%	¼	15½–16½%	+10½–11½%
			⅜	19½–20½%	1½– 2½%
			½ to 1¼	24½–25½%	8½– 9½%
LAP WELD					
2	50½%	38%	2	20½–21%	6½– 7%
2½ to 6	53½%	41%	2½ to 6	22½–23%	9½–10%
7 to 12	50½%	37%	7 to 12	19½–20%	6½– 7%
13 to 14	41%	....			
15	38½%				
BUTT WELD, EXTRA STRONG PLAIN ENDS					
⅜ to 1¼	55½%	43%	¼ to 1¼	24½–25½%	9½–10½%
2 to 3	56½%	44%			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	48½%	37%	2	21½–22½%	8½– 9%
2½ to 4	51½%	40%	2½ to 4	23½–24%	11½–12%
4½ to 6	50½%	39%	4½ to 6	22½–23%	10½–11%
7 to 8	46½%	33%	7 to 8	14½–15%	2½– 3%
9 to 12	41½%	28%	9 to 12	9½–10%	+2 –2½%

Warehouse discounts as follows:

	—New York— Black	Galv.	—Cleveland— Black	Galv.	—Chicago— Black	Galv
⅛ to 3 in. steel butt welded	44%	28%	42½%	33½%	57½%	44
2½ to 6 in. steel lap welded	39%	24%	44½%	29½%	53½%	41%

Malleable fittings. Classes B and C, Banded, from New York stock sell at plus 6%. Cast iron, standard sizes, 15% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

	Current
Copper, electrolytic	13.75
Tin in 5-ton lots	28 25
Lead	4 50
Zinc	6.00
ST. LOUIS (In carload lots)	
Lead	4 10
Zinc	5.60

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York Current	Cleveland Current	Chicago Current
Copper sheets, base	20 25	22.50	20 00
Copper wire (carload lots)	15 50	19.00	16.50
Brass sheets	17.25	24.00	19 25
Brass pipe	21.00	24.00	22.50
Solder (half and half) (case lots)	19.63	26.00	19.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill, 1,000 lb. and over, warehouse, net extra:

	Current
New York	15.25
Cleveland	20 00
Chicago	19.25

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f. o. b. mill + less 8% for carload lots..... 11.50

	Warehouse — In Casks Current	Warehouse — Broken Lots Current
Cleveland	13.70	14.30
New York	12.50	13.50
Chicago	14.50	14.95

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current
New York	6.00
Chicago	6.25
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	Current	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	10.00
Copper, heavy, and wire	9.50	9.50	8.50
Copper light, and bottoms	8.00	9.00	8.00
Lead, heavy	3.50	4.00	3.75
Lead, tea	2.25	3.00	3.00
Brass, heavy	6.50	7.00	9.75
Brass, light	5.00	5.00	5.50
No. 1 yellow brass turnings	5.50	5.50	6.00
Zinc	3.00	3.00	3.50

ALUMINUM—The following prices are spot from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.2@28.1	24.50	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.00
Chicago	19.00
Cleveland	22.00

BABBITT METAL—Warehouse price per pound:

	Current — New York	Current — Cleveland	Current — Chicago
Best grade	70.00	46.00	35.00
Commercial	30.00	16.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$1.00	+1.15
Hot pressed hexagon	List	1.00	+1.15
Cold punches hexagon	List	1.00	+1.15
Cold punched square	List	1.00	+1.15

Semi-finished nuts, $\frac{3}{16}$ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	70%
Cleveland	70%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	45%	60%	50%
1½ and 1¾ in. by 3 in. up to 12 in	25%	50%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $3.50 Chicago..... $2.50

For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $4.00 Chicago..... $4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	40%	50%	40%
Larger and longer up to 1 in. by 30 in.	40%	40%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets Current	Burs Current
Cleveland	35%	10%
Chicago	net	net
New York	50%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel $\frac{7}{16}$ and smaller	45%	50%	45%
Tinned	45%	50%	30%

Structural, ⅜, ½, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$5.08 Cleveland...$5.00 Chicago....$5.08 Pittsburgh..$3.90

Boiler, same sizes:
New York...$5.30 Cleveland...$5.10 Chicago....$5.18 Pittsburgh..$4.00

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	24.00	29.00
Brass	21.00	24.00	28.00

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼-2 in., inclusive in rounds, and ½-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.50 per 100 lb. In Cleveland—$8.50 per 100 lb.; New York price is 8c.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	13.50@14.00	13.00	14.25
Colored mixed	7.00@12.00	10.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York	$2.25
Philadelphia	2.00
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (25 bbl.)	$2.50
Philadelphia (25 bbl.)	2.50
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$4.50
Prompt foundry	5.50@6.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	0.85

LINSEED OIL—These prices are per gallon:

	Current — New York	Current — Cleveland	Current — Chicago
Raw in barrels (5 bbl. lots)	$0.73	$0.90	$0.75
5-gal. cans	.76	1.15	.90

WHITE AND RED LEAD—Base price per pound:

	Current — Red — Dry	Current — Red — In Oil	Current — White Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

Conn., Hartford — The Elm Garage, 93 Main St., has awarded the contract for the construction of a 1 story, 55 x 85 ft. garage on Park St. Estimated cost, $20,000. Noted Feb. 24.

Conn., Stamford — J. Cavelieri, Fairfield Ave., will soon award the contract for the construction of a 3 story, 50 x 95 ft. garage and service station, on Atlantic Ave. Estimated cost, $60,000. F. Urso, 453 West Main St., Archt.

Mass., Allston—(Boston P. O.) Coleman & Gilbert, 331 Huntington Ave., will soon award the contract for the construction of a garage on Brighton Ave. Cost to exceed $100,000. F. A. Norcross, 46 Cornhill St., Boston, Archt.

Mass., Boston—Pope & Cottle Co., 140 Carter St., is having plans prepared for the construction of a 1 story, 50 x 65 ft. garage. Estimated cost, $20,000. Monks & Johnson, Textile Bldg., Engr.

Mass., Indian Orchard—C. J. Laperle, 139 Worcester St., has awarded the contract for the construction of a 1 story, 50 x 66 ft. garage. Estimated cost, $10,000.

Mass., Springfield — Parsons, Reynolds Tire Co., 326 Dwight St., has awarded the contract for the construction of a 2 story, 45 x 70 ft. service station on Dwight St. Estimated cost, $25,000.

Mass., Whitinsville—The Whitin Machine Wks. will soon award the contract for the construction of a 3 story, 75 x 200 ft. garage and storage building. Estimated cost, $150,000. J. D. Leland, 41 Mt. Vernon St., Boston, Archt. Noted March 3.

Mass., Worcester — J. H. Fontaine, 530 Grafton St., will soon award the contract for the construction of a 2 story, 30 x 80 ft. addition to his garage. Estimated cost, $30,000. J. A. Jollette, 58 Front St., Archt.

MIDDLE ATLANTIC STATES

D. C., Anacostia—(Wash., P. O.)—The Bureau of Yards & Docks, Navy Dept., Wash., plans to build a shop building here.

N. J., Newark—The Mennen Co., Central Ave., will soon award the contract for the construction of a 1 story, 66 x 113 ft. garage and warehouse on Orange St. F. A. Phelps, 9 Clinton Ave., Archt. and Engr. Noted Jan. 13.

N. Y., Buffalo—Canisius College is having plans prepared for the construction of a Science Building (which is the first unit of a group of college buildings), containing machine shops, etc., on Main St., Hughes and Jefferson Aves. Total estimated cost, $1,000,000. M. J. Ahern, S. J., Pres.

N. Y., New York—(Borough of Manhattan) The Shamrock Towing Co., 667 West 50th St., is having plans prepared for the construction of a 2 story, 35 x 100 ft. garage at 661 West 50th St. Estimated cost, $75,000. W. J. Conway, 400 Union St., Brooklyn, Archt. and Engr.

Pa., Indiana—J. S. Hileman has awarded the contract for the construction of a 2 story garage. Estimated cost, $30,000.

Pa., Kingston—(Wilkes-Barre P. O.) The Delaware, Lackawanna & Western R. R. Mine Dept., Scranton, has awarded the contract for the construction of a 1 story, 60 x 60 ft. locomotive shop at Pettebone Mine, here. Estimated cost, $35,000.

SOUTHERN STATES

Va., Hampton Roads — The Bureau of Yards & Docks, Navy Dept., Wash., D. C., plans to build a machine and carpenter shop at the Naval Operating Base, here.

MIDDLE WEST STATES

Ill., Blue Island—The North Amer. Car Co., 328 South La Salle St., Chicago, is having plans prepared for the construction of a 1 story car shop on 135th St. and California Ave. Estimated cost, $50,000. H. G. Tregillus, 5 North La Salle St., Chicago, Engr.

Ill., Chicago — The Yeager Bennett Co., 1238 South Michigan Ave., is having plans prepared for the construction of a 2 story, 70 x 160 ft. auto repair shop at 2633 Indiana Ave. Estimated cost, $75,000. L. E. Russell, 25 North Dearborn St., Archt.

Ind., Indianapolis—F. J. Schneider has awarded the contract for the construction of a 1 story, 75 x 100 ft. machine shop on Ray St. Estimated cost, $20,000.

Mich., Detroit—The Wheel Truing Brake Shoe Co., 219 Tuxedo Ave., has awarded the contract for the construction of a 2 story, 50 x 90 ft. factory, for the manufacture of brake shoes. Estimated cost, $50,000. Noted Feb. 24.

Mich., Detroit—E. J. Whitney, 5955 Grand River Ave., is having plans prepared for the construction of a 2 story, 100 x 190 ft. garage and service station, on 2d St. and Cass Ave. Lane, Davenport & Peterson, Dime Bank Bldg., Archts. and Engrs.

O., Cleveland — The Ardmiller Co., 500 Cuyahoga Bldg., has awarded the contract for the construction of a 1 story, 97 x 104 ft. garage at 2074 East 65th St. Estimated cost, $50,000.

Wis., Appleton — The A. Brandt Power Co., 987 College Ave., will soon award the contract for the construction of a 2 story, 80 x 150 ft. garage, showroom and machine shop on Superior St. Estimated cost, $75,000. E. Wettengel, 578 Pierce Ave., Archt.

Wis., Lena—J. N. Bassett is having plans prepared for the construction of a 1 story, 60 x 120 ft. garage and repair shop. Estimated cost, $40,000. Foeller, Schober & Stephenson, Fox Blk., Green Bay, Archts.

Wis., Sheboygan — The Jenkins Machine Co., c/o A. Studeman, 318 North 8th St., has awarded the contract for the construction of a 2 story, 150 x 200 ft. machine shop on North 8th St. Estimated cost, $100,000.

Wis., Two Rivers—Langer Bros. Garage Co. has awarded the contract for the construction of a 2 story, 90 x 150 ft. garage and repair shop on Jefferson St. Estimated cost, $75,000. Noted Jan. 20.

Wis., Weyauwega—The Weyauwega Auto Sales Co. is having plans prepared for the construction of a 1 story, 60 x 120 ft. garage and repair shop. Estimated cost, $42,000. J. F. Dreger, Oshkosh, Archt. and Engr.

STATES WEST OF THE MISSISSIPPI

Mo., Joplin—The Union Iron Wks., 623-629 Kentucy Ave., will receive bids until April 1 for remodeling present building and constructing a 2 story, 20 x 40 ft. boiler room. Estimated cost, $10,000.

CANADA

Ont., Hamilton—The Winchester Repeating Arms Co., 275 Winchester Ave., New Haven, Conn., plans to build a factory, here, for the manufacture of firearms. Estimated cost, $500,000.

General Manufacturing

NEW ENGLAND STATES

Conn., New Britain—E. R. Hitchcock & Co., 303 Main St., will soon award the contract for the construction of a 3 story, 45 x 95 ft. factory for printing and binding, on Chestnut St. Estimated cost, $50,000. D. K. Perry, 27 West Main St., Archt. Noted Feb. 24.

Mass., Brockton—The Diamond Shoe Co., 53 Spark St., has awarded the contract for the construction of a 1 story addition to its shoe manufacturing plant. Estimated cost, between $25,000 and $30,000.

Mass., Pittsfield—The Pittsfield Milk Exchange, 125 Dawes St., has awarded the contract for the construction of a 2 story, 62 x 88 ft. dairy, etc., on Francis Ave. Estimated cost, $50,000.

MIDDLE ATLANTIC STATES

N. Y., Jamaica—The Metropolitan Tobacco Co., 22 Bergen Ave., has awarded the contract for the construction of a 1 story, 80 x 115 ft. factory on Bergen Ave. Estimated cost, $80,000. Noted Dec. 9.

Pa., Pittsburgh—The Standard Sanitary Mfg. Co., 551 Preble Ave., has awarded the contract for the construction of a 1 story factory on Preble Ave. and Ontario St. Estimated cost, $50,000.

SOUTHERN STATES

La., New Orleans — The Southern Mattress Co., 1109 Annunciation St., manufacturer of felt, moss, hair, excelsior mattresses and pillows, plans to acquire a site along the Mississippi River and build a 2 story, 100 x 150 ft. factory. Estimated cost including equipment, $125,000. J. J. Lazarus, Pres.

Miss., Norfield — The Denkman Lumber Co. has awarded the contract for the construction of a dry kiln. Estimated cost, $500,000.

N. C., Wilkesboro—The Superior Williams Mill Co. plans to build a factory along Reddies River, near here, to manufacture a new type of portable burr mills, etc. Estimated cost, $40,000.

MIDDLE WEST STATES

Ill., Chicago—The Franklin Printing Ink Co., 122 South Michigan Ave., plans to build a 1 and 2 story, 190 x 190 ft. printing plant on 47th and Whipple Sts. Estimated cost, $150,000.

Ill., Chicago — The Mickelberrys Food Products Co., 641 West 47th St., will soon award the contract for the construction of a 1 story meat products plant on 49th and Halsted Sts. Estimated cost, $100,000. F. D. Chase, Inc., 645 North Michigan Ave., Engr.

Ill., Chicago—The Pauls Bake Shop, 640 North Cicero Ave., has awarded the contract for the construction of a 1 story, 85 x 125 ft. bakery at 4157 West Grand Ave. Estimated cost, $75,000.

Ill., Chicago—The P. Schuttler Co., 2509 West 22d St., has awarded the contract for the construction of a 1 story, 125 x 150 ft. factory on 24th St. and Campbell Ave. Estimated cost, $85,000. Ideal Roller Co., manufacturer of ink rolls, 215 West Superior St., Lessee.

Ill., Chicago—Sewell Clapp Envelopes, 23 North Desplaines St., is having plans prepared for the construction of a 1 and 2 story, 200 x 300 ft. factory on Belmont and Tripp Aves. Estimated cost, $250,000. Berlin, Swern & Randall, 19 South La Salle St., Archts.

Ill., Chicago—Wolf, Sayer & Helleh, Fulton and Peoria Sts., will soon award the contract for the construction of a 4 story, 100 x 125 ft. sausage casing plant on 15th and Paulina Sts. Estimated cost, $200,000. P. Hausen, 830 Lawrence Ave., Archt.

Wis., Kenosha—The Blommer Ice Cream Co., 1502 North Ave., Milwaukee, will soon award the contract for the construction of a 1 story, 40 x 60 ft. plant and a 26 x 30 ft. garage on Erie St. Estimated cost, $45,000. C. Stehling Co., 401 4th St., Milwaukee, Archts. and Engrs. Noted March 10.

Wis., Racine—The New York Market Co., 1015 6th St., will open bids about March 25 for the construction of a 3 story, 96 x 100 ft. sausage factory. Packers Architectural & Eng. Co., 431 South Dearborn St., Chicago, Archts. and Engrs.

STATES WEST OF THE MISSISSIPPI

Ia., Cedar Rapids — Penick-Ford, Ltd., canners of molasses and sugar, etc., is having plans prepared for the construction of a 6 story factory between 1st St. and River and 8th and 13th Aves. Estimated cost, $700,000. A. W. H. Lenders, Genl. Mgr.

Mo., Chillicothe — The Producers Cold Storage Co. organized with $31,000 capital stock plans to build a cold storage plant.

WESTERN STATES

Cal., Covina—The City Trustees are having plans prepared for the construction of 3 school buildings, including a 1 story manual training building. Estimated cost, $350,000. J. C. Austin, 1125 Baker Detwiler Bldg., Los Angeles, Archt.

CANADA

Ont., Guelph — The Ontario Agricultural College plans to construct a dairy building. Estimated cost, $60,000.

Ont., Leamington — The Taylor Airless Tire Co., Detroit, plans to build a factory, here. Estimated cost, $1,000,000.

Ont., St. Marys—The St. Marys Milling Co. plans to rebuild its 2 story chopping mill which was destroyed by fire. Estimated cost, $30,000.

Ont., Whitby — The Ontario Hospital plans to build a laundry building. Estimated cost, $40,000.

Ont., Windsor — The Dominion White Lime Co. will soon award the contract for the construction of a 2 story lime factory and office building. Estimated cost, $35,000. J. Becker, 240 Pitt St., E., Mgr. Private plans.

Quebec., Montreal — The Liberty Tire & Rubber Co., Ltd., plans to build a plant to have a daily capacity of 300 tubes. Estimated cost, $150,000. J. O. Gourre, 311 Transportation Bldg., Engr.

Que., St. Anne de Bellevue—The Garden City Press, Ltd. will receive bids until March 30 for the construction of an addition to its plant. Cost including equipment, to exceed $100,000.

Sask., Maskakee Lake — The Maskakee Lake Development Co. plans to construct an evaporation plant for the production of Epsom salts, etc., to have a 30 ton daily capacity. Estimated cost, $75,000.

American Machinist

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The Cadillac Vertical Lathe

Machine Intended for Single-Purpose Work—Small Floor Space Required—Operation Semi-Automatic—Two Carriages Used—Piston-Turning Job Shown

By J. V. HUNTER
Western Editor, *American Machinist*

A VERTICAL lathe has been put on the market by the Cadillac Tool Co., Detroit, Mich. In making the announcement, the builder states that the development of the design has been brought about by the greatly increased cost of floor space for manufacturing. It is claimed that in a modern industrial plant the accumulated costs included in the construction and the maintenance of floor space during the life of a tool are greater than the value of the tool. Therefore, any saving in the floor area occupied by the machine leaves that much for other productive purposes or machines.

The Cadillac lathe is essentially a single-purpose machine, intended to be semi-automatic in its cycle of operation. It is built in one size, shown in Fig. 1, that will give a maximum distance between the centers of 16 in., and will swing 9 in. over the carriage.

The bed and column are formed by a single casting of box construction, internally ribbed to increase stiffness. The reservoir for the coolant is a compartment cast in the rear portion of the base. The drive mechanisms for transmitting and varying both the spindle speeds and tool feeds are inclosed in compartments cast integral with and on the outside of the main body casting. The column has ways planed and scraped on its front face. The ways are one-half V's, slanting on the outside only, with broad flat tops that give bearing surfaces approximately 3 in. wide. Between the side ways is another planed and scraped surface carrying a low dovetailed rib 4½ in. wide across the face. The purposes of this construction will be explained in connection with the design of the tool carriages.

The tailstock is a heavy one-piece casting mounted on the outside flat and V-ways, its bearing extending entirely across the flat tops, as well as being guided by the sides. It is gibbed against the backs of the ways in a manner that permits adjustment of its position.

The tailstock sleeve is operated by a rack driven by a pinion on the shaft of the spoke wheel on the right-hand side. The sleeve can be clamped in position by a lever-operated clamp on the lower end of the tailstock. This clamping attachment is reversible, so that the lever can be placed on the side most convenient for the operator. The shaft operating the rack on the tailstock sleeve is equipped with an adjustable friction brake that will hold the sleeve in any position and prevent it from dropping. The wings of the tailstock are bored and bushed to receive the slide-bars, as will be described later.

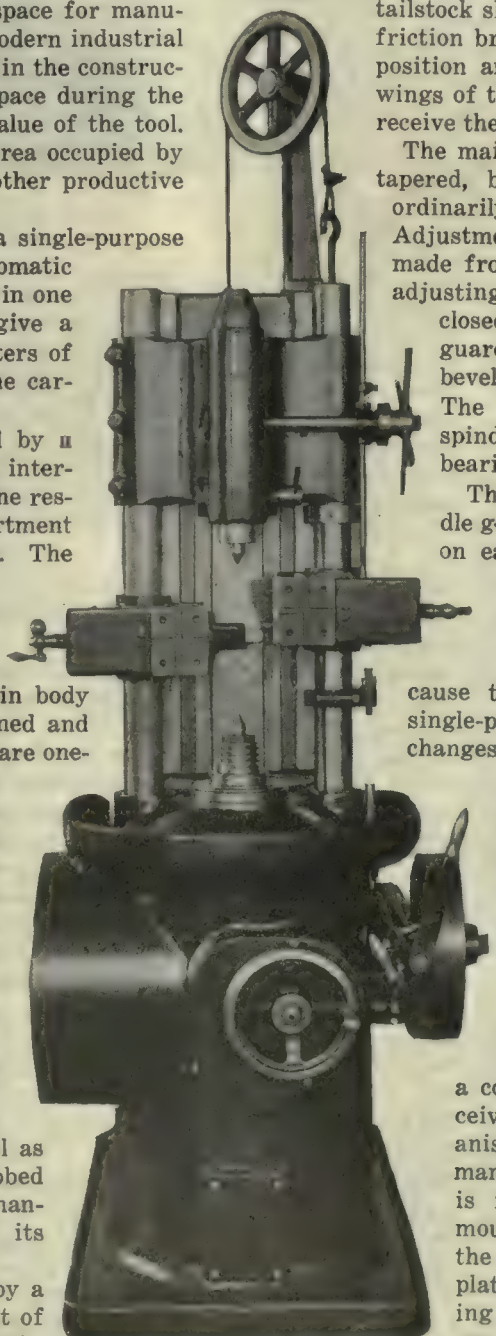


FIG. 1. CADILLAC VERTICAL LATHE

The main spindle is mounted in adjustable, tapered, bronze bushings, duplicating those ordinarily used in milling-machine practice. Adjustments of the upper bearing can be made from the outside of the machine, the adjusting nuts and spindle bearings being inclosed under a water- and dust-proof guard. The spindle is driven by a large bevel gear mounted on it near its middle. The entire weight and thrust of the spindle are carried by a ball-thrust bearing.

The bevel pinion for driving the spindle gear is on a shaft fitted with bearings on each side of the pinion. The shaft leads to the speed gear train, located in a compartment on the left side of the base, and shown with the cover removed in Fig. 2. Because the lathe has been designed as a single-purpose machine, the only speed changes are obtained by the removable change gears that can be mounted on the shaft ends in this compartment. The method of gearing permits the use of wide-faced gears, which are claimed to be more than ample to carry the heaviest cuts that can be put on work of the class for which the machine is designed.

The spindle is hollow-bored and its lower end opens into a compartment in the base of the machine, a compartment sufficiently large to receive an air-chuck cylinder or the mechanism for a spring-operated expanding mandrel, when either of these appliances is required for the chuck which is mounted on the spindle. An opening in the front of the base is covered by a plate that can be replaced with one having a slotted opening, through which can extend a foot-lever for the operation of the chucking mechanism.

The tool carriages are mounted on sliding bars *A*, Fig. 3, that pass through the base and through the tailstock. The bars are placed parallel with the vertical ways planed on the column. They are made of hardened and ground steel shafting, 3¼ in. in diameter, and they each slide through two bronze bushings, one located in the base and the other in the tailstock. The bushings are each 16 in. long. It is claimed that when rebuilding or overhauling the lathe, these bushings can be easily replaced and a new bar inserted.

The Feed Mechanism

It should be understood that the tool carriages are firmly clamped to the side bars, and that a tool is fed by sliding its bar downward. To feed the bar, it is cut with a 4-pitch rack that is driven by a pinion with power feed. The feed change gears are located in a compartment cast on the front of the base and inclosed by a cover-plate. The gearing is of the removable change type, the change gears necessary to feed any particular job being furnished. The handwheel *D* in front of the feed gear box, to be seen in Figs. 1 and 2, can be pushed in to engage a square-jaw clutch for hand-feeding when setting up the work.

The feed mechanism is driven through a train of bevel gears mounted on the main jackshaft. A horizontal shaft transmits the power from the change-gear box to a worm and worm-gear that, in turn, drive the pinion engaging the feed rack. On the machine as shown, the right-hand carriage alone is equipped for turning, but both carriages can be so arranged when the work requires it. Moreover, both slides can be arranged to feed in the same direction, or in opposite directions. In each case, the rates of feed on both slides will have to be equal. The tool carriage may be clamped to the bar in any desired longitudinal position. The thrust on the tool from the turning cut is taken directly back of the tool by an arm *B*, Fig. 3, on the tool carriage. This arm presses against the planed and scraped surface *C* on the face of the column. The center surface *D* is also finished, as has been mentioned, so that it too can be used for supporting tooling fixtures of the carriage. The pull of the cut will tend to draw the left-hand carriage away from the face of the column. This is prevented by extending a shoulder of the tool carriage beneath the dovetail finished under that side of the center rib *D*. For the sake of rigidity, both tool carriages are actually supported in the same manner.

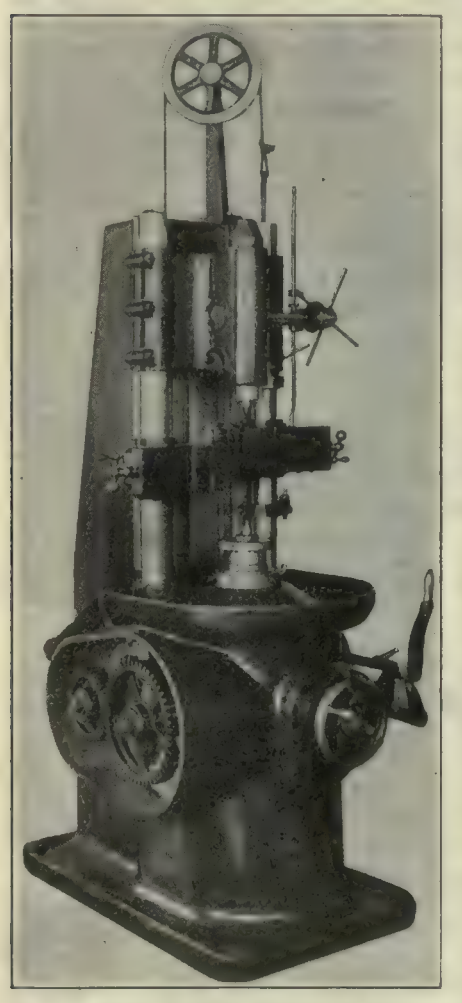


FIG. 2. LEFT SIDE OF MACHINE, SHOWING SPEED GEAR COMPARTMENT

Specifications: Built in one size. Maximum distance between centers, 16 in. Swing over carriage, 9 in. Maximum travel of toolslide, 18 in. Driving pulley, 16 x 3¼ in. Height overall, 8 ft. 5¼ in. Floor space, 42¾ wide by 45¼ deep.

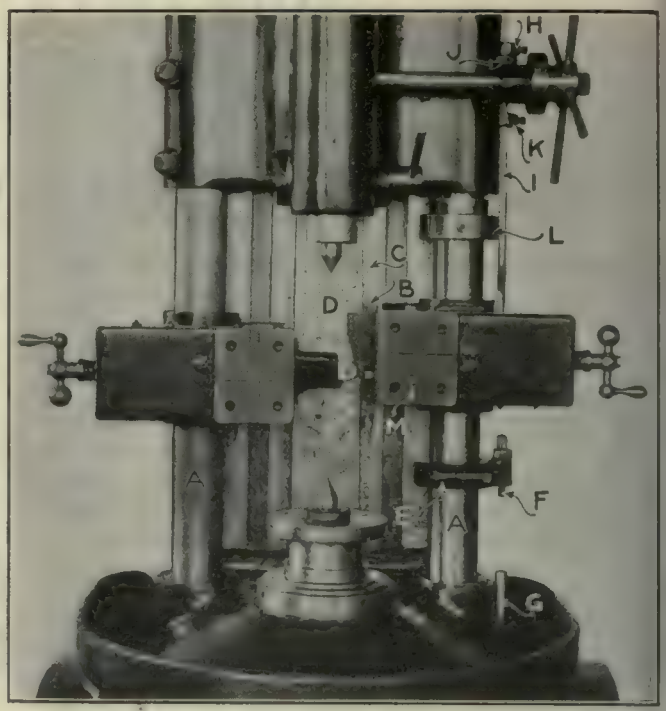


FIG. 3. PARTS USED FOR CONTROL OF SEMI-AUTOMATIC OPERATION

A Cycle of Operation

The details of operation of the feed mechanism are better shown by the study of a cycle of a semi-automatic turning operation. After loading the spindle, the operator engages the spindle drive clutch and then the feed drive. The right-hand tool carriage, which serves for turning operations, feeds downward. The right-hand sliding bar *A* carries a collar *E* with an adjustable screw stop *F*. When the stop comes into contact with the end of the trip bar *G*, the latter is depressed and the downward feed is immediately stopped. The screw stop may be so closely adjusted that it is possible to conduct turning cuts up to a shoulder, it is stated.

As the feed is tripped, a collar *H* on the bar *I* is at the same time making contact with an adjustable screw stop collar *J*. The feed causes it to pull up this bar at the same instant that the feed trips; and the bar operates a "jump" mechanism in the toolslide that causes the latter to draw away from the work about ⅛ in., so that it cannot score the latter. Tripping the feed, automatically releases the toolslide bar and it immediately slides upward, bringing the tool carriage into the starting position. The upward movement of the slide bar is actuated by a counterweight sliding inside the column. When the slide reaches the top of its travel, the collar *K* pushes the bar *I*, thus reversing the operation of the connected mechanism and returning the tool to its cutting position.

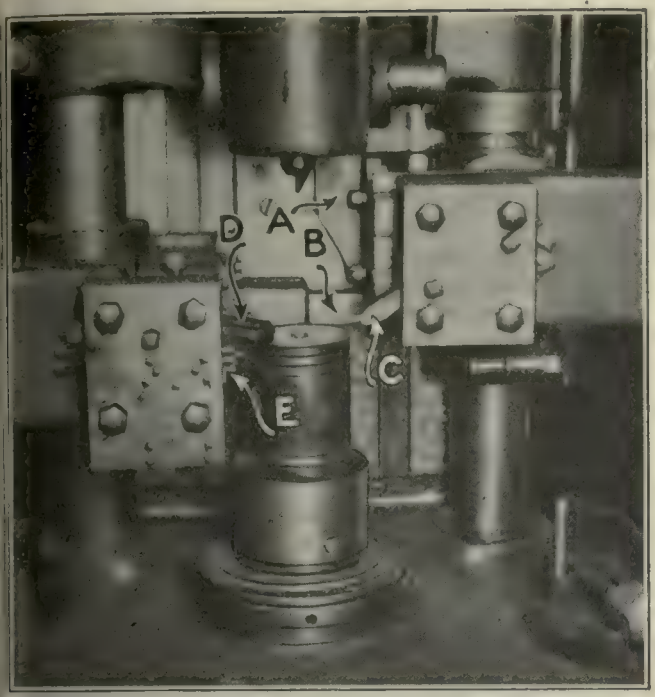


FIG. 4. MACHINE EQUIPPED FOR TURNING, FACING AND GROOVING OPERATIONS ON A PISTON

Since the slide-bar rises very rapidly, a pneumatic cushion is provided to absorb the force of the blow. This cushion is made by the collar *L*, whose sleeve slips into a counterbored recess in the wing of the tailstock. Its action results in bringing the slide-bar to a gentle stop without undue jar. The rotation of the spindle is stopped at the same time that the feed is tripped, and at the conclusion of the movement the machine is ready for loading for another cycle.

Method of Tooling

The toolblock is located on the toolslide by means of two hardened and ground keys, one vertical and the other horizontal. The keyways show in the illustration at *M*. The keys serve to give positive alignment in placing the toolblock on the slide. It is claimed that this method renders it possible to grind the tools in the toolroom and there set them to fit a master gage. The toolblock can then be placed on the machine with assurance that the tools will set accurately to fit the job. This method of grinding and setting up the tools insures against the loss of operating time on the machine, and it also obviates the necessity of skill on the part of the operator for tool setting.

Facing and Grooving Operations

Mention has been made of the possible use of the left-hand tool carriage for turning operations. However, its main function is intended to be the making of facing and grooving cuts. An application of tools for this service is shown in Fig. 4, for facing the upper end of and for grooving a piston.

For these operations, the left tool carriage is clamped in a fixed position on the bar, which also is stationary. The forward feed of the toolslide is actuated by the cam *A* carried by the right-hand tool carriage. Therefore, facing cuts can only proceed while the right carriage is in motion, so that both operations are conducted simultaneously. The cam pushes a spring-loaded plunger *B* having rack teeth that work through a spur gear rack mounted on the rear of the toolslide. The cam can be arranged for any rate or depth of feed desired for the facing operation, and can be adjusted vertically in its position on the right-hand turning slide, so that all operations are completed at the same time. The tools shown comprise a turning tool *C* carried on the right-hand slide, and a top-facing tool *D* and grooving tools *E* carried on the left-hand slide.

Drive of the Machine

The drive of the machine is controlled by a lever on the front that serves for both starting and stopping. It is provided with an automatic trip that operates at the conclusion of a feeding cut, and also has an emergency trip easily accessible to the operator. A second lever on the front of the base controls the feed mechanism for starting a cut. The machine can be fitted for either single pulley or motor drive, the former being shown in the side view in Fig. 5. Either form of drive is connected to the machine through a suitable clutch, so that the control by either the operator or the automatic trip is the same as has been described.

Lubrication to all running bearings on the machine is by a forced flow of oil provided by a pump, gear-driven from the main jackshaft. This pump is always in operation when the machine is running. The coolant is caught by a large trough surrounding the spindle head and returned to the reservoir in the rear of the base. To remove all chips and sediment, the coolant must pass through a catch basin and screen before reaching the reservoir. A gear pump is used for forcing the coolant to the work. The machine should develop a large field for itself on many types of turning work. The automotive industry has much use for a tool of this sort, particularly for the turning of pistons. The flexibility of the tooling arrangement provides for adapting the vertical lathe to work held either on centers or by a chuck, and requiring turning, facing or grooving. Shops doing production work might well adopt the principle of vertical turning for many jobs. The vertical lathe is intended by its maker to operate as a special or semi-special tool where the floor space is somewhat limited.

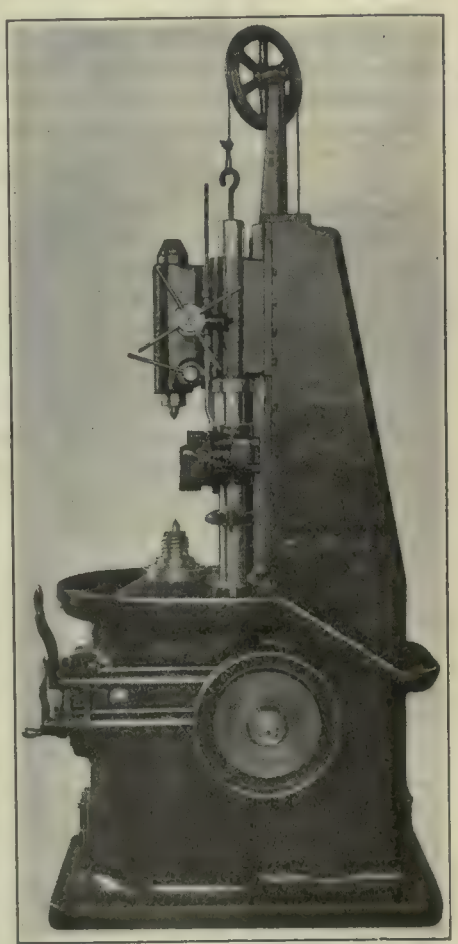


FIG. 5. RIGHT SIDE, SHOWING DRIVE PULLEY AND CONTROL LEVERS

Getting Executive Leadership

Danger of Over-Organization—Free Play for Initiative Desirable—One-Man and Committee Forms of Control—Competitive Decentralization Sometimes Advantageous

By W. R. BASSET
Of Miller, Franklin, Bassett & Co.

AN EXECUTIVE organization consists of something more than a chart which records that the executive power begins with the president, the chairman of the board of directors, or the chairman of the executive committee, as the case may be, and then descends and subdivides through a number of departments and executives, depending upon the size of the institution. Such a chart is exceedingly useful because it is about the only way the working of the business can be visualized. But the question that I find it necessary to ask when viewing one of these specimens of the draftsman's art is:

How much initiative and real power have these subordinate executives in their neat little charted cages?

It is in the answer to this question that we discover whether the division and subdivision of power make for a live and throbbing company of co-workers, or whether these lines merely show the routes by which all matters travel to the top. Is the chart a map of the confines of the human energy employed, or does it show the direction that the various units of human energy shall move in? Or, again, does it merely indicate how the "buck" passes?

In a previous article I have said that many of the difficulties that hamper a company's progress—and especially many of the labor disorders—arise from a lack of executive leadership. Therefore a form of organization must be adjudged good or bad according to whether it encourages or discourages leadership.

Danger in Over-Organization

An organization is nothing of itself. When one speaks of the automatic, smooth-running machinery of Big Business, one is talking nonsense. The wheels do not go around of themselves: they must be propelled by leadership. There is more danger, we are just beginning to realize, from over-organization than from under-organization because the former discourages leadership. George Eastman said not long since that one of his greatest fears was over-organization. He was afraid that, unwittingly, his large affairs might become so scientifically arranged that each man would find himself bound hand and foot with the red tape of an inflexible routine.

Some of our most effective business instruments have no conscious organization, and such an "unorganized" organization is often the best of all, for then the people are not concerned with limitations of authority, and they work together in a perfect harmony. That is the situation at the Newport News Ship and Engine Building Co., where, although there is a very specific organization, it is not down on paper. It exists by tacit agreement. An absolutley free play for initiative is always of the highest value—provided a check exists against any individual error of judgment going too far. In the shipbuilding company the check will be found in the close personal association of the various executives. They consult among one another because they honestly want to get the benefit of opinion and advice.

We are frankly in something of a transitory stag in the matter of executive organization. Years ag when interests were smaller, every concern, no mat ter how large it might be, was built up by one man he carried it on his shoulders. Our earlier merchant and manufacturers not only knew everything that hap pened, but every detail of everything that happened And no matter how large a force they might assembl around them, every member of that force was reall an office boy or a clerk—regardless of his title—an quite without discretion. For the small, one-man bus ness, this is still the best type of organization—pro vided the man at the head is content to stay everlast ingly on the job, and has the ability really to direc We are sometimes organizing when we had better b working.

With the growth of the larger corporation came th question of the delegation of authority. The term "del gation of authority" is unfortunate because really i means that the delegate has very narrow limits t his discretion. And, in an organization where authorit is delegated, we will find practically the old-time one man control, excepting that the affairs of the busines come to the head in abstract instead of in detail. Wit him still rests the final "yes" or "no." He does not re view—he decides. If the concern becomes large enough this method develops into a very highly centralized ma chine, with all of the motive power coming from on man at the head.

In order to get away from this rigid centralizatio another form has found favor in which the executiv power is apparently lodged in a committee or boar of managers, or some appropriately entitled group. I is supposed that a multiple-headed, rather than a singl headed, direction is better.

We have a still further development along simila lines in the large company that operates many factorie or stores in various parts of the country. The que tion there, too, is one of centralization. Is it better t concentrate all of the power in the home office, or ca a looser organization be made effectual?

There is not the slightest doubt that, from a pure scientific standpoint, a minimum of waste will occu in that sort of an organization which is planned aft the manner of a great machine with exactly fittin cogs, and every act, as well as every bit of materia exactly standardized. Then, applying the motive pow at the proper point, every part does just its work a all of its work—and nothing more or nothing less. B an executive organization represents a gathering t gether of human beings in order that their collecti energy may be of the utmost avail. Now remembe that we are dealing with human beings and are co cerned with getting the most out of them. We are n treating of something that is abstract—that if solv on paper will also be solved in practice.

For a time it was, indeed, believed that an organiz tion formula, or ritual, or system, could be so perfect that the head of a company might, by pushing a bu

ton, have practically any business task performed perfectly and on a scheduled routine. And further, it was supposed that, given a perfect plan, any kind of human being would fit into it like an interchangeable part and perform auspiciously at just about a living wage. "Get cheap people and plan their work" was the slogan. Most banks, for instance, were put together on this principle, and many still cherish the idea. Simply an immense number of routines were devised throughout our fair land by "experts in organization." We tried to do business on forms and card indexes. The theory was that if you put a high-priced man at the head, gave to him practically all power of decision, scattered a few moderate-priced people at points where minor decisions had to be made, then you could fill up all the spaces with the lowest-priced help. In the little view of business, any form of organization that promised an increased reward to the head officers, taken out, as it were, from the pockets of the less important, was not without an appeal.

It was, however, discovered, painfully it is true, that the main object of the executive side of business was not to perform a certain number of repetitive operations with machine-like regularity, that a busines was not static, that it had relations with the public, and that the public was not always satisfied to have a purely mechanical operation performed on it.

Take, for instance, a matter which is purely mechanical—that of billing. Mistakes will occur in billing—mistakes will occur everywhere. But there are few things that irritate an individual more than the receipt of an incorrect bill. No normal person receives bills with pleasure, and when he gets one that is excessive he is apt to shoot it back with the sharpest comment he can command. An incorrect bill promptly corrected can be made the opportunity to create good-will. The quick and courteous acknowledgement of a mistake often makes a friend.

Indifference to Complaints

But in a purely machine organization where there is no discretion excepting at the top, it is a long and arduous proceeding to get a bill corrected. The machinery will often have no reverse. There are department stores in this country, there are business organizations that seem to have no method at all of correcting an improper account. A customer will write pointing out the error, he will get a card acknowledging his communication, and then in due course he will get another incorrect bill, and this time probably it has as a companion a request for payment. The human cogs in the machine do not care; they are not paid to care. They are paid to go through certain motions, and they know that they are hired only because no cheaper means of doing the work can be found. Under such conditions they would be fools if they did care.

This same sort of thing shows in every public relation of this machine type of organization. It gets on to a basis comparable with that of a government office. Practically everyone has, at some time or another, complained to the postal department for some negligence in delivery. The first reply which comes after many days is purely formal. Then if the complaint is serious, one eventually receives a letter which, if it says anything at all, must be considered as saying that there is no basis for the complaint. The express companies had the same idea well worked out. A claim against an express company in any amount that was not worth going to court about was practically hopeless. If your claim were adjusted, it was, as a rule, about six months after the happening. And the managers wonder why the trials and tribulations of express companies and their perennial pathetic appeals are received by the public with gleeful derision!

Practically all public-service corporations for a time followed the same rules of machine conduct, so that it is today all but impossible for the average public-service corporation to receive from citizens the same treatment that those citizens would cheerfully accord to their fellow workers in distress. As an example of how the brainless, mechanical organization may function, take the example of a gas company near New York. It used to be very unpopular—so unpopular that finally it dawned upon the directors that perhaps the business was being injured, and they elected a new president who was instructed to see why it was the company had no friends. The new president was a young man who had no training in the then approved practices of public-service corporations. He started out to find the trouble, and, as a first step, abandoned the seclusion of the private office of his predecessor and took a desk out in the general room.

A peculiarity in the arrangement of the departments at once struck him. The cashier's window, at which bills were paid, was only a few feet from the complaint desk. This latter desk was presided over by a tired young man working for a tiny salary, and he seemed to think that his object was not to receive complaints but to get rid of them. He took the well-known attitude that anyone who objects to anything is by nature a crank and by disposition a knave, and so around the complaint desk from morning until night surged a battle; sometimes the clerk was efficient enough to have half a dozen complainants going at once. His notion of success was bound up in the word "fight." He would have made a fortune in the I. W. W.

The president noticed that many of the people in the cashier's line, overhearing the scraps at the complaint bureau, were spurred on to think of complaints that they might make on their own account, and a goodly portion of them, immediately after paying their bills, joined the line of the complaint bureau, anxious for the chance to break a lance with the company's representative. The complaint bureau thus not only did not settle complaints but helped to promote them. The president reasoned that every complaint was an opportunity to sell the company to the customer, so he abolished the complaint desk, opened a service room far removed from the cashier's window, and put it in the charge not of a clerk but of a specially elected executive of the company drawing a good salary, and under instructions to see that no reasonable complaint went by without satisfactory adjustment, and that even the most unreasonable complaints received at least adequate attention. Recently that company found itself forced slightly to increase the rates, and instead of being violently opposed they found that their people accepted the increase, not cheerfully, for that would not be human, but as cheerfully as the circumstances would permit and in confidence that the company was playing fair. The old management had simply taken for granted that their organization was sufficient. For if you have a department of complaints, have you not done your duty? Why bother with public relations?

A private business, organized in this fashion, may, if the idea behind it is sufficiently good, or if the competition is trivial, muddle through. Sometimes where the managing head has an ability approaching genius, the enterprise may prosper exceedingly, but neither the business nor the prosperity is stable. There is no proper foundation, and we may regard it as depending upon whether the ill-will that its management generates catches the good-will contained in the fundamental idea. Usually the ill-will, given time, wins.

But more important than any other consideration is the fact that a concern organized on this principle will gather to itself a minimum of ideas, and although it may be very busy and successful over a number of years, it will start downward once it meets the competition of a business that is constantly receiving new ideas.

It may seem haphazard to rely greatly on individual initiative. It would seem to be the part of wisdom to safeguard and to plan activities, to develop teamwork, and thus to eliminate waste of material and waste of human activity. That is undoubtedly the case. An unorganized business cannot get anywhere. Nothing gets done, although everyone is working overtime. But what I am warning against is the thought of trying to provide against every emergency and contingency by a documentary instead of by a human means. It is perfectly impossible to stifle individual initiative and to expect to achieve success.

"Efficiency" of Communism

To take the ultimate in regulation, look at the truly extraordinary inconveniences of bureaucratic government. In a Communist state each human being is supposed to occupy a particular pigeonhole to which he is assigned by an allocating body and which also prescribes what he shall eat and wear. There is a place for everyone, and everyone is in his place. On paper it is all perfect. The Communist state, from a draftsman's viewpoint, leaves nothing to be desired. They tried this out in Hungary for a while, they are trying it out in Russia, and they tried the same sort of thing, but differently entitled by reason of the war regulations, in most of the countries of Europe. What was the result? Wherever there was a highly scientific and well-systematized method for distributing food and clothing, those who needed food and clothing spent most of their time, regardless of the supply, waiting in line at offices to get the necessary authorizations. The other day I came upon a note made by a resident of Hungary during the Communist administration. He had broken a window and wanted it repaired, and this is what he had to do.

First he went to the local authority, stated his case and filed the papers necessary to inform officialdom that he was alive and a citizen—and had a broken window. He was then sent to the central authority, where he filed another set of papers more firmly establishing that he had a broken window. In due season that body authorized him to proceed to the department more intimately concerned with the repair of broken windows and the establishing of the fact that his window was broken. In officialdom repetition is synonymous with certainty. Here again he filed all of the necessary papers, and in due time a sort of Board of View composed of two eminent Communists came out and surveyed the broken window. They reported back in due course, and again in due course the householder received authority to go to a glazier and have the window replaced at a fixe price. The glazier, being authorized to act, then bega his official quest for a pane of glass of the proper siz and finally, at the end of about four months, the ne window was in place.

We regard this as a perfectly ridiculous exhibition what officials can do when right on the job, but, as matter of fact, there are plenty of corporations in th country in which a stenographer has to go throug about as cumbersome a routine in order to get a ne pencil. I know offices where the under-executives bu most of their own supplies rather than hang aroun waiting for their requisitions to be acted upon. Ther are highly organized companies where the employee frequently will not use proper tools or appliances, a though such are in the stockroom ready for use, mere because of the infinite trouble and delay in securir them.

Individualism and Teamwork

System up to a point facilitates operation, it takes th conscious effort out of small movements and liberat the mind for larger affairs; but, carried beyond th point, there is a likelihood that while conserving it w be wasting. Where the line must be drawn is alwa an individual matter, and in the most efficient organi ation, careful record will be made according to the ter perament of the executives and department heads order to avoid routine that will burden.

The nice point in executive organization is to mak the fullest use of individualism that is consistent wit teamwork, for then we are insuring the flow of fres ideas, while at the same time we are not letting indiv dualism run riot.

This general principle holds through the entirety corporate organization, through the tiny corporatio and through the great corporation, with many branche and subsidiary corporations, and is distinctly a moder development and a reaction to the highly centralize machine structure which was at first believed to be th ideal form of organization, just as for a time aft Taylor had begun his investigation it was thought (a though never by Taylor himself) that a man could b turned into a machine. It is the answer to the ide that the size of an institution is limited by the directin power of a single head.

We have to consider the human element, and it is question of fact in any given case whether any econom gained by centralization of management in purchasin or in sales, or in any department, is not balanced b the loss of human initiative.

Commercial Salesmanship

Take the chain stores, for instance. The five- an ten-cent stores depend upon a central purchasing powe and they distribute their product to counters in the various stores, at which are present, not saleswome but merely people to handle the money. The goods a supposed to sell themselves, and largely on price. Bu it has been discovered that the same principle will n work in a dollar store, or even in a 50-cent store. will not work wherever salesmanship is required. The the necessity for a personal contact appears, and tha personal contact is not gained through an uninte ested, ill-paid clerk.

This fact is advantaged in the cigar store and dru chains. There the purchasing is centralized, and might seem that the five and ten-cent store princip of quasi-self-service would obtain. But the purcha

of tobacco and drugs is on a personal basis. A man does not always want the same kind of cigar, or cigarette, or smoking tobacco; his taste changes, and he wants to shop around a little in the stock. It is likewise with a woman in a drug shop. Therefore instead of low-price-clerks, the more successful of these stores pay far above the average for retail salesmanship service and add a commission on sales that makes the employment distinctly well paid.

Centralized Purchasing Bureau

There is no question in chain distribution but that the purchasing should be from a central source, and in general purchasing can be best handled from a central source; but there are a not inconsiderable number of organizations, especially those joined through a holding company where centralized purchasing is not the most efficient because the relation between the using unit and the central purchasing agency cannot be made close enough to take advantage of the economies that may be effected in the price of things bought in bulk.

In the General Motors Co., for instance, most of the units are so large that there would be little advantage in combined purchasing, and the combined purchasing department would have to be a very complex affair. They have found it better in most cases to maintain wholly separate buying, manufacturing, and selling organizations for each of their branches, on the theory that the competition to achieve results will create a greater and more profitable business than were any of the attention of executives shifted to standardization of economy. The Eastman Kodak Co., is similarly organized. There each unit, although five of them are located in the one city, may take or leave the service of the centralized departments of the corporation. The head of the unit has, in this respect, an entire discretion. He is not merely the manager of his department; he has every indication of ownership. He does his own thinking, and his thinking is not judged by the application of a foot rule to its processes but purely by the results that he achieves.

A very striking example of the relative efficiency of large centralization as opposed to competitive decentralization is offered by the Standard Oil Co., and by several other large corporations which were dissolved by the courts as "trusts." Most of these companies were formerly managed in rigid fashion. The executives merely carried out orders. Whenever an emergency arose they wired headquarters as to what to do. In fact, the late George W. Perkins firmly believed that it was the telephone that created the big organization because without it the branches could not keep in constant touch with the home office. These corporations, after being officially dissolved and separated into their component parts, prospered so greatly that the total business done by the disjoined units far exceeds that ever done by the combination. Many people have inclined to the belief that this new prosperity was due to some sort of mysterious chicanery. They say that the Sherman Act is a joke. There is nothing mysterious about the process. The dissolution released a great fund of latent human ability that had previously been confined within rigid lines. It is entirely to be expected that the men, functioning for the first time on their own account, would apply all of their previously dammed-up energy to the extension of the new corporate units.

One of our very largest industries is now suffering acutely from too highly centralized an organization. It has had severe labor difficulties and will probably have more, and there is a supreme dissatisfaction extending through the whole executive staff. Through travail a new organization will there be born.

Some General Principles

What, then, do we really know about the organization either of a number of companies into a unit or of the executive work within a single company? The same general principles hold for both cases. It does not make much difference whether the departments are all under one roof or under a dozen in so far as executive management is concerned. The reasons for distributing the work through many locations arise from economic causes—or by accident.

These several things we do know:

(1) *That the one-man control is the best in the world if that one man is big enough to manage everything. But a business must be small, indeed, to permit one man actually to know and to supervise everything. The danger is always present that he thinks he knows when really he does not know. And naturally there is no permanency in this kind of management. If the one man is away or ill the business stops, and, of course, when he dies the business vanishes or has to be rebuilt.*

(2) *The one-man control is limited in scope; its scope is not extended by the imposition of a great amount of routine by which the results of all that is done are supposed to come before the chief executive. Regulation will not substitute for management, and a business formed on the theory that regulation can do more than regulate is bound to fail. Where, by reason of routine, the affairs of the company do get back to the head and he makes all of the decisions on abstracts of the facts, he will violate the first principle of one-man management—that is, of exact knowledge. He will have to decide on theory instead of on facts—but he will think that he is acting on facts. The result will be a static, listless organization that is always waiting around for decisions to be made. There will be no initiative anywhere excepting at the top, and there will be frequent clashes of authority among the lower executives. For when a man's authority is closely circumscribed he will be always tugging at his bonds and trying to get on the next fellow's premises. The only object of routine is to facilitate operations that are mechanical—to free the mind from sequential detail.*

(3) *The one-man type is not preserved in the committee or board of managers style of administration. In this plan the heads all meet and decide the policies among them. The result is that instead of individual responsibility we have group responsibility and inevitably the kind of action which is known as "playing safe." A great difference exists between consultation on policies of general import and an attempt to manage on commonly-arrived-at decisions. The first brings results to the table for general inspection and is of great value, for then each man is put upon his mettle; in the second the whole committee mulls through the whole progress of the business—although it must be obvious that they cannot all be specialists in every department of that business. Hence we obtain not the best that is in the men, but just the general average on which there can be an agreement.*

Take these principles. Does it follow that there

should be no organization? Should men just run on as they see fit? And should the chief executive have any duties?

To Eliminate "Passing the Buck"

The ideal organization is this: The chief executive is not an executive at all but a checker-up and inspirer. He properly should have no duties. His place is to see the results of each man's work and to discover what is wrong or how best the activity of a division may be increased, and then to see that the departments act in unison. He does not delegate authority: he reviews authority by results obtained. This throws the responsibility for results upon the under-executives, and, in the ideal type, each of these men has full authority in his own department. If he misuses his authority, it is not the fault of the plan but of the men: the wrong man is in charge, and it is the duty of the head executive to see that the right man is in charge. Likewise, within a department the head will allocate responsibility—each man will run his subdivision within the general plan and be responsible for obtaining results. Every man in the organization will be, so to speak, on a piecework basis.

How this can best be arranged is to be decided on the facts. The big point is to divide activities and to place responsibility so squarely that not only will, initiative, and consequently dignity, be built up, but also that the old game of "passing the buck" cannot be played.

With this type of organization the fullest in every man is realized, and there is no human limit at all to the size of the business. This is the new way of business. The centralization should come not in authority but in finance and research.

Making the Employee Tell "Why"

By Harry Botsford
Editor, *The Dodge Idea*

Perhaps the most difficult problem the man in charge of personnel work has to contend with is to get a definite worth-while expression from the employee of just what he thinks of the various forms of welfare work and of the organization that employs him. This was exactly the situation Dr. W. A. Moore, manager of Industrial Relations for the Dodge Manufacturing Co., of Mishawaka, Ind., ran up against.

There were six questions which puzzled Dr. Moore, and the six questions which puzzled him are questions that might well be asked in every organization, whether or not that organization is of sufficient size to warrant the employment of a highly trained personnel man.

The six questions which perplexed were: What is the Dodge spirit? Why do so many stay so long with Dodge? How can we get the old Dodge spirit into new men? How does an old Dodge man feel about the company? What are the impressions of a new man? How can we attract and hold the kind of a man who will stick?

Here were six vitally important questions—a knowledge of the answers would be of manifest advantage, not only to the manager of Industrial Relations but to the entire organization.

At last the idea came to carry out a prize contest in the *Dodge News*, our weekly internal house organ. Announcement of the contest was very brief and the rules governing were made just as fair as possible. Any employee was eligible; one subject could be selected and the answer was not to contain in excess of 1,000 words. No names were to be signed to any paper but the name, department and clock number of each contestant was to be written on a separate sheet of paper, inclosed in an envelope and attached to the entry. Three prizes were offered: $25, $10 and $5.

Judgment Absolutely Fair

The judges of the awards were the manager of industrial relations, the office manager, the superintendent of one of the shop departments, the manager of branch offices, the editor and assistant editor of the *Dodge News*, and the writer. Each of the judges read all of the many papers turned in and selected the three he believed to be the best and wrote out his selection and placed it in a sealed envelope, each making his decision independently of all the other judges. This assured absolute fairness in judging.

When the judges' decisions were compared it was found that the first prize was awarded to a worker in the steel shop who had chosen to give the impressions of a new Dodge man. This man had been a "boomer" and an industrial drifter all of his life but had decided that he liked the organization so well that he was going to stick. To say that the ideas he advanced were valuable to the manager of Industrial Relations is to put the matter mildly. For an organization to have something in it which will make a solid citizen and a steady worker out of a "boomer" is one thing, but to know what brought about the metamorphosis is several things. For example, we found this man liked our commissary, where we sell groceries and clothing to our employees at cost; he enjoyed the benefits of our relief association; he had saved money through our thrift club; he had particularly enjoyed the advantages of our employees' club, our cafeteria, and the *Dodge News*. He was especially grateful for the treatment accorded him by his superiors and for the general spirit of good-fellowship and co-operation between all units of the organization.

The second prize went to one of the office men, who told how we could attract the kind of men who will *stick*. The suggestions advanced were excellent and sensible in every way. The manager of Industrial Relations secured many worth-while ideas from this paper.

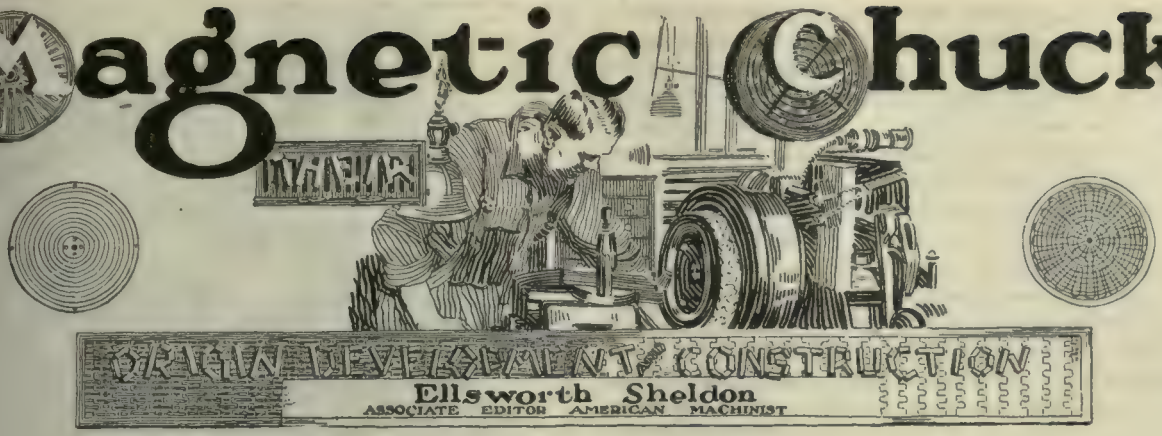
The third prize went to a member of the order department who has been with the organization for over twenty years. Naturally, this man selected as his subject why so many stay so long with Dodge. He treated his subject in rhyme, but nevertheless it was a sane and intelligent text which covered the entire subject.

Frank and Worth-while Opinions

The contest has been worth while from every standpoint. We secured the opinions of the workers on some matters which have been bothering us for same time. The opinions, in every case, were more frank and open than they would have been otherwise. The use of the prizes has more than justified the small expenditure required to put the idea across.

What we have accomplished is possible for any other organization to do; we have found out what our workers think of us, our plants, our ideals, and welfare plans. We have secured several valuable hints and ideas which will eventually develop into some changes in our present welfare and personnel work.

Magnetic Chucks



IV. The Walker Chuck

Development of the Walker Magnetic Chuck—Construction of the Rotary Chuck—Making It Waterproof —Origin and Principle of the Walker Demagnetizer

SINCE the day, 26 years ago, when a certain crude little contrivance of cast-iron, copper wire, and babbitt metal demonstrated its ability to hold work for the operation of surface grinding without recourse to bolts and straps, the magnetic chuck has passed through

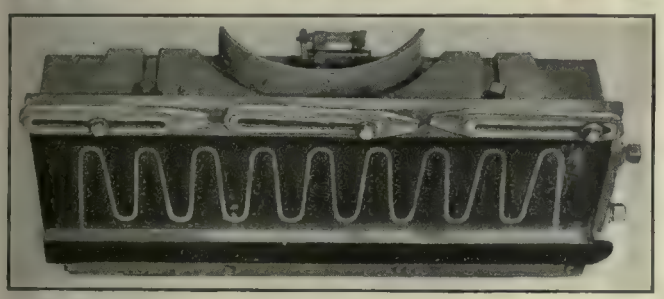


FIG. 51. ONE OF THE FIRST WALKER CHUCKS

many stages of development. The O. S. Walker Co., was the first, and for twelve years the only maker of the device, and this series of construction articles is, therefore, appropriately initiated by a description of the Walker chuck as it now appears, and of some of the operations followed out in its manufacture.

The experimental room of the O. S. Walker factory, at Worcester, Mass., is an excellent place to study the evolution of the magnetic chuck. Here may be found, completed chucks presenting many different combinations of polepieces, some of which are the subject of patents while others are not; partly finished chucks made to demonstrate the practicability or impracticability of a new idea; intricate patterns of interlocking polepieces that are a puzzle to put together, and, once assembled, equally puzzling to take apart; chucks with their active elements of different materials, such as cast iron, wrought iron, wrought steel, etc.; chucks that would not magnetize and others that once magnetized would not wholly demagnetize.

Though not all of the models are of the same type the idea of the single-magnet prevails. With chucks of this type all of the top surface is magnetic while with either multiple or independent magnets there must be a space at least equal to the thickness of wall of the shell that is neutral.

The first Walker chucks had cast-iron bodies and also cast-iron polepieces. The body was cast as a rectangular box with an irregular-shaped opening in the bottom (which became the top of the chuck) into which the polepiece fitted. The polepiece and magnet core was a single piece, one end fitting the opening in the box, the other being of suitable shape on which to wind the coil. The cover of the box (the bottom of the chuck) was fastened by screws to the side walls of the box and also to the core of the magnet, of which it became the back-bar.

An early change in the method of construction was to cast the shell with the magnet core as an integral part of the casting, and make the cover of the box in the form of a grid having openings to match the polepieces. This is the basic form of Walker construction at the present time. When this form was adopted it was thought necessary to make the core only enough shorter than the inside of the box to allow room for the coil—the chuck was literally a single magnet—but as the utility of the device became apparent, the demand for bigger chucks led to unwieldy and comparatively inefficient coils, and the design was again modified to permit the use of smaller ones. Fig. 52 shows the standard rectangular chuck as it is now made and in Fig. 53 may be seen the characteristic divisions of the Walker rotary chuck.

The active parts of the standard rectangular chuck are displayed in Fig. 54. It will be noted that in the body *A*, of this chuck, which is of cast iron, that

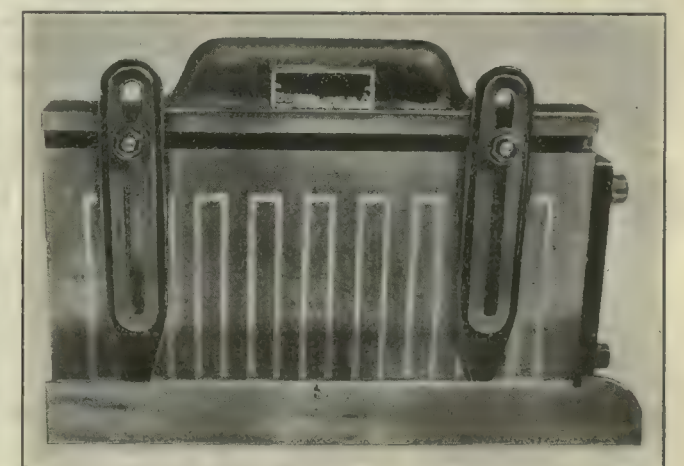


FIG. 52. THE WALKER CHUCK UP-TO-DATE

the magnet core, instead of being a single projection nearly the length of the box, is divided into two parts, each with its individual coil. It is still a single magnet by reason of the fact that the two coils are so placed as to pass the electric current in the same direction; becoming in effect but a single coil, as the corepieces are but two parts of a single core.

The grid *B*, and the polepieces *C* are of cast steel, this material being selected because of its higher magnetic permeability. The grid is recessed on the under side so that when the polepieces are set in place and the soft metal binder poured, the two parts become, mechanically considered, a single flat plate with the upper and under surfaces parallel. Magnetically considered it is, of course, still two distinct parts, separated from each other at all points by the thin layer of non-magnetic material.

Though the polepiece *C* of Fig. 54 is in two sections, this is not so of necessity, but rather as a matter of convenience in casting and handling. But one pattern is needed for each width of chuck; longer chucks being made by simply adding more pieces. This method of procedure, though possible, is not practical for molding the bodies and grids, therefore each size has its own set of patterns.



FIG. 53. WALKER ROTARY CHUCK 1920

In Figs. 55 and 56 may be seen castings for various styles and sizes of chuck, showing that, though differing in detail, they all follow the same general design. Fig. 57 shows a pair of large rectangular chucks that have been returned to the factory to have new topplates fitted. These chucks have been in use for several years by a well known firm of machinery builders and by repeated redressing of the surface the plates have become so thin as to require renewal.

Coils for Walker Chucks

A great variety of coils are used in the Walker chuck, both by reason of a wide range of sizes and because of the company's policy to keep in stock extra coils for all sizes of the chuck in use even though some of those sizes are no longer manufactured. A corner of the coil winding room is shown in Fig. 58, where may be seen a number of partly completed coils.

The large coil in the foreground is to replace a burned out coil on a chuck that is now obsolete, so

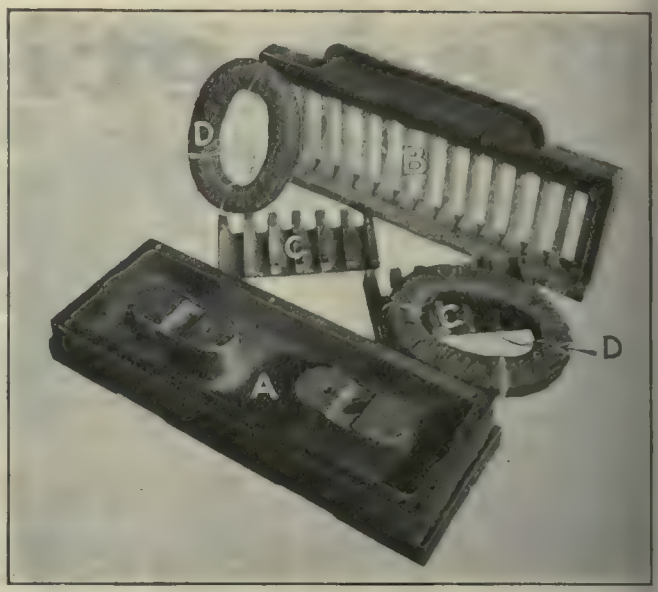


FIG. 54. ACTIVE PARTS OF WALKER CHUCK AS NOW MADE

far as its manufacture is concerned, but is still in use. The others are for the regular product. A peculiar feature of the Walker rotary chucks is that coils for all such chucks are wound on brass spools. Three of them may be seen at A in this illustration.

Methods of Winding Coils

Small coils are wound on a Universal winding machine; most of the larger ones on a special winding device that was built in the factory.

The job of winding one of the larger coils requires no little skill to do it well. Each turn of wire must be laid on straight and close to the preceding turn, so that there may be no open spaces in the coil; and each layer must be smooth with no crossing of turns to raise ridges and occupy extra space. In short, such a coil must contain exactly the right number of turns to fill a given space with mathematical accuracy. Such a coil is much more rigid than would be one that was carelessly wound, and much less liable to injury.

Coils are Impregnated with Insulating Compound

All coils are thoroughly impregnated by immersing them in a boiling solution of waterproof insulating compound; where they are left to soak long enough to saturate the fabric with which the wire is insulated.



FIG. 55. GRID AND POLEPIECE CASTINGS

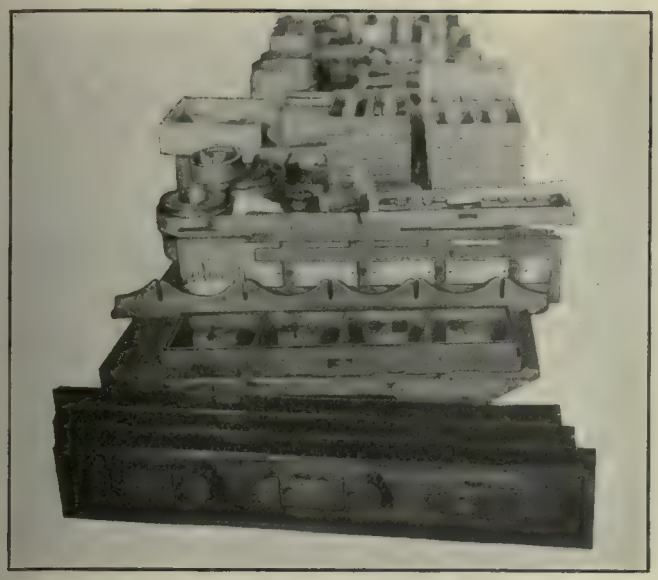


FIG. 56. BODY CASTINGS

They are then wrapped in cotton tape and again dipped in the compound.

The magnetic chuck is freely used in the shop on planer and milling machine, as well as in the grinding operations, as a factor in production. One, two, four, or even six chucks may be mounted on the platen of a planer, according to the size and nature of the work to be done. One place where it is used to advantage is in the pouring of the soft metal binder in the top plate.

A preliminary operation to the pouring is the surfacing of both grid and polepiece; which is done by grinding the parts as they are held on a magnetic chuck. In Fig. 59 are shown these parts for one of the small chucks—also used as a center in some of the large chucks—which will serve to illustrate the manner in which the work is done.

How the Top Plate of the Chuck is Assembled

At *A* in Fig. 59, may be seen a grid and a polepiece separately; also the two pieces assembled, both face up and face down. At *B* in the same illustration are four of the complete parts as they stand on the magnetic chuck after the soft metal has been poured. In the face view at *A*, it will be noted that the polepiece protrudes from the grid. The distance is about $\frac{1}{16}$ in. and when the pieces are placed face down on a smooth surface, both touching the surface, there will, of course, be this amount of space between them. A sheet of wrapping paper being spread over the face of a live chuck, as many of the parts to be assembled as the surface of the chuck will accomodate are placed in position and adjusted so that each polepiece is centrally located in its respective opening. Current is now turned on, holding all the parts rigidly in their respective positions while the soft metal is poured and allowed to set.



FIG. 58. COILS FOR WALKER CHUCKS

There is no danger of moving any of the pieces out of place while pouring; nothing but a hammer blow would move them. The paper protects the soft metal binder in the live chuck from damage by the hot metal above it. Altogether this method offers a simple and easy way to do a job that was formerly difficult and uncertain.

A planing operation is shown in Fig. 60, where two chucks are mounted upon a planer platen. The job in progress at the moment is the comparatively light one of planing a backstop for one of the longer chucks. Chuck bodies and top plates are held for planing and milling cuts in the same manner, and in practically all grinding operations the work is held by magnetic chucks.

The use of the rotary chuck as a production factor is confined rather strictly to the grinding machine. It can be used on a lathe if holes in the work are permissible, but in machining the bodies of magnetic chucks holes are not permissible and therefore such work is turned out from a standard make of turret machine specially tooled for the job. It could be used on the lathe for rough facing the round grids and polepieces if this work was not more satisfactorily and much more rapidly delivered by the grinding machine. It can be, and is, used to hold the round polepieces while turning the central stud, but this is about the limit of its usefulness on magnetic chuck production.

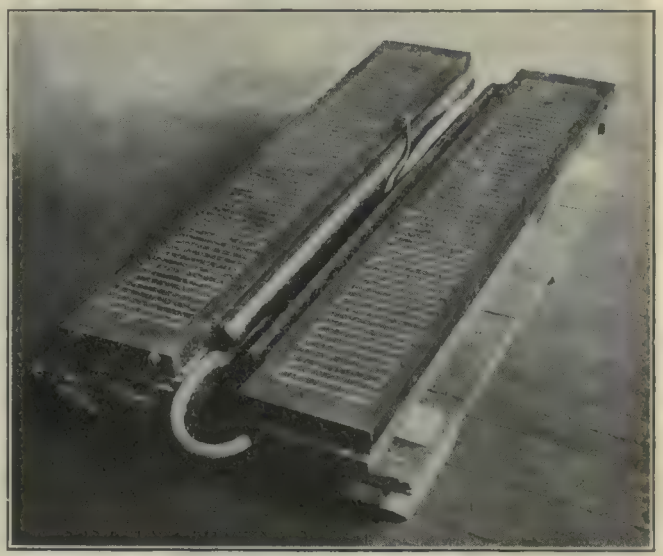


FIG. 57. CHUCKS TO BE REPAIRED

Construction of Rotary Chucks

Parts of rotary chucks are shown in Figs. 61 and 62. In the first, but one coil is used and that surrounds a central boss in the shell which, together with the stud of the polepiece, forms the core of the magnet. The part in the foreground is an extra (unfinished) polepiece which was put in the picture to show how it looks on the under side. The stud is turned to fit

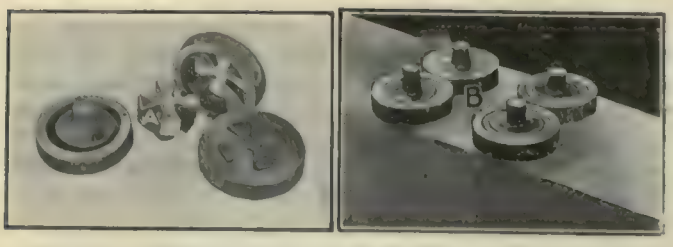


FIG. 59. METHOD OF HOLDING PARTS OF COVER TO POUR THE BINDING MATERIAL

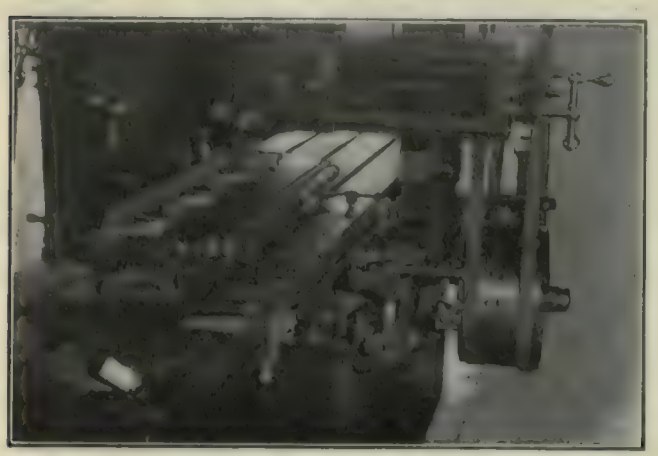


FIG. 60. USING THE MAGNETIC CHUCK ON A PLANER



FIG. 61. PARTS OF A SMALL ROTARY CHUCK

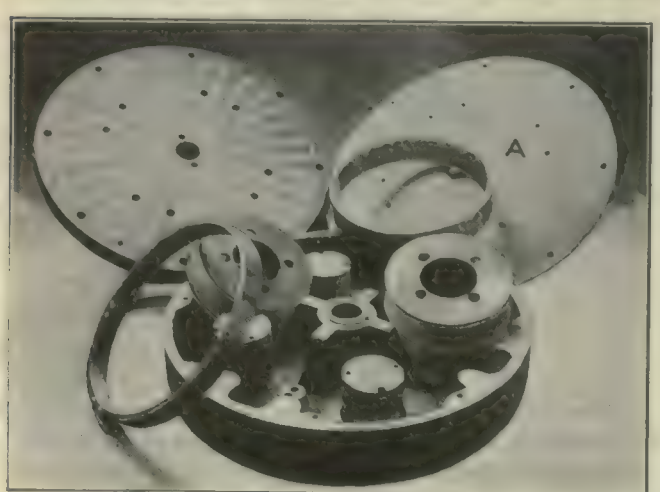


FIG. 62. FOUR-CORED MAGNETIC CHUCK

the hole in the center of the shell and the shoulder faced off to bear upon the surface of the boss, which in this case is slightly lower than the edge of the shell. The turning is not done until after the polepiece has been permanently joined to the grid, when the top plate can be handled as a unit. The brass spool for the wire of the energizing coil appears in the center of the picture.

In Fig. 62 the construction is somewhat different. This chuck has four coils and four cores. It does not differ however in principle, for all of the cores are of the same polarity. This size chuck is made both with the single polepiece as in Fig. 61, and with segmental polepieces, some of which may be seen in the foreground of Fig. 55. Only two brass spools are shown in the picture though four are necessary. The two brass rings of larger diameter are the collector rings that go on the back of the chuck to convey the electric current from the contact brushes to the energizing coils.

Difficulty in Keeping Out Water

Because this chuck is to be used on a vertical spindle grinding machine and therefore is expected to work under a flood of grinding compound, an additional precaution is taken to insure against leakage. It is difficult to make an absolutely water-tight joint in the top plate where the two parts join for the reason that the cast steel will not amalgamate with the type-metal.

The extra precaution is the placing of an unbroken gasket of tin (A) between the chuck body and the top plate. There are no holes in this gasket except where screws pass through it into solid metal beneath and therefore little likelihood of water getting past it, even should a leakage in the top plate develop through the constant abuse to which a chuck is subjected by reason of dropping heavy pieces of work upon it.

The Collector Rings

The brass collector rings, upon which devolve the duty of keeping the energizing coils of a rotary chuck always in touch with the source of supply of electric current, must be truly round, nicely finished, firmly set in the chuck, and carefully insulated from electrical contact with any metal part of the chuck body. They rest upon fiber studs or bushings through which pass the leading-in wires to the terminals of the coil and they are held in position by pouring around them molten sulphur. Their relative position is displayed in Fig. 63, which shows two views of a standard rotary chuck and also the standard energizing coil, one or more of which is used in all rotary chucks.

In Fig. 64 is another size of rotary chuck. This chuck is not a regularly manufactured product, but shows the proportions to which some special sizes of this device attain. The chuck shown in Fig. 64 is 6 ft. in diameter, the face is 11 in. across, and it weighs 2,500 pounds. It contains 48 energizing coils. As is the case with all standard chucks it is of the single-magnet type.

The Swiveling Chuck

Another standard chuck, very useful for grinding or planing bevels, is the swiveling chuck; the active parts of which are shown (unfinished) in Fig. 65, and a finished chuck disassembled in Fig. 66. As will be noted the construction, in so far as the holding capacity is considered, does not differ materially from the regular

form of rectangular chuck. There is but one corepiece, slightly longer and somewhat narrower than in the latter and the coil contains the same amount of wire. The grid and polepiece are also a little longer.

The body of this chuck is finished all over and is supported upon trunnions swinging in movable bearings that can be clamped to any machine table or to a special baseplate to make the chuck self-contained. A graduated ring, seen to the right of the chuck body in Fig. 66, fits upon the shoulder of the trunnion and facilitates the setting of the device to any desired angle. It is fitted with side- and back-stops and clamps to assist in holding pieces of irregular shape.



FIG. 64. A LARGE SPECIAL CHUCK

A Demagnetizer Found to Be Necessary

One of the difficulties early encountered in the use of the magnetic chuck was its propensity to permanently magnetize pieces of hardened steel that were brought in contact with it. As such pieces then constituted the major portion of the work for which the device was considered available, and as a piece of work so magnetized was ever after a cause of exasperation to the mechanic who had to handle it by reason of its affinity for anything made of iron or steel —particularly small particles of the latter that would persist in getting in the way of adjustments, interfering with measurements and otherwise conduct themselves in a very annoying manner—it was imperative that something be done to relieve this condition.

It was known that a permanent magnet could be deprived of its magnetism by placing it within the sphere of influence of a solenoid through which an alternating current was passing, and slowly withdrawing it. Just why this is so is a matter of speculation; but the fact had been amply demonstrated by experiment and the process was in use for demagnetizing watches.

At this period, however, alternating currents were not in general use, and to meet a serious objection to the use of the chuck, the Walker Co. was obliged to devise some means of demagnetizing a piece of steel. The result of experiments was the Walker demagnetizer, shown disassembled in Fig. 67.

Construction of the Demagnetizer

The principle of this device is very simple. An electromagnet, the core of which may be seen at *A* in Fig. 67, is held in a yoke *B* of cast brass having journals at each end upon which the yoke may revolve. Collector rings at *C* conduct an electric current to the magnet coil, wound on the brass spool *D*. So far only direct current has been considered. The magnet core is energized, and remains constant in polarity. The angle-pieces *E* are built up of thin sheets of iron for the reason that they are to carry *alternating* currents of magnetism. They are so attached to the frame of the machine that when the latter is assembled the core of the electromagnet lies between them, presenting a pole close to, but not touching, each of them.



FIG. 63. SMALL ROTARY CHUCK COMPLETED

It may readily be seen that if current were turned on with the axis of the magnet core lying horizontally, magnetic currents would be set up, inducing in these angle-pieces north-seeking polarity in one and south-

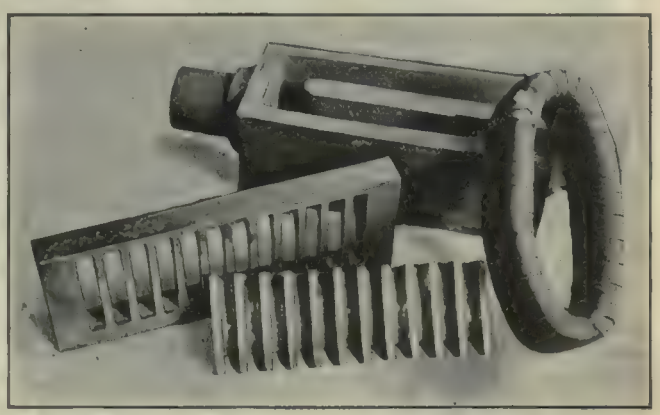


FIG. 65. ACTIVE PARTS OF SWIVELING CHUCK



FIG. 66. COMPLETE SWIVELING CHUCK DISASSEMBLED

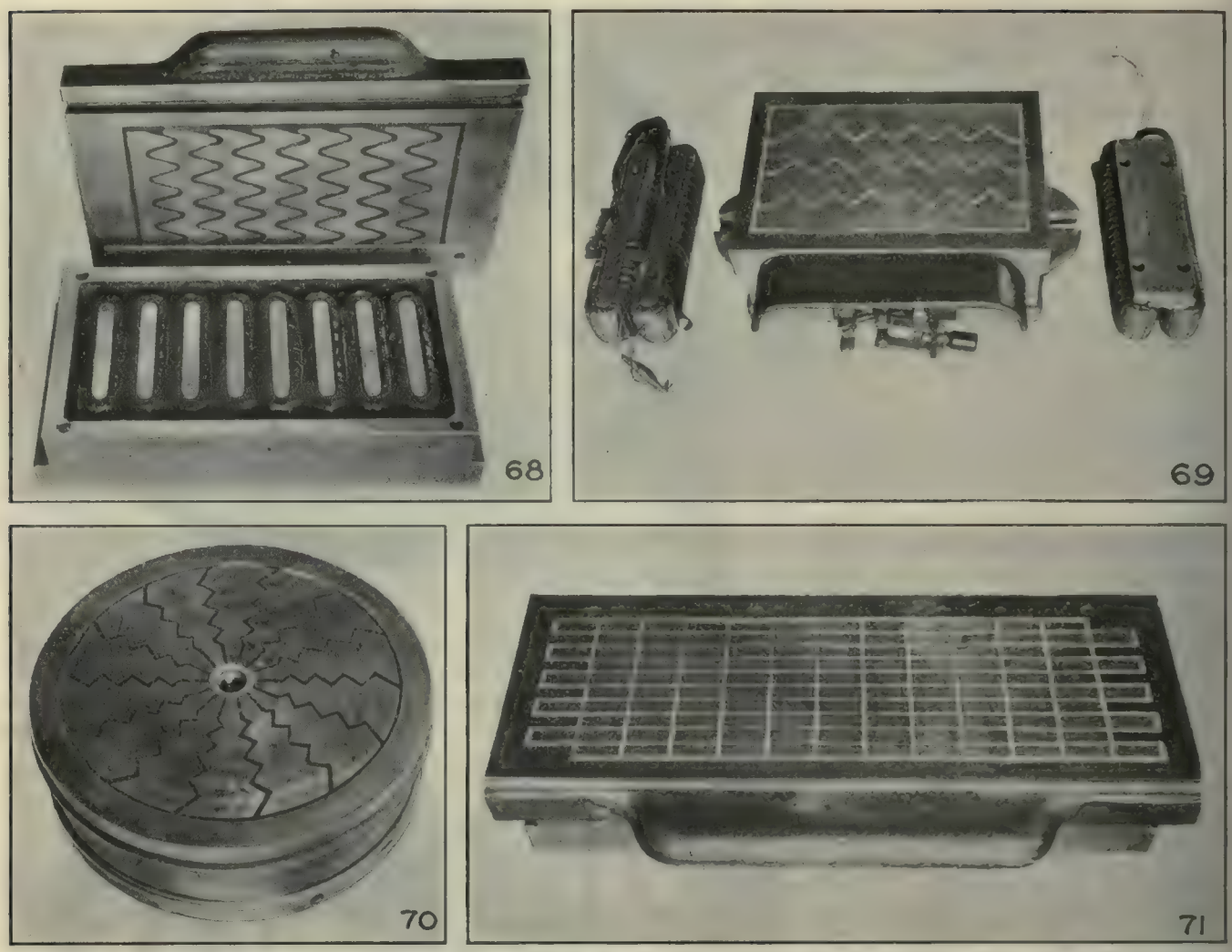


FIG. 68. MULTIPLE-MAGNET CHUCK WITH COVER REMOVED. FIG. 69—AN INDEPENDENT MAGNET CHUCK. FIG. 70—A ROTARY INDEPENDENT MAGNET CHUCK. FIG. 71—ANOTHER FORM OF THE MULTIPLE-MAGNET CHUCK

seeking polarity in the other, at their terminals, which are the steel plates attached to the top of the cover.

When the yoke is revolved, there is no change in polarity of the revolving magnet, but the polarity of the fixed polepieces is necessarily reversed twice during each revolution. There is, therefore, set up an *alternating* magnetic current amounting, at a speed of 1,200 r.p.m., to 2,400 reversals, or, as the electricians would express it, 20 cycles per second.

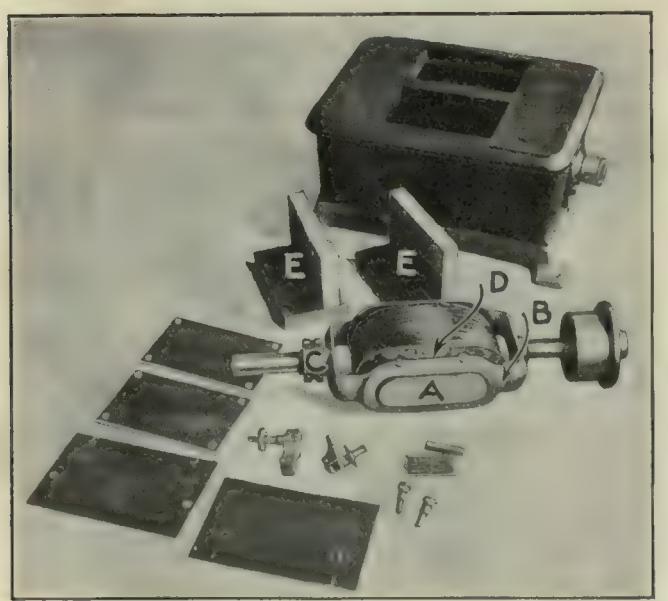


FIG. 67. PARTS OF THE WALKER DEMAGNETIZER

Though the standard product of the Walker Co. is the single magnet chuck, both multiple and independent magnet types have been made. Fig. 68 shows an example of the former, and Fig. 69 of the latter with two extra units lying outside of the chuck to show their construction. Figs. 70 and 71 show other forms of the independent magnet chuck.

World Atlas of Mineral Supplies

The United States Geological Survey, Washington, D. C., has just issued a World Atlas of Commercial Geography which sets forth graphically and concisely the basic facts concerning both the present and future sources of the mineral supply. In view of the experiences of the late war, which emphasized the advantages of having an adequate supply of raw materials close at hand, the value of such information is obvious. More than a score of geologists co-operated in the preparation of the atlas, which has 72 maps showing the mineral resources and production of the world by countries, these maps being accompanied by 72 more pages of descriptions.

Some Examples of Fast Gear Cutting

Gears Cut in One Operation—Pinions Mounted in Multiple Fixtures and Cut by Gangs of Cutters—Unusual Method of Cutting Gear Segments

By S. A. HAND
Associate Editor, *American Machinist*

WITH the advent of the farm tractor came the necessity for producing it cheaply. Gears for tractor use must be rugged; accurately cut, and produced in quantities at a minimum cost.

Some examples of fast gear cutting were recently seen at the shop of Gould & Eberhardt, Newark, N. J., on machines built for a large tractor works.

In tooling up the machines it was decided to eliminate the usual roughing cut and to provide cutters that would remove all the metal at one pass.

The Cutters

The cutters, as shown in Fig. 1, were made with hooked teeth, the angle of hook being 8 deg. The gashes, instead of being straight across, are at an angle of 10 deg. and inclined in opposite directions for alternate teeth. In addition the teeth are about $\frac{1}{32}$ in. thinner than standard, the reduction being made by removing the metal from the opposite sides of alternate teeth, as shown by the drawing. Thus each tooth has an acute cutting angle, presents no obtuse angle to the work, and cuts on one side only.

One general type of machine was used for all the work, special fixtures being provided for the different kinds of gears to be cut. The cutter slide is mounted on a vertical column and the work on vertical or nearly vertical mandrels so that all shocks and strains are imparted to and absorbed by the base of the machine. The vertical mounting of the cutter slide allows the chips to fall free from the slide ways.

The cutter spindle is driven by worm gearing and is provided at one end with a flywheel to give momentum to the cutters and to stabilize them during the cutting period. The cutter slide is counterbalanced by a weight and is fed to the work by a screw under tension. The return stroke is uniformly rapid at all feeds. The feeding, indexing and return movements are all interlocked so that no succeeding movement can take place until after the preceding movement has been completed.

The finished gears shown on the machine in Fig. 2 are made of semi-steel and have 72 stub teeth of 3—4 diametral pitch. Two teeth were cut at one time by the use of duplex cutters, the indexing being arranged to suit.

With three gears stacked on the mandrel and with a cutting speed of 70 ft. and a feed of 6.6 in. per minute, the time taken to cut the three gears was 81 minutes. It took 10 minutes to remove and replace the finished gears with blanks so that the total time was 91 minutes, equal to a production of about 16 gears in 8 hours.

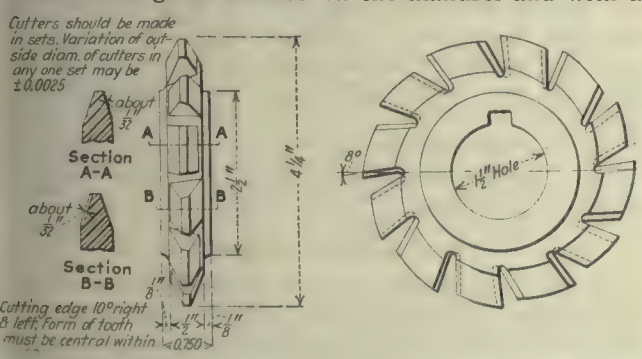


FIG. 1. GEAR CUTTER WITH RAKE IN TWO DIRECTIONS

Cutting Steel Pinions

Fig. 3 shows how the machine was arranged for cutting pinions. The fixture has two stations, one for cutting and one for loading, and is mounted on a turntable provided with means for locking it in position. The pinions are mounted in gangs of three on mandrels having outboard center-supports. Each station has its own set of centers mounted in blocks as at *A* and *B* and so arranged that they can be quickly adjusted and locked in position. The crank *C* and the ratchet and pawl *D* are for moving and holding the block *A*. A similar arrangement on the opposite side of the fixture takes care of the block *B*.

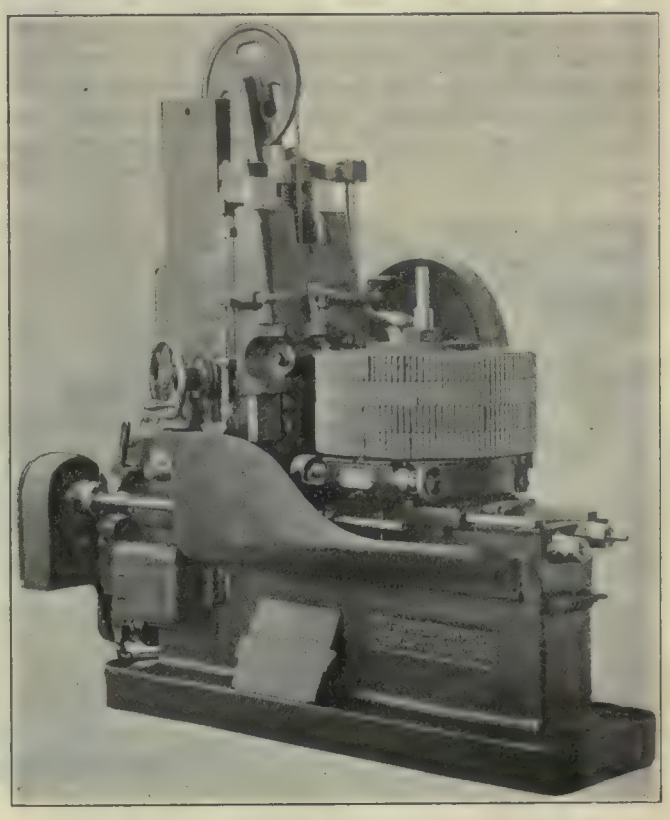


FIG. 2. MACHINE FOR CUTTING SPUR GEARS

The pinions are made of 0.50 per cent carbon steel and have 12 teeth, the pitch being 3—4. With a cutting speed of 100 ft. and a feed of 6.6 in. per minute, the time taken for cutting was 10.7 minutes. One-half minute was consumed in indexing the fixture, making the total time 11.2 minutes, or equal to a production of 128 in 8 hours.

Fig. 4 shows a two-stage revolving fixture for cutting steel bevel pinions of 5 diametral pitch. Here the

centers for supporting the mandrels have been omitted and the pinions are to be seen mounted in gangs of four. With a speed of 115 ft. and a feed of 4.6 in. per minute the production was 248 in 8 hours.

It will be noticed that the machine shown in Fig. 4 is provided with sheet-iron splash guards to keep the cutting oil from spattering over the floor and the operator. The machine shown in Fig. 3 is similarly equipped, but the guards had been removed at the time the photograph was taken so as to give a better view of the fixture.

Cutting Gear Segments

Among the toothed members used in the construction of tractors is the gear segment shown at the left in Fig. 5. The arrangement of the fixtures and cutters for cutting two bevel segments at once is shown in Fig. 6. In order to save back indexing or "fleeting up" for starting the cut after one set of segments has been finished, the following method is employed: The segments are first mounted on auxiliary fixtures, an empty fixture and one with a segment mounted being shown side by side in Fig. 5. The fixtures are then pushed on the work mandrels and the clamps *A*, Fig. 6, tightened on the projecting rims of the segmental faceplate *B*. The faceplates are loose on the mandrels and with the fixture and work in place are partially revolved until they strike a locating stop on the face of the work slide. The whole arrangement is then tightened on the mandrels by means of a spanner wrench and the notched nuts *A*, Fig. 5. The segments are located on the auxiliary fixtures by abutting against the pins *B* and held in position by the clamps *C*. The material of which the segments are made is cast iron and cutting is performed at an average speed of 60 ft. per minute.

With a feed of 6.6 in. per minute and an allowance of 5 minutes for changing the work; the production is about 87 in 8 hours.

Uninterrupted Production

The production given in each case is what the machine would produce in eight hours without interruption, but for the purpose of guarantees and for estimating the quantity of machines required, 80 per cent of the efficiency was taken.

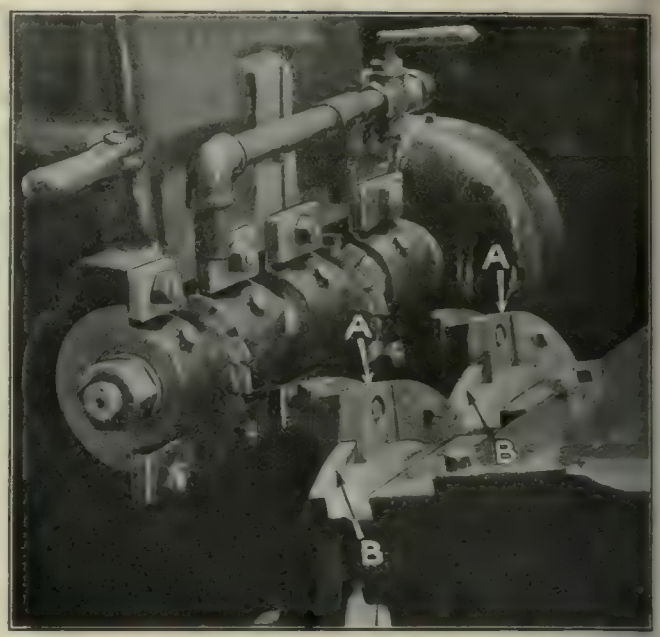


FIG. 6. HOW THE SEGMENTS ARE HELD IN THE MACHINE

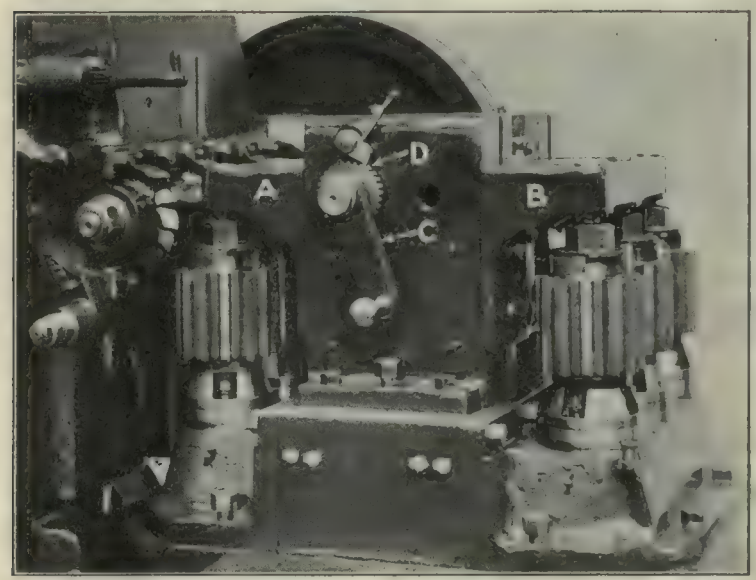


FIG. 3. FIXTURE FOR CUTTING PINIONS



FIG. 4. FIXTURE FOR CUTTING BEVEL PINIONS

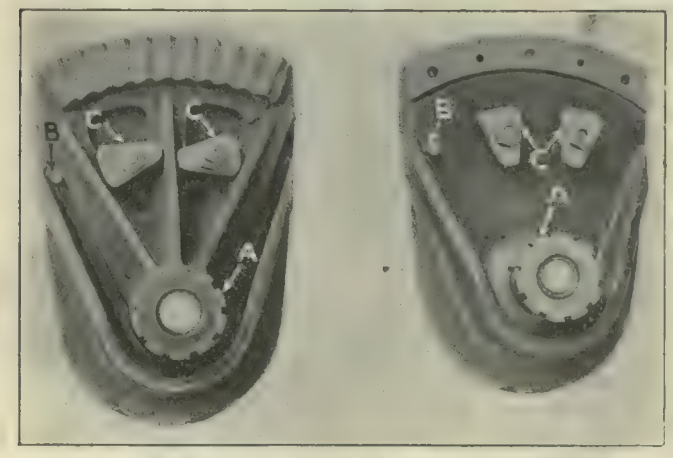
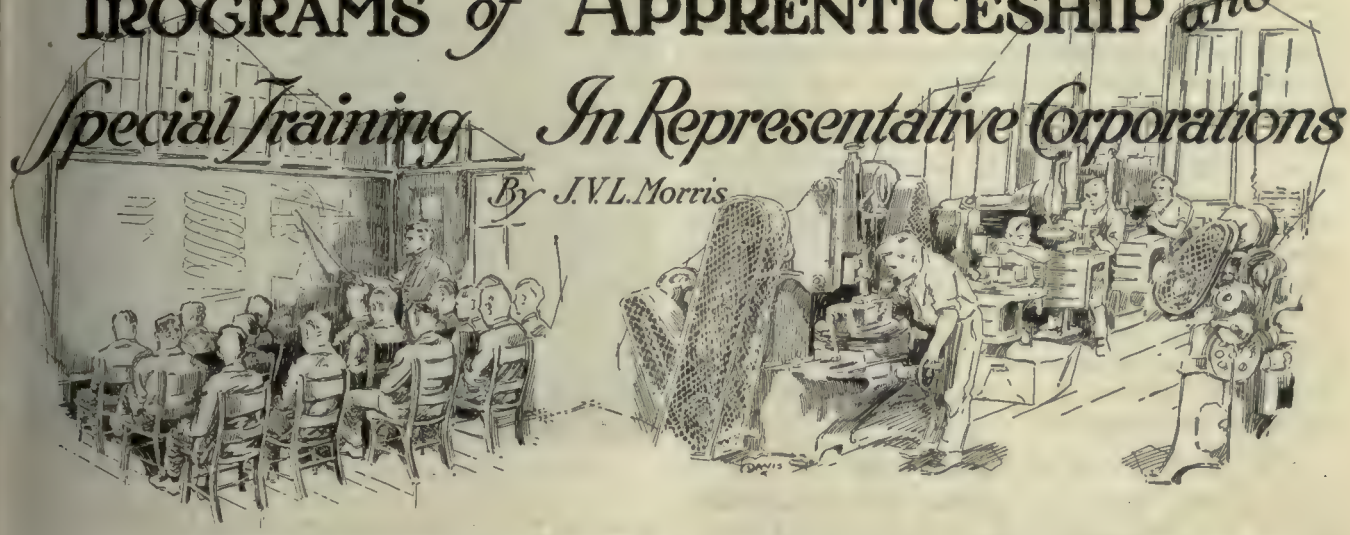


FIG. 5. AUXILIARY FIXTURE FOR HOLDING GEAR SEGMENTS

Programs of Apprenticeship and Special Training In Representative Corporations

By J. V. L. Morris



XI—The Goodyear Tire and Rubber Co., Akron, Ohio

This Large Organization Believes in Thorough Employee Training—The "Flying Squadron" Is an Interesting Development—The Industrial University Provides Instruction of Many Kinds

IN AN address before the foremen of the company on Nov. 1, 1919, the factory manager made this statement:

"The big development of the last fifty years in industry has been the development of machines. Today, as a result, we think too much of machines and too little of men. The day has come when machinery is almost universal. Today it is not the industry which has the best machinery that wins. It is the industry which has the best men and trains its men best to run these machines efficiently, that wins. The keynote of success is men, not machines."

The whole policy of the Goodyear Tire and Rubber Co. seems to be epitomized in that paragraph. To achieve the object of getting the best men, all the activities of the Labor Division should be considered: employment, recreation, service, safety and health, mutual relief and insurance, and industrial representation. We are here concerned, however, only with the educational work, as the method of direct action toward obtaining the personnel desired. The figures given and the conditions described were those existing at the time that the investigation was made, although some changes in the plan may have occurred since that time.

Large Educational System

How extensive is the educational work may be appreciated from the fact that, among a working force of 34,000, there are 6,100 taking some form of instruction, and that a staff of 112 full-time instructors is required. The management looks on the utilization in this manner of the large sum required as an investment fully justified, if, after the training, one-third of the graduates remain with the company. As a matter of fact, the records show that two-thirds of those who have completed regular three-year courses continue in the employ of this company, and there are now nearly two thousand graduates in the plant.

The Service Division is housed in the magnificent six-story building known as Goodyear Hall. Here three floors, each with an area of 170 x 400 ft., are given over to the Industrial Institute, which is the designation given to all supplementary educational work in the plant. Altogether, forty-five large classrooms are provided. These include three well-equipped laboratories for physics, chemistry, and rubber products, respectively, the chemistry laboratory being shown in Fig. 50.

Educational provisions may be conveniently considered under the principal headings: (1) "The Flying Squadron;" (2) apprenticeship, and (3) general industrial training, such as that for foremen, commercial and sales instruction, and Americanization. There is, also, throughout the plant a corps of labor-training instructors with its own foreman, a system which is under constant development.

The Flying Squadron

With regard to the first topic, in the company's house organ, "The Wingfoot Clan," on April 15, 1913, appeared the following editorial:

"It is the tendency of the times for most factories to develop among the workmen specialists who are skilled in a single operation. This sometimes throws the factory out of balance, because there are too few on another operation which is dependent on the first, with no skilled hands available to balance the production. With a view to overcoming this condition to some extent, we have instituted in The Goodyear Tire and Rubber Co., beginning April 15, a body of fifty men which will be known as the 'Flying Squadron.' These men will be selected from among the best workmen now on the various operations in the factory and they will be trained not on one particular operation, but on all the principal operations in the factory, becoming general experienced rubber men. Whenever any one department is in need of men to balance up the production, as many of the Flying Squadron as are necessary will be put on the work needed, to keep the production uniform. At

other times, these men will be changed from one operation to another, making piecework prices on the operations on which they work, with a minimum guaranteed day work rate. These men will be trained to become proficient in all the different operations in the factory, and when they have accomplished this, will be given certificates as 'Master Rubber Workers.' The Flying Squadron will have preference on steady work in the factory. This is an opportunity for a broad education in the different operations in a rubber factory, and those who demonstrate their ability will be in line for higher positions."

It is thus seen that this plan for all around training in rubber manufacture has been in operation more than seven years, giving abundant opportunity to test its value. That the number thus employed has increased from fifty to 1,200, suggests that the plan seems sound practice to the management.

Instruction of Squadron Men

The routine details of handling the scheme seem simple. For the first three to six months after a squadron is formed, the men are used exclusively for balancing production. In other words, they are put wherever they happen to be needed most, only with the care that they do not stay too long in any one department. For the rest of the year, some attention is given to insuring that they complete the circuit of all the important operations in the business, in order that full utilization may be made of their varied experience during the remaining two years of the course.

Throughout the three-year course, class instruction is always provided for two hours a week. As some 10 per cent are college men, and others did not finish the grammar grades, naturally this instruction has to be varied somewhat to correspond to the student's capacity. It is, however, of the same general nature for all.

During the first year, the principal instruction is in letter and report writing and in public speaking, under what is called personal salesmanship. For those who have not had enough of it, mathematics is also provided. The second year's class work is found mostly in industrial management and in the chemistry and economics of rubber. For the third year, a study of the company's organization and management, extending to general corporation administration, labor management, costs and statistics, with additional chemistry and public speaking, rounds out the course. Fig. 51 shows a class of the "Flying Squadron" men.



FIG. 50. CLASS AT WORK IN CHEMICAL LABORATORY



FIG. 51. A CLASS OF "FLYING SQUADRON" MEN

It is stated that 98 per cent of those who have completed the course have been promoted in one way or another, frequently to executive positions. It is probable that this is the most useful function of the scheme, and really justifies considering the plan as education rather than merely a clever scheme of managerial ingenuity for increasing production.

Value of the Squadron System

Other claims made for the plan by the factory manager are: (1) It has produced a group of workmen, who to an extraordinary degree work with spirit and breadth of vision, and their attitude of enthusiasm and co-operation has toned up the whole factory organization; (2) It fosters contentment by stopping unfair agitation. A squadron man's word counts against the rumors that may circulate through the plant, since he has first-hand information on the company's business and policy; (3) Examples are set for the other men. The squadron men are picked for their industry, as well as other good qualities, and working as they do at the same machines and at the same scale of wages as the ordinary operatives of the department, they are a very wholesome force in building up the morale of the organization; (4) It checks bad practices. At the weekly meeting of a squadron, members are encouraged to bring up whatever they have observed which can be improved. As they actually perform the work rather than merely supervise, they frequently can report what inspectors and foremen overlook. Also, they have the advantage of being able to compare practice in every department, so that often by this means a clever innovation in one department is more quickly transferred to all departments; (5) The men aid in handling new production problems. During the late war, the squadron men by their adaptability were particularly useful, in quickly changing from the customary production to that of balloons, gas masks and other war supplies. It is evident that, in the same way, they will be useful in adjusting themselves to new peace time products, or in furnishing the nucleus for a new factory to be installed in a foreign country or in a different city.

There are now around 1,200 men in about 50 squadrons, showing that in size they average between twenty and thirty men to a squadron. This would be nearly

4 per cent of the working force of 34,000 employees. It is stated to be a company policy to increase the number until it forms 10 per cent of the total number employed.

Engineering Squadrons

Also, there should be mentioned the 350 men in Engineering Squadrons, which are made up of technical college graduates who are provided experience upon principles similar to the others. Their period of training is also three years in length, and when graduated they are expected to recruit the engineering staffs of the planning, production and sales departments. Their instruction includes Economics, Civics, Mathematics, Drawing, English and Effective Speaking.

One interested in the revival of apprenticeship will probably be struck by the similarity of the flying-squadron scheme to certain types of apprentice training, especially that for machinists being developed at this plant for maintenance or production work. As a matter of fact, the outstanding difference seems to be that of the age of the worker, for the candidates for the "degree" of Master Rubber Worker are invariably grown men, although still young, while the almost universal practice is to require that apprentices should still be in their teens. The reason for this difference is, of course, that it is inadvisable to employ minors at many of the operations which squadron men perform in the manufacture of rubber products.

Apprentice Training

The soundness of a policy of training minors through a definite period for certain types of skilled mechanical employment, or, in other words, apprenticeship, has likewise been recognized by this company.

At present, we find the following enrollment of apprentices in the plant: Machinists, 54; Electricians, 4; Plumbers, 17; Carpenters, 9; Draftsmen, 11. Total, 105.

The ordinary period of apprenticeship as arranged by this company is three years, and the usual requirements are made, that the applicant shall have completed the eighth grade and be between sixteen and eighteen years of age.

The excellent practice of having apprentice shops separate from those used for regular production is observed for machinists and draftsmen. Also, the recognition that thorough training for the skilled trades requires strong technical and general educational preparation is met by giving two hours to school from each eight-hour day, leaving six hours for productive work. There are also two hours a week provided for gymnasium recreation. Furthermore, the company has recognized that the selected individuals desirable in this field should be attracted by a superior wage, and $6 a day has been established as the uniform rate of pay during apprenticeship.



FIG. 52. AMERICANIZATION CLASS FOR FOREIGN-BORN WORKMEN

As it is recognized that there will be an outlet for many of the machinist apprentices in the field of machine design, the instructor in mathematics does not stop with the limited arithmetic and trigonometry required in ordinary machine shop practice, but extends the instruction through the whole gamut of computation up to calculus. The educational course, in addition to this thorough mathematical course, embraces mechanical drawing, machine design, and shop notes.

The Industrial University

It is evident that a considerable teaching force is required for the two hours weekly instruction for the forty flying squadrons, the 350 technical men in the engineering squadrons, and the ten hours per week of instruction for the 105 apprentices. But, aside from these men, over 4,400 others are receiving instruction of various kinds. This work may be in special classes in Factory Practice and Management, or other educational work for foremen and inspectors. It may be one of the four-month, office-work training courses for recruits to the offices. It may be special provision for instruction by the screen for the 750 deaf mutes, who are a distinguishing feature of the personnel of the plant, and upon whom, of course, vocal instruction would be wasted, All this instruction is handled and furnished by the Industrial University, as it can well be called.

Such subjects as Business Arithmetic, Business English, Organization and Management, Economics, Modern Business Methods, Business Law and Corporation Finance, Public Speaking, Mechanical Drawing, Mechanics, Shop Mathematics, Electricity, Rubber-Manufacturing Practice, Spanish and Portuguese are taught. It will be noted that each subject has a practical bearing on the work of the company.

The times of the classes are so planned as to be the most convenient to the changes in the eight-hour shifts in which the men work. Thus, whether a man works on the day, evening or midnight-to-early-morning tour, he can enter a class which does not interfere with his work.

Americanization

Not the least important element of the work of the Industrial University is that among alien workers. Careful records are kept of the number in this category, and at present 96.7 per cent of all employees are American citizens. Out of the remaining 1,200-odd foreign employees of the company, 300 received instruction in English and assistance in naturalization, a class of the foreigners being shown in Fig. 52. It will be seen that this is about one-fourth of the number possible, which is a very creditable showing, since it should be recognized that only the younger men will greatly benefit. The effort is made to make the instruction thorough, including reading, writing and speaking, in order that the men may come to think in our language.

Metal Cutting Tools—VI

(Continued from last week's issue.)

THERE are really two classes of tools embodied in reamers; some reamers are really multiple boring tools, others are true reamers. It is somewhat difficult to define the difference between these two classes of tools, because they merge into each other. Their difference is a matter of degree. If we assume the multiple tool to have the general form of a cylinder, then it may be said that the boring tool cuts with the end, and the reamer with the face. This is, of course, only an approximation, because the corners of the boring tool are always more or less bevel or rounded, so that it is not quite true to say that the boring tool cuts with the end only. Similarly, it would not be quite true to say that the reamer cuts with the face only. The only way in which a reamer could be made to cut with the face only would be to have a tool with teeth on the face, with a diameter slightly larger than the hole in which it is to be used,

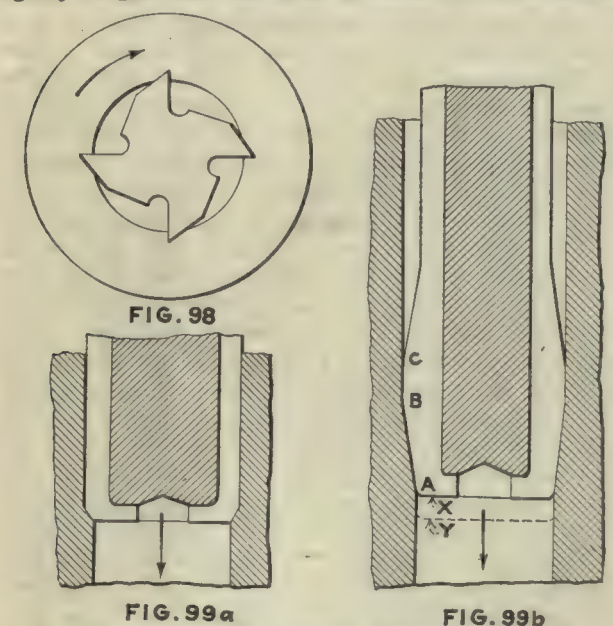


FIG. 98 FIG. 99a FIG. 99b

FIGS. 98 AND 99. ACTION OF REAMERS AND BORING TOOLS

and to drive this tool into that hole. Fig. 98 shows this in exaggerated form. As the tool is shown in the work, rotation in the direction of the arrow would remove metal out of the hole to the extent to which the reamer is driven into the piece. This, of course, is not the way in which a reamer is used.

Fig. 99a shows a boring tool in a piece of work and shows how the main cutting is done in the direction of the feed. The teeth on the face of the cylinder do not act. Fig. 99b shows a reamer at work, also in exaggerated form. The teeth at the end of the reamer do not act. The front portion of the reamer, which is very slightly conical, removes a chip when the reamer feeds in the direction of the arrow, so that the cutting part of the reamer is that portion between the points *A* and *B*. If the reamer advances during one revolution from the point *X* to the point *Y*, then the distance $BC = XY$ on the cylindrical portion of the reamer must have penetrated into the work during that one revolution; and this portion of the reamer, then, performs its function in the manner indicated in Fig. 98. A true reamer action, therefore, consists of two distinct actions: a penetration into the metal left in the hole, and a broad cut. Many reamers are ground to a different shape

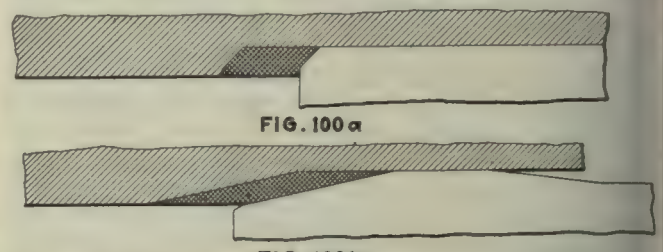


FIG. 100a FIG. 100b

FIG. 100. REAMER AND BORING TOOL CUTTING EDGES CONTRASTED

from that shown in Fig. 99b and, as a result, cannot be used with the broad feeds with which a reamer should be used.

Fig. 100a shows the action of a boring tool, Fig. 100b that of a reamer. In the first case the cut is deep and the chips are heavy when being split off. Therefore they have a tendency to tear the remaining metal. In the case of the reamer, though the same amount of metal is removed, it is spread over a larger area where it is being split off, so that at no single point will the strain be sufficient to tear the metal to any appreciable extent, and consequently the hole produced by this method will be smoother. Furthermore, in Fig. 100a all the work is done by a very short length of cutting edge whereas in Fig. 100b the work is distributed over a considerable length of edge so that the tendency to dull the tool is much greater in 100a than in 100b. On the other hand, if a true boring action is desired, that is, if considerable metal has to be removed, 100a would be preferable, because the other form of tool would have a tendency to chatter. In many shops a distinction is made between these two kinds of tools, but in most catalogs they are all grouped under one heading and in many establishments they are all ground the same way.

Where a reamer is ground as in 100a and where it is used in automatic machines, it is desirable to round the corner instead of beveling it, as shown in the illustration. This rounding of the corner curls the chip and prevents it from adhering to the cutting edge. In many automatic screw machine operations, for instance, it will be found that a reamer can ream only a limited number of pieces before the holes become scratched and rough. Examination will show that this is caused by small chips sticking to the cutting edge and scratching the hole. Where these corners are rounded, the danger of the

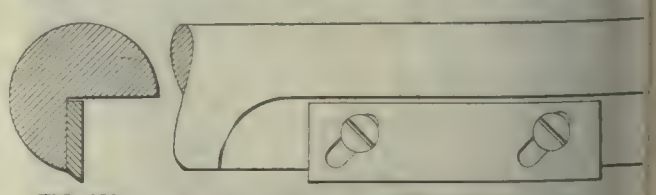


FIG. 101a FIG. 101b

FIG. 101. SIDE VIEW AND END SECTION OF KNIFE REAMER

chip sticking is minimized and it is possible not only to ream many more holes with such a reamer but also to take a heavier feed.

Where holes have to be produced round, smooth and

For the author's forthcoming book. All rights reserved.

to a very exact size, more than one reamer is required. Sometimes as many as three reamers are used and, in a few instances, four. In such a case the first reamer is really a boring tool and is guided in such a way that it locates the hole properly and makes it round. A second reamer follows for the purpose of removing whatever little error may have been left as to direction and roundness of hole. The third reamer is not guided and merely follows the hole, but brings it to its correct size. Where extreme accuracy of size is required a fourth reamer is sometimes used. This reamer also brings the hole to size. If only one sizing reamer were used, it would have to remove, say, one or two thousandths of an inch of metal, and in the course of a short time, the reamer would wear enough to cause a variation in the size of the finished hole of maybe half a thousandth. The fourth reamer would remove this last little bit of metal. As it removes very little, it will not wear readily and will maintain the size of the hole to a high degree of accuracy. Besides, such a fourth reamer would be a hand reamer and would be under constant inspection.

This last reamer is often used in the form of a knife

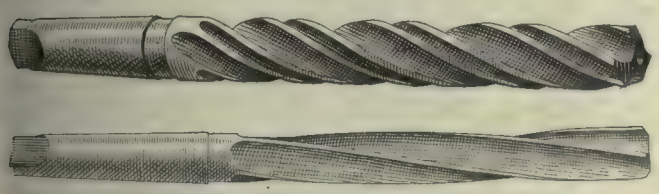


FIG. 102. THREE-GROOVED CHUCKING REAMER
FIG. 103. FOUR-FLUTED CHUCKING REAMER

reamer which is merely a hardened bar of practically the same size as the hole, and in which a knife blade is laid which is adjustable and can be set to produce the desired diameter. The holes produced are carefully inspected as to size and finish, and when a hole is found which comes close to the permissible lower limit, the blade is stoned and readjusted. Fig. 101a shows a reamer in section. Fig. 101b shows the body and blade in top view and the method of adjustment. Such a reamer can only be used by a skillful operator.

Reamers are used in two ways—they are guided or unguided. A reamer which is held in the spindle of a drill press by a taper shank is guided to the extent that the spindle must follow a certain path and that the reamer cannot move in the spindle. Similarly, a reamer held rigidly in the turret of a turret lathe is guided to a certain extent. However, it is not guided sufficiently to assure the desired direction and size of the hole. Due to the looseness of the spindle or the turret and the fact that the hole in the piece may not be in exactly the same direction as the direction of the feed, the reamed hole will have a direction depending on a number of conditions but never exactly the direction of the original hole, nor exactly in the direction of the feed. A reamer held in the spindle of the drill press and guided in a jig is guided much better, but if the hole is deep and the jig-eye short it is still not sufficiently guided to determine positively the direction of the hole. If the jig-eye is long and the hole is short very close results can be obtained. If, however, the direction of the feed is not the same as the direction of the axis of the jig-eye there must necessarily be some binding or cramping in the spindle and therefore it is customary, or at least it is good practice, to drive a reamer which is guided by a long jig-eye, by means of some kind of universal joint. A reamer which is guided by a pilot on either side of the hole, in addition to the jig-eye, will produce still better results because the reamer does not

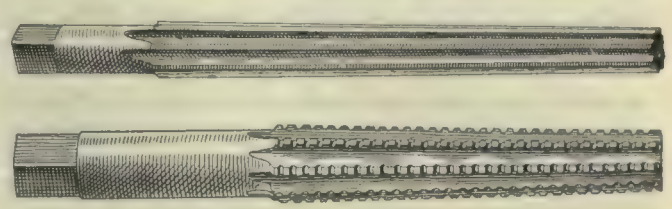


FIG. 104. TAPER PIN REAMER WITH STRAIGHT FLUTES
FIG. 105. NOTCHED TAPER REAMER

overhang and will not deflect to the same extent. If such a reamer is loosely jointed to the spindle the hole will be practically in line with the jig-eye and the pilot bushing.

If a reamer is held in the turret of a turret lathe and is guided in the spindle it will produce a hole the axis of which is correct. But due to the weaving of the turret such a reamer is apt to produce a taper hole. It will be seen, then, that where a reamer is used in a drill press, and where it can be properly guided, a hole is produced of the correct diameter and proper direction, but if a reamer is used in a chucking lathe and is guided by the spindle, it will produce a hole with the proper direction, but not necessarily of the same diameter as the reamer, nor will the hole be necessarily straight. In such cases the floating reamer is used.

The Floating Reamer

A floating reamer is for a particular purpose, ordinarily reaming, but so jointed to the holding member that it can move freely in any direction. It will, therefore, follow the hole and as it has no tendency to move around any axis except the axis of the hole, it will not disturb the direction of the original hole nor will it have a tendency to form a taper hole, but will simply enlarge the hole to the size of the reamer. It should be noticed, however, that a floating reamer must be truly floating in all directions, otherwise it is apt to generate a hole of which the section is not exactly circular.

To summarize: A properly guided reamer which revolves and feeds, as in the drill press, will produce a correct hole. A properly guided reamer, so far as it can be properly guided, in a chucking machine, will insure proper direction but not size nor uniformity of section. A floating reamer will not correct a faulty direction of the axis of the hole but will bring a hole to size and give it the proper finish.

These points should be carefully kept in mind when laying out a sequence of operations. Nothing seems to

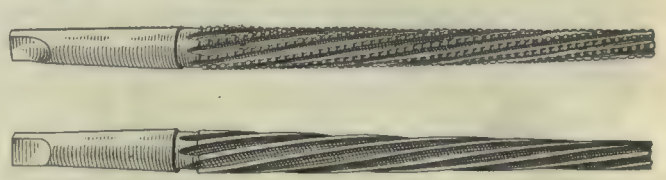


FIG. 106. ROUGHING TAPER REAMER WITH SPIRAL FLUTES. FIG. 107. SPIRAL FLUTED TAPER REAMER

be quite so much confused in the minds of many machinists as the function performed by various styles of reamers and various ways of applying them. It should be remarked here that a hand reamer is in all

respects a floating reamer. We might reverse this statement and say that a floating reamer is intended to imitate the action of a hand reamer. As a rule a hand reamer has a very large feed per revolution and a floating reamer should be used likewise. For that matter even a guided reamer should have a large feed so as to make it act as a reamer, that is, to make it cut on the side rather than in front. As a rule the straight side cutting portion of a guided reamer does not need to be more than $\frac{3}{8}$ in. whereas for a floating reamer or hand reamer the straight portion may be much more.

Fig. 102 shows a three-groove chucking reamer and Fig. 103 a four-fluted chucking reamer which, as has been remarked before, are not reamers in the proper sense of the word but are really multiple boring tools.

In Fig. 104 is shown a taper pin reamer with straight flutes. As is indicated by the square, such a reamer is used by hand and consequently there is no danger of chatter with this tool. If, however, such a reamer were used in a machine we would have a condition similar to a very broad-nosed tool taking a finishing lathe cut. The chip made by the tool would be of the same section at all points so that the change of pressure required at the moment when the chip splits off is always the same and recurring at regular periods. Chatter, therefore, is very apt to result. In addition, a taper reamer taking such a wide cut would rapidly clog up with the thin but bulky chips and would have to be withdrawn very frequently. Taper reamers which have to remove considerable metal, in other words, reamers which make a taper hole out of a straight one, are generally made as shown in Fig. 105, where the cutting edges are notched in. These notches should preferably be placed on a spiral around the reamer, but not necessarily so.

To overcome the chatter caused by the broad cut of a taper reamer various methods have been employed among which are the following:

(1) An odd number of blades; (2) uneven spacing of the blades; (3) spiral reamers; (4) spiral reamers with uneven spacing, with odd number of teeth, and with notches.

There is some foundation for all of these methods. The odd number of teeth is supposed to bring more pressure to bear on one side of the hole than on the other. If, for instance, we have five blades in the reamer there will always be three on one side of a centerline and two on the other. There will be more resistance met by the three blades than by the two and consequently the reamer will be pushed toward the side with two blades. After the reamer has turned one-half of a revolution, it will be pushed in the opposite direction for the same reason. Thus there will be a constant change of conditions existing between the reamer and the metal around the hole. This breaking up of the condition is supposed also to break up the tendency to chatter. However, this way of overcoming the trouble works better on paper than in practice.

The uneven spacing of the blades works more or less the same way. As the distance between blades 1 and 2 is greater than that between 2 and 3, blade 2 must take a heavier chip than blade 3, and as the reamer is turning this condition changes. Here, again, the reamer would be pushed from side to side, or rather, it would have a tendency to describe an eccentric path, and this would clear the reamer and have a tendency to break up vibration. This method also sounds much better than it acts.

The third method, that is, placing the blades of the reamer spirally around the body, does overcome the trouble if properly carried out. The spiral blade acts the same way as the round-nosed tool for the fact that the edge is a spiral makes it curve. However, the way most spiral reamers are made, the spiral has so much lead that the curve is very flat and the action would be similar to a broad-nosed tool slightly rounded over. The effect of the roundness is beneficial to a certain extent but not enough to overcome chatter.

A question which has been discussed many times over is whether the spiral reamers should be made with right-hand or left-hand spiral, and there have been many discussions as to how the nature of the metal to be reamed affects this point. A little thought will show what happens if the reamer has a right-hand spiral and also turns right hand. Imagine a reamer with very short spiral resembling, in fact, a screw. Imagine this screw to be hight-hand and the reamer to turn in the right hand direction. Then the screw will try to form its own path in the metal to be reamed out and pull the reamer forward. This action takes place however great the lead may be, though, of course, the effect is less marked with a long lead than with a short one. When the reamer has been pulled in by the thread until it takes a fairly heavy cut and there is enough power in the machine to turn the reamer, it will take a heavy chip, become free, permit the spiral to pull the reamer in again, take another cut, become free again, etc. This again means chatter. In this case the period of vibration or chatter is a different one from the period which would have been caused by the change in pressure due to the splitting off of chips but the result will be just as bad—in fact, it may be worse. It may therefore be stated as a rule that spiral taper reamers should have a left-hand spiral for right-hand rotation and vice versa.

Regarding the effect of the material on the spiral we may say that the spiral reamer will always act in the same manner, that is, it will have a tendency to pull in and cause chatter if spiral and rotation are in the same direction. But how strong this tendency to chatter will be depends somewhat on the material. When the material is of a granular nature and breaks off in short chips, there is, of course, not very much tendency to pull in, just as a screw would not have much tendency to pull itself in if turned in loose beach sand. On the other hand, if the chip is continuous and tough it forms a backing for the spiral by which it can pull itself in so that the effects of the long spiral are much more marked in mild steel than in cast iron, for instance. However, there is never any benefit in making the spiral in the same direction as the direction of rotation.

Figs. 106 and 107 show a spiral fluted taper reamer for roughing and finishing, respectively. As a rule, spiral reamers are made with greater lead than the ones shown. The writer's experience, however, has been that still less lead gives even better results.

Marking Tools by Etching

By C. E. Hallen

Referring to an article under the above title on page 1047, Vol. 53, of the *American Machinist*, I have to say that in regard to marking nickel-plated tools and articles with aqua regia, I have had two different chemical laboratories make up aqua regia but neither would "bite" the nickel.

Any information as to what to use for etching nickel-plated articles will be appreciated.

Improvements in Methods of Handling Railway Shop Material

Danger in Transporting Car Wheels and Trucks Lessened by Improved Devices—Compressing Springs and Cutting Off Coupler Yokes with Safety

BY FRANK A. STANLEY

SOME interesting changes in methods of handling parts around the railroad shop are brought out in the accompanying illustrations. Along with improvement in general machining operations, much has been done in the direction of simplifying and making more satisfactory the processes of moving material about the shops, and in handling parts generally in assembling or in stripping material for reclamation. Incidentally it may be noted that the attempt to make shop work as safe as possible has done much toward simplifying and improving various devices employed for the classes of operations referred to above. In other words, the safeguarding of machine and shop work in general has been accompanied or closely followed by the application of desirable measures of safety in respect to the operations and equipment for the handling of parts around the plant.

The halftone, Fig. 1, illustrates a former method of handling car wheels and axles from place to place in the shop. It formed a very satisfactory method of picking up the load and the heavy low trucks were amply rigid for the job. They were easily applied under the ends of the axles and with the V-supports under the axle-necks the work was removed with a reasonable degree of safety and convenience. Still there was always the possibility of one end or the other of the axles coming off from its truck and as four men were required for the work, the operation was far from 100 per cent perfect. Experience with this form of truck led to the improved design shown in Figs. 2, 3 and 4.

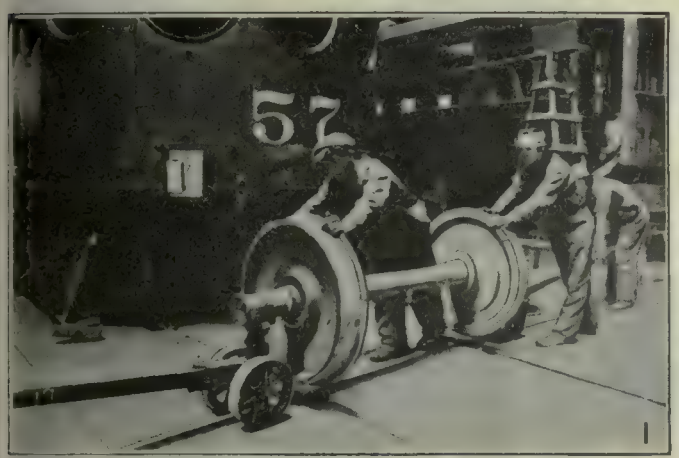


FIG. 1. FORMER WAY OF HANDLING CAR WHEELS AND AXLES

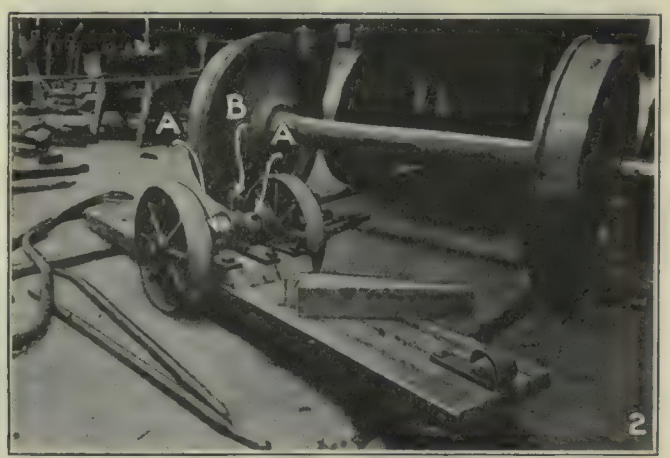
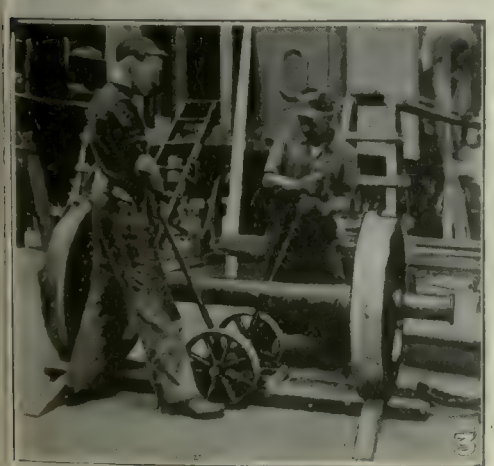


FIG. 2. NEW STYLE TRUCK OR BUGGY FOR HANDLING WHEELS AND AXLES

In the first of these views the new style of truck, or wheel buggy as it is called, is shown in front of a pair of wheels ready for loading. The platform of this buggy is underslung from an axle carried between a pair of fairly low wheels. The axle is made with journals eccentric to the body proper and by turning this axle over in its brackets the platform is raised.



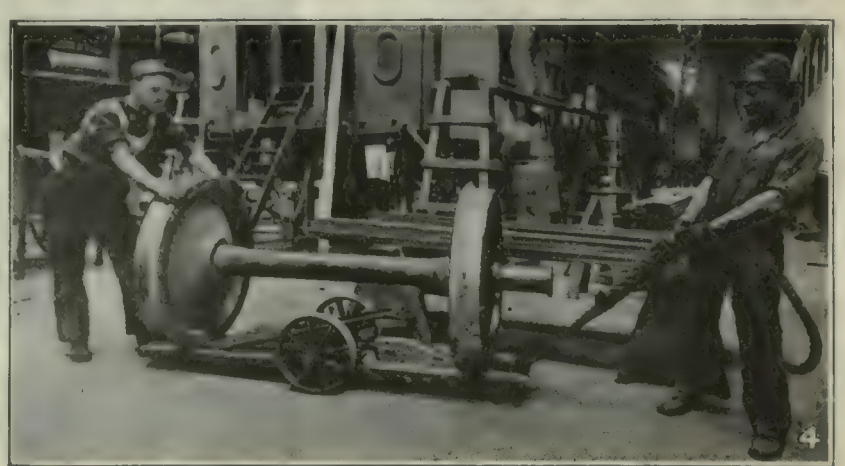


FIG. 3. SHOWING WHEELS IN PLACE ON BUGGY AND METHOD OF ELEVATING PLATFORM FOR FLOOR
FIG. 4. EASILY MOVED AND HANDLED BY TWO MEN



FIG. 5. FORMER WAY OF RAISING 6-WHEELED TRUCKS

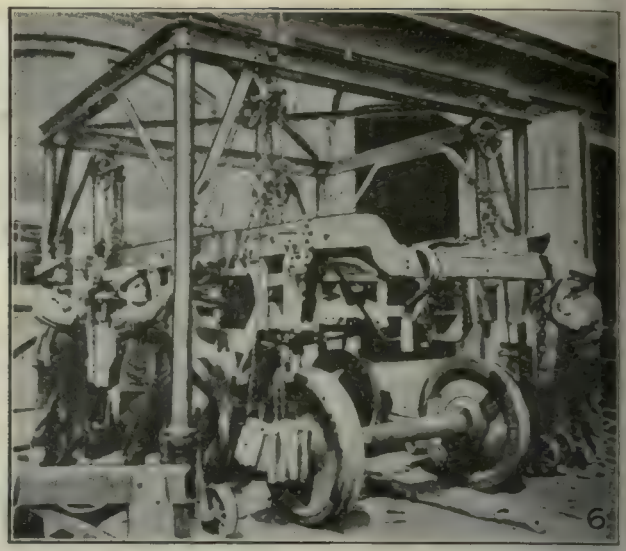
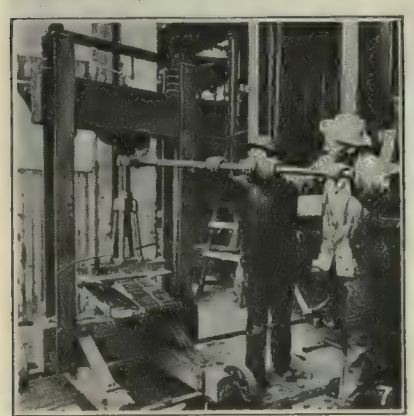
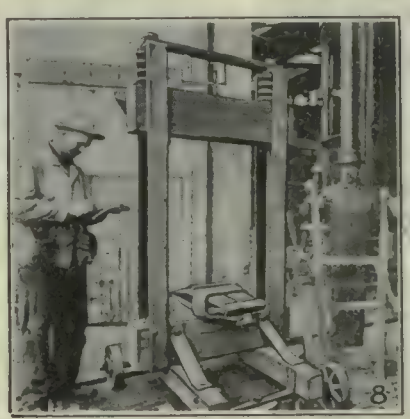


FIG. 6. IMPROVED METHOD AND APPARATUS FOR HANDLING 6-WHEELED TRUCKS

Before the truck is ready for lifting, however, the wheels are placed aboard by rolling them up a pair of inclined wedges, shown in Fig. 3. Then two bars are applied to revolve the buggy axle over so as to lift the platform clear. The operating-bar holes in the axle will be noticed in Fig. 2 at *A* and also the clamp screw *B* for securing the eccentric axle in position when adjusted up or down.

The moving of the buggy with its load is the simple operation shown by Fig. 4. Thus two men do a job which formerly required the services of four. At the same time it makes a safe operation of the wheel mov-





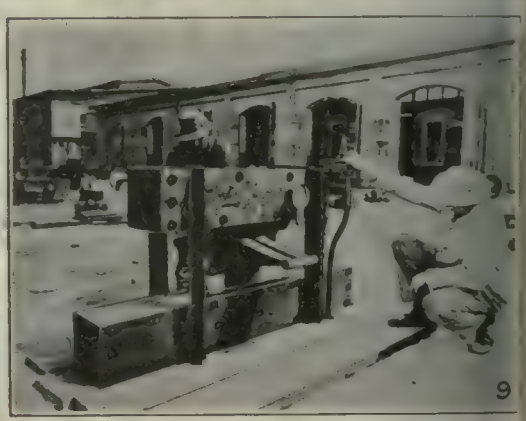


FIG. 7. OLD DANGEROUS WAY OF COMPRESSING SPRINGS. FIG. 8. METHOD OF CLAMPING TRUCK SPRINGS TO BE APPLIED TO TRUCK WITHOUT BEING TAKEN APART. FIG. 9. IMPROVED METHOD OF COMPRESSING SPRING



FIG. 10. OLD HAND-METHOD OF CUTTING OFF COUPLER YOKES



FIG. 11. CUTTING OFF COUPLER YOKES BY POWER

ing process and provides greater flexibility in the shifting of the work. The new buggy can be drawn straight ahead or swung around short, turning with equal ease and with the same degree of security in reference to the stability of the work.

An interesting comparison of former and present methods of handling 6-wheel trucks is presented by Figs. 5 and 6. The first view shows the use of jacks at the truck corners for lifting the ends, which means the raising of the jacks to about their maximum lift with all the accompanying possibilities of one of them being insecurely placed, or the truck frame slipping at one side or the other.

The new arrangement for lifting the trucks comprises a substantial steel frame work erected around heavy uprights and from the four corners of the overhead structure are suspended four chain hoists for lifting the truck evenly from all sides. The saving in time and effort and the freedom from possibilities of accidents with the newer arrangement will be apparent.

Changes in Methods of Compressing Springs

Fig. 7 shows a former method of compressing springs for clamping as in Fig. 8, to be applied to trucks without taking apart. This method was considered dangerous owing to the necessity of using a tall, especially designed jack screw with the possibility of its slipping from place and allowing the spring to kick loose from the clamp. Moreover the heavy jack with its blocks was an inconvenient device for handling and so the whole arrangement was superseded by the power compressing machine shown in Fig. 9, which is a rigid device requiring only the operation of a valve to force the jaws against the spring, closing it sufficiently for the clamp.

The old method of cutting off coupler yokes by hand sledge and chisel is illustrated in Fig. 10. This method was slow and the flying rivet heads and other pieces of metal also made it dangerous. The new way is to shear off the rivets by means of a horizontal press which is similar to a short wheel press, as illustrated in Fig. 11. The coupler head is suspended by a chain hoist in horizontal position at the front of the press with the yoke between the square end of the ram and an anvil. In this position the end of the ram acts against the side of the coupler-head shank while the back side of the coupler yoke abuts against the anvil in the press. When pressure is applied to the ram it shears off the rivets and forces the shank of the coupler out of the yoke.

Federated American Engineering Societies Attacks Industrial Waste Problem

Purpose and Plan of Work of Committee on Elimination of Waste in Industry Appointed by Herbert Hoover, President

By L. W. WALLACE
Executive Secretary, F. A. E. S.

THE object of the Federated American Engineering Societies as stated in the constitution: . . . "Shall be to further the public welfare wherever technical knowledge and engineering experience are involved, and to consider and act upon matters of common concern to the engineering and allied technical professions" . . "A comprehensive organization of the community, state and nation."

With this thought strongly in his mind Herbert Hoover, the president of the organization, said in a speech at Washington in November:

"It is primary to mention the three-phase waste in production; first, from intermittent employment; second, from unemployment that arises in shifting of industrial currents; and third, from strikes and lockouts. Beyond this elimination of waste there is another field of progress in the adoption of measures for positive improvement in production.

"In the elimination of the great waste and misery of intermittent employment and unemployment we need at once co-ordination in economic groups." . . .

In an executive meeting of The American Engineering Council Mr. Hoover further discussed the need for an intensive study of all causes for industrial waste, emphasizing those factors that contribute to labor or man-power waste. He suggested to the council, the governing body of The Federated American Engineering Societies, the advisability of appointing a committee of fifteen carefully selected engineers to undertake a study of waste in industry.

The council readily consented to the request of Mr. Hoover. He then formed the Committee on the Elimination of Waste in Industry.

In selecting the personnel of this committee care was exercised to secure men of broad experience, of clear concepts, of unbiased attitude toward labor problems and representative of managerial, consultant, educational and editorial activities as well as having a widely distributed and a varied industrial contact.

At the organization meeting of the committee in January its purpose was stated to be:

First: Determine the cause of labor, material and equipment waste in industry. The material and equipment phases of the problem to be studied only in so far as they may cause labor waste.

Second: In so far as possible determine the extent of the waste that arises through each major cause.

Third: Suggest means of removing the cause for such waste.

To accomplish the purposes of the committee it has been found necessary to make studies along the following lines:

First: Organization—which assigns responsibilities and relationships, and the discharge of same.

Second: Engineering—which comprises the design, construction and maintenance of plant, machinery and tools and the design of the product.

Third: Production Control and Cost Control. Under this division fall all the factors relating directly to production and their proper direction and accounting.

Fourth: Physical Factors. This division relates to the storage and inspection of raw and processed materials and to matters of internal transportation. It also includes consideration of the physical condition of the plant as regards lighting, heating, toilet facilities and the like.

The important subdivisions of the major factors, organization, production and cost control and physical factors, to which special attention is directed are enumerated as follows:

ORGANIZATION

(a) Nature of operation:

(1) Contractual. This form presents many problems that affect personal relations. Building operations are largely contractual. This form of relationship is quite common in the clothing industry.

(2) Repetitive. A large portion of the industrial activity is repetitive. This phase of industry makes prominent the question of monotony and occupational diseases.

(3) Continuous. Steel and chemical industries are typical. In this form of operation the question of the number of shifts is considered important.

(b) Types:

The type of organization is some index to the quality of the management, and as such is an essential consideration:

(1) Functional; (2) Line and Staff; (3) Staff; (4) Mixed; (5) Committee.

(c) Personal Relations:

(1) Employment policies; (2) Representation—To what extent each plan has been tried, and with what results.

(a) Federal plan; (b) Joint committee; (c) Employees' co-operative association.

(3) Strikes and lockouts—The cause of the duration of, the man-hours lost, and the total cost.

(4) Restrictions by Management and Labor—An investigation of the means employed by management and by labor to restrict production. Such practice produces an unstable condition and hence leads to uncertain labor conditions and disturbed relations.

(5) Unemployment:

(a) Quantity of; (b) Causes of; (c) Remedy for.

(6) Seasonal and intermittent employment:

(a) Quantity of; (b) Causes of; (c) Remedy for.

PRODUCTION CONTROL AND COST CONTROL

(a) Planning.

All of these factors have a direct influence upon the productivity of the individual worker. If inadequately or ineffectively provided for the worker loses time, compensation, and hence a high morale is not sustained.

(b) Establishing standards.

This is very significant, as many labor disputes have arisen over the method and fairness used in establishing such standards. They have a direct bearing upon the earnings of the worker.

(c) Maintenance.

If equipment is not properly maintained the operator does not accomplish standard tasks and dissatisfaction results.

INDUSTRIES TO BE STUDIED

Ten representative industries have been selected. They were selected because of their general importance and interest to the public. The ten selected are: (1) Bituminous coal; (2) Building trade; (3) Transportation; (4) Men's readymade clothing; (5) Printing; (6) Paper; (7) Metal trades; (8) Textiles; (9) Shoes; (10) Rubber.

From three to ten plants of each selected industry are being visited by an experienced engineer who will secure the information desired by the committee. A carefully prepared list of questions has been placed in the hands of each field worker. The information obtained by the field investigator is being supplemented by such authoritative data as may now exist in the form of reports made by reliable parties or agencies. Through this means sufficient information is to be secured to enable the committee to formulate specific conclusions as to the major causes of industrial waste.

STAFF

A small staff is to be maintained at headquarters to plan and direct the work. The field work is to be done by engineering firms. The firms are to be carefully selected for their fitness for the work. Thus the committee will obtain the benefit of the experience and knowledge of that firm that has had most intimate contact with a given industry. The firms are doing the work at actual cost to them. All profit is being waived.

All authoritative literature upon each general topic is to be carefully searched and digests made by well-qualified firms. The headquarters staff will compile all the data and write the final report, which is then to be reviewed by the committee as a whole. Every effort is to be made to secure authentic and quantitative information and care will be exercised to prevent any bias or prejudice from influencing the work.

PROGRESS OF WORK

The work of the committee is well under way. Reports on the first investigation in each industry were made on Feb. 21, carrying out the time schedule set Feb. 7. At a meeting of the planning board held on March 1 further reports were presented and plans made for continuing the investigations more intensively. These reports were uniformly encouraging and there is every reason to believe that the investigation will yield information that will have an important bearing on the nation-wide movement inaugurated by the engineer to eliminate waste in American industry. In New York, New England and Pennsylvania the fuel investigation is practically completed.

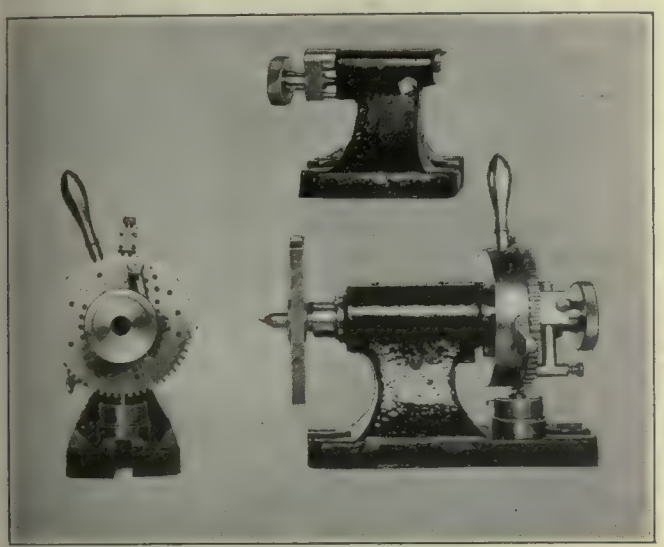


Shop Equipment News

(Continued from page 532.)

Geiras "Lightning" Indexing Head

The Geiras Manufacturing Co., Inc., 417-19 East 156th St., New York, N. Y., has recently placed on the market an indexing head known as the "Lightning"



GEIRAS "LIGHTNING" INDEXING HEAD

and shown by the two views in the illustration. It is stated: That the head can be easily operated by one movement, in a fractional part of a second, from practically any position at the front or end of the milling machine; and that, should the operator move the handle far enough to disengage the locking pin from the index plate, the mechanism and index plate will remain locked together until whatever stroke or division the tool has been set for has been completed; also that, if the handle is not returned to its proper starting position, it is impossible to move it forward.

With nine index plates, any division from 2 to 100 with the exception of prime numbers above 40 can be cut. The index plates are unlike the ordinary in that there is no complete circle of holes. There are only from 2 to 5 holes in any one row.

There is an adjustable arm on the plate end of the head, which arm is the key for the index plate and spindle, and has a spring plunger at the end that is set in the proper row of holes. A plunger on the base engages the notches on the edge of the plate. To cut, for instance, 40 teeth, using a plate with 60 notches, the operating handle is set so that the plunger will operate in every third notch, which would give 20 teeth on the gear, and by moving the arm one hole, the additional 20 teeth required to complete the gear can be cut.

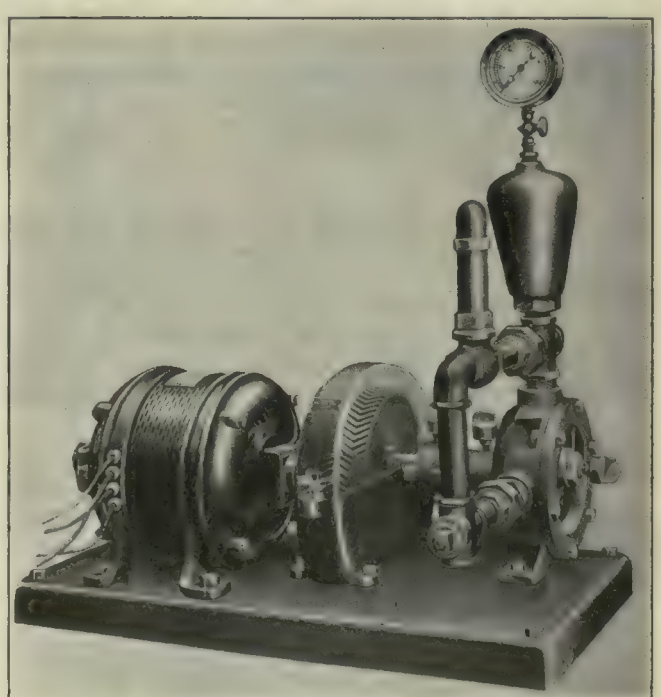
All important parts are hardened and ground and some are lapped. The mechanism is not complicated and it is stated that any tooth can be returned to position under the locking pin any number of times, and the variations will not exceed 0.0001 part of an inch. Special plates or styles of heads, either vertical or horizontal, can be made to suit special work. The standard device consists of an indexing head, the tailstock, driving plate, draw tube for collets and nine index plates. The swing is 12 inches.

Bowser Motor-Driven Rotary Oil Pump

The illustration shows the motor-driven rotary oil pump recently placed upon the market by S. F. Bowser & Co., Inc., Fort Wayne, Ind. The pump is intended for the purpose of unloading tank cars, supplying oil to furnaces, and transferring oil from one place to another, as to the different floors of a plant or from one tank or vat to another. The motor is connected to the pump by means of reduction gears of the herringbone type, the gear being cast iron and the pinion bakelite. The gears run in oil in a cast-iron case, so that both wear and noise are greatly reduced. The entire outfit is mounted upon a rigid cast-iron base, so that it can be easily moved from one place to another.

The pump is of the rotary type, it being said that it contains only two moving parts, each part being self-supporting and having clearance around it, so that wear and friction are greatly eliminated. The foot valve is furnished with each outfit, but the other accessories shown are extra. An air chamber can be provided to relieve the shocks that occur when the discharge valve is quickly closed while the pump is still running. A pressure gage indicating up to 100 lb. pressure is attached to the upper part of the air chamber. A bypass with a relief valve can be provided, so as to protect the pump against breakage, due to any overpressure occurring because of an obstruction in the pipe line. The device can be set to automatically bypass when a predetermined pressure has been reached.

The pump is made in seven sizes to fit pipe lines from ½ to 3 in. in diameter. The motors required are from

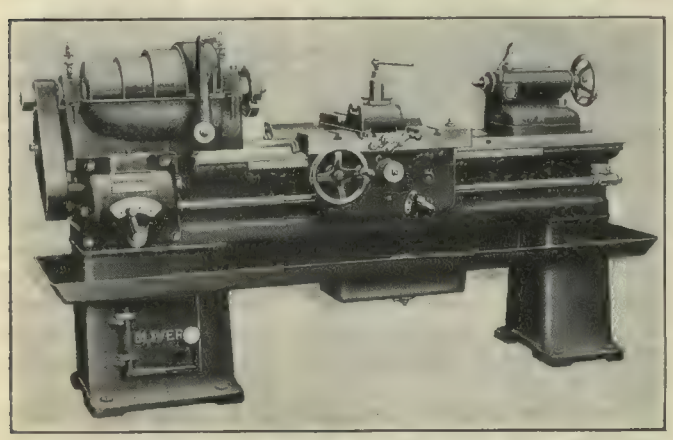


BOWSER MOTOR-DRIVEN ROTARY OIL PUMP

½ to 15 hp., and depend in size upon the character of the oil and the pressure necessary in the pipe line. The floor space required is 10 x 20 in. for the smallest machine and 27 x 45 in. for the largest. The shipping weight, exclusive of the motor, varies from 85 to 900 lb.

Oliver 16-In. "Rapid Production" Lathe

The Oliver Machinery Co., Grand Rapids, Mich., has recently placed on the market the 16-in. lathe shown in the illustration. The machine, designated as the "rapid-



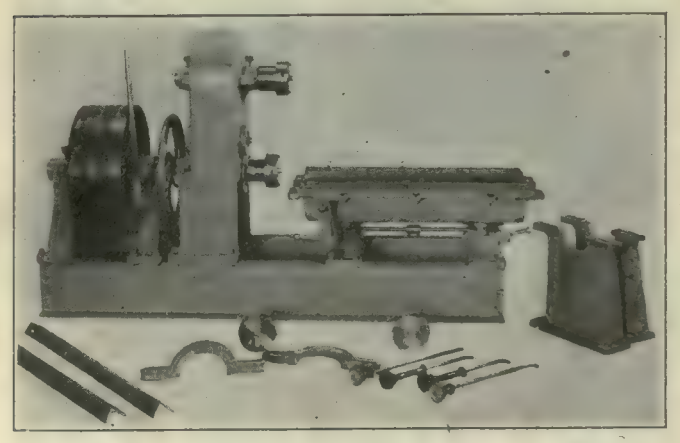
OLIVER 16-IN. "RAPID PRODUCTION" LATHE

production" lathe, resembles the heavy-duty lathes made by the same concern and described in the *American Machinist* on page 786, Vol. 43, and on page 478, Vol. 47. It has, however, been simplified, so that it does not contain features not necessary for production work. The machine is said to be very heavily constructed throughout, with the working parts well guarded.

The headstock is driven by a wide belt on a three-step cone pulley. Each step of the cone is large in diameter, so that a powerful drive of comparatively high speed can be obtained. The large lever shown in front of the headstock operates the clutch for starting and stopping, thus giving easy and rapid control. The headstock can be furnished without back gears, with single back gears, or with double back gears. Four feeds are provided for the carriage through the quick-change gear box. The heavy toolpost is mounted directly on the cross-slide, no swiveling slide being used. Provision is made to furnish a continuous flow of cutting compound to the point of the tool.

Canedy-Otto Universal Burning-in Machine

The illustration shows the Universal burning-in and running-in machine recently placed on the market by the Canedy-Otto Manufacturing Co., Chicago Heights, Ill., for use on automotive engine bearings. It is stated that the machine can be used for any type of motor. Only one attachment is required, it being used for valve-



CANEDY-OTTO UNIVERSAL BURNING-IN MACHINE

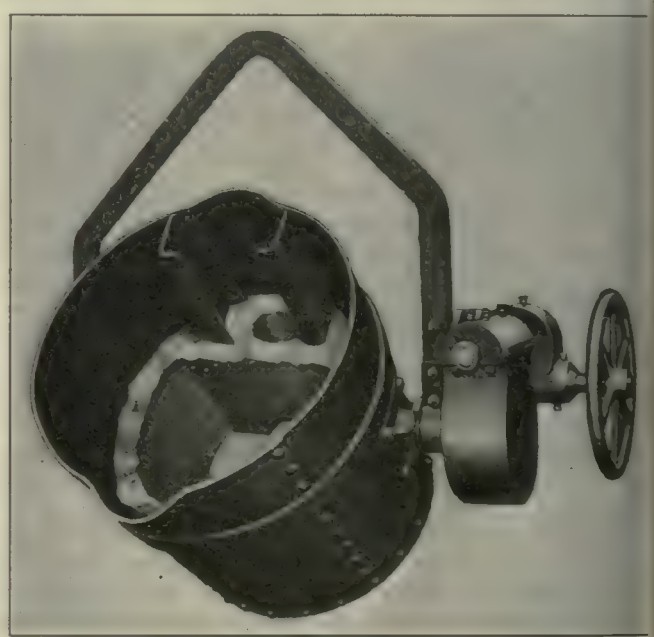
in-the-head, V-type motors. It can be quickly attache and is furnished as part of the regular equipment. Thi attachment is used also for motors which do not hav detachable heads.

The machine is said to be both simple and flexible The table is raised and lowered by means of a singl control. It is grooved and allows the motor clamps t be adjusted to the size of the motor. The center of th table serves as a sump or crankcase for the motor, a that the crankshaft splashes in oil, the action bein similar to that of a motor in operation.

The clutch is of a heavy toggle type, driving throug a silent chain. It is said that the operation is so noise less that the operator can test the timing of the moto or detect noises after the bearings have been run i The machine requires a floor length of only 90 in. ove all, the base measurement being 79 in. Twenty hors power is said to be sufficient to run the machine to it capacity under the most severe conditions and with th largest of motors. A single lever controls the raisin and lowering of the table, a lock being provided to hol the table in place.

Whiting Teapot-Spout Crane Ladle

A crane ladle, made by the Whiting Corporatio Harvey, Ill., and having a teapot style of spout insid the bowl to assist in pouring, is shown in the accom



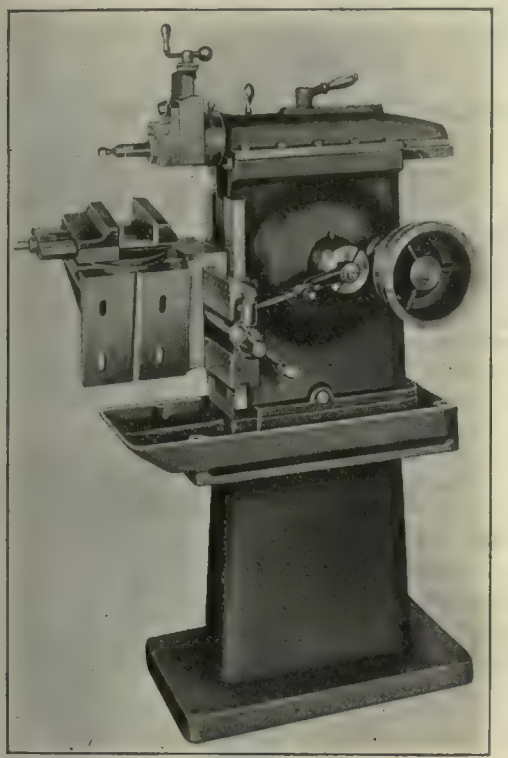
WHITING TEAPOT-SPOUT CRANE LADLE

panying illustration. The spout is formed by the gan ister lining, being reinforced by two channels. It i stated that, because of the good balance obtained, th trunnions can be placed nearer the center line of th bowl, thus insuring easier handling while pouring; an that the bowl of the ladle, being of one-piece rivete construction, has little tendency to warp out of shap from usage.

Since the metal being poured is taken from the botto of the bowl, the ladle is self-skimming. The ladle ma be used with either brick or ganister lining, the latte being somewhat easier to form. It is manufactured i twelve standard sizes, having capacities from 700 t 10,500 lb. of steel.

Pletz 9-In. Shaper

Carl Pletz & Sons, 3116 Spring Grove Ave., Cincinnati, Ohio, has recently placed on the market the small shaper shown in the illustration. The machine



PLETZ 9-IN. SHAPER

Specifications: Length of stroke, 9½ in. Strokes per minute, 25 to 100. Feed of table: cross, 10⅛ in.; vertical, 10 in. Vertical feed of toolhead, 3 in. Table surface: top, 8 x 8 in.; side, 8 x 8⅛ in. Maximum distance: bottom of ram to table, 10⅛ in.; bottom of ram to top of vise, 7 in. Ram bearing: width, 5 in.; length in column, 14 in. Vise: size of jaws, 1½ x 6 in.; maximum opening, 4¼ in. Cone-pulley diameters, 3¾, 4⅞ and 6⅛ in. Gear ratio, 6¾ to 1. Countershaft speed, 280 r.p.m. Floor space, 26 x 30 in. Bench type: net weight, 535 lb.; weight boxed for export, 635 lb.; export box, 13⅛ cu.ft. With pedestal: net weight, 735 lb.; weight boxed for export, 850 lb.; export box, 20 cu.ft.

can take cuts up to 9 in. in length, and is intended to handle small shaper work in the toolroom, die shop and experimental shop. It is stated that, due to its sturdy construction, the machine can be used as a manufacturing tool, and can handle with more speed and less power consumption much of the work ordinarily done on 14- and 16-in. shapers. It is particularly adapted to small keyseating work.

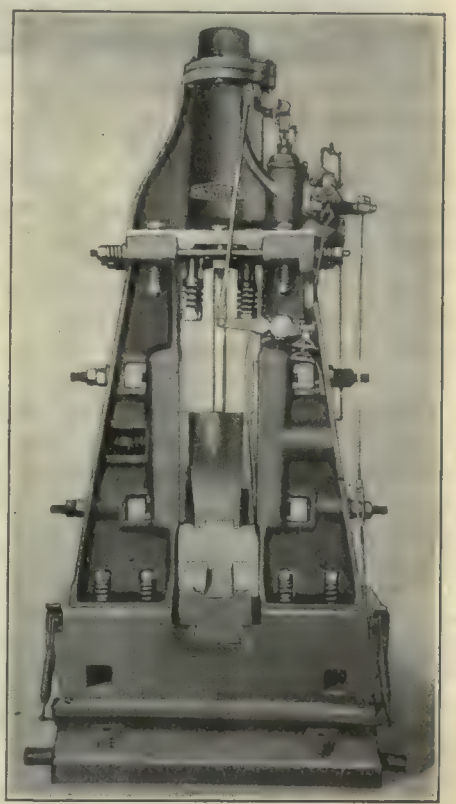
The ram is heavily constructed, with large bearing surfaces. It can be easily set to any length of stroke within its range, the graduated scale on the rocker arm indicating the length. The bearings are fitted with felt oilers to insure constant lubrication. The column is of heavy construction and is flanged at the bottom, where it bolts on the base. The ram is fitted with a taper gib, adjustable for wear.

The cross-rail slides on a wide bearing on the column, being gibbed to it, with provision to take up wear. The swivel table is of box section and secured to the saddle with four bolts. It can be swiveled on a horizontal axis to any angle, being graduated in degrees. A dowel pin locates the table at zero. The vise is provided with hardened steel jaws, and it can be swiveled to any angle, the base being graduated. The automatic feed operates in either direction and can be varied to suit the requirements of the job.

The drive is by a three-step cone pulley, which runs on a sleeve, thus taking the pull of the belt off the pinion shaft. The main bearing is bronze-bushed and provided with an oil reservoir. The standard equipment includes a universal table, two wrenches and the countershaft. The shaper can be furnished either without the pedestal for bench use, or mounted on it, as shown.

Massillon Quick-Acting Steam Drop-Hammer

A line of quick-acting steam drop-hammers of small sizes has been developed by the Massillon Foundry and Machine Co., Massillon, Ohio, for use on light work. These hammers are built in sizes of 400, 600 and 800 lb. capacity, but other sizes can be built to meet special requirements. The hammers can be operated by compressed air in place of steam, if so desired. The housings and base are steel castings and the cylinder is a semi-steel casting. The company has incorporated in these small hammers its design of adjustment for the ram guides that was originally brought out on hammers of larger size, to permit of the ready removal of damaged push-bolts. The guide adjusting screws are threaded through nuts set in open pockets in the side housings.



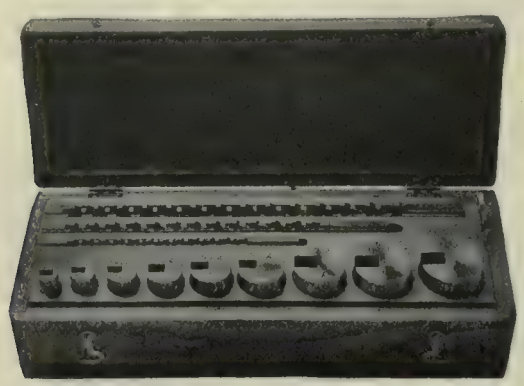
MASSILLON QUICK-ACTING STEAM DROP-HAMMER

Velco "Broach-Well" Keyway Set

The Velco Manufacturing Co., Inc., Greenfield, Mass., has placed on the market a set of broaches for cutting keyways in bores, the tools being particularly adapted to the use of repairmen, millwrights, garages, and shops where keyways are cut but where the nature of the work does not require a broaching machine. The outfit, shown in the illustration, is known as the "Broach-Well" keyway set, the tools being grouped in convenient sizes and used in connection with an ordinary arbor press. It will cut a wide range of standard keyways; and by the use of special broaches, keyways of special shape, such as dove-tail and half-round, may be cut.

The tools are rugged in design and the method of operation is simple. A tool-steel broach or cutter, of the staggered-tooth type, described on page 199 of the *American Machinist*, is guided in a bushing fitted to the bore in which the keyway is to be made. The key-

way is cut by placing the work containing the bushing beneath the ram of an arbor press, and pressing the broach through the work in exactly the same manner



VELCO "BROACH-WELL" KEYWAY SET

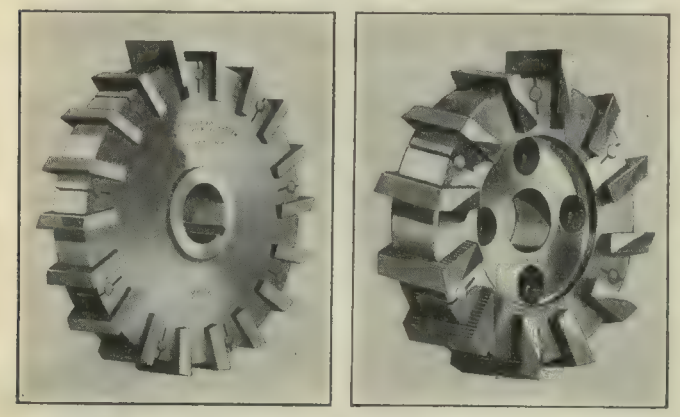
that an arbor would be removed. The entire operation requires less than one minute, it is said, and the keyway thus produced is accurate and has a smooth finish. Should more than one keyway be required in a single piece, it is only necessary to turn the piece on the bushing to the required angle and repeat the operation.

The set is packed in a hard-wood case, measuring 13 x 5 x 3½ in. and weighing only a few pounds, so that it can be easily carried where needed.

Cleveland Inserted-Tooth Milling Cutters

The illustration shows milling cutters of an inserted-tooth type recently placed on the market by the Cleveland Cutter and Reamer Co., 1619 Merwin Ave., Cleveland, Ohio. The cutter at the left is for side milling and the one at the right for face milling. The body of the cutter is made of machine steel, and blades of either carbon or high-speed steel can be furnished. The blades have corrugations on their backs, the corrugations fitting into corresponding grooves in the slots of the cutter body. The blades are clamped in position by means of wedges driven into slits between alternate blades.

In order to preserve the diameter of the cutter, the blades can be moved outward as they become worn, the size of the smallest step being the pitch of the grooves. It is stated that the blades are solidly held, that no



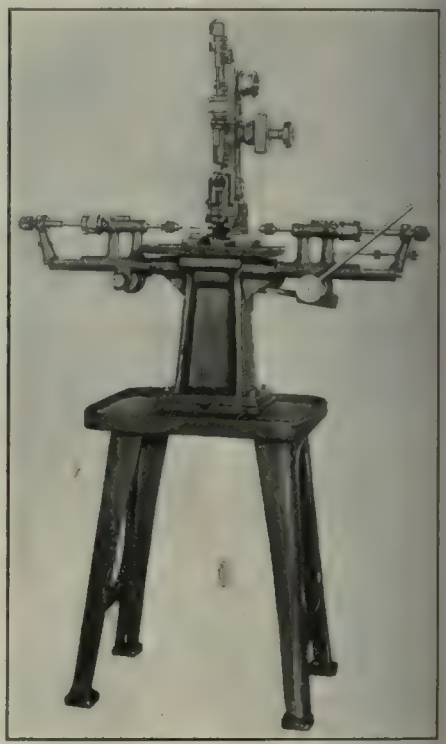
CLEVELAND INSERTED-TOOTH MILLING CUTTERS

packing is required underneath them, and that they can be moved out very far, thus prolonging their life. The corrugations prevent slipping and tilting of the blades, which are interchangeable.

The side milling cutters are made in diameters from 6 to 12 in., being 2 in. in width and having either 1¼- or 1½-in. holes. The face milling cutters are made in a width of 2¼ in., and with diameters from 5½ to 9½ in. They can be provided with taper or threaded holes, to be used on an arbor or fitted directly to the nose of the milling machine spindle. Cutters of special size and shape can be furnished, to suit special requirements.

Langelier Three-Spindle Drilling Machine

The Langelier Manufacturing Co., Arlington, Cranston, R. I., recently built the three-spindle drilling machine of the type shown in the illustration. The machine is intended for the drilling simultaneously of three ⅜-in. vent holes in the cover of a storage battery. There are two horizontal spindles and one upright spindle, the latter being inclined to the rear at an angle of 8 deg. with the vertical. Different sizes of battery covers can be handled by the same machine, the output being stated as five covers per minute. The drills are held in chucks fastened to the spindles. The two horizontal spindles are driven at a speed of 3,200 r.p.m. by separate belts from the overhead countershaft. The vertical spindle is driven in the same manner at 2,900 r.p.m., the belt passing over the two idler pulleys at the top of the column. The feed of the drills is operated by hand, the movements being so connected that only one lever is necesary to cause the motion of the spindles. The slides holding the two horizontal spindles are moved by means of rack-and-pinion mechanisms, the two pinions being connected by means of a tilted rack, which engages the top of one pinion and the bottom of the other. In this way, both spindles move inward and outward simultaneously.



LANGELIER THREE-SPINDLE DRILLING MACHINE

By means of another pinion engaging the tilted rack, the vertical rack at the side of the column can be moved, its movement then being imparted to the slide carrying the upright spindle. Thus the three movements are so connected that they operate simultaneously, the motion being inward for all spindles at the same time. The feed-operating lever can be placed on either one of the pinion shafts.

The machine is mounted upon a stand, which provides a shelf for the holding of work. The work is secured in position for drilling by means of a special clamping arrangement. A small table underneath the work serves for catching the chips.



Graphical Determination of the Relation Between English and Metric Screw Thread Pitches

By H. W. Bearce

The fineness or coarseness of an English screw-thread is ordinarily expressed in terms of the number of threads per inch; while in the case of metric threads

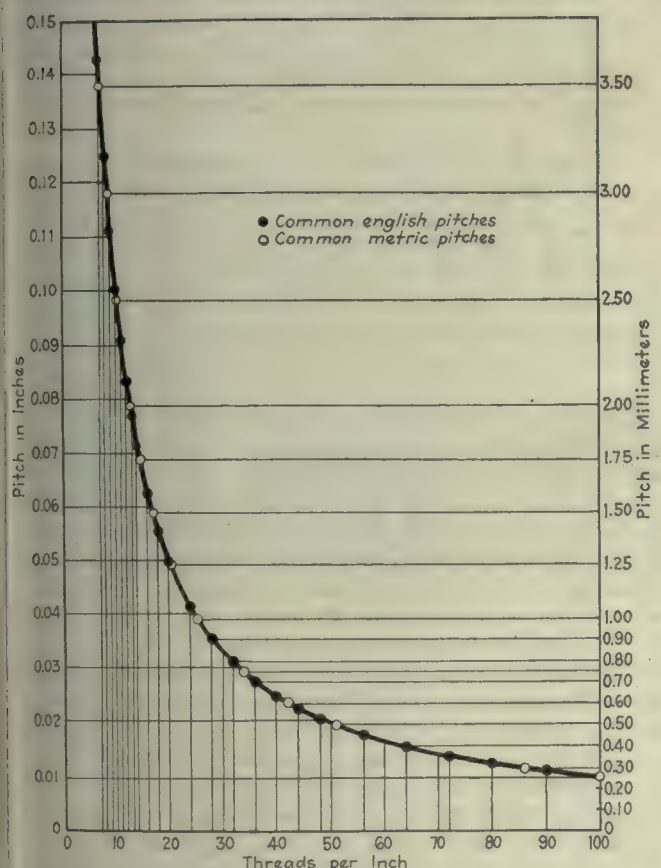


CHART SHOWING RELATION BETWEEN ENGLISH AND METRIC PITCHES

the same thing is ordinarily expressed in terms of the length or thickness of a single thread, that is, in terms of the pitch.

On account of this difference in practice, in order to determine the nearest equivalent metric pitch corresponding to a given English pitch, or vice versa, it is necessary to go through a certain mental transformation in addition to that of changing from inches to millimeters, or millimeters to inches.

In the accompanying chart a simple method has been devised for making this transformation graphically.

Suppose it is desired to find the metric pitch most nearly corresponding to 32 threads per inch. First, look along the horizontal line at the bottom of the chart until 32 per inch is located; then go up vertically to the point where this line cuts the curve, and then horizontally to the right-hand margin of the chart. The point where this horizontal line cuts the vertical line will be the pitch in millimeters.

Again, suppose it is desired to find the threads per inch most nearly corresponding to a 2-mm. pitch. Look along the vertical line of metric pitches until 2 mm. is located; then go horizontally across the chart to the point where this line cuts the curve, and then vertically downward to the line showing threads per inch. The point of intersection will be the threads per inch corresponding to a pitch of 2 millimeters.

Again, if it is desired to find the pitch in inches corresponding to a given pitch in millimeters, or vice versa, it is only necessary to go horizontally across the chart from the one to the other.

Using Taper Pins for Repairs

By E. A. Dixie

I recently overhauled an upright gas engine which was located in the country, far from any machine shop. There wasn't anything much the matter with it except that it had been running for a long time and links and levers of the spark mechanism had worn badly. Not so badly that the engine would not work, but bad enough to make a noise and cause me to wish to take the shakes and jumps out of it. The engine is used for pumping and as water may be required at any time it would have been poor practice to send it to a repair shop, so I decided to do the work with hand tools in such a way that at any time during the repair period the engine could be operated within a few minutes of notice that water was wanted.

The valve and spark motions of the engine are very simple, being nothing more nor less than a few little levers and links which are pivoted on straight cylindrical pins each having a head on one end and a cotter pin through the other.

It was in the joints that all the slackness had developed. The pins had worn oval, and the holes in which they were located had also worn the same shape. While the individual wear in no hole was more

than about $\frac{1}{64}$ in. the accumulated wear in all the pins and all the holes amounted to quite a lot.

To have put in new cylindrical pins of larger size would have meant having them made specially. It would also have meant drilling and reaming the holes in the levers and links to some bastard size, which of course would have required the use of one or more special reamers. The job was not worth all the fuss

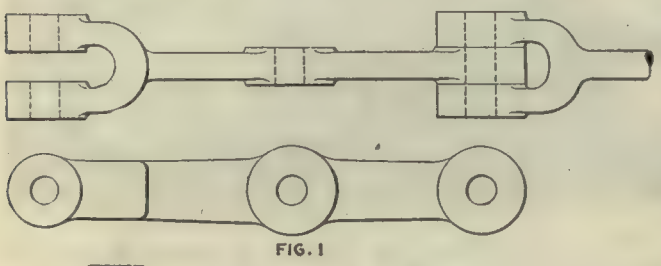


FIG. 1

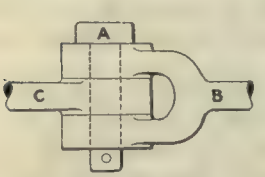


FIG. 2



FIG. 3

FIG. 1. LINK AND YOKE. FIG. 2. FORMER CONSTRUCTION FIG. 3. REPAIR WITH TAPER PIN

that this would entail so I set about the work with standard tools and supplies which can be bought at any tool supply house. I refer to ordinary standard taper pins and reamers.

On going over the work and measuring the worn holes I found that No. 8 and No. 9 taper pin reamers would be all right to clean and round up the holes once more. As we have a complete set of taper pin reamers in the shop I borrowed these two and took them home with me at the end of the week as this was a Saturday job. I also bought half a dozen of the longest pins I could find to suit the reamers and took a hacksaw and frame to cut the pins off when they had been properly fitted.

Taking one joint at a time I removed the cylindrical pin and inserted the reamer using a carpenter's brace to turn it. As soon as a partial bearing had been reamed for the pin the reamer was withdrawn and a taper pin inserted but not driven tight. The engine was then started to see whether it would function properly. If it did, the hole was reamed until it cleaned up all over.

There were several joints similar to the yoke and link shown in the illustration. The old method of construction was to have the straight pin *A* a working fit in all the holes; that is to say in both holes in the yoke *B* and also in the hole in the link *C*. This is poor practice because practically all the wear took place on the short hole in the link *C* and comparatively little in the two sides of the yolk *B* because the area of the holes in the yoke was about twice that of the hole in the link.

After reaming the two parts together the link was removed and the reamer passed into the yoke and a very little more reamed out of the holes. The yoke and link were again assembled and the taper pin inserted and the engine again started to see whether it would function properly. As it functioned properly, the pin was driven firmly to a seat in the link *C*. Owing to the fact that the holes in the yoke had been reamed larger, the pin was a working fit in them and any further wear must fall on the two long bearings in the yoke and not in the link *C*, as the pin is a drive fit in its hole.

In this way all the fulcrum pins were fitted. The whole job took about two hours and the cost for taper pins was less than 50 cents.

There are an endless number of machine parts similar in construction to those shown which today are assembled as shown in Fig. 2. Not only would the construction shown in Fig. 3 be much easier but more satisfactory in every way and should repairs become necessary they could be more easily accomplished. By the use of taper pins any degree of tightness or slackness can be obtained in the joints.

Formula for Finding the Deflection of Rubber Stripper Pads

By J. B. Conway

On page 190 of "Practical Die Making," by Colvin, is an article descriptive of the use of rubber pads for strippers in punch-press work; and on the succeeding page is a chart intended to show the amount of deflection of the rubber pad under a given load or weight. The chart is constructed with the deflection in inches laid off on the vertical axis and the corresponding load in pounds on the horizontal axis, the diagonal line through the chart representing the other factor of the equation.

An analysis of the chart is interesting, as a formula can be evolved from it, whereby the results can be obtained, as well as from the chart. The diagonal line slopes upward from zero, which is at the lower left-hand corner of the chart, and makes an angle of approximately 30 deg. with the horizontal. The uniformity of the line indicates that this factor of the equation is a constant, either for multiplying or dividing.

With this to start, let us take the example given on page 190, where it is required to find the load that will deflect a pad of rubber 0.250 in. The result from the chart equals 340 lb. Dividing the deflection in inches by the load in pounds, we obtain a constant which in this case is 0.000735. Now, if the load in question is multiplied by this constant, of course we obtain the corresponding deflection in inches. Similarly, if the load in pounds be divided by the deflection in inches, we obtain another constant, which for the above example is 1,360. Taking, for example, a load of 200 lb., required to find the deflection in inches, we obtain, by multiplying 200×0.000735, 0.147 in., which corresponds to that value shown on the chart.

Putting these factors into the form of an equation, we have the following, when P = pounds pressure; C = compression or deflection in inches; and M = 0.000735 and D = 1,360

$$C = P \times 0.000735, \text{ or } C = \frac{P}{1{,}360},$$

or $C = PM$ and $C = \frac{P}{D}$.

Similarly,

$$P = CD, \text{ or } P = \frac{C}{M}.$$

By the above formulas, results checking closely with those obtained from the chart can be arrived at, when the chart is not conveniently at hand.

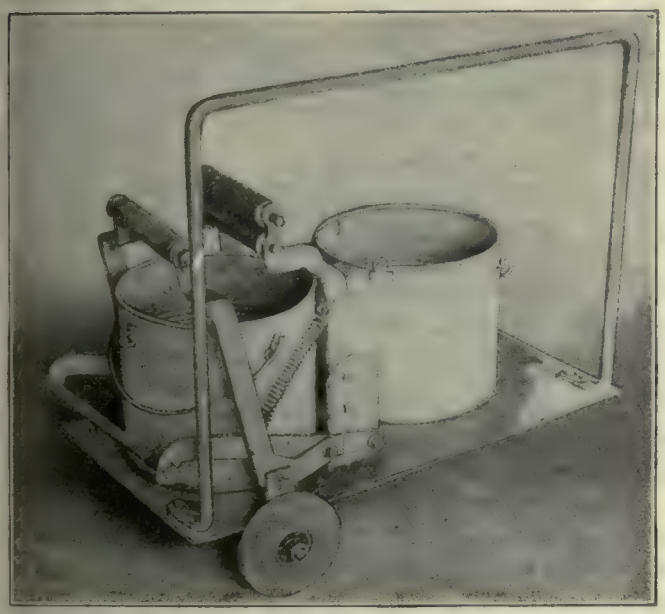
It might be well to state here, that the results on the chart are based upon extensive experiments with a trimming and embossing die, where it became necessary to emboss before trimming, with the result that the rubber pad and stripper pins had to withstand the resistance of embossing. Naturally, the results are liable to variation with different rubbers, in which the resiliency varies. The chart, however, indicates that the variation found due to the load applied is directly proportional to the load.

Using the Mop and Pail on a Toolroom Floor

By J. H. Vincent

Toolmakers usually keep their quarters in a neater condition than the rest of the shop, and this is generally looked upon as having a good moral effect on the quality of the work produced. The toolroom of the Decatur locomotive shop of the Wabash Railway is no laggard in respect to neatness, even the floor attests that fact. Regularly, every day or two, it is mopped up with hot water and soda to remove all accumulations of grease and grime.

The truck shown in the illustration has been made to provide a convenient means for transporting the



A MOPPING OUTFIT USED IN A RAILROAD TOOLROOM

pails, mop, wringer and accessories. Its floor is a thin steel plate; to this the rear axle is riveted and a single wheel in front (at the right end of the truck) is mounted on a swiveled trunnion. The handle for pushing the truck extends along one side and thus can act as a support for brush and mop handles. The wheels have ball bearings that were salvaged from old locomotive headlight generators. The mop wringer is similar to many of the commercial variety now found almost everywhere on the market, although this particular one was built in the shop.

Precision Gages

By Earle Buckingham

In the article by H. W. Bearce under the above title on page 66 of the *American Machinist*, there appears to be a typographical error in the list of sizes suggested for a 31-block set. Apparently the first item in the second line should be 0.050 instead of 0.50, as printed.

The usual 81-block set gives all sizes from 0.20 up by 0.0001. The original 34-block set gives a range from 0.20 to 0.30 by 0.001, and by quarter-thousandths above 0.30. The quarter-thousandth unit is not in very common use in our shops. Another 34-block set which has been on the market for more than a year gives a range from 0.20 to 0.30 by 0.001 and from 0.30 up by 0.0001. This set is made up as follows: 0.1001 to 0.1009 by 0.0001; 0.101 to 0.109 by 0.001; 0.110 to 0.190 by 0.01; 0.100; 0.200; 0.300; 0.500; 1; 2 and 4.

This follows the decimal system, and seems more logical and practical than the set of the same number of blocks giving sizes by quarter-thousandths.

Referring now to the 31-block set suggested by Mr. Bearce, a change in the sizes of four blocks would increase the working range of the set without changing its cost. Substituting sizes 0.060, 0.070, 0.080 and 0.090 for the sizes 0.11, 0.12, 0.13 and 0.15 we should have a set of 31 blocks which would give all sizes from 0.1 to 0.150 by 0.001 and from 0.150 up by 0.0001, whereas the set as suggested by him does not fully cover the range from 0.110 to 0.20.

If there were no unusual difficulty in securing and maintaining flatness in blocks much thinner than 0.1, the 31-block set, as amended, would have advantages. From the manufacturing point of view, however, the thin blocks are found more difficult, and their price is correspondingly higher. In use they do not hold their flatness as well as thicker blocks.

The wave length of monochromatic light is not a matter of much concern where the optical method is used only for determining flatness and for comparing blocks with masters where the difference in length is very small. The "optical flat" with almost any light is a simple method of determining the flatness of a polished surface. For comparing gage blocks with known masters the mechanical comparator developed by the National Physical Laboratories (England), and already in use in this country, is found convenient, measuring almost instantly, on an open scale, variations in length of a very few millionths, depending upon the care taken regarding temperature, cleanliness, etc.

Finishing Edge Cams

By J. W. Stewart

A recent article on cam cutting reminded me of a method I used some time ago to finish some edge cams. I removed the swing arm from a Yankee drill grinding machine and put a table in its place. Next I mounted the master cam and the rough cam blank on a shaft, placing a collar between them. The table had a projecting stop, the edge of which was set in line with the face of the abrasive wheel. The alignment is obtained by shifting the table back or forth on the swing arm support. The master cam is then kept in contact with the stop and moved around its periphery, the wheel thus grinding and reproducing the contour on the blank.

In twenty minutes I have ground cams with a ⅝-in. face and a periphery of 15 to 20 in., and after grinding 200 cams the emery wheel would show very little wear. In refinishing worn cams the table can be moved toward the wheel far enough to grind out the worn spots. The resulting cam will be somewhat smaller but will have the same relative throw, which is generally all that is required.

IN THIS ISSUE

THIS issue is the fourth, out of the last six, leading off with a description of tools recently developed. The present article describes the Cadillac vertical lathe, a machine intended for single-purpose work and designed for the use of two carriages, semi-automatic operation and limited floor space.

We continue with our drive for improved management. We feel that this week we are making a valuable and what will prove to be a welcome addition to the management articles previously published. It is by Basset and carries the very expressive title "Getting Executive Leadership." Mr. Basset probably has in times past led many to believe that he is irrevocably pledged to system and lots of it. We think that this article will show that his fondness for system does not extend beyond a commendable amount and that it is tempered with good judgment. He tells this week of the dangers of over-organization, the desirability of free play for initiative, one-man and committee forms of control and the possibility of advantages in competitive decentralization. Witness the following quotation: "An organization is nothing of itself. When one speaks of the automatic, smooth-running machinery of Big Business, one is talking nonsense. The wheels do not go around of themselves; they must be propelled by leadership. There is more danger, we are just beginning to realize, from over-organization than from under-organization, because the former discourages leadership. George Eastman said not long since that one of his greatest fears was over-organization. He was afraid that, unwittingly, his large affairs might become so scientifically arranged that each man would find himself bound hand and foot with the red tape of an inflexible routine." Page 492.

We have let Sheldon in this week for more than we intended, but the job of splitting his very good six-page article on the Walker magnetic chuck was too much for us. We are certainly given in this installment, beginning on page 497, a good opportunity to acquaint ourselves with the components of the Walker chuck and the methods of winding and waterproofing. The origin and principle of the Walker demagnetizer also are taken up and detailed to some extent.

Coming Features

Next week's issue will be given over in large part to series articles or articles that tie up with some that have gone before. There will be Colvin's sixth on the foreman and his job, De Leeuw's seventh on metal cutting tools, Sheldon's second on the use of special fixtures in grinding, and Schell's third on industrial management.

Colvin dwells upon the value of individuality and the importance of being able to think. De Leeuw enters into a general consideration of milling cutters. Sheldon explains fixtures for holding gears and other parts while grinding. Schell gives his ideas on the trend of industrial management.

There will be several complete articles, among them a railroad article by Hunter on trepanning tools for locomotive main and side rod forgings, and an automotive article by Colvin on methods used by transmission specialists.

The article by Associate Editor Hand, that we promised last week, begins on page 503. It tells how gears for tractor use were cut at one pass, without including the usual roughing out. The cutters that were designed for the job and various methods of holding are illustrated. A very good feature is that there are figures on the production attained.

An apprentice series such as Morris' would not be complete without a description of the training departments of the Goodyear Tire and Rubber Co., Akron Ohio. You will find the beginning of the article on page 505. It is boiled down to three pages that are of necessity confined almost entirely to bare statements. The Goodyear flying squadron, engineering squadrons, apprentice department, the industrial university and the work of Americanization are explained in this brief story.

The conclusion of the sixth part of "Metal Cutting Tools" begins on page 508. You will remember that this part deals with the construction and use of the boring head, multiple boring and taper boring tools and reamers.

There is another railroad article by Stanley, page 511, this time on improvement in methods of handling shop material. It includes some simple and worth-while pointers.

The Federated American Engineering Societies has made a start on a big job—which is nothing less than finding out the causes for and the extent of waste in industry and the suggestion of corrective means. The job was proposed and the Committee on the Elimination of Waste in Industry was formed by Herbert Hoover, the president of the F. A. E. S. L. W. Wallace, executive secretary, who is now in active charge, has set forth the purpose and plan of work of the committee. His statement appears on page 513.

Last week we called attention to the large "Shop Equipment News" section and reminded you that it had been equally large the previous week. Our expectations were to run nine pages this week, but we had to do better than that to get everything in—so we have thirteen. The section begins in its usual position, page 524, and is continued from 532 to 515.

On page 533 we have Hoover's outline of the scope of work to be done by the Commerce Department.

EDITORIALS

Going After Industrial Waste

THE engineers of the country have declared war on industrial waste. Although keenly conscious for many years of the inroads made on American industry by inefficiency exemplified in wastefulness, they have been compelled to suffer in silence through lack of an organization to make their voice heard.

A brighter outlook is ahead, however. The first big job of the Federated American Engineering Societies is a survey of industrial waste. It is now under way and the early returns should be in within a very few weeks. On another page we have the plan of attack as outlined by L. W. Wallace, the executive secretary of the American Engineering Council.

The engineers may have no more success in their attempts to eliminate unemployment, smooth out seasonal variations in industry and generally increase our national efficiency than have other organizations with equally good intentions. But at least they are going at it in an engineering way and if they do not uncover some startling figures we shall be greatly surprised.

There is one factor that will have much to do with their success. Their president, Herbert Hoover, is also Secretary of Commerce in Mr. Harding's cabinet and his recently issued statement of the scope of the work to be done by his department emphasizes the importance he attaches to waste elimination. The full statement is in our News Section.

Mr. Hoover has a habit of finishing what he starts out to do. With the united engineers of the country and the organized power of a national department co-operating under his direction to banish one of the worst of our national evils, results should follow speedily.

Improved Machinery Helps Make Liquid Assets

IT IS probable that most manufacturers of machinery have decided not to buy any new machinery until the demand for their products utilizes all their present equipment. This on the face of it, might seem like the sane and logical course of action.

But there is another side to the question and one which does not seem to be generally considered. It is the time element in the turning over of the capital invested in the business.

The progressive retail dealer in products of various kinds realizes this element fully. He frequently sells out his stock, or a portion of it at cost or at a loss, to make way for goods on which he will make a profit. If he can turn his capital over several times a year, he not only ties up less capital but can sell on a closer margin.

If the equipment in a shop requires two weeks to put through a lot of five hundred motors, the investment in those motors is tied up for that time, plus the time taken to secure payment. Improved machine equipment which will enable the five hundred motors to be turned out in one week, would reduce the capital investment one-half, even if it saved nothing in labor and overhead.

When castings today become bills receivable tomorrow you have a business which is flexible, easily handled financially and free from the enforced speculation of long-time manufacture that opens the door for cancellation of orders.

The time element of production must be considered from the viewpoint of interest on invested capital and the desirability of having capital liquid and frequently available, as well as from the angle of labor cost on the particular piece.

This is a phase of the problem of new and improved equipment which does not always receive the attention it deserves. It adds to the prestige of the company to be able to turn out orders promptly, the banks prefer customers who turn their money over quickly, and the question of preventing cancellations is at times of great importance. It should be carefully considered before deciding not to invest in new and better equipment until the older machines are filled with work.

Repairs and Repair Parts

FROM several sources comes the news that the small shops are busy even in places where the big ones are not. What are they doing? It seems reasonable to suppose that they are doing what the small shop has always excelled in—repair jobs.

It is cheering to know that they at least have plenty to do, but there is a suggestion in their activity. If you have not already attended to all the repair work on your equipment necessary to put it in the pink of condition, now is the time to do it. Order the repair parts you need and keep your men busy installing them. It will provide useful and necessary work for your own good mechanics and help others by keeping their shops running on the production of spares.

Don't forget that when business picks up, as it is beginning to do, you will need to have your equipment ready for minimum-cost production if you expect to get your share of the business.

Another Bright Spot

WHEN you can ship two big boring mills on the same flat car during the "worst depression since '93," you begin to wonder if things really are as bad as they are painted. Yet that is exactly what happened one day two or three weeks ago in what somebody has called "the gloom center of the machine tool business."

And the next day they got a telegraphic order for another big machine of a different type. When people order by telegraph these days they want action, and when they want action as badly as all that they must be expecting to do business in the immediate future.

All of which goes to show that there are orders to be taken and work to be done. Clean house and keep scratching! Mixed metaphor, perhaps, but a pretty good motto, nevertheless.

SHOP EQUIPMENT NEWS

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and equipment

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs and equipment

Cleveland Semi-Automatic Spacing Table

A semi-automatic spacing table with many features worthy of examination is made by the Cleveland Punch and Shear Works Co., Cleveland, Ohio. It is stated that the design reduces the number of movable parts required and simplifies the operation. The table can be applied to either vertical open-gap punches or multiple punches, and it can be used for plates, angles, beams, girders, channels or other structural shapes, and has a capacity up to and including 24-in. beams.

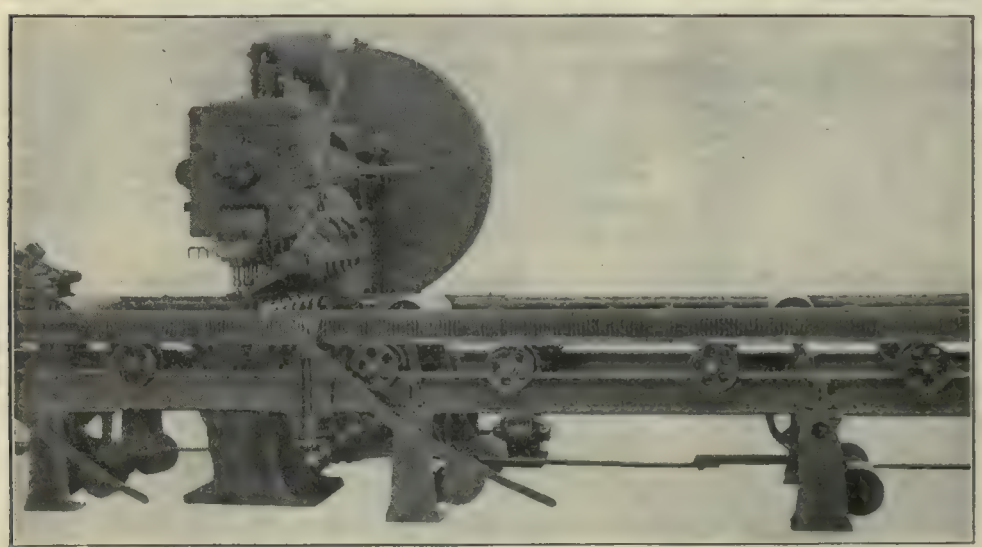


FIG. 1. CLEVELAND SEMI-AUTOMATIC SPACING TABLE

The machine, illustrated in Fig. 1, has a runway 100 ft. long and a table that will handle pieces up to 50 ft. long. Both these parts can be furnished in lengths to suit the requirements, and provision is made for adding sections to both the table and runway. Additional runway units require only foundations, and can be bolted in place. The table moves on rollers and is propelled by a rack and pinion on each side. A casting provided at each end of the table for tying together the two sides, is provided with clamps, as shown in Fig. 2, for gripping various styles of material. The clamps permit punched material to be released and the table returned for reloading before removing the punched piece, so that loading and unloading can be conducted at the same time. The table is constructed so that the pieces can be fed from either side. The strippers and gags can be placed on either side of the machine.

The rollers for supporting the work are counterbalanced by weights and are raised and lowered by a rack and gear segment that shows underneath the runway. They have a range of adjustment of 24 in. from the top of the dies, so that material up to 24 in. in height may be handled. The rollers can be adjusted so that the material will ride clear of the dies and thus eliminate friction there. After they have been set in position the rollers can be locked at that level by a device located at the end of the runway. The jaws for locking this device are either locked or released by the lever for raising and lowering the rollers. The device has springs which act as a cushion when the punches force the stock down on the dies, closing the space by which the work ordinarily clears the dies. These springs also absorb the shock caused in loading work on the table.

Rollers are provided for setting up angles that are punched in multiple. The supporting rollers for plate work can be set high enough so that the plates will clear the table; and then plates equal in width to the throat depth of the machine may be punched. Under this condition it is necessary to unload before the table can be run back for a new load.

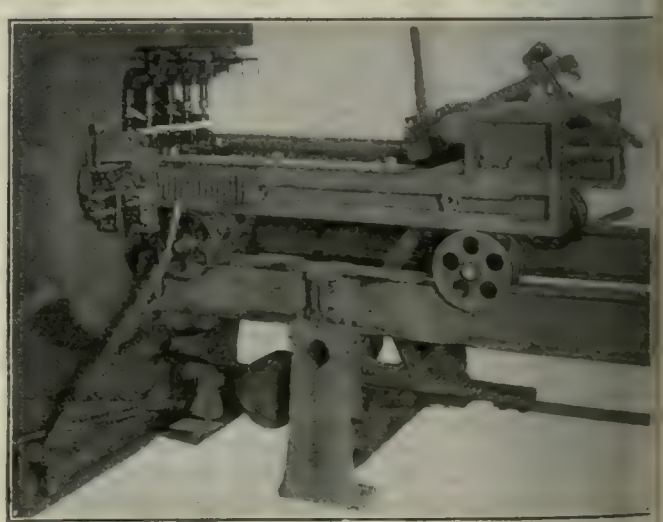


FIG. 2. CONTROL SIDE FOR OPERATING SPACING TABLE

Adjustable roller guides, shown in Fig. 1, are provided close to the die sockets so as to gage angles as they pass under the punches.

The table is propelled along the runway by a push-button controlled motor that drives through double friction clutches. The correct pitch or spacing of holes is obtained by either a notched bar or by adjustable stops. When feeding the material through the machine, the large friction clutch lever, see Fig. 2, is thrown forward; and the operator starts the table travel by releasing the stop pin, which starts the motor. The pin rides along the notched bar on top of the table until it falls into another notch and depresses a control button, thus stopping the motor. The table travel is stopped by dynamically braking with the motor. When necessary, the table may be moved to points between the regular stops by another control button on the motor-starting mechanism. At the end of a piece, the friction clutch is reversed and the table can be run back at high speed. The table speed for feeding the work is 10 ft. per minute, and the quick-return speed is 35 ft. per minute.

Melling Cam-Turning Lathe

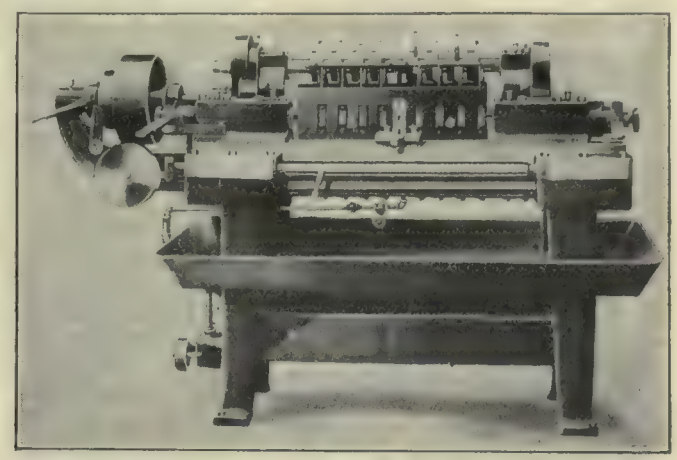
The Walcott Lathe Co., Jackson, Mich., has recently placed on the market the Melling cam-turning lathe, so named from Herman Melling, designer of the tool. The machine, a front view of which is shown in the illustration, is intended for the turning of the cams on automotive-engine camshafts, so as to eliminate the process of rough grinding from the forging.

The machine consists essentially of a flat bed on which is placed all of the mechanism for turning the shafts. A chip pan is placed underneath the bed, while below it is the tank for holding cutting compound. Both the bed and the pan are supported by legs of heavy construction. A "master cam" shaft is used, being placed at the back of the machine at the same height as the shaft to be turned. It is stated that the master cams are exactly reproduced, all of the cams on the rough shaft being turned at the same time.

The camshaft to be turned is placed near the front of the machine, being driven by collet chucks on both ends, and a steadyrest on the center bearing preventing the shaft from springing away from the cutting tools. A cutting tool is provided for each cam, it being given a reciprocating motion by means of the lobe of the master cam, so that it reproduces the shape of the master. Of course, the two shafts revolve at the same speed. In order that the clearance and the top rake of the tool will remain the same while cutting at different parts of the lobe, the tool is tilted by means of a bell-crank lever while turning the eccentric parts of the cam. The long end of this lever carries a roller engaging the tool-control cam on the topmost shaft of the machine. The outline of each cam is dependent on the shape of the corresponding cam on the master camshaft.

Springs press the cutting tools against the work, while the cams themselves draw the cutting edges away from the work, so that "hogging in" is not apt to occur. The toolholders are mounted in individual brackets or heads, in order that they may be independently spaced in relation to the cams to be turned.

While the cams are being turned, the work table moves the camshaft in a direction parallel to its axis, so as to feed the tools across the faces of the cams. The feed is entirely automatic, so that the machine is semi-automatic in operation. The duties of the operator are to place the camshaft in the machine, clamp it in position, and start the machine, being sure that the work table is in the rough-turning position. The manipulation of hand-levers and the making of adjustments for each camshaft are eliminated.



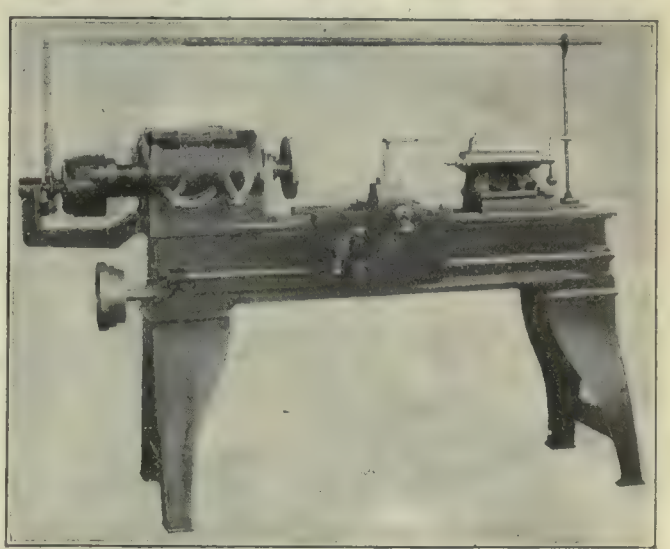
MELLING CAM-TURNING LATHE

It is stated that the time required to turn one camshaft is less than two minutes. The shaft is run at a speed of 140 to 200 revolutions per minute, the feed being about 0.008 inch per revolution. A 5-hp. motor is ordinarily used to drive the machine.

Sebastian Geared-Head Plain Lathe

The Sebastian Lathe Co., Cincinnati, Ohio, has placed on the market the plain, geared-head, production lathe shown in the illustration. The lathe is made in 13 and 15 in. swings, and is similar to the engine lathe made by the same firm and described on page 1065, Vol. 52, of the *American Machinist* The lead-screw assembly and other parts are not furnished, however.

The lathe is fitted with a plain toolrest for doing plain turning. It is furnished at the back with a friction



SEBASTIAN GEARED-HEAD PLAIN LATHE

pulley and is operated by a stick. No countershaft is needed, as the machine can be connected up direct with the line shaft. A 3-in. belt is used.

It is stated that the lathe has taken a cut $\frac{5}{8}$ in. deep in steel, reducing the diameter $1\frac{1}{4}$ in., with a $\frac{1}{32}$-in. feed. The lathe can be furnished with either a $4\frac{1}{2}$, 5 or 6 ft. length of bed.

Chicago Steel Angle Shear

The illustration shows the Chicago shear intended for cutting steel angles, and recently placed on the market by the Dreis & Krump Manufacturing Co., 2909-23 South Halsted St., Chicago, Ill. The device is similar in principle to the slitting shear made by the same concern and described on page 392 of the *American Machinist*. The frame and base are made of one piece of pressed steel. A geared lever actuates the upper shear blade, which is reversible and has two cutting edges. An important feature is said to be the fact that the upper blade can be raised high enough to allow the angle to be inserted from the front of the machine. A hold-down is provided, to keep angles in place, the illustration showing the position of an angle while being cut.



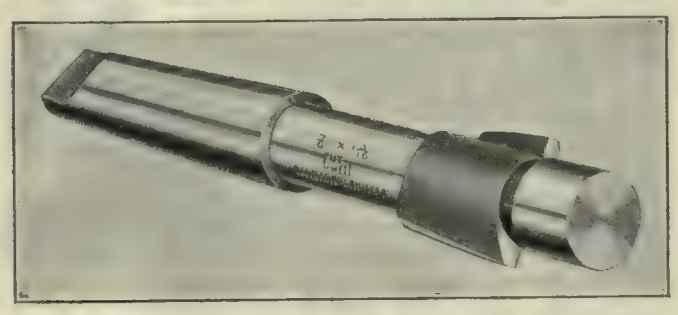
CHICAGO STEEL ANGLE SHEAR

It is stated that the steel frame, combined with the principle of the geared lever and the peculiar action of the blades, makes it possible to build the shear with only about one-third the weight of the ordinary cast-iron frame angle shear of similar capacity. The machine will be manufactured in large quantities, it is said, the parts being interchangeable between shears. The maximum capacity of the machine is for angles 1½ x 1½ x $\frac{3}{16}$ in. in size. The length of the base is 9 in., and the height of the frame is 8 in. The handle is 25 in. long, and the weight of the shear is 22 pounds.

Bickford-Switzer "Cutwell" Counterbore

The Bickford-Switzer Co., 50 Norwood St., Greenfield, Mass., has recently placed on the market the counterbore shown in the illustration. It is known as the "Cutwell" counterbore, and is intended for general counterboring and spot-facing.

The device has only two lips, placed helically on the body of the tool. It is stated that the tool makes



BICKFORD-SWITZER "CUTWELL" COUNTERBORE

chips of the same sort as cut by a drill, thus permitting of very rapid work. The space between the lips allows of easy sharpening.

The body of the cutter is solid, being circular between the lips. Different mountings, tapers and pilots can be furnished to suit the special conditions of the work. The tool is made in standard sizes; and additional sizes are made for spot-facing, the diameters being the same as the distances across the corners of hexagon capscrews. The tool is said to be adapted to the performing of counterboring on a production basis.

Bilgram Cutter-Grinding Machine

The Bilgrim Machine Works, 1217-35 Spring Garden St., Philadelphia, Pa., has added to its line a machine for grinding the prismatic cutting tools used on Bilgram bevel-gear generators. The grinding, ordinarily performed on a surface grinder, is done on the ends only of the cutting tools. The rectilinear movements of a standard surface grinder are approximated in this machine by movements of levers in circular arcs.

The grinding fixture for holding the tool is clamped in an upright position upon a table below the wheel, as can be seen in the accompanying illustration. Two levers control the movement of the table. The reciprocating movement of the work is imparted by the operator with his right hand, while the lateral feed movement is given with the left hand. The upward adjustment of the table is effected by a vertical screw operated by a handwheel in front of the machine. By means of a lever having a limited movement and provided with a pawl engaging a ratchet cut in the handwheel, an upward movement in steps of 0.004 in. is obtained. Abrasive wheels are held on each end of the spindle, one being used for grinding the gear generator tools leaving the other to be used for general purposes. Below the latter wheel is provided a sliding table on which a work rest or fixtures can be placed. Fixtures for use in grinding cylindrical milling cutters and rotary gear cutters are furnished with the machine. Fixtures for grinding angular milling cutters, side milling cutters and similar tools can be furnished.



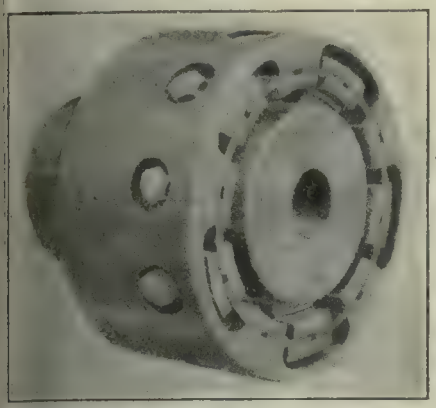
BILGRAM CUTTER-GRINDING MACHINE

Specifications:—Wheel size, 6 x ¾ in. x ¾ in. bore. Distance beteween wheels, 12¾ in. Diameter of pulley, 2¾ in. Width of driving belt, 1¼ in. Diameter of base, 16 in. Height to center of spindle, 4 ft. Approximate shipping weight, 750 lb.

A.E.G. Flexible Coupling

The flexible coupling shown in the illustration is intended for direct electric-motor drive of machine tools, pumps, elevators, and the like, and is made by the Algemeine Electrizitäts Gesellschaft, Berlin, Germany. It can be used for either continuous or reversible drive.

The coupling consists of two main parts. The bell-shaped outside part is made of one piece in the smaller sizes; but for larger sizes it is made of two parts screwed together, the cylinder of the bell forming one part, and the bottom, containing the hub, the other. The inside part has five or more oblong projections, and the outside part an equal number of shoulders on its inner surface. To each of these projections and shoulders a flat piece is bolted, thus holding strips of leather belting connecting the projections. To prevent this leather from slipping, it is secured by spring washers. To produce as much gripping as possible on the leather, the faces of the shoulders are rough cut and the clamping pieces receive a file cut. When the drive is in one direction, one half of the leather strips is in action, transmitting the force by tension; when the motion is reversed, the other half comes into action. The bolt heads are all accessible from the outside.

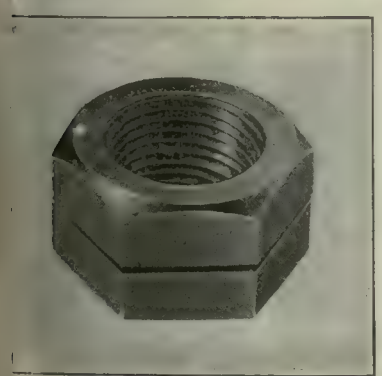


A.E.G. FLEXIBLE COUPLING

The coupling can be used for any drive, but it is best used for electric drive, as it is insulating. Its dimensions are said to be small, considering the capacity, so that even for high running speeds it can be made of cast iron, while a larger coupling must be made of steel.

The Sevigne "Non-con-cen-tric" Locknut

The Sevigne Foundry and Machine Co., Nashua, N. H., has brought out a single-piece, patented locknut that is claimed to be capable of holding its position under conditions that will loosen and displace the regular double-nut arrangement. The nut is made by cutting a slot, as shown in the illustration, partly through the nut in a plane parallel to the helix angle of the thread. The depth of the cut is so regulated as to pass completely across the hole, stopping at the thread on the further side and leaving the remainder of the nut uncut. The upper part of the nut is then slightly offset with relation to the lower part, the amount of the offset varying with the service to which the nut is to be put.



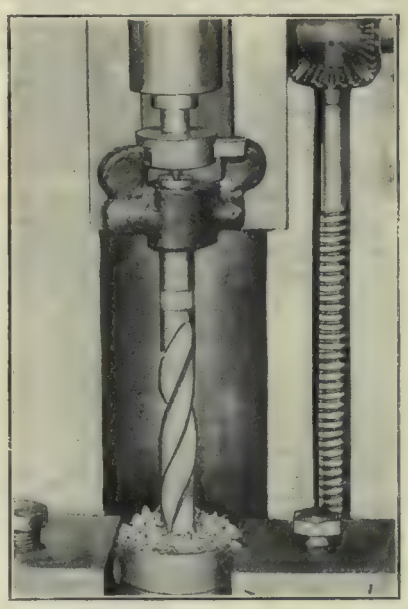
SEVIGNE "NON-CON-CEN-TRIC" LOCKNUT

The direction in which the offset is made is of importance, as the nut can be turned in the direction in which the offset is made with comparative ease, although offering resistance varying in accordance with the amount of the offset to a moment in the reverse direction. Because of this departure from concentricity, it is claimed that the upper part of the nut exercises a gripping action analogous to the gripping action of pipe-tongs.

W-B Self-Centering Drill and Reamer Holder

The Woodall-Basch Tool Co., 450 Weiting Block, Syracuse, N. Y., has placed upon the market a self-centering drill and reamer holder. The device is intended for use upon drilling machines, lathes and screw machines, its purpose being to grip the drill or reamer so as to prevent it from turning, as well as to center it. It consists of a sleeve having a head, through which a T-slot is milled at right-angles to the center line. This sleeve can be made straight, if desired, or turned to the taper necessary to fit the machine on which it is used. It has a taper hole reamed in the head end, so as to receive a center point, upon which the rear end of the drill or reamer fits.

Fitted so as to float freely in the T-slot, is a dog in the form of a yoke having an elongated hole, in which the shank of the drill or reamer can be gripped. A headless setscrew holds the shank against the V in the hole, thus preventing the drill or reamer from turning in the dog. The dog can adjust itself to the size and position of the shank of the cutting tool, so that the tool will be in proper alignment, provided that the centers are correct. In the accompanying illustration the holder is shown driving a drill, the holder in this case rotating, as does the drill. When used for holding a drill or reamer in a lathe, where the tool does not rotate, a handle, which fits into the yoke on the side opposite the setscrew, is provided, so that the handle rests upon the carriage of the lathe and prevents the holder from rotating. It is stated that the device is sturdily constructed, that it enables the saving of considerable time in the setting and fastening of a drill or reamer, and that it insures correct alignment of the tool.



W-B SELF-CENTERING DRILL AND REAMER HOLDER

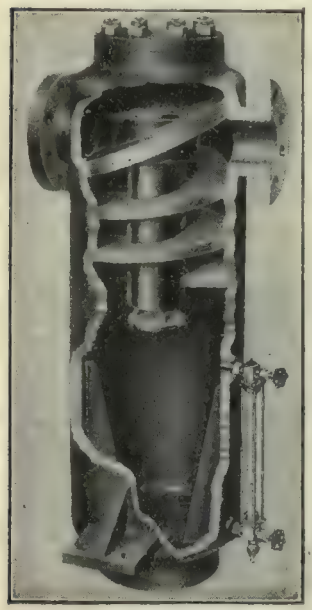
The holder can be furnished in two sizes, the No. 1 having a capacity up to 1-in. shanks and the No. 2 up to 2-in. shanks.

G-R Stratton Separator

The Griscom-Russell Co., 90 West St., New York, N. Y., has placed on the market the re-designed Stratton separator, a sectional view of which is shown in the illustration. It is stated that the helical path has been made long, in order to increase the centrifugal action. A spatter cap has been added on the outlet pipe, so as to make the separation as complete as possible.

The separator is intended for use with either steam

or compressed air. It is said that water is effectively removed from high-pressure steam entering an engine or turbine, regardless of the velocity and of the quantity of water present. The device is adapted also to the removal of water from the compressed air used for driving air tools and sand-blast machines. The collected water can be drained out when necessary from the sump in the bottom of the cylinder, a gage glass being provided to indicate the amount of water present. The separator when made of cast steel is capable of withstanding a working pressure of 250 lb. per square inch. When the device is made of cast iron, the sizes from 1¼ to 2 in. are capable of withstanding a pressure of 250 lb. per square inch, and the sizes from 2½ to 8 in. a pressure of 200 lb. per square inch.

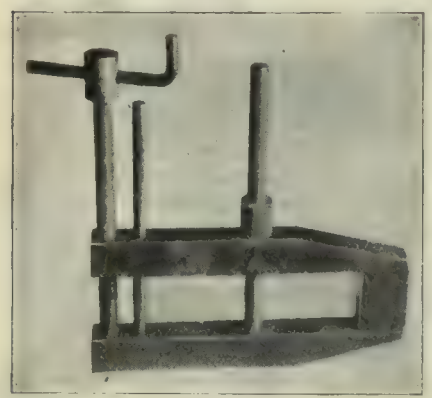


G-R STRATTON SEPARATOR

The separator is built in four types. The ordinary horizontal type is the one illustrated, the inlet being at one side and the outlet directly opposite it at the other. However, the inlet can be furnished at the side and the outlet at the top. In the vertical type the outlet is at the bottom, while the inlet can be placed either at the top or at the side. The device is made to fit pipe lines from ½ to 8 in. in diameter, the sizes below 2 in. being fitted with screwed connections and those above 2 in. having flanged connections. The height of the smallest size is 10$\frac{13}{16}$ in. and that of the largest size 65¾ in. The diameters vary from 3½ to 27⅞ in. The shipping weights range from 16 to 3,680 lb.

Hill Toolmaker's Clamp

The illustration shows a toolmakers' parallel-jaw clamp made by M. B. Hill, 10 Eden St., Worcester, Mass. The jaws are packhardened and left in the natural color. The fulcrum screw is fixed in the outer jaw and slides loosely through the inner one, a knurled thumbnut on this screw regulating the position of the inner jaw so as to conform to the size of the piece to be held. The clamping screw is threaded through the inner jaw and bears in a socket in the outer jaw. A steadying pin is also fastened in the outer jaw, and, sliding through a hole in the inner jaw, it prevents the latter from turning out of place. The head of the clamping screw has a bent wire through it for the purpose of tightening it with the fingers, and by this means a sufficiently powerful grip can be obtained without the necessity of using a wrench. Two sizes are made, with 4- and 6-in. jaws, respectively.



HILL PARALLEL-JAW TOOLMAKERS' CLAMP

Anderson Friction-Driven Tapping Machine

The Anderson Die Machine Co., Iranistan Avenue, Bridgeport, Conn., has brought out as an addition to its line a light, independently driven tapping machine for use in tapping small parts, such as those incident to the manufacture of electrical appliances.

It is driven by a ⅛-hp. motor through the medium of an adjustable friction disk continuously in contact with two friction cones, which transmit their motion alternately to the tapping spindle. The motor is mounted on the top of the pedestal upon two trunnions disposed at a right angle to the axis of the motor shaft, so that the friction disk, which is keyed to the end of the motor shaft may be elevated or deflected from a central position between the two driven cones.

The surface of the driving disk is shaped as a portion of a sphere, the center of curvature of which is coincident with the axial center of the trunnions upon which the motor swings, so that any deviation of the motor shaft from a horizontal position makes no change in the frictional contact, but has the effect of bringing one of the driven cones nearer to the center of rotation of the driver, at the same time moving the other driven cone further from the center. Thus, by elevating the operative end of the motor shaft, the rotative speed of the upper cone is decreased while that of the lower cone is correspondingly increased.



ANDERSON FRICTION-DRIVEN TAPPING MACHINE

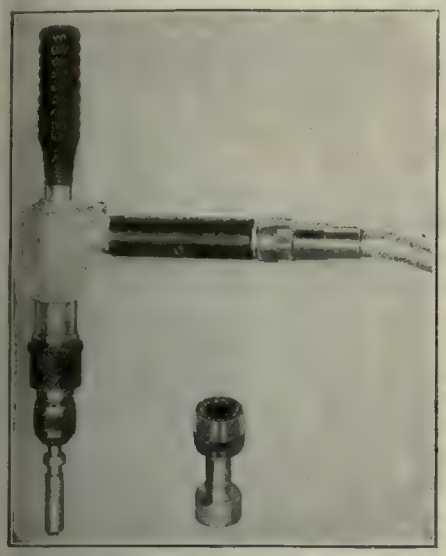
In operation, the vertical spindle is lifted slightly by the pressure, bringing the conical surfaces of the upper friction together and revolving the tap. When the tap has entered the work far enough, the upward pressure is released by the operator, allowing the spindle to drop into contact with the lower friction, thus withdrawing the tap at a higher rate of speed. The relative speeds, forward and reverse, of the tapping spindle may, therefore, be varied at will from 1 to 1 up to 10 or more to 1.

A table, having a vertical movement actuated by hand lever or treadle as desired, is a part of each machine, and the work can be presented to the tap by laying it on the table and raising the latter; or, in case of small pieces, the table may be dropped out of the way and the work held in the operator's fingers. The machine is supplied with a suitable length of flexible cord.

Strand Flexible-Shaft Screwdriver and Nut-Setter

A screwdriver and nut-setter driven by power through a flexible shaft is now made by N. A. Strand & Co., 549 West Washington Blvd., Chicago, Ill. The applia-

shown in the illustration, is used in connection with the standard type of motor drive and flexible power shaft made by the company. It is made in four sizes, Nos. 4, 5, 6 and 7, requiring motors of ¼ hp. for the two smaller units, a ½- to 1-hp. motor for the No. 6, and a 1- to 2-hp. for the No. 7. The respective weights are 3, 4, 8 and 12 lb. The device has two handles, so that it may be easily controlled and can be used at any angle. It is claimed that, owing to the type of belt-drive, there is no chance of burning out the motor when driving screws or nuts to a dead stop. Moreover, an adjustable tapered friction device may be set by the knurled nut on the sleeve to drive the work with any desired maximum torque.

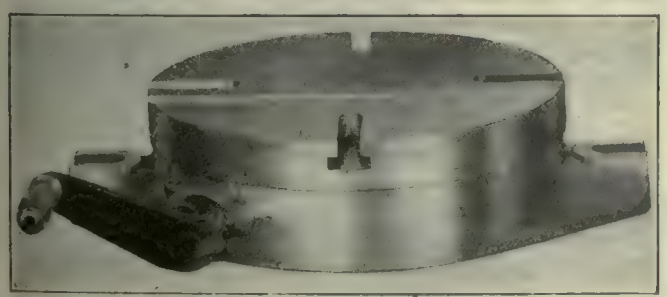


STRAND FLEXIBLE-SHAFT SCREW-DRIVER AND NUT-SETTER

The motor can be furnished mounted on either an iron stand or a plain cast-iron base. The standard length of flexible shaft is 5 ft., but lengths up to 10 ft. can be furnished. The machine is provided with a reversing switch for use when it is desired to back out screws. A worm gear reduction is provided in the small case from which the handle and shaft extend. The driving spindle has a release clutch. The device is shown fitted with a short-shank screwdriver bit with a screw guiding sleeve. The type of nut wrench used is also shown.

"Industrial" Indexing Table

An indexing table, shown in the illustration, for use on machine tools, is made by the Industrial Engineering Co., 25 E. Fort St., Detroit, Mich. It is made in two sizes, with table diameters of 10 and 16 in. A single movement of the handle indexes the table 180 deg. and clamps it to the base, no other movement by the operator being necessary for clamping the table.



"INDUSTRIAL" INDEXING TABLE

Specifications: Built in two sizes. Table diameter, 10 and 16 in., respectively. Height overall, 3¾ in. Length overall, 14 and 20 in. Weight, 45 and 105 lb.

It is stated that the low height of the fixture and the large diameter of all bearings make it a very rigid device. All working parts are of steel, hardened and ground. The indexing is controlled by a lock which automatically takes up its own wear, and is claimed to be positive and fool-proof. A keyway is cut across the face of the table for use in aligning jigs or other fixtures, and T-slots are supplied for bolting them in place.

McKneat Oil Burner

The McKneat Manufacturing Company, Easton, Pa., has recently put on the market a line of oil burning equipment, the illustration showing one type, for general use in all kinds of machine and repair shops, iron, steel, brass and malleable-iron foundries, shipbuilding plants, steel car building and repair plants, where compressed air is available; and also a vaporizing type for use where compressed air is not available. The latter type includes a portable winter thawing outfit for use both on railroads to thaw packed snow and ice from frogs, switches, signal apparatus and fixtures, and also for thawing pipe lines in oil and gas fields, in addition to ore and other materials that become frozen while in transit in steel cars. The compressed-air type will burn crude oil, fuel oil or kerosene, the fuels producing 1,800, 2,500 and 2,900 deg. F. of heat, in the order named.



McKNEAT OIL BURNER

The vaporizing type burns kerosene only. The features of the compressed-air type are said to be efficiency, simplicity of construction, and durability. United states standard 12- and 10-gage steel plates are used for the tanks, and all joints are electrically welded and subjected to a hydrostatic pressure of 225 lb. The fittings are standard, thus avoiding expense and loss of time in case repairs are necessary. The hose is constructed to withstand the effect of oil and air pressure up to 125 lb. Electric steel castings are used for the back and front heads of the burner tip, which is removable and can be easily replaced.

Coats No. 5 Prestometer

The Coats Machine Tool Co., Inc., 110 West 40th St., New York, N. Y., has recently added to its line of Prestometer fluid micrometer gages a No. 5 size. The gage is shown in Fig. 1 equipped for the measuring of pistons. The instrument has a capacity up to 6½ in. and is, therefore, suitable for marine, truck and tractor engine pistons exceeding 4½ in. in diameter, which size was formerly the maximum capacity of the Prestometers. The total height with the arm in the uppermost position is 22 in., and the width of the cast-iron base 8¾ in.

The instrument is equipped with both flat and slanting bases, the flat base being held down by two screws. The gage may, therefore, be used either tilted back or on the flat base. The size of the surface plate is 6 x

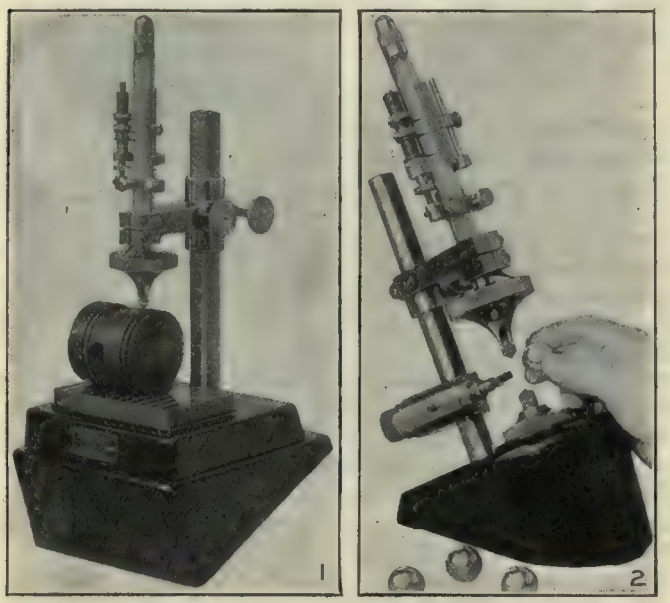


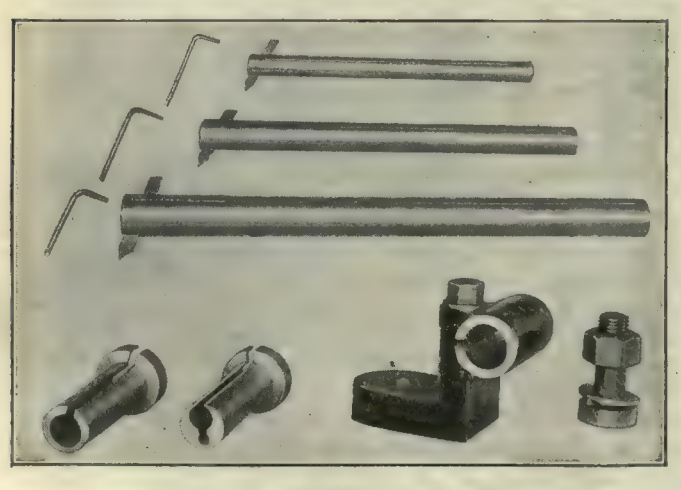
FIG. 1. COATS NO. 5 PRESTOMETER EQUIPPED FOR MEASURING PISTONS. FIG. 2. ARRANGEMENT FOR GAGING BALLS ON THE PRESTOMETER

4 in. The rack column is 1¼ in. in diameter and 13 in. high. The bearing surface of the adjustable arm on the stem extends above as well as below the center line of the arm, giving greater rigidity than in the former models. The plunger pin is now equipped with a detachable ⅜-in. ball. This is a standard ball, and may be revolved until worn all over, after which it may be replaced by a new ball.

In Fig. 2 is shown the machine equipped with a micrometer, V-type backstop for use in the inspection of steel balls. Removable, loose steel-ball contact points touch the ball from above and below. It is said that wear of the contact points is very slight and their replacement easy, and that the arrangement gives very satisfactory results.

Cascade Boring Tool Set

The Cascade Tool Co., 71 Washington Ave., Cohoes, N. Y., has added to its products a line of boring-tool sets in which several distinct features are incorporated.



CASCADE BORING TOOL SET

The illustration shows the standard set for 18-in. lathes, consisting of a holder, clamp bolt, two eccentric spring sleeves and three boring bars, ¾ in., 1 in., and 1⅜ in. in diameter respectively, each fitted with a high-speed-steel bit. An advantage of the tool is said to be the offset in the holder, which can be swung around so as to enable the operator to turn the outside of work that cannot be reached with the ordinary tool.

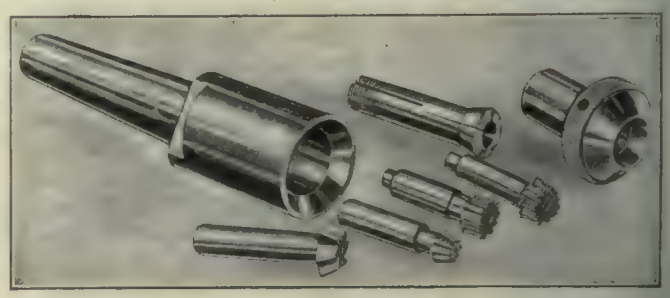
Sets can be furnished in any combination to suit the purchaser, and are made to fit any size of lathe.

Phoenix Draw-in Chuck Adapter

The Phoenix Tool Co., 2 Remer St., Bridgeport, Conn., is putting on the market a self-contained adapter by means of which spring- or draw-in collets may be used in the spindle of any engine lathe or milling machine without the necessity for a draw-bar or for a through hole in the spindle. The illustration shows the adapter disassembled, the parts in the foreground being milling cutters to be held by the device.

The thread for drawing the collet is in the body of the adapter and the knurled ring has a pin fitting the spline in the collet so that the latter may be closed or released by turning the ring, either with thumb and fingers when the hold is light or with a spanner in case a firmer grip is desired.

Because of the absence of the draw-bar the adapter can be used in the dividing head of a milling machine without interfering with the angular setting of the



PHOENIX DRAW-IN CHUCK ADAPTER

head. It is also convenient for use in the spindles of large lathes and milling machines where the length of the head would place the usual handwheel on the rear end of the spindle out of reach of the operator.

The adapter can be furnished to take any standard spring collet, and the shank can be fitted to any standard taper. It will also be furnished with the shank unturned, if desired, so that the purchaser may fit it to any machine.

"Sacrey" Oil-Grooving Machine

The Philadelphia Engineering and Machine Company, 1130 Race St., Philadelphia, Pa., has recently placed on the market a tool called the "Sacrey" oil-grooving machine, and shown in the illustration. The machine will cut practically every type of oil-groove, including straight, cross, and right- or left-hand helical, on internal and external surfaces. The cutter-spindle can be operated vertically, without rotating, this arrangement permitting the cutting of straight grooves, keyways, and die slots, as the tool relieves at any point on the circle.

The chuck, which is of the three-jawed scroll type, is attached to two upright steel posts at the top of the

achine, and is adjustable up and down to accommo-ate various lengths of bushings or other work in which o grooves are to be cut. The chuck can easily be removed to permit the use of special fixtures for holding odd-shaped work. Work up to 4½ in. in diameter may be held in the chuck body with no overhang, while work up to 6 in. in diameter can be mounted on top of the chuck or held in a special fixture. The stroke of the crank is adjustable from ⅛ to 7 in.

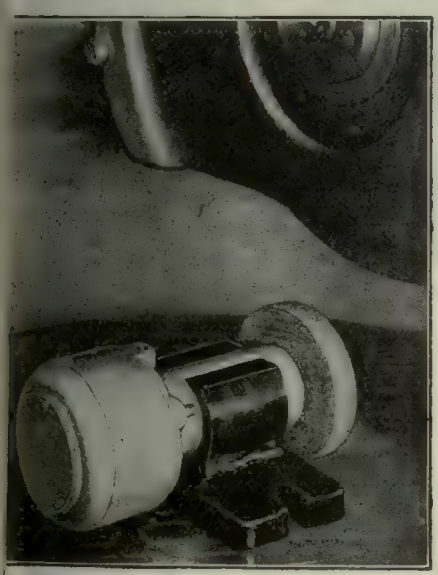


"SACREY" OIL-GROOVING MACHINE

Feeds are both by hand and automatic. The maximum depth of the groove is $\frac{5}{32}$ in. The machine stands about 4 ft. high and occupies a floor space 24 in. in diameter. The only xtensions are the tight and loose pulleys or motor on ne side, and the crankshaft on the other. The approxiate net weight is 650 lb., the shipping weight 750 lb., nd the shipping dimensions about 24 x 40 x 52 in.

"Precision" Wheel-Truing Machine

The Precision Truing Machine and Tool Co., Cincinati, Ohio, recently placed on the market a wheel-ruing and dressing machine known as the Style 21. The device can be applied to any surface- or tool-grinding machine, being shown in the illustration on the magnetic chuck of a rotary-table surface-grinding machine.



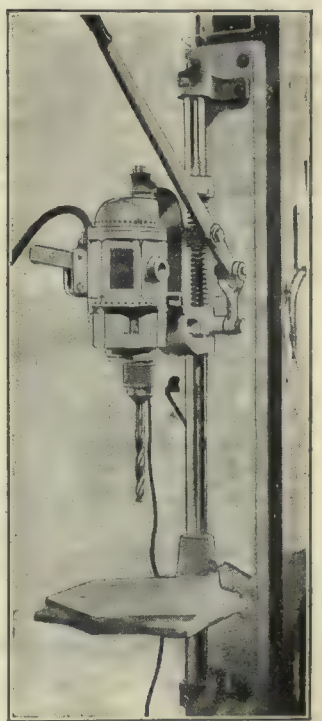
PRECISION WHEEL-TRUING MACHINE MOUNTED ON A MAGNETIC CHUCK

The device consists essentially of a spindle mounted on ball bearings and carrying a flywheel on one end, the whole being encased in a dust- and waterproof aluminum housing. On the other end of the spindle is mounted a small hard grinding wheel. To operate, the device is placed on the table of the grinding machine with the sides of the two wheels parallel. By bringing the faces of the wheels together while the grinding machine is running, the wheel of the device is made to revolve, and the action of the two wheels running together trues and dresses the grinding wheel.

The finish produced with the device is said to be at least equal to that produced with a diamond, the character of the finish being changed by varying the speed with which the truing wheel is passed over the face of the grinding wheel. For a high finish, water is used and the truing wheel passed slowly and lightly over the grinding wheel. The wear of the truing wheels is said to be slight, the cost amounting to about ½ cent per working hour of the grinding machine. A table bracket and three wheels are furnished with the device.

Black & Decker Post Drill

The post drill shown in the illustration has been designed by the Black & Decker Manufacturing Co., 661 Liberty St., Baltimore, Md., for the purpose of adapting a standard portable electric drill to use as a drill press for heavy drilling or precision work. It is stated that the construction is very rigid. The vertical column is a steel shaft $1\frac{7}{16}$ in. in diameter and is clamped to the wall, or post, by means of brackets at the top and bottom.



BLACK & DECKER POST DRILL

The device is adapted to the use of the ⅜-, ½-, $\frac{9}{16}$-, ⅝- and ¾-in. Black & Decker portable electric drills, which can be quickly attached and detached. The bracket carrying the drill can be raised, lowered, or swung around on the vertical column and secured in any desired position by means of a split collar and clamping screw. A helical spring returns the drill to the top position when the feed lever is released.

The table also can be raised, lowered, or swung around on the column. Both the vertical and the horizontal adjustments are locked by means of one clamping-screw. In the table are six tapped holes to accommodate ½-in. studs, used to clamp work in place. One stud, a nut and a clamp are supplied with the stand.

The feed lever gives a ratio of 6 to 1, so that heavy pressures can be obtained with but little effort on the part of the operator. On account of the flexibility of the outfit, it is said to be well adapted to garages, wheelwright shops and general machine shops.

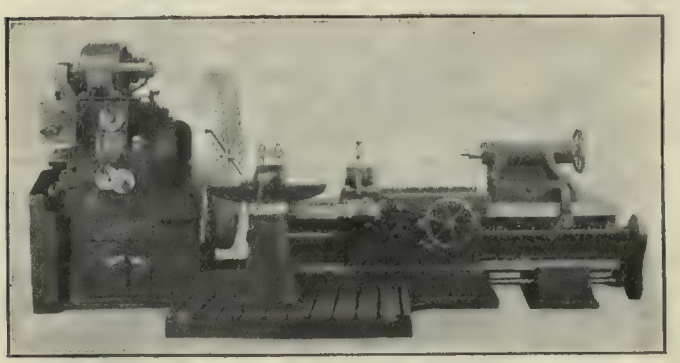
Specifications: Length of column, 46 in. Vertical adjustment of drill, 25¾ in. Drilling radius, 7 in. Horizontal adjustment of drill, 180 deg. Feed by lever, 4½ in. Weight: net, 80 lb.; shipping, 130 lb. Shipping dimensions, 19 x 14 x 49 inches.

Canada 74-In. Gap Lathe

The illustration shows a 74-in. by 10-ft. break or gap lathe made by the Canada Machinery Corporation, Ltd., Galt, Ontario, Canada. One of these machines was recently shipped to China for use in the shops of one of the larger Chinese railways.

This lathe is built with the Canada Machinery Corporation's standard 27 speed head, 18 of the speeds

being obtained through the spindle and 9 through an internal gear on the faceplate. The speed changes are obtained by levers located on the head of the machine, the motor being mounted on top and driving to the



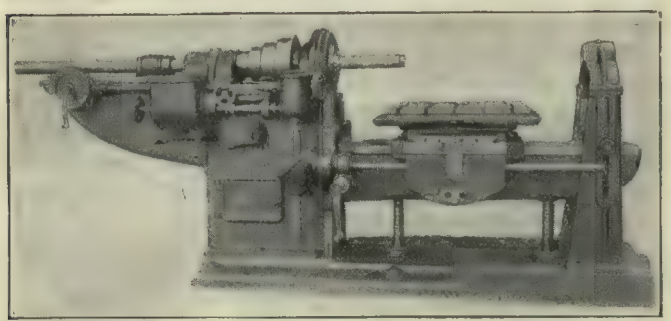
CANADA 74-IN. GAP LATHE

head by means of steel and rawhide gears. A friction clutch is mounted in the gearing for convenience in starting and stopping. The bed is provided with three large inverted V's, the tailstock resting on one V and one flat surface, and the saddle bearing on two V's and the flat surface,

The bed may be moved on its base by means of a rack and pinion, operated by a wrench at the rear of the machine. It is supported by a box leg, in order to eliminate any strain from overhang when it is at its extreme length. A thread-chasing dial for indicating the correct point for engaging the nut is provided on the carriage. In addition to the compound toolrest on the saddle, a compound pillar rest is provided, with an English toolpost mounted on the extended base. This toolrest is subject to variable longitudinal feeding by means of an overhead rocking shaft operated from a lever on the headstock. The lathe weighs approximately 30,000 pounds.

A Swiss Horizontal Boring Machine

The accompanying illustration shows a horizontal boring machine recently placed on the Continental market by the Machinenfabrik Hinwil, Hinwil, Switzerland. The machine is intended for medium sized work. The spindle is 3 in. in diameter with a 28 in. length of power feed. It runs in tapered phosphor-bronze bush-



HORIZONTAL BORING MACHINE MADE IN SWITZERLAND

ings and is fitted with a faceplate having gear teeth, which engages with the single back gear. The back gear and the 4-step cone together give eight spindle speeds, ranging from 9.8 to 250 r.p.m.

The boring bar is of the same diameter for its entire length. It can be adjusted at will and engaged with the feed mechanism at any point. It has double spline keyways, and the end is threaded and bored with No. 5 Morse taper hole. It possesses quick adjustme by hand in each direction and four power feeds obtain through a quick-change gear box. The power feeds va from 0.008 to 0.053 in. in size.

The work table has power-driven longitudinal, cro and vertical feeds. The size of the longitudinal fee ranges from 0.007 to 0.044 in., the crossfeeds fro 0.0076 to 0.0468 in., and the vertical feeds from 0.00 to 0.062 in. A safety device prevents the simultaneo engaging of the longitudinal and the cross feeds. Th knee and table are balanced, so that the table can co veniently be raised by hand when heavy pieces are bei machined. The sliding gears of the gear box are steel, most of them being hardened. The outer suppo is split near the top, so that when necessary the upp structure can be removed.

The maximum distance between the faceplate and t outer support is 56 in., and the working surface of t table 28 x 32 in. The maximum distance of the tab from the spindle is 20 in., the longitudinal travel of t table 32 in., and of the cross table 30 in. The net weig of the machine without the countershaft is 6,100 lb.

Reliance Industrial Tractor

The Reliance Trailer and Truck Co., San Francis Cal., has placed on the market the gasoline-driven indu trial tractor shown in the illustration. The machine



RELIANCE GASOLINE INDUSTRIAL TRACTOR

said to be strongly constructed, and adapted to bot pushing and towing.

The wheels are equipped with Timken bearings, an the axles are said to be heavy enough to support a loa of 2 tons. A heavy, perforated, steel bumper plate i front protects the radiator. The motor is equipped wit a fan and a centrifugal circulating pump for cooling The machine is provided with fenders, running boards and an upholstered spring seat having a back.

The tractor is 6 ft. 6 in. overall in length; 50 in overall in width, has a 42-in. tread and a 50-in. whee base. It can turn in a circle 12 ft. in diameter on th inside. The maximum running speed is 11 miles a hour. It is stated that a five- to six-ton load can b towed by the machine, as built. If it is desired to to heavier loads, the ballast box under the seat can be filled with weights, so as to increase the traction.

(Shop Equipment News continued on page 515.)



NEWS SECTION

Secretary Hoover Outlines the Scope of Work to Be Done by Commerce Department

Upon assuming office as Secretary of ommerce in the new cabinet, Herbert [oover gave out the following state- ıent:

"The Department of Commerce hould be in the widest sense a depart- ıent of service to the commerce and ıdustry of the country. It is not a epartment for the regulation of trade nd industry. In order to do service) the greatest advantage I wish to stablish a wider and better organized)-operation with the trade and com- ıercial associations, and will in a short me present some plans to this end. want to see our efforts to push our)reign commerce more closely related) our industries. This sort of enlarged ctivity is within the original purpose f the department and requires neither egislation nor burden upon taxpayers. 'his is no time to ask for appropria- .ons to undertake new work. It is the ıme to search for economy and regula- 'on, for effective expenditure on essen- als, the reduction of less essentials, nd the elimination of duplication.

"Outside of voluntary measures, the nly immediate extension of service lies ı securing greater internal efficiency ı which I am certain all the burdens)in. The future of the department in s abilities to meet the needs of our ıdustries and trade must await the horough reorganization of the whole xecutive machinery, now being vigor- usly undertaken by Congress.

"The great economic difficulties that e inherit from the war are obvious nough and they emphasize the neces- ity of better government machinery) assist in their solution. Their final emedy must rest on the initiative of ur own people—the rate of recovery an be expedited by greater co-opera- ion in the community and with the ommunity by the government, and this epartment and the whole government ishes to assist wherever it can to timulate and assist this co-operation.

"In the long run, we may as well ealize that we must face a lower tandard of living in Europe many ears ahead. The production costs of er people will in consequence be lower han ever before the war. If we meet this competition and still maintain our high standards of living we will have to work harder; we will have to eliminate waste; we will need to still further improve our processes, our labor relationship and business methods. If we would so improve our national efficiency and our foreign trade we must consider our transportation, both railway, water and marine as one system directed to serve the Nation as a whole. The development of certain trade routes through our mercantile marine as the real extension of our inland transportation; the improvement of great waterways; the opening of the Great Lakes to ocean-going vessels; the development of great electrification of our power necessities; and the handling of our labor readjustment by moderate men on both sides are all problems that have a fundamental bearing on the recovery in commerce and on our ability to compete.

"If I were outlining one of the most essential directions for expansion of governmental activity, it would be in the constructive study and ventilation of the gamut of these possible improvements and of elimination of our great wastes in labor, in material, in power and a host of other directions.

"There are some of these directions in which I believe this department can secure some results by co-operation within the different trades and industries. Through this co-operation we shall be able to improve some of our business practices; to extend the standards in manufactured products which would make great savings to our consumers, and promote our foreign commerce. These are not in any event, however, possible of accomplishment by regulation. They must be accomplished first by proof of necessity, and then by co-operation of the trades who must have a part in their determination and development. I am convinced that they are only too anxious to develop such demonstrated things. For instance, every builder knows that modern building codes, standards in sizes and grades of material, etc., would greatly lessen building costs.

"There are some economic difficulties arising from the war that will no doubt solve themselves with time, but an indefinite amount of misery could be saved if we had the same spirit of spontaneous co-operation in every community for reconstruction that we had in war. Government departments can at least try to do something to inspire such renewed co-operation. For instance, we have three or four million idle men walking the streets, and at the same time we are short more than a million homes; our railways are far below their need in equipment, our power plants, waterways and highways are all far behind our national needs in normal commerce. To apply this idle labor to our capital equipment is one of the first problems of the country. Its solution involves construtcive action in many directions, but among other things definite resolution of each local community to secure co-operation in itself. In the building trades, for instance, a get-together attitude on the part of labor, material manufacturers and contractors in every locality to eliminate mispractices and bring down the expense of housing would comprise the first step of recovery—of re-employment.

"Another outstanding economic trouble is that our farmers and our manufacturers are overloaded with foods, raw material and goods that we cannot market abroad, and at the same time great masses of people overseas are cold and hungry. These people can only purchase on credit pending their own economic recuperation, and our own recuperation depends greatly upon theirs. We are thus not facing overproduction, but a breakdown of credit links between us and the areas of underconsumption. Congress has provided the way for creation of foreign credits by banking co-operation under the Edge act and the logical and economic thing in the whole national interest is for our bankers to work something out. Foreign credits are better than rotten food.

"There are some new forces in the world's commerce that must cause concern. There is a tendency in European nations to definitely mobilize the export, and in some cases the import trade for militant commercial invasion. In some instances this is being done under Gov-

ernment direction and organization, and often even with Government finance; in others, it is being carried out by Government leadership and suggestion. Such formal or informal combinations may render the position of our merchants and exporters precarious indeed. Beyond this, where these controls are instituted over their own imports of cotton, food, and other agricultural products, they seriously dominate the prices of our own farmers, and where they are instituted to secure control of the world's natural resources in minerals, oils, etc., they may dominate our future supply of these vital raw materials. Our competitors are within their rights in these matters, but we must protect ourselves. Our commercial community has the right in law and has been encouraged by Congress to combine for business outside our frontiers, precisely for the purpose of meeting such contingencies as this. But it all requires that our trades co-operate in an enlightened sense of national service, as well as immediate interest.

"All together more economic taxation, large economy in government through internal bureaus, regulation and agreements on disarmament and systematic government co-operation will all contribute to help us out of the ditch. We will get out—yet when all is done the rapidity with which we get out will depend upon the degree to which we pull together."

Southern Tariff Association to Establish Tariff Councils

The appointment of a board of governors of the Atlanta Tariff Council to actively carry on the work of the Southern Tariff Association in the Atlanta territory in its efforts to bring about the enactment of such legislation as will provide ample tariff protection to all manufactured products of the South, has been announced by John H. Kirby, of Houston, Tex., president of the association. At the second annual conference of the organization, held recently in Atlanta, the forty industries represented worked out a plan to establish tariff councils in all leading cities of the South to expedite the work of the association as a whole. The Atlanta council is the first of these to be formed, and includes in its membership twenty-three of the leading manufacturers of the city and state representing a number of lines of industry.

The membership of other councils to be formed will also include leading manufacturers and officials of various industrial associations that are active in their efforts to obtain a protective tariff for their products. Among the members named to the Atlanta council are Thomas K. Glenn, of the Atlantic Steel Co.; Charles Krueger, of the Krueger Manufacturing Co.; J. F. Dickinson, of the Southern Belting Co.; J. W. Leroux, of the Virginia Bridge and Iron Co.; J. W. Rawlings, of B. F. Avery & Sons, and J. W. Yopp, secretary of the Georgia Manufacturers' Association.

Tilt Over W. D. Sale of Unserviceable Motor Cars

When the War Department advertised an auction of unserviceable motor vehicles at Camp Holabird, Md., last month, the Baltimore Automobile Dealers' Association, Inc., made a prompt protest. They sent a set of resolutions against the sale to every senator and representative from the State of Maryland, with the request that they use their influence to bring about a discontinuance of further disposal of Government motor vehicles at Camp Holabird. The dealers declared that it would materially injure the automoblie industry in Maryland, and particularly in the City of Baltimore.

In spite of their resolutions the sale was held according to schedule. Hundreds of interested buyers flocked to Baltimore to take advantage of the opportunity, and more than $372,000 was realized by the Government from the sale of unserviceable vehicles. This was in accordance with a previously expressed wish of Congress that surplus material be disposed of without delay and prompted, no doubt, by the approaching change in administration.

The auctioneer reported that 90 per cent of the unserviceable vehicles sold went out of Baltimore, and while the buyers were present they also invested pretty largely with the local dealers in new automobiles, one firm reporting the sale of seven new cars to out-of-town persons who had come for the three-day auction.

The Baltimore dealers have acknowledged their error in the following letter to the auctioneer, which has just been brought to the attention of the department.

"Acknowledging receipt of your favor of the 24th inst., there was apprehension on the part of some of our members in regard to the sales at Camp Holabird, fearing it might be a detriment to their business.

"We thank you for your favor of the 24th, giving us details in regard to same, which tends to show that the apprehension to a great extent was groundless.

"(Signed) Baltimore Automobile Trade Association, Inc.

"A. H. Bishop, president."

New Car Plant Receives Big Order

The new pressed-steel car plant of the Chickasaw Shipbuilding and Car Co., now under construction at Birmingham, Ala., is expected to be completed and ready to operate by May 1, according to officials of the company.

The Louisville & Nashville Railroad has placed an order for 2,700 cars which will keep the plant going at capacity—25 completed cars per day—for some time. The new plant is so synchronized with the structural steel and fabricating shops as to really be a part of them.

The same machinery will turn out shapes for cars, or for ships and other structural lines.

Lowering of Steel Prices To Follow Reduced Freight Rates

The move on the part of the r- roads, headed by the Pennsylvania o its announcement of a sweeping re- tion in wages, is of the utmost mom t to the iron and steel industry. The - dustry has been straining every ne e in a concerted effort to reduce pro- tion costs that it might sell its finis d products at a price acceptable to e consumer. The one insurmountable - stacle encountered has been the h n freight rates which it has been for d to pay in assembling the raw ma- ials. The leading interest owns m t of its railroads and this item is th - fore partly eliminated so far as i s concerned. But when it is realized h it takes six tons of raw material o make one ton of pig iron and t these six tons have to be hauled f n different localities varying in dist e to a central point, the furnace, e plight of the independent iron and s l masters is plainly discerned, for fre t rates are 50 per cent higher than - fore the war.

That the United States Steel Co - ration will shortly reduce wages is e belief of the American Federation f Labor, and plans are being laid by s association to organize the steel in - try shortly after such reductions e made. The plants of the corpora n are open shop. The wage policy in e Connellsville coke district has alw s been formed by a subsidiary of the le - ing interest, the H. C. Frick Coke the largest operator in that field, t the lead has now gone into the hand f W. J. Rainey, Inc., the second lar t interest, which has announced a - duction of 18 per cent effective Apr l for both oven and mine labor. S e 2,500 men are affected and the rest f the independents are expected to fol w suit shortly.

Equipment orders from the railro s have fallen to a minimum and there s hardly a new inquiry in sight. Of e 228 independent mills in the Pittsbu h Valley and Wheeling districts o about 92, or 40 per cent, are operati . In the Birmingham district water - gas pipe manufacturers are operat g at only about 50 per cent of capa y while about 30 per cent of the sanit y shops in Alabama are producing o n 30 per cent of capacity basis.

Penn. R.R. To Reduce All Wa s

The board of directors of the Pe - sylvania Railroad issued a statem t today announcing they had passe a resolution directing the executive - cers of the road to give as promptly s possible proper notice that it is the - tention of the company to reduce sa - ies and wages of all officers and e - ployes to accord with economic mo - tions. All procedures in affecting s d readjustment of salaries and wages d be taken in an orderly manner and n strict accord with the Transportat n act, the statement said. The order d affect approximately 215,000 men.

Business Conditions as the Big Banks of the Country See Them

Guaranty Trust Co. Urges Fostering Foreign Trade—Will Be Reflected in Domestic Markets

The industrial interdependence of the trading nations of the world places an inescapable responsibility on the United States as the principal creditor nation and has a vital bearing on the future progress of our foreign business. American industry can compete successfully with that of any other nation, and if we are to develop and maintain adequate markets for the vast surpluses of our fields, factories and mines we must fearlessly invite and even foster this competition by strengthening foreign productive machinery.

The productive capacity of the United States has increased more rapidly in the last ten years than the consuming capacity. Our standards of living have risen and our national wealth has increased during the decade, but not sufficiently to provide domestic markets for the newly created surplus of production. New customers can absorb a portion of our excess goods and old customers can continue to take their share, but it must be borne in mind that only as Europe, our oldest and best customer, is industrially rehabilitated can America obtain in full measure the benefits of her creditor position.

Effect on Our Markets

The maintenance of this co-operative interest in foreign production and consumption is incumbent on the manufacturer, the farmer, the laborer and the exporter—those naturally affected by any improvement or decline in industrial conditions. Curtailed operations in any of the basic industries of European countries are inevitably reflected in varying degree abroad. The trend of the British textile industry, for example, has its effect on the business of American cotton growers and manufacturers of machinery, and, indirectly, on the railroads, financial and distributing agencies, etc. The same interdependence can be traced through the majority of the leading industries of the other European countries.

Encouraging steps which will assist Europe in regaining her former industrial position have been taken during the last year in the organization of various corporations for the furtherance of our export trade. Their operation will primarily be of service in removing our foreign business from the unsound short-term credit basis on which it has been maintained since trade became so unbalanced. But, indirectly, they also will assist European countries to place industry once more on a firm footing, which will be an important step toward the ultimate return of commerce to normal conditions.

America's machinery for financing foreign trade has been greatly expanded during the last three years. Corporations for foreign trade now in operation have aggregate capital and surplus of more than 60 million dollars and organizations announced since the first of this year, including the Foreign Trade Financing Corporation, propose to add more than $120,000,000 of capital and surplus to this figure. This preparation for the future of America's foreign trade has been accompanied by a rapid growth of the market for acceptances, about five billion dollars worth of which were used during 1920.

The United States cannot, of course, effect any immediate and direct cure for Europe's economic and industrial ills. This country is, however, in a better position than any other force in the world to take stock in Europe's industrial future, to assist her in regaining her former productive efficiency, and thereby lay the foundations for future expansion on a sound basis of our business in those most important markets.

National City Bank Analyzes German Indemnity and Its Possible Effects on the United States

The effects likely to be experienced by the United States as a result of the payment of an indemnity by Germany to France and Great Britain are receiving scant attention in the newspapers and other publications of this country. The probable explanation lies in the extreme difficulty of the subject and the fact that economic precedents from which conclusions might be drawn are almost entirely lacking. Perhaps all that can be done is to point out the difficulties of the subject, but if there are any measures which the United States can take to prevent this country being left "holding the bag" now is the time to ascertain what they are.

Our Interests Ignored

By reason of the peculiar circumstances growing out of the failure of the United States to ratify the Versailles treaty and the consequent absence of any representative of the United States from the discussions which have taken place with representatives of the German government at Paris, Spa and London the economic interests of the United States in the method of paying the indemnity have been almost entirely ignored. But students of economics know that certain effects are bound to follow certain causes and that results will assert themselves in obedience to laws that neither peace treaties, parliaments, reichstags, threats of reprisals nor the fiats of premiers can alter. The peace settlement is at heart not one of boundaries or nationalities, but of economic agreements, and in those agreements the United States has an interest profound and far-reaching. England and France may dictate terms to Germany based solely on their natural desire to extract a maximum of benefits while suffering a minimum of injuries, but in future years the policies they lay down now are bound to affect all the trade of the world and hence every branch of industry and every citizen of the United States.

U. S. Will Pay for War

The world is an economic unit and, in the end, great losses of wealth through such wholesale agencies of destruction as the late war fall on those who possess the most. It is impossible to cause loss to an individual or a nation that has nothing. In one way or another during the next fifty years the United States will pay most of the cost of the European war. With higher manufacturing costs, higher standards of living, greater productive and greater consuming capacities than any other nation in the world, the United States will be the natural, economic target for every other nation in the world.

U. S. the Dumping Ground For German Exports

In the present case both England and France are determined that Germany shall pay, but neither wants to have its markets flooded with German goods. Mr. Lloyd George has repeatedly admitted the seeming impossibility of any means of payment by Germany other than a large volume of exports, but where these exports are to be sold is a point seldom discussed by the statesmen of either England or France. Clearly public opinion in both countries regards the United States as the great clearing house through which German goods may find a market and credits be created for eventual transfer to England and France, principally, of course, the latter.

This brings the matter to the point where the United States may be expected, in the vernacular, to sit up and take notice. From him that hath shall be taken, is the crude law of panics, and who is he today that hath—but America.

Railroads Break More Records for Freight Transportation

Reports received from the railroads of the United States and compiled by the Bureau of Railway Economics show that for the second successive month, the carriers in December established a new record in the average load carried by each loaded freight car. The average for the month was 31.2 tons which was seven-tenths of a ton more than that attained in November when a new mark also was reached.

This increase in the average was made despite the fact that freight tonnage declined during the month and would indicate that even in the face of a falling off in business, the efficiency of the railroads in the movement of freight is being maintained. This mark is 1.2 tons higher than the goal set by the railroad executives last summer in a program outlined by them for the purpose of bringing about increased efficiency in freight movement.

Compared with December, 1919, when the roads were still under federal control, 31.2 tons is an increase of 3.5 tons over the average made then while it is also a gain of 1.4 tons above the average for the same month in 1918.

The average movement of freight cars in December was 24.8 miles per day compared with 26.8 miles in November. This was due principally to the increase in the number of empty freight cars moved to "home roads." In December, 1919, the average however, was only 22.3 miles and in the same month in 1918 it was 22.8 miles.

The decline in traffic during December was reflected in compilations showing that the net ton miles for the month, the number of tons of freight carried multiplied by the number of miles transported, totaled 34,722,365,000 which was a reduction of 2,736,259,000 compared with the total for November. It was however, an increase of 3.3 per cent over the net ton miles for December, 1919.

DeVlieg Manager of Handley-Knight Co.

President J. I. Handley, of the Handley-Knight Co. of Kalamazoo, Mich., recently announced the appointent of R. A. DeVlieg as chief engineer and factory manager of the Handley-Knight Co.

Mr. DeVlieg is well known in the industry and brings to the Handley-Knight company an extensive and varied experience in automobile engineering and manufacturing.

For five years prior to his association with the Handley-Knight, he was connected with the Dodge Brothers Co. Prior to that time he was for a number of years attached to the engineering staff of the Cadillac Motor Car Co. of Detroit. Through these connections Mr. DeVlieg gained an experience in automotive engineering and manufacturing that has established him as one of the nation's real experts in motor car building.

Keith Evans Heads E. A. A.

Keith J. Evans, advertising manager of Joseph T. Ryerson & Son, Chicago, Ill., was elected president of the Engineering Advertisers' Association at the annual meeting held March 8 at Chicago. Mr. Evans succeeds J. J. Arnsfield, advertising manager of the Fairbanks-Morse Co.



KEITH J. EVANS

Other officers elected were Julius Holl, advertising manager of the Link Belt Co., vice-president; D. T. Eastman, advertising manager of the Eagle-Picher Lead Co., secretary; J. H. Patterson, district manager of the P. H. & F. M. Roots Co., treasurer. G. S. Hamilton, advertising manager of the Conveyors Corporation of America, Edward I. Pratt, advertising manager of the Kellogg Switchboard and Supply Co., Benjamin Brooks, advertising manager of the Clay Products Association, and W. F. Leggett, advertising manager of the Webster Manufacturing Co., were elected directors.

New Orleans Metal Trades Revising Pay Schedule

The New Orleans Metal Trades Association is now engaged in revising the schedule of wages for the current year, whereby the pay schedule is to be reduced 10 per cent or more. The reduction will affect the pay of several thousand workmen, according to Warren Johnson, secretary of the association, which comprises about twenty-six of the large metal plants of New Orleans.

The association will also seek to change the present scale of labor from forty-four to forty-eight hours a week, the hours of labor asked of the men in pre-war times. Five per cent of single time will also be the pay for all double shifts. Skilled metal workers today are receiving 90 cents an hour from the association and the others 60 cents an hour. The reduction which is to be effective early this spring will first be submitted to the Metal Trades Council—the governing body of the workmen—for consideration, after which it will be referred to the employees themselves for action.

Annual Dinner and Meeting of the Chicago Branch of the National Metal Trades Association

The twenty-third annual dinner and meeting of the Chicago branch of the National Metal Trades Association was held at the Mid-Day Club, Chicago, Ill., on Tuesday evening, March 8. In addition to the annual reports of the officers a short program of addresses had been prepared. Among those present were national president, A. H. Newton, of Worcester, Mass., and second vice-president, W. W. Coleman, of Milwaukee. Mr. Newton's address dealt with the subject of the national organization and the present movement for the open shop, or American plan shop. Chairman William R. Moss, of the Executive Committee of the Chicago Association of Commerce, also addressed the meeting on the subject "A New Business Problem." The following officers were elected for the Chicago branch to serve during the ensuing year: President, S. T. Nelson, Sullivan Machinery Co.; vice-president, Harold B. Smith, Illinois Tool Works; treasurer, William Ganschow, William Ganschow Co.; secretary, Paul Blatchford, Room 1915, City Hall Square Building, all of Chicago.

England Reports Greater Output of Steel in 1920

The National Federation of Iron and Steel Manufacturers of Great Britain reports that production of pig iron, which, owing to the coal strike, fell from 741,000 tons in September to 533,200 tons in October and 403,200 tons in November, rose in December to 675,300 tons, making production for the year 8,000,700 tons, compared with 7,398,000 tons for 1919. Production of steel ingots and castings, which declined from 884,700 tons in September to 544,300 tons in October and 505,100 tons in November, rose to 745,400 tons in December, bringing the total to 9,055,600 tons, compared with 7,894,000 tons in 1919.

Col. House Endorses Foreign Trade Financing Corporation

Col. E. M. House, in a letter received recently by the Foreign Trade Financing Corporation, says that, had adequate system of long-term credits been previously available for the foreign purchaser, the surplus crops and manufactures which we have been unable to dispose of in overseas markets might have been moved. Through the means offered by corporations organized under the provisions of the Edge Law, an elevation of the foreign exchange rates and a stabilization of commerce will be made possible, he believes.

The letter was written to John M. Hugh, chairman of the committee on organization of the Foreign Trade Financing Corporation.

Progress of Railroad Reconstruction in France

The following details of the condition of the French railroads and their reconstruction since the armistice demonstrate the rapidity with which France has recovered from the effects of the war. Of the 2,404 kilometers of double track line totally destroyed during the war, all have been completely reconstructed. To permit normal traffic along these lines, it was necessary to wholly rebuild 1,400 signal towers, culverts and small bridges of the total of 1,503 destroyed. In addition, of the 2,785 kilometers of single track line destroyed, 1,810 have been entirely reconstructed and opened to traffic. Work on the remaining 975 kilometers is at present being carried out, but is progressing more slowly because double track line is being built instead of the single track line.

Some Actual Figures

The number of locomotives in service in France at the signing of the armistice was 14,537. On December 31, 1920, this number had increased to 18,429, of which 14,827 were French, 1,679 German, 1,299 of the Pershing type, and 624 of the American Government type. Orders for 1,200 locomotives are at present being carried out. The number of freight cars at the disposal of the French railroads in November, 1918, totaled 410,308. On Dec. 31, 1920, this number had increased to 518,810 of which 432,038 were French, 48,891 German, 18,194 of the Pershing type, and 9,687 American Government type. Work is at present being carried out on 2,500 freight cars for various roads. The figures for the railroads of Alsace-Lorraine are not included in the above total. These railroads have at their disposal 1,566 locomotives and 42,997 freight cars. They are to receive from Germany under the terms of the Peace Treaty a further 289 locomotives and 10,000 freight cars.

Placing Orders for Equipment

Not only are the French railroads placing orders for a great deal of new rolling stock and locomotives, but they have opened new repair shops to keep their present material in good condition. In the period immediately following the armistice, French railroad shops were able to repair 115 locomotives and 88,000 freight cars a month. In 1920 they repaired an average of 190 locomotives and 116,214 freight cars a month.

Further proof of the recovery of French railroads is given by the notable increase in traffic handled during the last three months of 1920, as compared with the last three months of 1919. The 1920 figures show an increase of 80 per cent in the number of passengers handled, of 95 per cent in the number of tons of fast freight handled, and of 20 per cent in the number of tons of ordinary freight carried. As a whole, the traffic of French railroads equals that of before the war.

Evolution of an "American Machinist" Article—V

This is a sketch of the *American Machinist* make-up man. Sometimes, when he has had the pages of an issue all made up and the M. E. insists on his re-making them to get in a rush article, he looks much worse. However, this doesn't happen often and between times he behaves fairly well. The make-up man receives proofs of the type and cuts of all articles; with these and sheets of paper the exact size of the published page, he makes his layout, or dummy, by



pasting proofs of the cuts and type in the location where they will finally be published. These proofs are so lettered and numbered that the printer will know where to locate the type and cuts. This man is responsible for the artistic appearance of the magazine. At times an article will not fit into a page exactly and a few lines will have to be cut out, or added to the article. In this case he either trims or adds a few words, or calls for the aid of the editor who edited the article.

The work of electrifying certain French roads, which started in 1920, has made rapid progress. The Midi Co., has 150 kilometers of double track electric line in operation and the work of electrifying a further 3,000 kilometers of track belonging to this road is actually in progress. The reconstruction of two hydro-electric plants, which will furnish 150,000 hp. each is nearly complete. The road has placed orders for 50 new electric locomotives of the type used by the Chicago, Milwaukee & St. Paul railroad. Two other French railroads have undertaken the electrification of sections of their line, the Orleans which is electrifying 3,000 kilometers, and the P.L.M., which also is electrifying 3,000 kilometers of road. The electric power for the Orleans road will be furnished by the water falls of the Upper-Dordogne, and for the P.L.M. by the falls of the French Alps. The cost of electrifying these roads will be in the neighborhood of 5,000,000,000 francs. The saving in coal will exceed 3,200,000 tons per annum, which, supposing the price of coal per ton to be above or equal to 100 francs, will, at the current rate at which money may be borrowed in France for such work, more than pay the interest on electrification bonds issued.

Ford Says Business Has Improved

The worst of the business depression is over, says Henry Ford, the automobile manufacturer. He declared business was improving steadily in Detroit and that similar gains should result in other parts of the country soon.

"Different conditions will prevail after the readjustment than before the war," he said. "There will be more economy in every way, but the volume of business will continually grow."

Duty Raised on Imports to India

According to a cablegram from Consul-General A. W. Weddell, Calcultta, the new budget of British India provides for a general increase of import duties effective March 1. The general increase on most products is from 7½ per cent ad valorem to 11 per cent.

Cotton machinery, which has been free of duty, has been assessed 2½ per cent ad valorem, is now dutiable at as motor cars and motorcycles, the duty has been increased from 7½ per cent to 20 per cent ad valorem. Sugar, formerly dutiable at the rate of 10 per cent ad valorem, is now dutiable at 15 per cent ad valorem, and tobacco has been changed from specific duties to 50 per cent ad valorem.

Personals

GEORGE C. WINCHEL, for several years associated with various Akron and Cleveland industries as special machine designer and engineer and for two years experimental engineer for the B. F. Goodrich Rubber Co., has opened offices at 304 Everett Bldg., Akron, Ohio, as a consulting and designing engineer of special, automatic and general production machinery, including general plant design and factory layout.

C. W. STAFFORD has been appointed manager of the Harriman Foundry and Machine Shop, Huntington, W. Va.

ALFRED W. CLARK has assumed the duties of general sales manager for the E. T. Fraim Lock Co., Lancaster, Pa.

VICTOR GREIFF, E.E., who joined the American Bosch Magneto Corporation of Springfield, Mass., a year ago, for the purpose of installing and putting into operation a research laboratory for the study and development of electrical automotive equipment has completed the work and returned to his home in New York City.

H. TERHUNE, formerly with the drop-hammer department of the Chambersburg Engineering Co., is now with the Massillon Foundry and Machine Co., Massillon, Ohio.

T. J. DAVIS, C. E. BLOCK and C. B. COLE have formed a tool distributing company in Chicago and have incorporated under the name of the Tool Sales and Engineering Co., with an office and warehouse located at 546 W. Washington Blvd., as direct factory representatives in several states in the Middle West.

L. FORD MERRITT, who has been serving as secretary and treasurer of the Wright-Fisher Engineering Co., Detroit, Mich., carrying on this work in his spare time, will now devote his full time to that organization, having resigned his position as consulting engineer of Joseph N. Smith and Co.

WILLIAM P. STOUT has been appointed district manager of sales of the Columbia Steel and Shafting Co., at Boston, Mass., succeeding R. C. MacMillen, resigned. Mr. Stout was formerly district manager of sales at Philadelphia and has been succeeded in that city by Joseph J. Conlisk.

H. J. GAUMOND, formerly with the Federal Machinery Sales Co., has been appointed Chicago district manager for the Gardner Machine Co. of Beloit, Wis. His office will be located at 12 North Jefferson St.

L. BREWSTER JACKSON has been appointed sales agent of the Philadelphia, Pa., branch office of the Wickwire-Spencer Steel Corporation of Buffalo, N. Y., and Worcester, Mass., to succeed his father, Lathrop Jackson, who died January 12 this year.

JAMES R. LOWE has been made general sales manager of the Harrisburg Foundry and Machine Works, Harrisburg, having recently been sales engineer with the Midwest Engine Co., Anderson, Ind.

CHARLES E. HILDRETH, formerly president and general manager of the Whitcomb-Blaisdell Machine Tool Co. of Worcester, Mass., has been elected a director and also general manager of Churchill-Morgan-Crittsinger, Inc., of Worcester, Mass., builder of grinding machinery. Mr. Hildreth is very well known to the machine-tool trade, having been for five years the general manager of the National Machine Tool Builders Association. Mr. Hildreth resigned Jan. 1 last from the Whitcomb-Blaisdell Co.

HENRY D. SHARPE, president and treasurer of the Brown & Sharpe Manufacturing Co. of Providence, R. I., machinery manufacturer, was recently elected vice-president of the Eastern States Agricultural and Industrial League of Springfield, Mass. This association runs the annual Eastern States Fair at West Springfield, Mass.

MARSHALL A. ELLIOTT, who will represent the Yale & Towne Manufacturing Co. of Stamford, Conn., in South Africa, will set sail for Cape Town about the middle of March. Mr. Elliott is also associated with the Denver Rock Drill Manufacturing Co.

SIDNEY L. CRAWFORD, advertising manager at the Boston headquarters of the combined companies of Reed-Prentice Co. and Whitcomb-Blaisdell Machine Tool Co., both of Worcester, Mass., and the Becker Milling Machine Co. of Hyde Park, Boston, has recently resigned his position.

JOHN P. CLARK has been appointed representative in Phoenix, Ariz., of the general sales department of the Gilbert & Barker Manufacturing Co. of West Springfield, Mass. Mr. Clark was formerly the representative of the company at Phoenix, but resigned a year ago to engage in the cotton growing business.

RICHARD GARLICK, treasurer of the Youngstown Sheet and Tube Co., Youngstown, O., was elected a director of the B. F. Stearns Co. at the company's annual meeting in Cleveland.

B. C. KRAMER, of Toledo, Ohio, was elected vice-president, when directors of the Maibohm Motors Co., Sandusky, O., organized. Harry C. Maibohm was re-elected president and W. J. Corr, secretary and treasurer.

JACOB R. KEISER, 416 South Broad St., Philadelphia, Pa., and associates, have organized the Sheet Metal Products Co. to manufacture metal specialties. They will operate a plant at Shamokin, Pa.

RALPH W. WOODRUFF, Selinsgrove, Pa., and associates, has organized the Monarch Manufacturing Co., to establish a plant for the manufacture of machinery and parts.

Business Items

The Austin Machinery Corporation New Orleans, La., with a capital o $100,000 preferred stock and $200,00 common stock, announces its incorpora tion under the laws of the State o Louisiana, as sole distributors fo Louisiana, Arkansas, Mississippi an Tennesse of the products of the Austi Machinery Corporation, manufacturer of contractors' equipment.

The Marion Metallic Vault Co. Marion, O., capitalized at $75,000, wil engage in the manufacture of thre different types of grave vaults. Th company plans to erect a plant whic will be equipped with electric weldin apparatus. The officers are: Presiden B. F. Waples; vice-president, C. F Werley; and secretary and treasure Jay H. Maish.

Directors of the Thomart Motor Co Akron, O., were re-elected at a recen meeting of the stockholders. The fol lowing officers were also elected: W. G Thompson, president; James L. Stew art, vice-president and general man ager; and B. A. Shearer, secretary an treasurer. Since last August ove $750,000 of the $1,000,000 stock of th first issue has been sold.

M. M. Nemirovsky, formerly a mem ber of the firm of S. Nemirovsky & Son has formed the Philadelphia Machin ery Exchange at 117 North 3d St Philadelphia, Pa., and will carry a ful line of new and used tools.

The Gilbert & Barker Manufacturin Co., of West Springfield, Mass., has an nounced the following recent addition to the sales force of the company: V H. Wilson, to the Pacific Coast divi sion, at Alameda, Cal.; William F Crabb, Leonard, Texas.

The Millers Falls Co., of Miller Falls, Mass., tool manufacturers, hel its annual meeting in Millers Falls o Feb. 18, and the following officers wer elected for the ensuing year: Presi dent, Philip Rogers; vice-president, J W. Smead; treasurer, G. W. Nims board of directors named were E. F Stoughton, G. W. Eddy, W. G. Steb bins, Philip Rogers and J. W. Smead

The Skinner Chuck Co., of New Britain, Conn., chuck manufacturers etc., recently filed a certificate wit the Secretary of State to add $225,00 to the capital stock of the company.

The Remington Arms Co., Inc., a Bridgeport, Conn., has resumed ful time operations after a six weeks partial time program. The change af fects over 3,500 employees in the arms ammunition and cutlery departments o the concern.

Manning, Maxwell & Moore, Inc., 11 West 40th St., New York, has take over the merchandise and good will o Patterson, Gottfried & Hunter, 21 Center St., New York. The liquida tion will take place May 1.

The Equipment Co. has just completed its organization for the purpose of handling locomotives, cars, railroad equipment, rails and rail accessories, machinery of all kinds, contractors' equipment and other things in the line of second-hand machinery and equipment. The company is taking over the equipment, rail and machinery business of A. Marx & Sons, Southern Scrap Material Co., and the Ship Supply Co. It will be under the direct management of Mr. Cleveland, who has been the manager of the New Orleans branch of the General Equipment Co., offices located at 411 Whitney-Central Building, New Orleans, La.

E. L. ESSLEY, president of the E. L. Essley Machinery Co. of Chicago, Ill., has recently purchased the entire interests of Frank S. Shields and others in the Cleveland Planer Co. and is now sole owner, president and treasurer. W. B. Currier, Jr., is vice-president, secretary and general manager.

The Myerstown Foundry and Manufacturing Co., Myerstown, Pa., has recently purchased the plant that it has been operating for a number of years, from the Treadwell Engineering Co., and will soon make a number of improvements. It has a fully equipped gray iron foundry, pattern forge and machine shop, but it is expected to purchase a lot of new tools in the near future. The officers of the company are L. F. Krum, president; E. R. Euston, vice-president; S. P. Line, secretary and treasurer.

Announcement is made of the organization of the Consolidated Instrument Co. of America, with offices at 461 Eighth Ave., New York, N. Y. The company will be the sole distributors of Jones tachometers and Hasler-Speed indicators. A special engineering service department has been formed which is at the disposal of clients. No charge is made for such service.

The Liberty Tool and Gauge Co., Detroit, Mich., which was organized in September, 1919, has been incorporated with a capital stock of $20,000. The company has acquired property on which to build a plant, but owing to present building and business conditions this has been postponed. The company manufactures precision machine tools, dies, gages, jigs and fixtures. The officers are: President and treasurer, Frank O'Neill; vice-president, John O'Neill; and secretary, Joseph Kepes.

At a recent stockholders meeting of Houston, Stanwood & Gamble Co., Cincinnati, Ohio, manufacturer of large lathes, steam engines and boilers, directors were elected as follows: C. R. Houston, J. B. Stanwood, A. W. Pope, Jr., W. W. Bishop and E. Goepper.

The new high school at Wheeling, W. Va., will be equipped with a modern machine shop. Plans are now under way to expend $30,000 for the purpose of buying material to equip the shop with the latest models of machine tools.

The Superior Williams Mill Co., North Wilkesboro, N. C., is installing a plant for the manufacture of the Superior "Williams" Burr mills, the manufacture of patterns and to conduct a general machine shop. The company also plans to deal in machine tools, steam and oil engines, saw mills, woodworking machinery, concrete mixers and mill supplies. E. V. Williams is general manager.

The Jig Bushing Co., maker of jig bushings for use in motor car plants and in other machine equipped plants, will begin production of a full line of its products at a new factory at Pontiac, Mich., on April 1. The plant is the largest industry to come into Pontiac. O. R. Briney and L. M. Richards, the latter a Cleveland man, are the owners.

The Campbell Foundry Co., with an office at 313 Manor St., Harrison, N. J., filed a certificate of incorporation today, in which John Campbell of 342 Clifton Ave., Newark, N. J., is named as statutory agent. The incorporators are John Campbell, Anton Hierman, and William Campbell. The company will engage in general metal foundry work.

The American and British Manufacturing Co., with plants at Bridgeport, Con., and Providence, R. I., has been placed in the hands of a receiver. The company asked for a receivership to protect its assets and also to carry on the business. George C. Van Tuyl, Jr., of New York, has been appointed receiver by the United States District Court.

The machine shops, foundry and cleaning room of the Mutual Enameling Co.'s new plant at Alton Park, Chattanooga, Tenn., are now under construction and operations are expected to begin about July 1, according to Hollis M. Caldwell, of the Cahill Iron Works, Chattanooga, who is also an official of the Mutual company.

The furnaces of the Roane Iron Co., at Rockwood, Tenn., have been shut down for an indefinite period for the first time in the fifty-three years the company has been in business.

Darwin & Milner, Inc., maker of crucible and electrically melted carbon and alloy steels, has removed its office and warehouse from New York to 403 Long Ave., Cleveland, Ohio. H. Reinhardt, 80 Rutland, Rd., Brooklyn, N. Y., will act as general district agent for New York and adjacent territories, while the Brooklyn Steel Treating Corporation, 8-10 Franklin St., Brooklyn, N. Y., will be its special representative for New York City and also carry some stock.

The Southwark Foundry and Machine Co., Philadelphia, Pa., has opened a district office at 804 Swetland Building, Cleveland, Ohio. Stewart Bolling, who for seven years has been engineer salesman for this company, will be in charge of this office.

The new Chilean tariff schedule which became a law Feb. 23 makes no changes in the import duties on machine tools.

Trade Catalogs

Portable Drills. The Neil & Smith Electric Tool Co., Cincinnati, Ohio. Drill Bulletin No. 9, twelve pages, 6 x 9 in., giving full description and specifications for various types of N & S portable drills. One section is devoted to a summary of the results of a drill test entered into by six drill manufacturers.

Hasler Speed Indicator. Consolidated Instrument Co. of America, 461 8th Ave., New York, N. Y. A four-page circular describing "the world's most accurate" instrument for use in measuring speeds of engines, motors, turbines and other mechanical appliances.

Jones Tachometers. Consolidated Instrument Co., of America, 461 8th Ave., New York, N. Y. Circular describing briefly the type "B" tachometer which was designed especially for use on U. S. War and Navy Department aircraft during the war. Full details of construction and operation, and specifications are included.

Gear Hobbers. Hercules Machine and Tool Co., New York, N. Y. Ten page catalog, 8½ x 11 in., giving full description with illustrations of Hercules 8-in. and 24-in. gear hobbing machines. Valuable information on gear tooth parts and hobs is included.

Euclid Cranes and Hoists. Euclid Crane and Hoist Co., Euclid, Ohio. Catalog No. 19, forty-eight 8½ x 11 in. pages; describing the many types of Euclid electric hoists, monorail trolleys, traveling cranes, wall and jib cranes, etc.

Safety, Sanitation and Welfare. United States Steel Corporation, New York, N. Y. Bulletin No. 8, ninety-six 8½ x 11-in. pages. A model work of the printer's and engraver's art; a comprehensive survey of safety sanitation and welfare work in the many plants and branches of this great corporation.

Forthcoming Meetings

The National Metal Trades Association will hold its annual convention at the Hotel Astor, New York, on April 18, 19, 20, 21. Homer D. Sayre, Peoples Gas Building, Chicago, Ill., is secretary.

The fifth annual convention of the American Gear Manufacturers Association will be held in Cincinnati, Ohio, April 27, 28, 29 and 30.

The ninth annual meeting of the Chamber of Commerce of the United States will be held at Atlantic City, April 27 to 29, with headquarters at the Traymore Hotel.

The annual meeting of the American Welding Society will be held in the Engineering Societies Building, 29 West 39th St., New York, on April 28.

The Society of Industrial Engineers will hold its national convention in Milwaukee, Wis., on April 27, 28 and 29. Geo. C. Dent, 327 So. La Salle St., is business manager.

The National Foreign Trade Council will hold its eighth annual convention in Cleveland, Ohio, on May 4, 5, 6 and 7. J. G. Hammond, care of the Council, 409 Park Bldg., Cleveland, is secretary.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The spring meeting of the American Society of Mechanical Engineers will be held at the Congress Hotel, Chicago, May 23-26. Calvin W. Rice, Engineering Societies Bldg., 239 West 39th St., New York, is secretary.

The Society of Automotive Engineers, 29 West 39th St., New York announces that its summer meeting will be held at West Baden, Ind., on May 24 to 28 inclusive.

Condensed-Clipping Index of Equipment

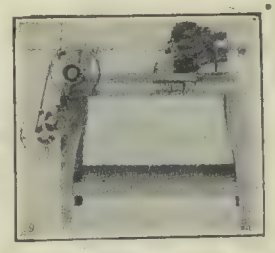
Patented Aug. 20, 1918

Furnace, Moving-Floor, Automatic-Feed
Advance Furnace and Engineering Co., Springfield, Mass.
"American Machinist," Feb. 10, 1921



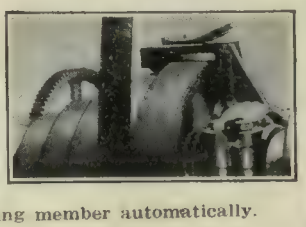
This furnace is intended to heat work for hardening, carbonizing or annealing. The operation of the feeding device is intermittent, power being supplied at predetermined intervals by either hydraulic or pneumatic pressure. The moving parts are under control of an electric timing device, and consume no power except during the short period required to make each movement. The timing device is operated by an electric motor of not more than ⅛ hp. The furnace may be of any desired length and the movements of the feeding device made long or short in proportion to the length of furnace, so that long work can be accommodated and pre-heated in successive stages.

Boring Machine, Combination, Automotive-Engine
K. R. Wilson, 10-16 Lock St., Buffalo, N. Y.
"American Machinist," Feb. 10, 1921



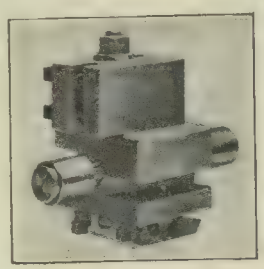
The machine is intended for work on automotive-engine cylinder blocks and crankcases. It is adapted to boring, reaming and running in main bearings, as well as boring cylinders. Two speeds are provided. The spindle is worm-driven, with a speed reduction of 20 to 1. The boring bar is supported at each end of the cylinder by bearings in stationary guides, its location in the center of the cylinder being determined by means of split taper plugs fitting on the bar. The bar is driven from the head through a universal joint and is fed forward by means of a screw, a split nut being caused to engage the thread on the spindle for this purpose, thus advancing the bar 1/40 in. per revolution. The boring bar is 1⅞ in. in diameter, and the cutter is supported close to the point.

Brake, Lathe, Friction.
Ephriam M. Kaust, 136 Lincoln St., Steelton, Pa.
"American Machinist," Feb. 10, 1921



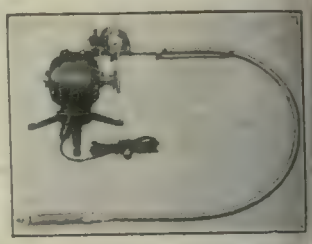
The brake can be fitted to any size cone-driven lathe up to 40-in. swing. The frame of the brake is bolted to the front spindle cap of the lathe, using the original cap bolts and it reaches up and over the rear guard. The braking member, which has a renewable leather contact, engages on the face of the large cone pulley. The normal position of the brake lever is parallel to the spindle. When the brake is released, a coil compression spring disengages the braking member automatically.

Toolholder, Lathe, Combination
Ashley Machine Works, 714 University Ave., Rochester, N. Y.
"American Machinist," Feb. 10, 1921



The holder is intended to reduce machining operations performed on turret machinery. It is furnished with a toolblock, a pilot stem, and a pilot bushing of any standard size, and is made in two sizes, Nos. 1 and 2. The No. 1 holder has a 1¼-in. shank and carries ⅝-in. tools. Two pilot stems, Nos. 3 and 5 are made for this size. The No. 3 is used for bushings ranging from ⅝ to ⅞ in., and the No. 5, for bushings ranging from 1⅛ to 1⅜ in. The No. 2 holder has a 1½-in. shank and carries ⅝-in. tools. Two pilot stems, Nos. 4 and 6, are made for this size. The No. 4 is used for bushings ranging from 1 to 1⅜ in., and the No. 6 for bushings ranging from 1⅛ to 3 in.

Flexible-Shaft Machine, Die-Sinking, Type H-5
R. G. Haskins Co., 27 South Des Plaines St., Chicago, Ill.
"American Machinist," Feb. 10, 1921



This machine is fitted with a swivel base mounting which allows it to rotate through a complete circle. In this way considerable bending of the shaft is avoided, since the wheel or tool on the working end of the shaft can be brought without cramping into any desired position. A leaf spring supports the flexible shaft at the motor end, so that the radius of bend is reduced at this place, which is the most common point of failure of flexible shafts. It is claimed that the improvements on the machine decrease the amount of bending and friction in the shaft, thus prolonging its life.

Squaring and Fluting Head, Multiple-Spindle, No. 1½
Miller & Crowningshield, Greenfield, Mass.
"American Machinist," Feb. 10, 1921



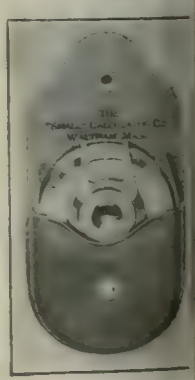
This head can be furnished with either four or six spindles, being intended for the squaring of the ends and the fluting of taps and reamers. The tail centers are removable and interchangeable. Centers of different types, for holding either round or square stocks, can be furnished. Specifications: No. of spindles, 4 and 6. Combined length of two blocks, 17 in. for 4 spindles, 24 in. for 6 spindles. Width of headstock, 8½ in. for 4 spindles, 11⅜ in. for 6 spindles. Height to center, 3 7/16 in. Can swing work up to 1⅝ in. in diameter. Capacity: to square taps, ½ to ⅝ in. in diameter; to flute taps, ⅝ to 1 in. in diameter; to flute reamers, ½ to 1½ in. in diameter. Net weight, 130 to 260 lb. depending upon size.

Grinder, Air-Operated, Turbine
Turbine Air Tool Co., 710 Huron Rd., Cleveland, Ohio.
"American Machinist," Feb. 10, 1921



This grinder is intended for cleaning castings, but can carry wire brushes and buffing and polishing wheels. It is fitted with a throttle at the point where the hose attaches, and the housing between the wheel and the motor provides a grip for the operator. The housing is made of aluminum, and the turbine of an aluminum alloy of high tensile strength. Ball bearings are used. The tool weighs 16 lb. when equipped with a 6 x 1-in. wheel. It consumes 30 cu.ft. of free air per minute at from 80 to 100 lb. per square inch pressure. It is claimed that the grinder will maintain the proper speed for the wheel when grinding. The tool is said to have but few parts and to be compactly made, to have perfect speed control and to be free from vibration.

Calculator, Pocket
Small, Small & Co., Waltham, Mass.
"American Machinist," Feb. 10, 1921



The device is intended primarily for performing such calculations as are ordinarily performed on a slide rule. It consists essentially of a 6-in. logarithmic slide rule, with the scale bent into a circle, so as to form a compact and small instrument. It is composed of a baseplate carrying continuous scales on its periphery and lower face; a moveable top plate, or rotor, arranged to turn on the hub of the first member and carrying similar scales on its periphery and face; a slotted hub nut to keep the rotor in place and to adjust the friction; a runner with a hair line; and pointers to be used in setting and reading the values. An instruction book is furnished.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED SHOPS



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Mass., Boston—The Keystone Mfg. Co., 53 Wareham St., E. M., Swarts, Purch. Agt. —one power driven bar folder, about 30 in.; also power sheet metal beading machine with small shafting.

Mass., Shrewsbury—J. Supple—one small screw cutting lathe.

N. J., Trenton—The Trenton Flint & Spar Co., Marion St.—$50,000 worth of machinery.

N. Y., Rochester—The North East Electric Co., 348 Whitney St.—medium sized thread milling machine similar to Foster machine used on fuses in munition plants.

La., New Orleans—The A. M. Lockett Co., 521 Baronne St. sensitive bench drill.

N. C., Sims—The Neverson Granite Co.—large lathe.

Tenn., Memphis—The Tractor Cultivator Co., 608 McCall Bldg., R. N. Phipps, Secy. gear cutting machines, milling machines, etc., for the manufacture of farm tractors, etc.

Va., Richmond—The Bitner Motor Repair Shop, 301 North Gilmore St., A. Bitner, Purch. Agt.—automatic screw machine, 16 in. engine lathe, milling machine, spindle drill press and an 18 in. stroke shaper.

Va., Richmond — J. K. O'Shannon, 722 West Broad St.—one (new or used) 13 in. lathe, drill press and emory buffing stand, for his machine and auto repair works.

Va., Richmond — The Younglove Body Wks., 308-10-12 North Henry St., A. Younglove, Purch. Agt.—rotary shears, drill press and combination woodworking machinery.

Mich., Bay City — The Cooley Castings Co.—complete machine tool equipment for small machine shop (used equipment in good condition preferred).

Mich., Niles—W. C. Shinn Mfg. Co.—swaging machine for pointing ¾ in. copper cubes (used).

O., Cincinnati—The Jones Machine Tool Co., 435 East Pearl St., A. Jones, Purch. Agt.—No. 3 or No. 2 Williams & White bulldozer, (or equal), and a 6 ft. Universal radial drill.

O., Lorain—The Long Garage Co.—14-16 in. engine lathe, 18-20 in. drill press, and miscellaneous equipment (used).

Wis., Beaver Dam—The Bell Mfg. Co., manufacturers of barn equipment, S. Krapp, Jr., Purch. Agt.—additional machine tools.

Wis., Cedarburg — The Lauterbach Auto Sales Co., J. Lauterbach, Purch. Agt.—1 cylinder grinder.

Wis., Milwaukee—A. Kiefer & Co., Mason and Milwaukee Sts., manufacturers of sheet metal, A. Keifer, Purch. Agt.—one square shear and one bending roll.

Wis., Milwaukee — The Lincoln Light Corp., 151 7th St.—sheet metal working machinery.

Wis., West Allis — J. Barnekow Garage Co., 87th and Greenfield Sts., J. Barnekow, Purch. Agt.—lathe suitable for auto repair work.

Machinery Wanted

Conn., New Britain — The Niedzwicecki Bakery, Farmington Ave. — bakery equipment.

Mass., South Braintree—(Boston P. O.) The Monatiquot Rubber Wks. Co.—special rubber machinery, presses, vacuum dryers, etc.

N. J. Old Bridge—The Enamel Brick & Tile Co.—machinery.

N. J., Trenton—A. M. Mander, c/o Amer. Rotex Mfg. Co., leather manufacturers — $100,000 worth of new machinery for plant here.

Pa., Waynesboro—The Frick Co., A. O. Frick, Vice Pres. and Genl. Mgr.—equipment for proposed foundry.

Fla., Jacksonville — Farris & Co., 410 Davis St.—complete equipment for cold storage plant and slaughter house.

Va., Crozet—The Crozet Pin & Bracket Co., W. P. Bickers, Purch. Agt.—one barrel heading (automatic) turner of standard make such as Greenwood or Trever; one 24 x 4 double-roll single surfacer planer, and one 4 ft. barrel heading jointer with 20 in. knives.

Ky., Prestonburg—The Bailey Ferguson Coal Co., S. C. Ferguson, Genl. Mgr.—mining machinery, including screens, tipples, fans, engines, etc.

Ill., Chicago—The Great Northern Chair Co., 2500 Ogden Ave.—4 side sticker for 4 in. material.

Ind., Ft. Wayne—Comrs. Allen County—kitchen, laundry, ice and refrigeration equipment.

O., Cleveland—The Gilman Printing Co., 623 St. Clair Ave.—20 in. band saw.

O., Logan—The Logan Products Co., J. J. Pfieffer, Pres.—complete sewer pipe manufacturing machinery, including crushers, etc.

O., Pleasantville—The Pleasantville Window Glass Co., W. S. Warrick, Genl. Mgr. —$75,000 worth of new equipment.

Wis., Ft. Atkinson—The Creamery Package Mfg. Co., manufacturers of dairy equipment, H. Curtis, Purch. Agt.—brass foundry equipment.

Wis., Milwaukee—The Atlas Bread Co., 927 Central Ave.—bakery equipment.

Wis., Milwaukee — Ellsworth & Thayer Mfg. Co., 336 Bway., manufacturers of gloves and sheepskin lined coats—power sewing machines, etc.

Wis., Randolph — The Randolph Wagon Co., c/o W. Gossink, Secy.—wood-working and power machinery.

Col., Denver — R. B. Lamb, Engr., 711 Symmes Bldg., is in the market for machinery for the Gem Mining Co., at Idaho Springs.

Metal Working

NEW ENGLAND STATES

Conn., Hartford—The Brodrib Bros. Auto Co., 59 Congress St., plans to build a 1 story, 50 x 75 ft. garage on Maple Ave. Estimated cost, $15,000.

Conn., New Haven—J. W. Hine, Inc., 88 Commerce St., plans to build a 1 story, 90 x 90 ft. addition to garage. Estimated cost, $30,000. D. E. Smith, 152 Temple St., Archt.

Conn., New Haven—The New Haven Gas Light Co., 80 Crown St., has awarded the contract for the construction of a 1 story, 40 x 45 ft. addition to its exhaust machine building on Railroad Ave. Estimated cost. $12,000.

Mass., Allston—(Boston P. O.) Coleman & Gilbert, 331 Huntington St., have awarded the contract for the construction of a 2 story garage on Brighton Ave. Estimated cost, $100,000. Noted March 17.

Mass., Brighton—(Boston P. O.) J. S. McLearn, 160 Allston St., has awarded the contract for the construction of a 2 story garage on Chestnut Hill Ave. Estimated cost, $60,000.

Mass., Holyoke—The Dept. of Pub. Wks. plans to build a garage on Sargent St. Estimated cost, $20,000.

Mass., Malden—(Boston P. O.) M. Foley plans to build a 1 story, 90 x 110 ft. garage on Main and Clinton Sts. Estimated cost, $50,000.

Mass., Malden—(Boston P. O.) Potter Bros., 339 Main St., have had plans prepared for the construction of a 1 story, 50 x 100 x 50 ft. garage on Eastern and Main Sts. Estimated cost, $40,000. W. T. Littlefield, 9 Hamilton Pl., Boston, Arch. and Engr.

Mass., Whitinsville — W. J. Walker, Church St., has awarded the contract for the construction of a 1 story, 60 x 80 ft. garage. Estimated cost, $20,000.

R. I., Providence — The Builders Iron Fdry., 9 Codding St., has awarded the contract for the construction of a 1 story machine shop, to cover 12,000 sq.ft. floor space, on Kinsley Ave. Estimated cost, $20,000.

MIDDLE ATLANTIC STATES

N. J., Newark—Bender & Son, c/o N. J. Convery, Archt. and Engr., 790 Broad St., are having plans prepared for the construction of a 1 story, 50 x 100 ft. machine shop on Emmet St.

N. J., Old Bridge—The Enamel Brick & Tile Co. has awarded the contract for the construction of a 1 story, 50 x 80 ft. machine shop and dye storage building. Estimated cost, $15,000.

N. J., Trenton—J. E. Thropp Sons Co., Fair St., will build a 1 story, 30 x 75 ft. forge shop, for the manufacture of tire making machinery. Estimated cost, $25,000. J. O. Hunt, 114 North Montgomery St., Archt.

N. J., Trenton—The Trenton Flint & Spar Co., Marion St., has awarded the contract for the construction of a 2 story, 30 x 190 ft. flint plant and a 30 x 50 ft. motor room. Estimated cost, $75,000.

N. Y., New York—(Borough of Bronx) J. Rinaldi, 167 East 121th St., New York City, has awarded the contract for the construction of a 1 story, 120 x 135 ft. garage on Southern Blvd. and 141st St. Estimated cost, $30,000.

N. Y., New York—(Borough of Brooklyn) T. Roulston, 100 9th St., has awarded the contract for the construction of a 1 story, 100 x 105 ft. garage at 9th St. and 2d Ave. Estimated cost, $80,000.

THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$30.75
Northern Basic	28.52
Southern Ohio No. 2	30.50
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	33.16@34.16
BIRMINGHAM	
No. 2 Foundry	26.50
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75 sil.	*27.25
Virginia No. 2	*34.75@35.75
Basic	†27.25
Grey Forge	*27.75
CHICAGO	
No. 2 Foundry local	25.00@27.00
No. 2 Foundry, Southern, sil 2.25@2.75	33.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26.00
Basic	25.00
Bessemer	27.00

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse	New York Delivered	Cleveland	Chicago
Structural shapes	$3.58	$3.68	$3.58	$3.58
Soft steel bars	3.48	3 88	3.34	3.48
Soft steel bar shapes	3.48	3 58	3.48	3.48
Soft steel bands	4.18	4.28	6.25	....
Tank plates	3.78	4.78	3.78	3.78

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.25@$2.35
Warehouse, New York	3.48
Warehouse, Cleveland	3.52
Warehouse, Chicago	4.12

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.20@3.55	4.50	4.00	4.68
No. 12	3.25@3.60	4.55	4.35	4.73
No. 14	3 30@3.65	4.60	4.40	4.78
No. 16	3 40@3.75	4.70	4.50	4.88
Black				
Nos. 17 and 21	3.75@4.15	5.30	4.95	5.55
Nos. 22 and 24	3.85@4.20	5.35	5.10	5.60
No. 25 and 26	3.90@4.25	5.40	5.15	5.65
No. 28	4.00@4.35	5.50	5.25	5.75
Galvanized				
No. 10 and 11	4.25@4.70	5.40	5.50	6.10
No. 12 to 14	4.35@4.80	5.50	5.60	6.20
Nos. 17 and 21	4.65@5.15	5.90	5.90	6.50
Nos. 22 and 24	4.80@5.25	6.05	6.05	6.65
No. 26	4.95@5.40	6.20	6.20	6.80
No. 28	5.25@5.70	6.50	6.50	7.10

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$5.50	$5.25	$4.84
Flats, squares and hexagons, per 100 lb.	6.00	5.75	5.34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	50%
Cleveland	50%
Chicago	50%

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	
Ingots	38	Cold rolled rods (base)	
Sheet bars	40	Hot rolled sheets (base)	

Special Nickel and Alloys	
Malleable nickel ingots	
Malleable nickel sheet bars	
Hot rolled rods, Grades "A" and "C" (base)	
Cold drawn rods, Grade "A" and "C" (base)	
Copper nickel ingots	
Hot rolled copper nickel rods (base)	
Manganese nickel hot rolled (base) rods, "D"—low manganese	
Manganese nickel hot rolled (base) rods "D"—high manganese	

Electric Welding Wire—Welding wire in 0-lb. lots sells as follows, f.o. New York: 5/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per l

MISCELLANEOUS STEEL—The following quotations in cents per pou are from warehouse at the places named:

	New York	Cleveland	Chica
Openhearth spring steel (heavy)	6.00	8.00	9 0
Spring steel (light)	8.00	7.00	12 0
Coppered Bessemer rods	8.50	8.00	7.0
Hoop steel	4 58	4.04	4 1
Cold rolled strip steel	9 00	8.25	9 2
Floor plates	5.75	4.00	6 0

WROUGHT PIPE—The following discounts are to jobbers for carload lo on the Pittsburgh basing card:

Inches	Steel Black	Galvanized	Inches	Iron Black	Galvanize
BUTT WELD					
⅜ to 3	57½%	44%	¼	15½–16½%	+10½–11½
			⅜	19½–20½%	1½– 2½
			½ to 1¼	24½–25½%	8½– 9½
LAP WELD					
2	50½%	38%	2	20½–21%	6½– 7%
2½ to 6	53½%	41%	2½ to 6	22½–23%	9½–10%
7 to 12	50½%	37%	7 to 12	19½–20%	6½– 7%
13 to 14	41%	....			
15	36½%				
BUTT WELD, EXTRA STRONG PLAIN ENDS					
⅜ to 1¼	55½%	43%	⅜ to 1¼	24½–25½%	9½–10½
2 to 3	56½%	44%			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	48½%	37%	2	21½–22½%	8½– 9
2½ to 4	51½%	40%	2½ to 4	23½–24%	11½–12
4½ to 6	50½%	39%	4½ to 6	22½–23%	10½–11
7 to 8	46½%	33%	7 to 8	14½–15%	2½– 3
9 to 12	41½%	28%	9 to 12	9½–10%	+2 –2½

Warehouse discounts as follows:

	—New York— Black	Galv.	—Cleveland— Black	Galv.	—Chicago— Black	Galv
⅜ to 3 in. steel butt welded	44%	28%	42½%	33½%	57½%	44%
2½ to 6 in. steel lap welded	39%	24%	44½%	29½%	53½%	41%

Malleable fittings. Classes B and C, Banded, from New York stock sell a plus 6%. Cast iron, standard sizes, 15% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quota tions in cents per pound, in quantities up to car lots:

Copper, electrolytic	13 50
Tin in 5-ton lots	29 25
Lead	4 50
Zinc	6.00

ST. LOUIS (In carload lots)	
Lead	4.10
Zinc	5.60

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.25	20.00	20 00
Copper wire (carload lots)	15.00	17.50	16.5
Brass sheets	17.25	24.00	19 2
Brass pipe	21.00	22.00	22 5
Solder (half and half) (case lots)	19.00	26.00	19.5

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 2 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill, 1,000 lb. and over, warehouse, net extra:

New York	15.25
Cleveland	19.00
Chicago	19.25

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill + less 8% for carload lots..... 11.50

	Warehouse	
	In Casks	Broken Lots
Cleveland	13.70	14.30
New York	12.50	13.50
Chicago	14.50	14.95

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.25
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	10.00
Copper, heavy, and wire	9.00	9.50	8.50
Copper, light, and bottoms	8.00	9.00	8.00
Lead, heavy	3.25	4.00	3.75
Lead, tea	2.00	3.00	3.00
Brass, heavy	6.00	7.00	9.75
Brass, light	4.50	5.00	5.50
No. 1 yellow brass turnings	5.00	5.50	6.00
Zinc	3.00	3.00	3.50

ALUMINUM—The following prices are spot from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.4	24.50	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.00
Chicago	19.00
Cleveland	22.00

BABBITT METAL—Warehouse price per pound:

	New York	Cleveland	Chicago
Best grade	70.00	46.00	35.00
Commercial	30.00	16.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$1.00	+1.15
Hot pressed hexagon	List	1.00	+1.15
Cold punches hexagon	List	1.00	+1.15
Cold punched square	List	1.00	+1.15

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	70%
Cleveland	70%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	45%	60%	50%
1½ and 1¼ in. by 3 in. up to 12 in	25%	50%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $3.50 Chicago..... $2.50

For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $4.00 Chicago..... $4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅜ by 6 in. and smaller	40%	50%	40%
Larger and longer up to 1 in. by 30 in	40%	40%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	35%	10%
Chicago	net	net
New York	50%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	45%	50%	45%
Tinned	45%	50%	30%

Structural, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$5.08 Cleveland...$5.00 Chicago...$5.08 Pittsburgh..$3.90

Boiler, same sizes:
New York...$5.30 Cleveland...$5.10 Chicago...$5.18 Pittsburgh..$4.00

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	29.00
Brass	21.00	24.00	28.00

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ⅛-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.50 per 100 lb. In Cleveland—$8.50 per 100 lb.; New York price is 8c.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	13.50@14.00	13.00	14.25
Colored mixed	7.00@12.00	10.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York	$2.25
Philadelphia	2.00
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (25 bbl.)	$2.55
Philadelphia (25 bbl.)	2.55
Chicago	4.90

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$4.50
Prompt foundry	5.50@6.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$6.00
Cleveland	100-lb. bag	[illegible]

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.73	$0.90	$0.75
5-gal. cans	.76*	1.15	.90

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13
12½-lb. keg	13.50	15.00	13
5-lb. cans	16.00	17.50	
1-lb. cans	18.00	19.50	

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; [illegible] lots less 10-7½% discount.

N. Y., New York—(Borough of Manhattan) R. Hartshorne, c/o L. A. Sheinart, Archt. and Engr., 194 Bowery, will build a 2 story, 100 x 175 ft. garage at 550 West 25th St. Estimated cost, $125,000.

Pa., Homestead — The Homestead Valve Mfg. Co., 6th Ave., is having plans prepared for the construction of a 3 story, machine shop. Estimated cost, $200,000. C. N. Hoggart, 4th Ave., Pittsburgh, Archt. and Engr.

Pa., Middletown—Heagy & Alberts Co. will soon receive bids for the construction of a 2 story, 110 x 120 ft. garage in Eagle Heights. Estimated cost, $75,000.

Pa., Waynesboro—The Frick Co. recently increased its capital stock from $2,000,000 to $5,000,000 and plans to build additions. One of the first projects to be undertaken will be the construction of a new iron foundry. A. O. Frick, Vice-Pres. and Genl. Mgr.

SOUTHERN STATES

Va., Richmond—The Advance Realty Co., Governor and Ross Sts., has awarded the contract for the construction of a 3 story, 40 x 50 x 120 ft. garage at 1300 Block, West Broad St. Estimated cost, $50,000.

MIDDLE WEST STATES

Ill., Chicago—The Christopher Motor Co., 3812 Sheffield Ave., has awarded the contract for the construction of a 1 story, 100 x 210 ft. garage and auto sales building at 5051 Bway. Estimated cost, $135,000.

Ill., Chicago—The Sellers Mfg. Co., 332 South Michigan Ave., manufacturers of railway supplies, plans to build a 1 story, 100 x 150 ft. addition to its factory at 4651 Pensacola St. Estimated cost, $100,000. H. D. Hudson, 2047 Ogden Ave., Engr.

Ind., Ft. Wayne—Vetter Bros. will soon award the contract for the construction of a 2 story, 85 x 120 ft. garage at 5 Bway. Estimated cost, $75,000. L. Bowers, Ft. Wayne, Archt.

Ind., Kokomo — The Worth Wire Wks. plans to build a 1 story, 60 x 100 ft. wire factory on North Washington Ave. Estimated cost, $15,000. C. Ferriter, Kokomo, Archt.

O., Cincinnati—V. Stange has awarded the contract for the construction of a 1 story, 60 x 250 ft. and 60 x 120 ft. garage and service station on Gilbert Ave. Estimated cost, $40,000.

O., Cleveland—J. Babin, 827 Superior Ave., will receive bids until April 1 for the construction of a 1 story, 90 x 110 ft. garage on Hough Ave. and East 55th St. Estimated cost, $50,000. N. Petti, Williamson Bldg., Archt.

O., Columbus—The Gaddis Harrison Brick Co., Brunson Bldg., is making sketches for a 2 story, 60 x 94 ft. service station on South 5th St. Estimated cost, $75,000. Private plans.

O., East Cleveland—(Cleveland P. O.) C. Mormino, 12432 Superior Ave., has awarded the contract for the construction of a 2 story, 52 x 122 ft. garage on Superior and Bender Aves. Estimated cost, $50,000. Noted March 3.

O., Logan—The Logan Products Co. will build a factory for the manufacture of sewer pipe to replace the one which was recently destroyed by fire. Estimated cost, including machinery, $300,000. J. J. Pfiefer, Pres.

Wis., Cedarburg—The E. & W. Mfg. Co., 325 Oregon St., Milwaukee, manufacturers of motor trucks and trailers, plans to build a 1 story, 60 x 120 ft. factory, here. Estimated cost, $50,000.

Wis., Green Bay—The Green Bay Drive Calk Co., State and 9th Sts., has awarded the contract for the construction of a 2 story, 50 x 190 ft. forge plant, etc. Estimated cost, $75,000.

STATES WEST OF THE MISSISSIPPI

Mo., Kansas City—D. L. Piggott, 12th and Prospect Aves., has had plans prepared for the construction of a 1 story, 113 x 144 ft. garage, on 12th and Illinois Aves. Estimated cost, $40,000. W. E. Harris, 2110 North 5th St., Kansas City, Kan., Archt. Noted March 3.

WESTERN STATES

Cal., Los Angeles — A. Hamburger & Sons, 8th St. and Bway., have awarded the contract for the construction of a 1 story, 35[illegible] x 360 ft. warehouse and garage on [illegible]erson and Grand Aves. Estimated cost, [illegible]000.

General Manufacturing

NEW ENGLAND STATES

Conn., Hartford—A. Goldstein, 593 Windsor St., will construct a 3 story, 48 x 65 ft. mercantile building and garage on Morgan and Front Sts.

Conn., New Britain—The Niedzwiecki Bakery, Farmington Ave., is having plans prepared for the construction of a 2 story, 45 x 65 ft. bakery. H. A. Ludorf, Mutual Bldg., Archt.

Mass., Cambridge—Mason & Hamlin Co., 492 Boyston St., is having preliminary plans prepared for the construction of a piano factory on Bway and 3d St. Monks & Johnson, 99 Chauney St., Engrs.

Mass., New Bedford—F. Bosse, 1861 Purchase St., manufacturer of brooms, has had plans prepared for the construction of a 2 story factory and garage. Estimated cost, $30,000. O. Cropo, 514 Bowditch St., Archt.

Mass., Salem—Michaud & Co., 221 Essex St., plans to build a 2 story, 40 x 100 ft. factory on Canal St., for the manufacture of shoe trimmings. Estimated cost, $20,000. G. H. Fanning, c/o owner, Archt.

Mass., South Braintree—(Boston P. O.) The Monatiquot Rubber Wks. is having plans prepared for the reconstruction of its factory which was recently destroyed by fire. Estimated cost, $200,000. J. O. DeWolf Co., 45 Bromfield St., Boston, Archts. Noted March 3.

Mass., Springfield—J. Whitcomb & Co., Railroad Ave., manufacturers of cigars, will soon award the contract for the construction of a 4 story, 35 x 40 ft. addition. H. L. Sprague, 310 Main St., Archt.

MIDDLE ATLANTIC STATES

N. J., Trenton—The Amer. Rotex Mfg. Co., Cleveland, O., leather manufacturers, has purchased the Trenton Lamp, Brass and Copper Wks., here, and plans to build additions. Estimated cost, $30,000.

N. Y., Union Hill—The Consumers Dairy Co., 400 Fulton St., has awarded the contract for the construction of an addition to its 3 story dairy. Estimated cost, $100,000.

SOUTHERN STATES

Fla., Jacksonville—Farris & Co., 410 Davis St., plans to build a 3 story, 75 x 100 ft. cold storage plant for meat packing. Estimated cost, $50,000.

MIDDLE WEST STATES

Ill., Chicago — Pauls Bake Shop, 640 North Cicero Ave., has awarded the contract for the construction of a 1 story, 85 x 125 ft. bakery at 4157 West Grand Ave.

Ill., Chicago—E. O. Reed, Inc., 2956 North Leavitt St., has awarded the contract for the construction of a 1 story, 125 x 140 ft. candy factory at 1249 Fletcher St. Estimated cost, $65,000.

Ill., Decatur—The Decatur Lumber Mfg. Co., 606 North Water St., plans to build a 3 story, 66 x 130 ft. factory. Estimated cost, $50,000.

Ind., Connersville—C. Hall, local manager of the Standard Oil Co., will receive bids until April 1 for the construction of an oil filling station on Central Ave. Estimated cost, $12,000.

Ind., Evansville — The Karges Wagon Wks., Morgan Ave., plans to build a 1 story, 60 x 250 ft. factory. Estimated cost, $35,000. Private plans.

Ind., Indianapolis—Allen & Thomas, 1061 West 30th St., plans to build a 1 story, 30 x 86 ft. dry cleaning plant on West 30th St. Estimated cost, $15,000. McGuire & Shook, 320-22 Ind. Pythian Bldg., Archts.

Ind., Indianapolis—J. F. Concannon, 1327 Silver Ave., plans to build a 2 story, 70 x 110 ft. ice plant and slaughter house. Estimated cost, $40,000. Private plans.

Ind., Indianapolis—The Polar Ice & Fuel Co., 20th St. and Northwestern Aves., has awarded the contract for the construction of a 1 story, 48 x 84 ft. ice plant. Estimated cost, $40,000.

Ind., Indianapolis—The Western Oil Refining Co., 307 North Penn St., plans to construct a 2 story, 120 x 149 ft. office building and filling station on North New Jersey St. Estimated cost, $75,000.

Ind., Ft. Wayne—The Ft. Wayne Da[illegible] Co. plans to build a 2 story, 60 x 100 creamery on Baker Ave. Estimated c[illegible] $50,000. R. J. Aurentz, Ft. Wayne, Ar[illegible]

Ind., New Haven—The Visible Pump [illegible] plans to build a 2 story, 80 x 80 ft. and [illegible] story, 80 x 120 ft. factory. Estimated c[illegible] $75,000. W. E. Bell, 704 Shoaff Bldg., Wayne, Archt.

O., Baltimore—The Fairfield Paper [illegible] has awarded the contract for the constr[illegible] tion of a 2 story, 90 x 790 ft. factory [illegible] warehouse. Estimated cost, $400,000.

O., Cincinnati—C. L. Greene Co., 325 M[illegible] St., manufacturer of upholsterers' suppl[illegible] has awarded the contract for the constr[illegible] tion of 1 story, 60 x 285 ft. factory Chase Ave. along the tracks of the Cinc[illegible] nati, Hamilton & Dayton R.R. Estima[illegible] cost, $100,000.

O., Cleveland—The Arnold Woodenw[illegible] Co., 1369 West 9th St., has awarded [illegible] contract for the construction of a 2 st[illegible] 60 x 187 ft. factory and warehouse at 5[illegible] Detroit Ave. Estimated cost, $100,000.

Wis., Kenosha — The Star Cleaners [illegible] Dyers, 265 Park St. plan to build [illegible] story, 50 x 60 ft. dry cleaning and dy[illegible] plant. Estimated cost, $40,000.

Wis., Manitowoc — Juul Smith, Arc[illegible] Imig Bldg., Sheboygan, will receive [illegible] about April 1 for the construction of [illegible] story, 60 x 120 ft. seating factory on M[illegible] St., for the Amer. Seating Co., 16th [illegible] Wollmer Sts. Estimated cost, $30,000.

Wis., Milwaukee—The Atlas Bread [illegible] 927 Central Ave., will soon receive bids [illegible] the construction of a 2 story, 80 x [illegible] ft. addition to its wholesale bakery Central Ave. Estimated cost, $60,000. D. Koch, Wells Bldg., Archt. McCorm[illegible] Co., Inc., Century Bldg., Pittsburgh, En[illegible] Noted Dec. 16.

Wis., Milwaukee—The Wells Bldg. [illegible] 120 Wisconsin St., will rebuild 4 story [illegible] tory on Bway. which was recently [illegible] stroyed by fire. Estimated cost, $40,[illegible] Ellsworth & Thayer Mfg. Co., 336 Bw[illegible] manufacturers of gloves and sheepsk[illegible] lined coats, lessee.

Wis., Racine—The New York Market [illegible] 1310 Washington Ave., will receive [illegible] about April 15 for the construction of [illegible] 3 story, 96 x 110 ft. sausage factory Standard St. Cost between $75,000 [illegible] $100,000. Packers Architectural Co., De[illegible] born St., Chicago, Ill., Archt.

Wis., Sheboygan—The Gutsch Brew[illegible] Co., 1012 New York Ave., will receive [illegible] about April 1 for the construction of [illegible] story, 55 x 152 ft. ice manufacturing pla[illegible] Estimated cost, $75,000. C. F. Ringer [illegible] Son, 432 Bway., Milwaukee, Archts.

Wis., Waukesha — The Waukesha [illegible] Cream Co., c/o D. A. Williams, 208 Cha[illegible] St., has awarded the contract for the c[illegible] struction of a 2 story, 40 x 60 ft. facto[illegible] Estimated cost, $40,000.

STATES WEST OF THE MISSISSI[illegible]

Col., Idaho Springs—The Gem Min[illegible] Co., 711 Symmes Bldg., Denver, soon [illegible] ceives bids remodeling and enlarging A[illegible] Mill, here, to have a daily capacity of [illegible] tons. Estimated cost $250,000. R. [illegible] Lamb, 711 Symmes Bldg., Denver, Engr

Minn., Bemidji—The Bd. Educ. is hav[illegible] plans prepared for the construction of [illegible] story, 148 x 230 ft. junior and senior h[illegible] school, to include a manual training dep[illegible] ment, etc. Estimated cost, $300,000. [illegible] F. Becomhall, 719 Alworth Bldg., Dulu[illegible] Archt. and Engr.

Minn., Waconia—Maiser Bros. plans [illegible] rebuild their 3 story, 28 x 80 ft. flour m[illegible] to have a daily capacity of 100 bbls. E[illegible] mated cost, $45,000.

Okla., Oklahoma City—The Dinks Parr[illegible] Laundry, 2 Bway Circle, will build a 2 st[illegible] laundry on 4th and Harrison Sts. E[illegible] mated cost, $40,000.

Tex., Point Isabel—The Bureau of Ya[illegible] & Docks, Navy Dept., Wash., D. C., [illegible] receive bids until April 13 for the c[illegible] struction of a water system and carpen[illegible] shop, here.

CANADA

Ont., Connaught Station—T. Woolings[illegible] Co., Englehart, plans to build mills, l[illegible] for rossing pulp wood. Estimated c[illegible] $80,000.

Ont., Dundalk — The Dundalk Woo[illegible] Mills plans to rebuild its mills which w[illegible] partially destroyed by fire. Estimated c[illegible] $50,000. W. Heimbecher, Mgr.

Ont., Windsor — The Neal Baking [illegible] Slater Ave., is having plans prepared [illegible] the construction of a bread factory Sandwich St. Estimated cost, $250,000. [illegible] Neal, Mgr.

American Machinist

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Methods Used By Transmission Specialists

Frame Case and Bell Case Types of Transmissions—Machining Operations on the Two Types—Special Tools, Fixtures and Methods for Economical Production

By FRED H. COLVIN
Editor, *American Machinist*

THE Brown-Lipe Co., Syracuse, N. Y., makes a specialty of transmission units for motor vehicles. Beginning early in the development of automobile business and having good mechanics at the head of the institution, this company soon built up a reputation which has resulted in its sharing the growth of the automobile industry to a noteworthy degree. This growth has developed new methods and new machinery but there are many notable examples of utilizing standard machines in new and interesting ways. All through the plant one sees the hand of the practical mechanic.

There are two distinct types of transmissions, one known as the frame case, which forms an independent unit attached to the frame, behind the motor, and the other, the bell case, so-called because the front end of the transmission case has something the form of a bell so as to bolt solidly to the frame of the motor when desired.

While the pieces which make up these transmissions have many operations in common, they are sufficiently distinctive to involve interesting operations on both cases.

Beginning with the separate case, the first operation is to mill the upper surface to receive the cover, this being done with a large inserted tooth cutter, as shown in Fig. 1. The case is supported on the two blocks shown, the blocks being connected by the square bar *A* which passes through the lower gear shaft opening in the case. After the holes are drilled so that two of them can be used for positioning the case during the next operation, it goes to the double ended Beaman & Smith boring machine shown in Fig. 2. Here the case rests face down on the base of the fixture which carries two dowel pins and is held in position by the floating clamp shown at *A*.

The type of boring tool can be readily seen from this view, inserted tooth cutters of both the single and double point variety being shown. Provision is made for facing cutters which are not shown in position. These short, rigid boring tools have little tendency to spring and give very satisfactory results. The tool-board shown at *B* is of a type designed especially for this machine but can, of course, be applied elsewhere.

The method of drilling for the idler-gear shaft is shown in Fig. 3. The piece *A* which carries the bushing *B*, has a projection that fits into the hole already bored for the upper gear shaft. The case is slipped over the bar *C*, which is fastened to the drilling machine table. The piece *A* is then slipped over the central post and into the hole in the case, the C-washer allowing it to be readily clamped in position. A suitable stop located with reference to its vertical position and the piece *A* insure the proper center distance.

Testing Alignment of Holes

Two methods of testing the alignment of the holes in the transmission case, are shown in Figs. 4 and 5. The test bars *A* and *B*, carrying four rings which fit the holes already bored, are placed in position in the case, as

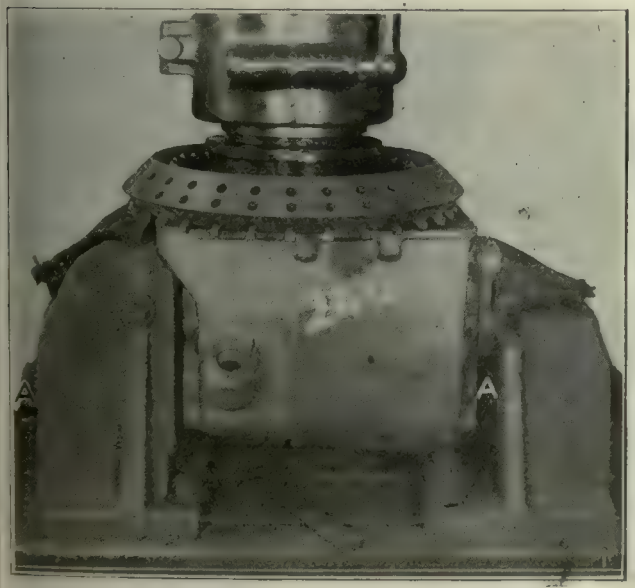


FIG. 1. FACING THE TOP OF TRANSMISSION CASE

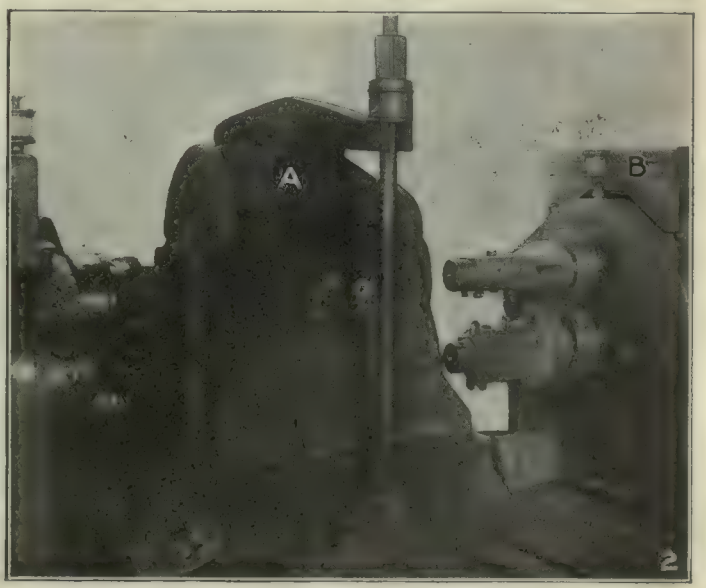


FIG. 2. BORING BOTH ENDS OF CASE

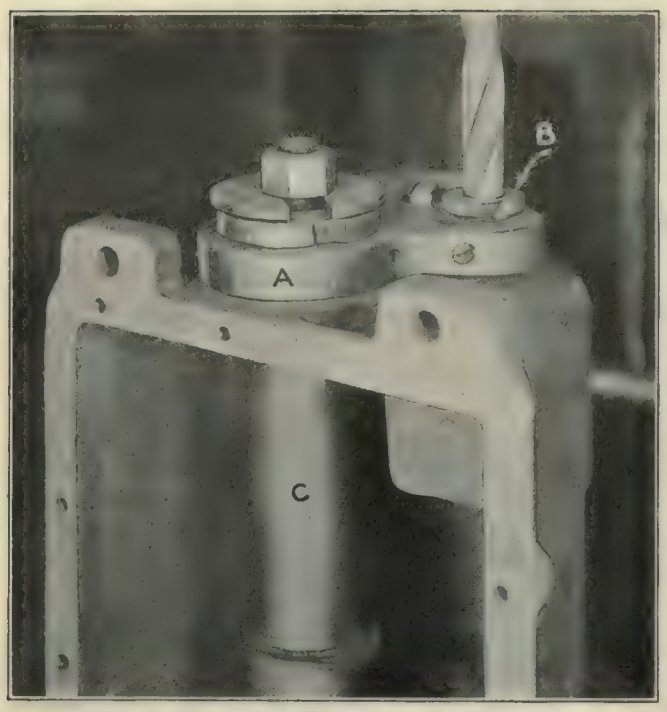


FIG. 3. DRILLING IDLER GEAR SHAFT HOLE

shown. Then the case, with the ends of the bars projecting, is placed on the two parallel uprights, *C* and *D*. Strips of tissue paper are then placed under each end of both bars and if any of this can be pulled out, it indicates very clearly that the holes are not parallel in this plane. A very slight "wind" will show at once by this method.

The next test is for alignment in the other direction and is made as shown in Fig. 5, by measuring the test bars with a micrometer which indicates the amount these shafts are out of parallel. The necessity for maintaining the proper center distances of the gears in order to insure quiet running, makes it advisable to take every precaution of this kind.

Boring the bell type of case is shown in Fig. 6. The same form of floating clamp as shown in Fig. 2 is used for holding the work in position, but the support for the cover case is somewhat different. The flange of the case is positioned by the stop *A*, while clamping screws *B* and *C* hold the case sideways. This view shows the facing cutters at *D* and *E* and also more details of the way in which the boring cutters are held and adjusted. The cutter *F*, for example, is adjusted by the screw *G* and held by the setcrew *H*.

Turning the flange of the ball must be very carefully done to avoid vibration and to insure its being square with the bore of the case. The case is, therefore, mounted on the expanding mandrel *A*, Fig. 7, and driven by the angle plate *B* which bears against the surface that has already been milled for the transmission case cover. This arrangement drives the piece easily and without distortion and allows the flange to be faced by sharp single pointed tools as shown at *C*.

Boring the Cross Holes

Boring the cross-holes for the gear-shifting shaft and the drilling of other holes is shown in Fig. 8, a special double-headed machine being used for this purpose. The case sets on a platform, having an angular face *A*, and a side plate *B* which carries the drill bushings, a similar plate holding the bushing for the boring and drilling tools in the other head.

The washer which is provided with the handle *C* enables it to be handled readily inside the bell of the case. The nut *D* holds the case firmly in position by means of a bolt connected with the back of the fixture.

For some motors, the bell type of housing requires a cover, as shown in Fig. 9. This view shows the cover being faced and bored for the connection to the motor. This is a faceplate job, the facing and boring tools being shown in the four-sided turret toolposts. In addition to these tools, a counterbore is carried in the carriage turret at *A*, and a bushing is provided at *B* for guiding the bar centrally in its work.

The method of supporting the cover while turning the flange is shown in Fig. 10. The cover is slipped over a central stud *A*, and positioned against the stop *B* which acts as a driver. The faceplate is provided with three steadying jacks, one of which is shown at *C*, the plunger *D*, being set against the back side of the flange so a

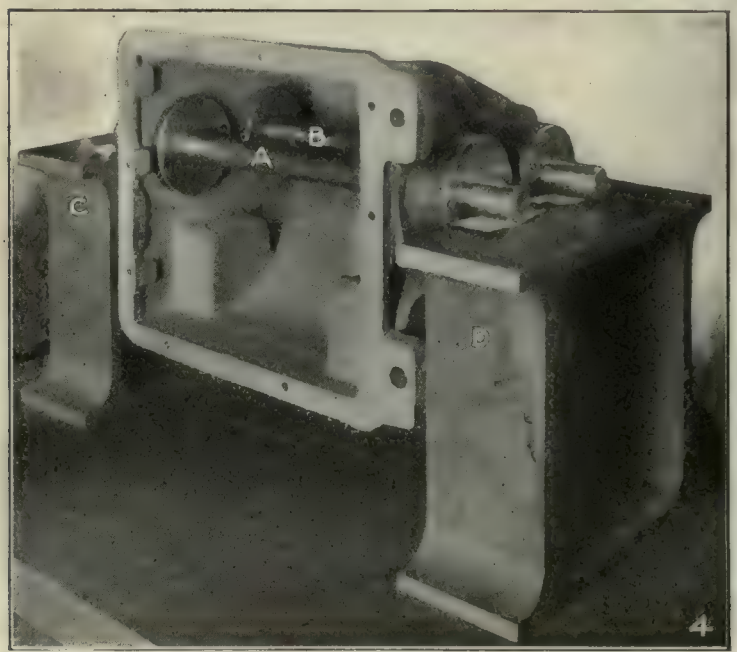


FIG. 4. TESTING ALIGNMENT OF HOLES

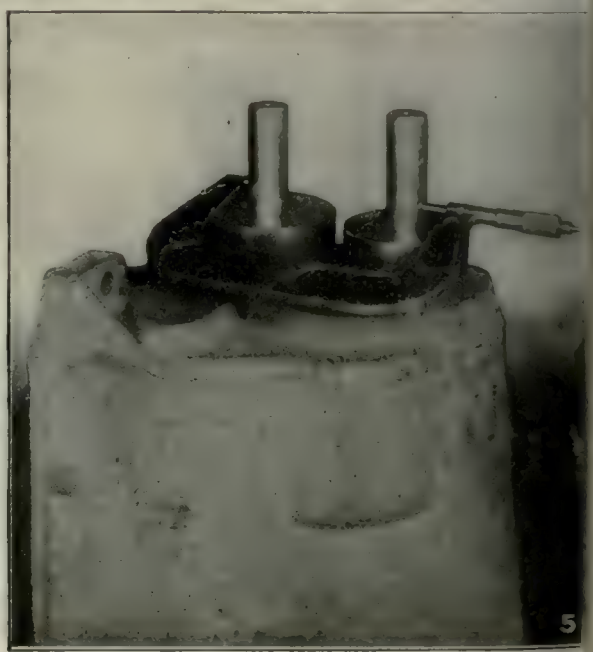
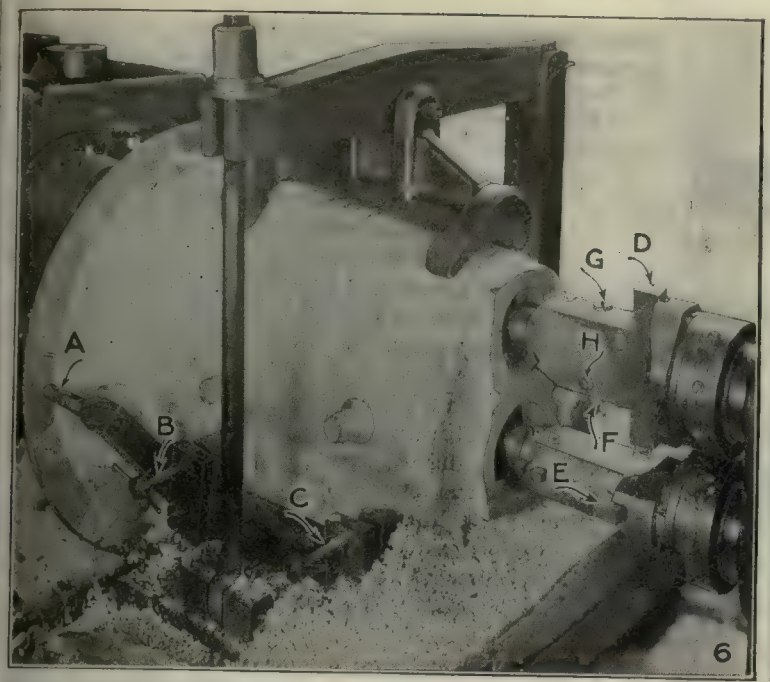
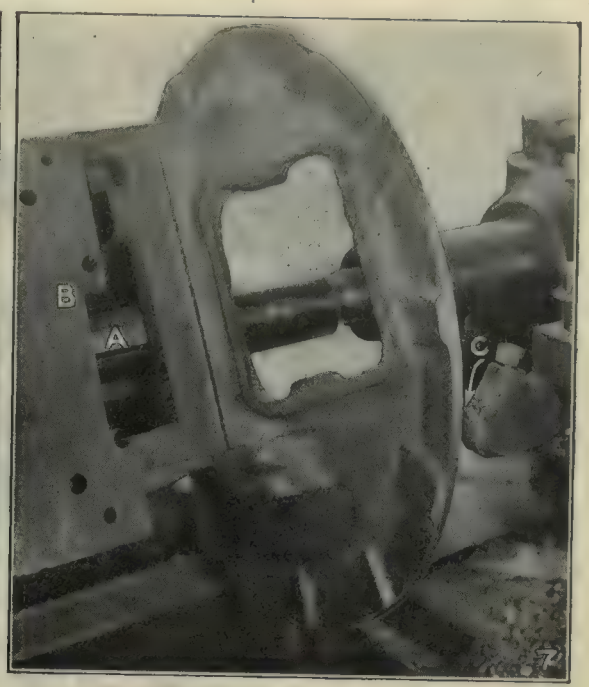
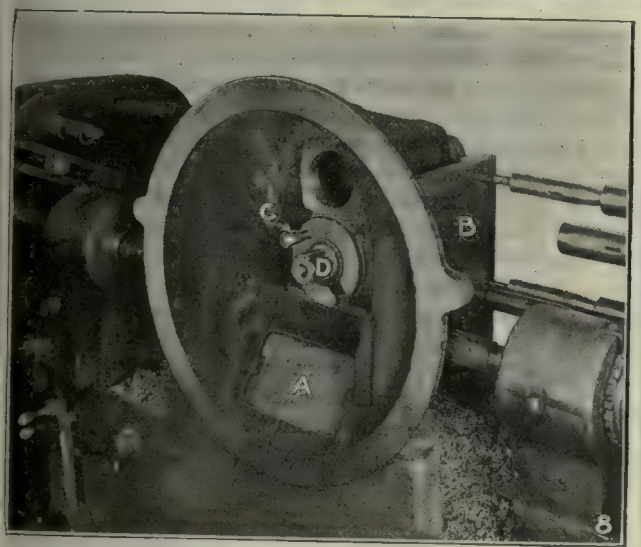
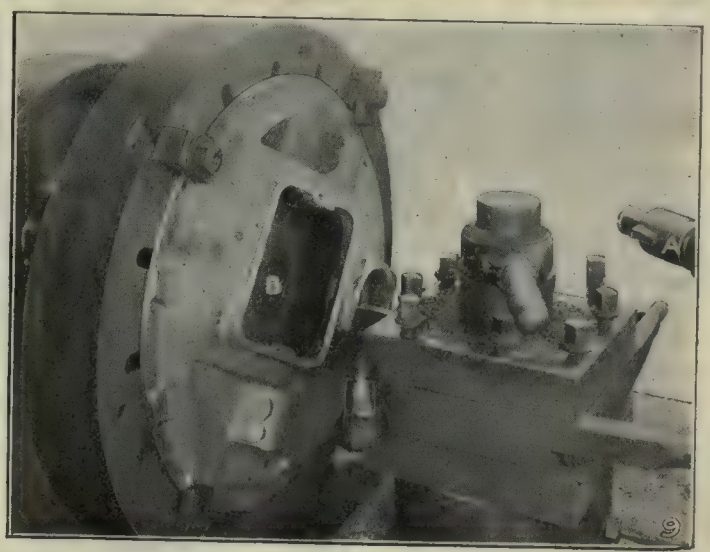


FIG. 5. MEASURING CENTER DISTANCES











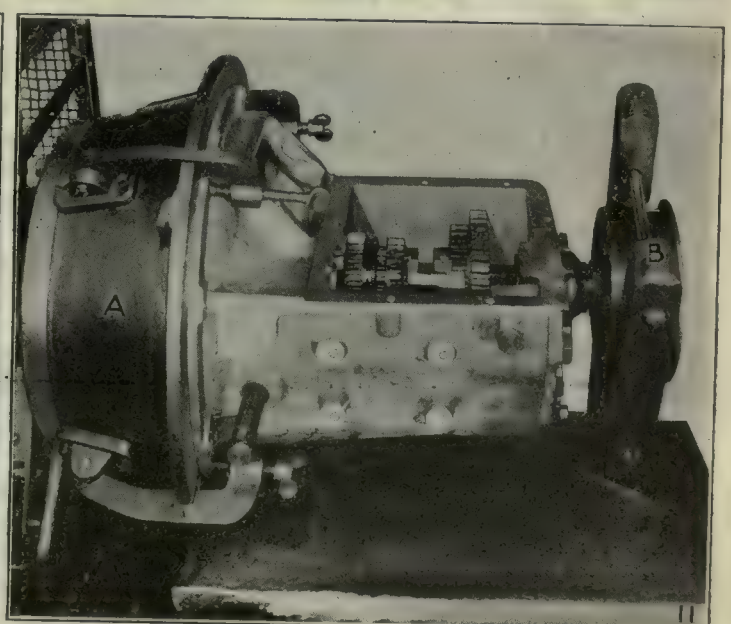


FIG. 6. BORING BELL TRANSMISSION CASE. FIG. 7. FACING THE FLANGE. FIG. 8. BORING AND DRILLING CROSS HOLES. FIG. 9. BORING CLUTCH COVER. FIG. 10. TURNING FLANGE OF CLUTCH COVER. FIG. 11. RUNNING TEST OF COMPLETE TRANSMISSION



FIG. 12. TESTING WINTON-SIX TRANSMISSION

to hold it in the proper position and also help support it against the thrust of the cutting tool. The handwheel *E* is then tightened to hold the cover back against the faceplate at its central point.

The completed transmission with the gears in place is tested by being driven with an electric motor on the test stand shown in Fig. 11. This view shows how quickly the case can be clamped in position against the bell shaped housing *A*, the clamps swinging in and out of position so as to allow easy handling. The load is put on the transmission by means of the brake *B*, which consists simply of a pulley and two friction blocks. Running the gears shows up any irregularities and gives the inspector an opportunity of noting any noise which may develop. The elimination of noise requires better machining of gears and better alignment of gear shafts.

Fig. 12 shows a special testing stand which has been rigged up in order to insure the transmission made for the Winton Six car being tested under running conditions. A Winton motor is installed on the substantial frame *A* and every transmission is connected to this motor and given a test in addition to the plate test which has been previously applied. In order to pass this kind of inspection, not only must the gear case be correctly machined but also the gears themselves as well as the shaft on which they are mounted. The way in which some of these parts are manufactured will be described in another article.

What Industry Pays for Delays in Road-Building

BY SAMUEL G. KUHLEN
Austin Machinery Corporation, Chicago

The cost of deferring road contracts is out of all proportion to the savings that may or may not be effected.

Even if later construction would cost considerably less, which is not as assured as is generally supposed, the fact remains that the benefits to the individual contributing to the good roads program would be inconsequential in comparison with the losses now being sustained by the class most directly effected, the shippers and their customers. Viewed from this angle it would appear to savor of unwarranted discrimination if truck transportation were not so completely interwoven with the entire industrial fabric. As it is, the burden is to a certain extent distributed over the public through the shippers.

Industry is paying dearly for the hope of a drop in paving prices. A glance at the basis of this hope is not out of place. Can the demand-and-supply law of price regulation be disregarded in this instance? Is it reasonable to assume that material prices which have been maintained in the face of little or no demand will break with the advent of accelerated demand? And labor—there is no precedent in history to indicate a decline in wages right on the very eve of wholesale employment.

Railroads are advising shippers to move their freight now to avoid future congestion. Automobile and truck makers are issuing warnings of later shortages of their products and are pushing preparations for capacity production. Building permits point to increasing activity in building construction. When these three recognized barometers of business agree that business is on the incline prudence suggests the wisdom of following their lead.

Progress in all lines is obstructed by unimproved highways. Aside from the excessive cost of transportation as shown below any action which retards their construction is inexcusable.

Getting down to brass tacks on hauling costs a concern or individual which operates five five-ton trucks loses about half of the potential capacity of his equipment when compelled to operate over bad roads. An average of about six miles an hour, or forty-eight miles per eight-hour day of continuous running is his limit for each truck, making a total of 240 miles for his entire fleet; while, on the other hand, his drivers would be called to account if they did not do twelve miles an hour or better per truck—480 miles—on roads as they should be. The drivers' wages are the same in both cases. Good roads reduce operation and depreciation in a much greater ratio than the mileage would indicate.

South American Markets

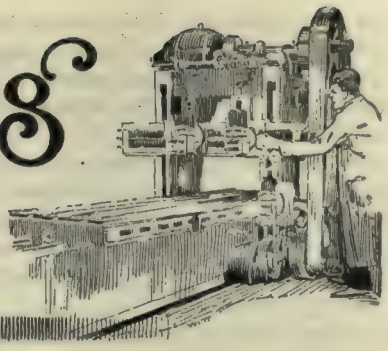
The entire American capital in South America does not exceed by much the annual interest on European capital invested there. With European capital of seven and one-half billion dollars as a backlog, Europe has a potential buyer in those markets that all the salesmanship in the world cannot dislodge. We should match this investment, peso for peso, and we should give extended credit to the merchants of these countries, for it will help them and it will help us even more.—*From the Journal of the American Bankers Association.*

Some interesting figures have just been published regarding the restoration of the German state railroads. Since Jan. 1, 1920, 2,174 locomotives have been repaired in private works, in addition to 880 locomotive boilers, 2,246 passenger and 98,600 freight cars. This repair work required an expenditure of 1.7 milliard marks in 1920 and will require another 1.3 milliard marks for the present year. It is stated that much better results were obtained in the private works than in the shops operated by the government, and that the small price difference had been fully compensated by better and quicker work. Some of the larger state works will be enlarged and equipped with up-to-date machinery.



Metal Cutting Tools.

By A.L.DeLeeuw



VII. Milling Cutters

General Consideration of Milling Cutters—Feeds and Revolutions of Cutters—Causes of Chatter and Remedies

THERE are really two kinds of milling—very different from each other and requiring separate discussions. One kind is that done with a face mill and which resembles in its action the action of a planer or lathe tool. The other is that done with a plain or spiral mill or, for that matter, angular or formed mills. The action of these tools is so different from that of a planer tool that a separate discussion is needed to explain the various peculiarities and troubles one meets when milling. It will also explain why a much greater output can be obtained than with tools discussed heretofore.

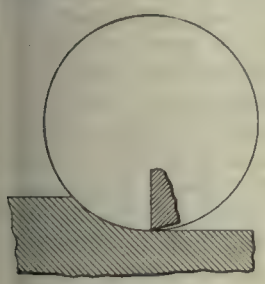


FIG. 108

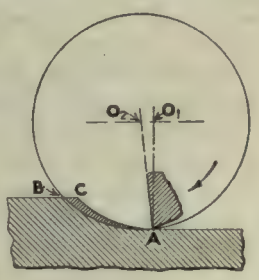


FIG. 109

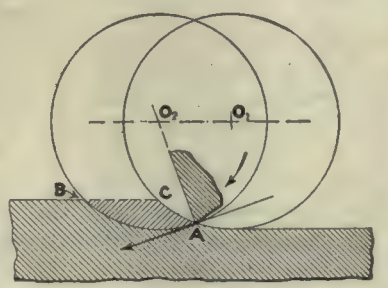


FIG. 110

FIG. 108. PLAIN MILLING CUTTER WITH ONE STRAIGHT TOOTH. FIG. 109. SAME CUTTER AFTER MOVING FORWARD. FIG. 110. CRUSHING ACTION OF TOOTH EXAGGERATED

To start the discussion of the action of a milling cutter, we will imagine a plain milling cutter with straight teeth taking a cut over a piece of work of which the width is less than the length of the cutter. To simplify the discussion still further, we will imagine the cutter to have only one tooth. Fig. 108 shows such a milling cutter in diagrammatic form after it has partly finished a piece of work. Fig. 109 shows the same cutter advanced, its center having gone from O_1 to O_2. In this view we show a section of the metal ABC which the tooth of the cutter is going to remove. We have imagined that the cutter was first moved from O_1 to O_2 and that now it will begin to revolve. As will be seen, the face of the tooth, O_2A, is not at right angles to the work, and when this tooth begins to revolve in the direction of the arrow, the point A must go further down before it reaches a vertical position. In going down it must crush the metal at A. This condition is shown in much exaggerated form in Fig. 110. The tooth, moving in the direction of the arrow, would meet a sufficient amount of metal to compel it to crush it. This crushing strain would cause the splitting off of chips in a manner similar to that described in "Planing Tools." But with a cutter as shown, there is no rake; in fact, the effect is the same as if there were negative rake. With the conditions actually met in practice, the distance from O_1 to O_2 is very small, and is the distance traveled by the cutter during the time that the tooth revolves through the angle contained between two adjacent teeth. Suppose we had a cutter with ten teeth, and having a feed of 0.050 in. per revolution, which is a fairly heavy feed, then the cutter would have advanced from O_1 to O_2, a distance equal to 0.050 in. divided by the number of teeth, or 0.005 in. The height of the little hill shown as A in Fig. 110 would be very small—a very small fraction of 0.001 in., smaller in fact than the little round which we will necessarily find at the cutting edge, so that the cutter would not penetrate into the metal, but slip over it. As it does so, the thickness of the chip which it ought to remove, becomes thicker and thicker as shown in Fig. 109. The cutter is pushed farther and farther away by the work, and the strain in the arbor becomes greater and greater. Finally a point is reached where the cutter presses with so much force on the work that it crushes the metal and begins to act as a cutting tool.

Consideration of Rake

In the previous illustration the cutter was represented as being without rake, which used to be the universal practice until a few years ago and is still the practice in the majority of shops. Fig. 111 represents the cutter with rake. The amount of rake shown in Fig. 111 is not very great. In fact, the line AP, which is the front line of the cutting tooth extended, passes somewhere between O_1 and O_2, which shows that the angle between the line AP and the tangent to circle O_1 at the point A is less than 90 deg., but that, on the other hand, the angle between AP and the circle to O_2 at point A is more than 90 deg., so that this tooth AP has rake for the circle O_2 but not necessarily

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for the circle O_1. This would mean that there is true cutting at the lower portion of the chip ABC, but largely crushing at the upper portion of that chip. This is the condition when the distance O_1O_2 is relatively large, and the angle of rake is relatively small; and such a condition rarely or never exists in practice. The distance O_1O_2 would never be more than a very small fraction of an inch—probably never more than 0.015 in.; so that, even with a cutter of small diameter, the rake need be but a small angle in order to have rake at all points of the chip.

It was pointed out just now that the amount of rake is not the same at various points of the chip. This

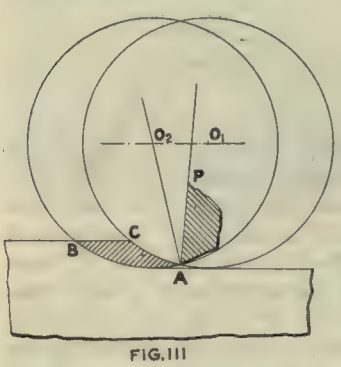


FIG. 111

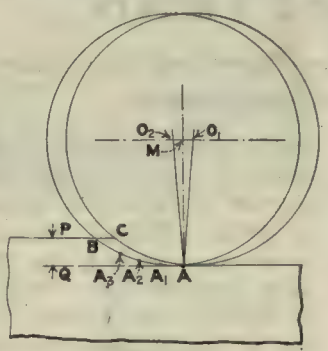


FIG. 112

FIG. 111. PLAIN MILLING CUTTER WITH RAKE. FIG. 112. DIAGRAM TO ILLUSTRATE MILLING CUTTER ACTION

will result in additional deformation of the chip. When using a planer tool with a width greater than the width of the piece to be placed, the deformation of the chip takes place only by the fact that the sections of the chip, after having been split off, must slide along the front of the tool, and this compels them also to slide over each other. The chip sections themselves are not distorted beyond the distortion we naturally expect before being split off. In a milling chip, however, there is additional distortion, due to the fact that the various points of the tool act on the various points of the chip at different angles. This is one of the reasons why it requires more power to remove the same amount of metal with a milling cutter as compared to a planer tool or a lathe tool. Another reason why more power is required lies in the fact that, even under the best conditions, a milling tooth must slide over the work for a considerable distance before it can penetrate. To illustrate this better, we will assume certain figures for a cut. We will take figures such as may be used in actual practice. We will take a 3½-in. cutter with eight teeth, a cut ⅛ in. deep, and with a feed of 0.048 in. per revolution of the cutter. We will plot out a thickness of the chip measured along the radius of the cutter and at various positions of the cutting tooth.

Amount of Feed

The feed per revolution is 0.048 in., the number of teeth is eight, so that the feed per tooth is 0.006 in. As all values which we will get in the following calculations will be very small, we will express them in thousandths, so that we will call the feed per tooth 6; similarly, we will say the diameter of the cutter is 3,500. The distance PQ, Fig. 112, which is the depth of the cut, is 125. The lines O_1A and O_2A are drawn to the point where the two circles intersect, as is more clearly shown in the exaggerated illustration, Fig. 110. This illustration shows clearly how a little hill is formed. Drawing the line AM to a point midway between O_1 and O_2, we can readily calculate the length of this line, and the difference between this line and the line OA_1 is the height of the little hill formed at the point A. As O_1A is 1,750—half the diameter of the cutter—and the line MO_1 is 3—half the feed per tooth—we find that the line AM is 1749.997, or 0.003 less than the radius. This shows that the height of the hill, caused by this ample feed of 0.048 in. per revolution, is about three-millionths of an inch. When the point A of the cutter travels from the point A as shown, to a point directly under O_2, it will have to penetrate this amount of less than three-millionths of an inch. However sharp the cutter may be, there will certainly be a radius at the cutting edge of not less than three-millionths of an inch. In other words it will not penetrate. If we select a point A_3, 50 to the left of A, then it will be found that the thickness of the chip at that point is 0.170, at the point A_2 0.340, and at the point A_1 0.510, these points being taken 50 apart along the bottom of the chip.

By the time the cutter has reached a point 500 from the starting point, the thickness of the chip is 1,690. Translating this back again into fractions of an inch we see that as far as 0.100 in. from the starting point the thickness of the chip is only 0.00034 in. At 200 from the starting point, the thickness is 0.00068 in. If there is any little variation in the diameter to which the different teeth of the cutter are ground, then some of the teeth will fail to take a cut and others will have to take a heavier cut. As has been pointed out before, it is this fact that the cutter must start with a chip of infinitestimal thickness which causes the action of a milling cutter to be very different from the action of other cutting tools, and it is the fact that this thickness of a chip increases so slowly which makes this peculiarity of so much importance. The slightest degree of dullness of a tooth of the milling cutter will cause that tooth to start cutting much later than it should, and probably much later than some other tooth starts; so that not only is the action of a milling cutter not continuous, but it presents the same sequence of conditions at each revolution. In other words, the action of a milling cutter is not only variable but periodical.



FIG. 113

FIG. 113. DIAGRAM SHOWING THREE TEETH AT WORK

Everybody is, of course, familiar with the aspect of a surface which has been milled by a plain cutter. Such surface shows ridges or parallel lines. Even when the finish is very good and the surface very smooth, these parallel lines will be visible. A nicely milled surface will be very smooth to the touch, and the finger will not discover any ridges, yet this surface looks to the eye as if the ridges were quite high. As a rule the quality of the finish is judged by these ridges and it is customary to require the ridges to be close together when a nice finish is desired. Though it has been mentioned in many books and papers that these ridges appear one for each revolution of the cutter, yet there are many mechanics who believe that one ridge appears for every tooth of the cutter, and it may seem strange at a first glance that this should not be so.

If we refer again to Fig. 110 and assume the diameter of the cutter to be 3½ in., and the amount of feed per revolution—that is, the distance from O_1 to O_2—to be 0.020 in., and if we further consider that the cutter has only one tooth, then a simple calculation

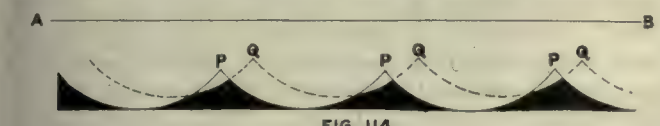


FIG. 114

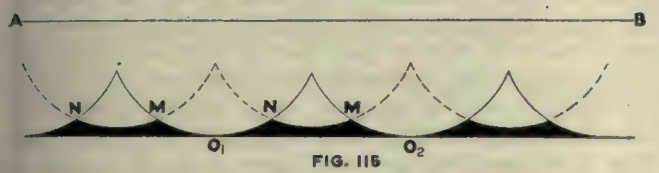


FIG. 115

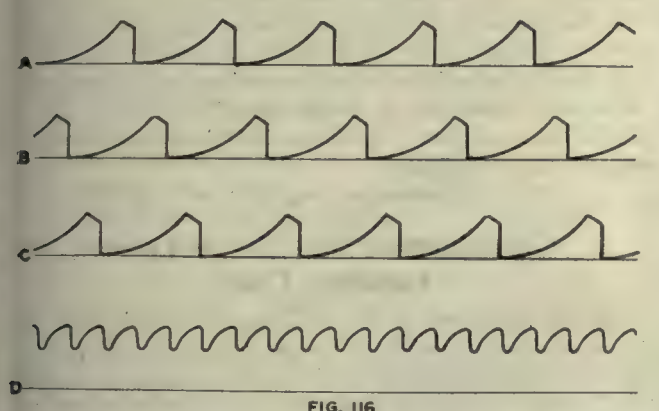


FIG. 116

FIG 114. EXAGGERATED DIAGRAM OF MILLED SURFACE. FIG. 115. ANOTHER CASE WHICH IS PURELY HYPOTHETICAL. FIG. 116. DIAGRAM OF TORSIONAL VARIATIONS

will show that the height of the point *A* above the finished surface is not quite 0.00003 in. If the feed were 0.030 in., the height would be not quite 0.00007 in.; and if it were 0.050 in., the height would be not quite 0.00012 in. If we now consider a regular cutter with a number of teeth, and if one of these teeth should be on a diameter slightly greater than the other teeth, that one tooth would make the deepest impression, and would cause hills. If the height of such a hill were 1 in., and if at the same time, one of the teeth of this cutter were standing out beyond the others more than 1 in., then none of these other teeth could possibly reduce the hill made by the long tooth. In the first case we were considering, the height of the hill was only 0.00003 in., so that in order that any of the other teeth should reduce this little hill, these other teeth must not stand back more than 0.00003 in. In other words, the cutter would have to be a cylinder so true as to be hard to produce, even with the most refined methods; and even if it were that accurate, the smallest variation in the arbor or the spindle or the hole in the cutter would probably amount to several times the height of the little hill generated. Even with such a wide feed as 0.050 in. per revolution, the height of the hill is only slightly more than 0.0001 in. When we consider all the elements which cause a cutter to run out of true we find so many that it is not likely that we ever will have a cutter which runs true within the limits of 0.0001 in. If the cutter is absolutely round, and absolutely concentric with its hole, if the hole is absolutely round and there is no clearance between the hole and the arbor, if the arbor is absolutely round and straight, and if it is not sprung by the collars being out of parallel, if the taper of the arbor is concentric with the arbor itself and absolutely round, if the hole in the spindle is absolutely round and concentric with the outside of the spindle, and if again this spindle is absolutely round and has no clearance in a perfectly round bearing, then the cutter will run absolutely true. This is merely another way of saying that a cutter will *never* run true, even with the best of care, and that the amount it is out of true will be more than the height of the little hill raised by the longest tooth, even under the best conditions; and all this is merely another way of saying that the ridges we see on a finished piece of work are revolution marks and not tooth marks. This is important, because the finish of a piece is judged by the distance between the revolution marks, and if these marks were tooth marks, it would merely be necessary to increase the number of teeth in the cutter in order to get a better looking finish. However, as these marks are revolution marks the finish will not be affected by the number of the teeth in the cutter.

This should not be understood to mean that a cutter with only one tooth would be just as good as one with a number of teeth, because there will be many other things besides the looks of the finished piece to be considered. But this much is true: That it is practically impossible to see the difference in finish on a piece of metal when a light finishing cut has been taken, either with a cutter with only one tooth or with a cutter with a large number of teeth. If a roughing cut had been taken, there would be a difference, because if one tooth has to take all of the cut required for one revolution, the chip would be so heavy that the metal would be torn out, whereas with a number of teeth, the cut would have been divided, and the chip per tooth would have been much lighter, so that this tearing effect would not have been so pronounced.

Feed and Revolutions

If the height of the revolution mark is less than the variation in the working radius of the various teeth, the mark must be made by one tooth only and the other teeth can have no effect upon it. But if the feed is very coarse and the variation of the working radius of the teeth is small, that is, if the cutter runs very

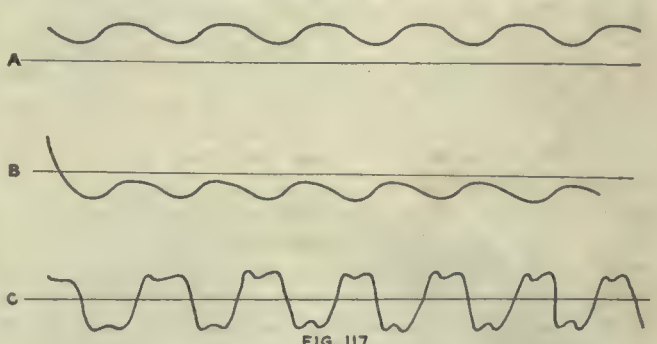


FIG. 117

FIG. 117. IMAGINARY FORCE DIAGRAM SHOWING FLUCTUATIONS

true, then some of the teeth might modify the revolution mark.

In Fig. 114, *AB* is the top of the work before the milling cut is taken. The full line scallop *P-P-P* is the finish which would have been produced if one tooth

only (the longest one) had been at work. The dotted line scallop *Q-Q-Q* shows the finish which would have been produced if some other tooth had been the only one at work. The figure shows plainly how the two scallops intersect and how the hill caused by the longest tooth is cut down by the others; but only if the cutter runs true and the feed is wide. Fig. 115 shows how it would be possible to produce two marks per revolution. The dotted scallop intersects the full line in two points *N* and *M*, and the finish line will take the shape O_1-*N*-*M*-O_2. As the distance from O_1 to O_2 is the length of a revolution mark (feed per revolution), it will be seen that under the conditions as sketched there are two marks per revolution. However, this is only possible with conditions which are not met in practice. A little calculation will readily show this.

Let us imagine that the diameter of the cutter is 3½ in. and the feed 0.120 in. per revolution (an excessive feed for that size cutter), and let us calculate the height of the point of the solid scallop. We will find this to be 0.0011 in. If the amount that the cutter runs out of true is considerably less than this amount, and if, besides, the next longest tooth is about diametrically opposite the longest, we will have a condition as sketched in Fig. 115 and this is a set of conditions very difficult to produce in practice.

If a plain milling cutter had only one tooth, and if it were to take a heavy cut, the following would take place: It would start in with a cut zero at *A*, Fig. 109, and as it could not possibly penetrate until there is enough radial pressure exerted on the cutter by the material, it would move some distance in the direction from *A* to *B*, and be lifted until the pressure in the arbor became so great as to enable the tooth of the cutter to crush the metal in front of it and penetrate. This would suddenly release the pressure—at least partially. The pressure was caused by the movement of the cutter and its inability to penetrate the metal. As the cutter is mounted on an arbor, this arbor was, to a certain extent, twisted, and at the moment when the cutter penetrates into the metal and the pressure is somewhat relieved, there will be a corresponding release of the twist in the arbor. From this moment on, the cutter proceeds making a chip, and this chip becomes heavier and heavier until the tooth stands in the direction of O_2C, when the pressure is a maximum. Between O_2C and O_1B the pressure diminishes and becomes zero at *B*. The distance which the cutter travels from *C* to *B* is very small, and we may almost say that there is a sudden release of pressure. No metal is met when the cutter travels through from *B* to *A*, and the same cycle of conditions starts over again at *A*. If there were two teeth, or even more than two, the same condition would prevail as long as one tooth gets entirely out of the cut before the next one enters, and if this is the case, we get a very jerky action of the cutter, which is hard on machine as well as cutter—hard on the machine because the strains range repeatedly between zero and maximum, and hard on the cutter because the tooth must slide over the work for a considerable distance before it can penetrate, which dulls the edge. If a sufficient number of teeth were in the cutter so that a new tooth begins to cut before the previous tooth has reached *C*, a somewhat different set of conditions would prevail.

In Fig. 113 is shown three teeth at work. No. 1 has almost completed its cut, No. 2 is midway and No. 3 is just entering. Diagram 116 shows at *A* how the torsional force for tooth No. 1 proceeds; *B* shows the same for No. 2, and *C* for No. 3, while *D* is a combination of these diagrams.

This diagram shows clearly how the fluctuations in torsion have been ironed out. But there is more than this. If tooth No. 3 alone were at work it would ride over the work and spring the arbor. This upward pressure is counteracted by the downward component of the pressures on teeth Nos. 1 and 2. All kinds of combinations of these up and downward forces are possible. It may happen that the arbor is sprung upward all the time, or it may be that there is always a downward pull (except for a moment when the cut is started); or again it may be that the force on the arbor works alternately up and down. In diagram 117 the horizontal line is the zero line for these forces and points above or below this line indicate forces acting up or downward. The diagrams *A*, *B* and *C* are some imaginary fluctuations of these forces—imaginary in amount and form but not in principle. The conditions of these forces determine often how a piece should be milled, how it should be held, etc. A study of these conditions is usually very profitable.

Part VII continued in next week's issue.

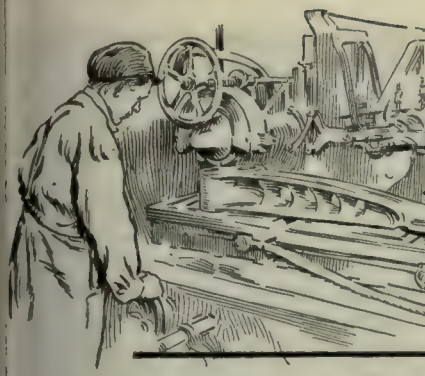
Construction Men Act to Lower Building Costs

At a conference of the National Federation of Construction Industries in Chicago March 2 and 3, 1921, an investigation and comparison of the elements included in the cost of construction disclosed the facts that current costs of construction still remain much and irradically higher as compared with pre-war costs, and as compared with the average of all other commodities that current construction labor costs have not had proper adjustment to accord with present conditions; that practices and conditions surrounding financing of building construction require modification; that relations between employers and employees call for improvement and stabilization to secure continuity of operation in all building construction, and full rates of production and that employers and contractors have not proceeded to the needed extent in effecting reasonably prompt deflation of values throughout the construction industry (and all stages thereof from raw materials to finished products) including their own overhead and profit.

In view of the foregoing conditions, resolutions were adopted urging manufacturers, producers and distributors of building materials to take such further deflation as may be possible, to announce selling prices in which the public may be justified in having confidence, and that having established such prices, the respective manufacturers prepare promptly definite statements to be used to explain to the public the elements of increased cost over which the manufacturer has no control.

Contractors, builders and employers are called upon to proceed promptly to the creation of a basis of labor costs which will be in conformity with present conditions and requirements for the re-establishment of industry. This will consist of the proper readjustment of wages, elimination of irregularity of work, improvement of rates of production and efficiency of labor, and the improvement of labor-saving methods.

The business interests which finance building operations are called upon to co-operate by accepting a recession in profits.



The Use of Special Fixtures in Grinding Operations



By Ellsworth Sheldon
ASSOCIATE EDITOR AMERICAN MACHINIST

Finish Grinding the Bores a Final Operation in Making Gears—The Use of a Gear as a Chuck Upon Which to Finish Another Gear—Grinding Tapers Without Traverse

THE finishing of machine parts of hardened steel has, until within comparatively recent years, called for skilled workmanship of the highest order. Long after the use of jigs and fixtures in manufacturing operations where the nature of the parts permitted the use of soft material had become common, hardened parts were handled almost as individual jobs; made as nearly perfect as possible before hardening and expected to take their place in the machines and perform their functions without further manipulation.

This method involved the use of steels that were least susceptible to distortion in hardening, as well as the utmost care in making and hardening the parts. Even with every precaution taken to guard against the changing of shape, the final assembling often disclosed the necessity for tedious lapping and polishing, to reduce high spots and make the parts function properly, and the loss from pieces hopelessly distorted was high. The inversion of the established routine, by hardening the parts first and finishing them afterward, made possible by modern grinding machinery, is nowhere more accentuated than in the production of the small gears that go to make up the "transmission" apparatus of the automobile or the highly refined parts of an airplane engine, where the highest possible degree of efficiency per unit of weight is exacted.

The Bryant Chucking Grinder Co., of Springfield, Vermont, is often called upon to design special chucks, fixtures, or attachments for its machines, or to devise ways and means of handling work of this nature for its customers, in a manner that will secure the highest degree of accuracy together with the maximum rate of production consistent with the necessary degree of refinement.

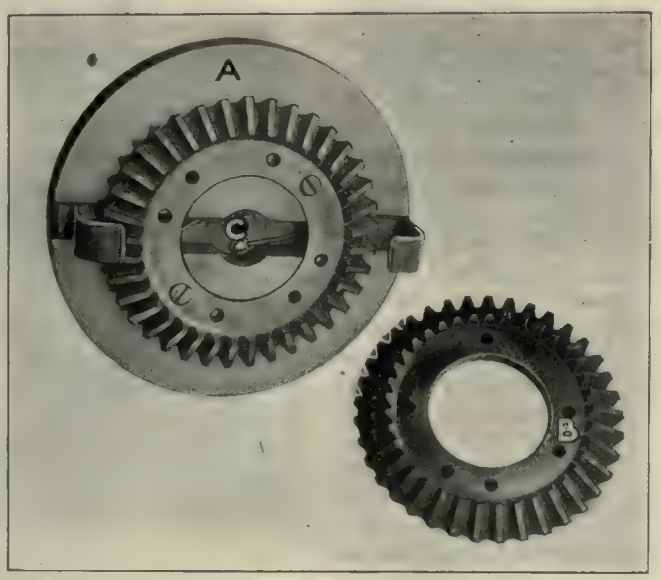
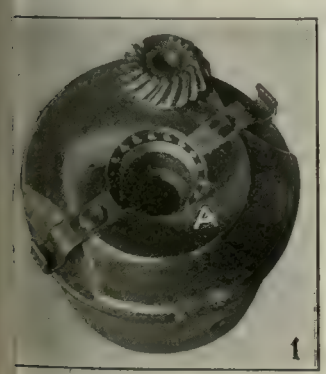
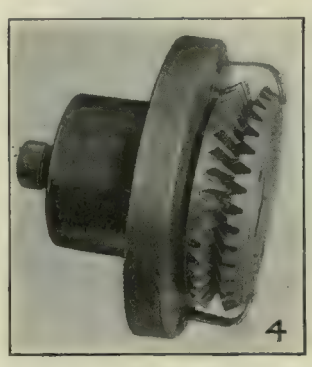


FIG. 3. ANOTHER FORM OF CHUCK FOR BEVEL GEARS

A helical bevel gear is a sufficiently difficult manufacturing proposition under the most favorable circumstances; but when these parts are demanded by thousands, each gear required to be mechanically perfect, *after* the natural distortion that inevitably follows any hardening process, no matter how carefully planned and skillfully executed, the old methods cannot be relied upon to produce satisfactory results. The illustrations, Figs. 1 and 2, show a chuck designed by the engineers of the above mentioned firm that enables the manufacturers of helical bevels to turn out perfectly running gears in which each tooth bears its full share of the load with no high spots to take more than their share and break down under the excessive strain.







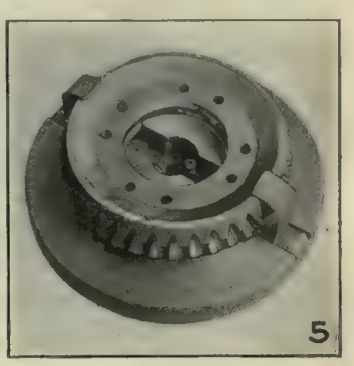


FIG. 1. CHUCK FOR HOLDING HELICAL BEVEL PINIONS. FIG. 2. THE CHUCK WITH PINION IN PLACE.
FIGS. 4 AND 5. SHOWING HOW THE WORK IS HELD

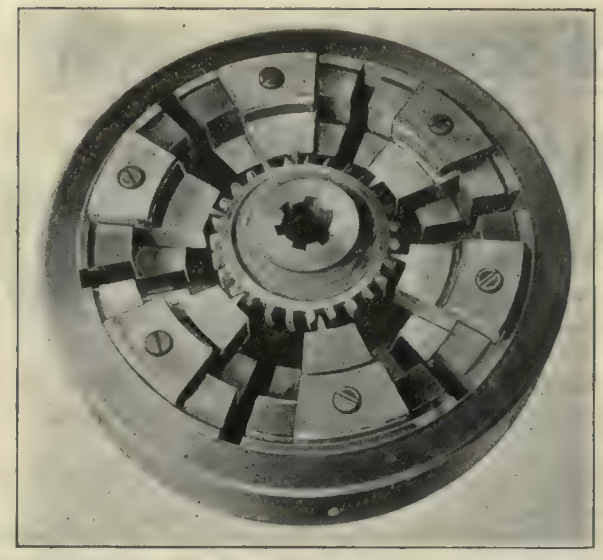


FIG. 6. DRAW-IN CHUCK FOR HOLDING SPUR GEARS

The chuck itself is of hardened material, carefully ground in place upon the spindle of the machine with which it is to be used, and is designed to hold the gears by means of steel balls that bear upon the teeth of the gear at the pitch circle. The balls rest in a circular chamber, much like the race of a ball bearing; the hardened and ground washer *A* resting upon the balls and holding them in place until the chuck is adjusted and tested, after which molten babbitt is poured between the balls to make sure that they may not be shifted accidentally from their position. The gears are, of course, accurately finished in respect to their tooth contour before they are hardened, but the central hole is purposely made under size, so that in the final finishing its concentricity is a resultant instead of a determining factor. Thus when a hardened gear is placed in the chuck, its pitch circle resting upon the true-running circle of steel balls and held thereto by the sliding springs, its tooth

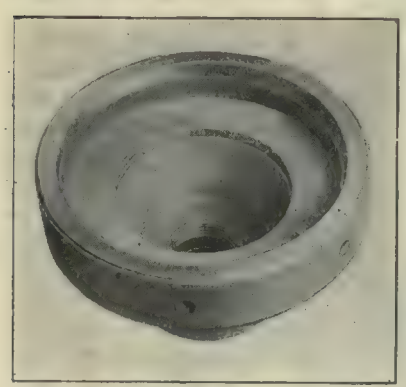


FIG. 7. THE SLEEVE OF THE DRAW-IN CHUCK



FIG. 8. WORK HOLDING SLEEVE FOR JONES & LAMSON MACHINE SHOWING CHUCK AND WHEELS FOR GRINDING

contour is bound to run as true as the surface that hold it. Any error due to distortion will, therefore, be mani fested in the inaccuracy of the center hole, and a suffi cient amount of metal, determined by experiment, ha been left at this point to bring the hole true to finishe size by grinding.

From the nature of the device it will readily be see that the chucking is quick, certain and accurate. Ther is no opportunity for a careless operator to get a piec in wrong, for wherever he puts it, it is right, and th pressure of the springs upon the back of the gear brin it to center. The remainder of the operation is but t lower the wheel into position so that the grinding hea bears upon the guide at the back of the machine, an start the traversing mechanism. The position of th guide determines the nature of the hole, whether para lel or taper, and the sizing mechanism of the machir attends to the rest.

Using a Gear to Chuck a Gear

A chuck similar in principle but with a different ce tering medium is used to hold bevels with radial teeth This chuck, shown in Figs. 3, 4 and 5, is also groun to a true, flat surface upon the spindle of the machin with which it is to be used and is fitted with a gea

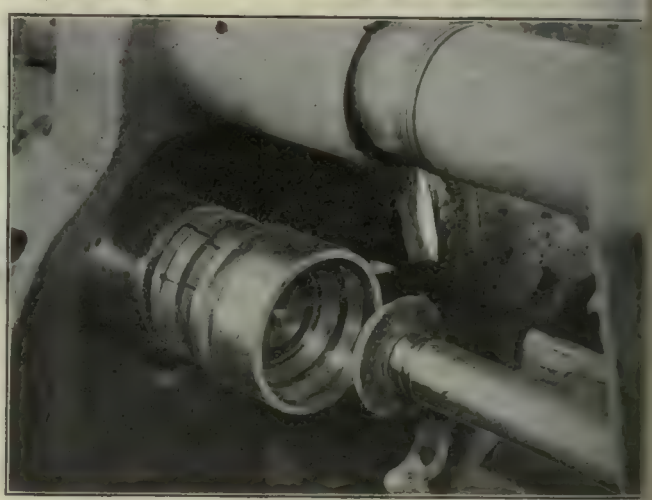


FIG. 9. HOLDING THE SLEEVE FOR THE INTERNAL GRINDING

the counterpart of the gear it is to hold, which ha been corrected to the utmost limit of accuracy by th usual toolmaker's methods. In Fig. 3, *A* is the chuc with what may be termed the master-gear permanentl attached to its face. The work *B* is held in contact wit the master-gear by springs as in the first instance, bu these springs, instead of being independently operated are closed by wires attached to a central stud, as indi cated at *C* and operated by a hand-wheel at the rear o the main spindle of the grinding machine.

It will be noted that the gear shown in these illustra tions is of the kind that is fastened by screws to separate part which takes the place of the hub, and th central hole is depended upon only to center it in posi tion. The back of the gear where it bears upon th shoulder of the other piece is also ground at this sam setting, insuring accurate relationship between the cen tral hole and the face upon which it depends for th transmission of its power. The Bryant machine lend itself admirably to this double operation.

When this chuck was first brought to the attention o the writer he did not believe that it could be depende

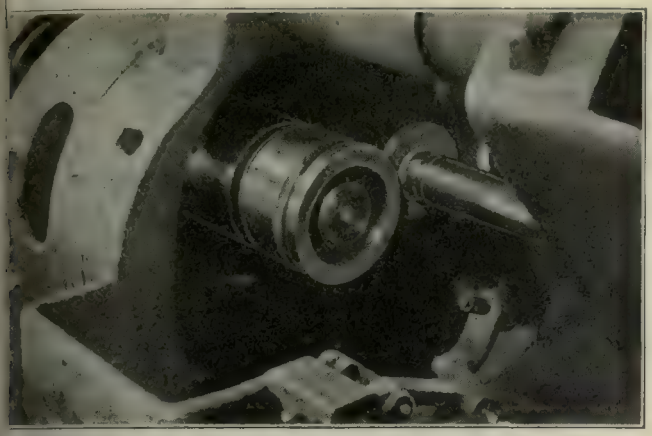


FIG. 10. GRINDING THE GROOVE

upon to bring the work accurately to center, but upon being invited to test it he was compelled to revise his opinion. Not only will it hold the gear shown, but by changing the master gear to conform to the work, almost any bevel gear with radial teeth may be held. This type of fixture is used chiefly for bevel ring gears with pitch cone angle greater than 60 degrees.

Spur gears are provided for by the fixture shown in Fig. 6. This is in effect a "draw-in" chuck in which the regular jaws are fitted with special extensions designed to hold the particular gear under consideration. The extension jaws are held in place in the chuck by a single fillister-head screw in each and may be changed from one kind or size of gear to another in a very few minutes. The extension jaws do not depend upon the holding screw to position them but, being accurately ground upon their periphery, bear upon a ledge that is a part of the regular jaws of the collet.

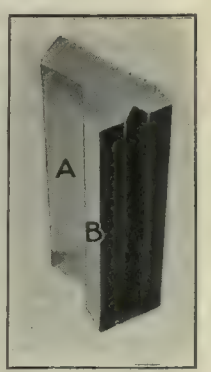


FIG. 11. A DIFFICULT PIECE TO GRIND

It may hold a gear by the base circle, the addenum circle, or the pitch line, as desired. The extension jaws shown in the photograph do not belong with the gear shown in place, nor in fact, are they all of the same set. They were put in place merely for the purpose of photographing to show the principle of the device. Instead of changing jaws with each change of work, extra collets may be provided with extension jaws always in place; in which case the change is accomplished by merely backing out the draw bar and substituting another collet. The chuck body is shown in Fig. 7.

Some Grinding Fixtures at Jones & Lamson's

At the Jones & Lamson shops many parts are regularly finished by grinding. One such part is shown in Fig. 8 with the fixture for holding it and the various wheels used in the grinding operations. This part does not require absolute accuracy upon its outer surfaces, and it is therefore finished in this respect, except for the groove, before the finish grinding is done upon the interior. The smaller diameter is first ground while the part is held in a standard chuck and becomes the locating points for subsequent operations which include the grinding of the two large interior diameters and the bevel, as well as the groove upon the outside.

The holding device is the inverse of the usual draw-in collet—an expanding chuck. It is made to hold the work in two positions as shown in Figs. 9 and 10. The part to be ground is, itself, the sleeve of a draw-in chuck and there is constant endwise movement between itself and its mating part, resulting in serious wear upon the beveled portion.

For this reason and to make renewal inexpensive and easy of accomplishment, the actual wear at the bevel comes upon six inserted plugs of tool steel, the position of which may be seen in Fig. 9. After the smaller interior diameter has been ground in a preceding operation, the piece is held by this ground surface upon the corresponding diameter of the plug, as seen in Fig. 9, in which position the intermediate and larger diameters are ground; a special guide plate on the grinding machine taking care of both sizes. Without moving the piece on the chuck the wheel is changed for the small beveled wheel to be seen in Fig. 8, and the beveled surface is ground by bringing up the wheel and holding it without traverse until a true surface is secured.

In a succeeding operation the piece is reversed on the same chuck and the larger wheel in Fig. 8 substituted, for grinding the groove by feeding straight in. The stock has been removed from this groove by a machining operation so that the wheel really has little to do other than to true up the surfaces and bring them to size. The operation is shown in Fig. 10.

Grinding Concentric Arcs in Fixture

The part shown in Fig. 11 belongs to another machine built by Jones & Lamson. The surfaces *A* and *B* are arcs and must be ground concentric, though of different radii. An ingenious fixture for meeting the requirements is shown in Fig. 12 and again in a different position in Fig. 13.

The base of the fixture is ribbed to fit the table of a standard cutter grinding machine. The part is held by clamps to the swinging yoke of the fixture and the yoke is provided upon its under surface with a wormwheel segment meshing with a worm mounted upon a transverse shaft turned by the small handwheel in front.

The operation is entirely manual and the accuracy of the radii depends upon the skill of the operator in manipulating the elevating screws. The designer of the



FIG. 12. HOLDING FIXTURE FOR GRINDING CIRCULAR ARC

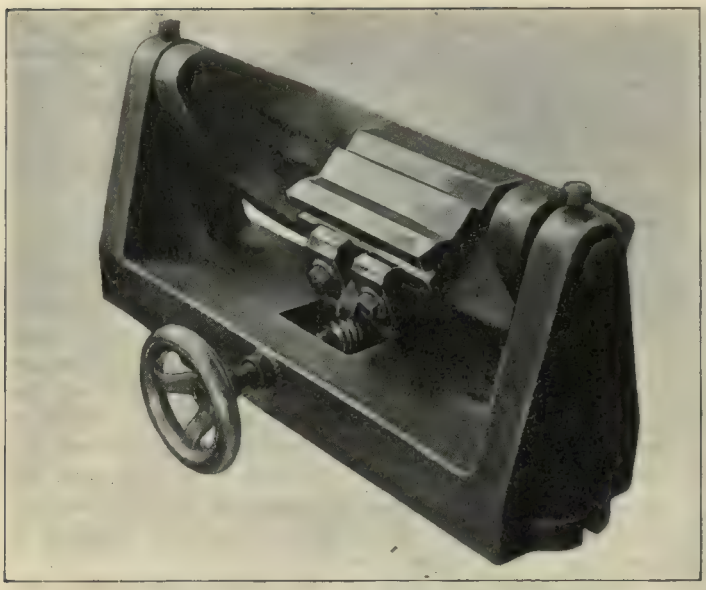


FIG. 13. THE FIXTURE IN EXTREME POSITION

fixture does not claim speedy production for it, but it accomplishes very neatly the principal result desired; which is the production of two circular surfaces to a true arc, parallel with and concentric to each other, and at a certain definite radius for each.

A Commonplace Job

A minor part, or rather pair of parts, is shown in Fig. 14. While there is little about the grinding of these parts that is out of the ordinary, it is a further exemplification of the practice of grinding interior surfaces after the outer ones are finished, and the operation as conducted at the Jones & Lamson plant is very fast. The centers are made in pairs, broken in two after the shank is ground and the bevel finished while the part is held in a taper bushing. The bushing is first finish-ground upon the outside while held by a mandrel, and the bore is ground in a succeeding operation with the bushing held in the correspondingly tapered spindle of the grinding machine.

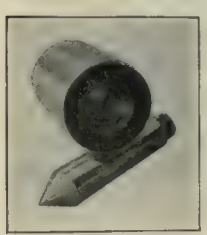


FIG. 14. CENTER AND BUSHING

How to Write a "Want" Ad to Get the Right Man for the Job

By Charles Steinecke, Jr.
Supervisor of Classified Advertising, McGraw-Hill Co., Inc.

I have been very much interested in Frank H. Williams' article, "Putting Punch Into Help Wanted Ads" (*American Machinist*, Vol. 53, p. 611), and the articles of the many contributors who have written under the same and similar titles since his article was published. Although the subject has been taken up from many angles I believe that there are still some points that have not been brought out.

Those using "Want" ads to locate men should make their announcements specific. The average "Position Vacant" advertisement fails to give the information necessary to attract the right man and eliminate those who are not qualified.

A small advertisement presents the same problems as a large one, except that in the case of the small one the writer is obliged to condense his thoughts into a space of a few words.

The "Want" ad writer should answer definite questions for himself, such as:

Kind of man desired?
Married or single preferred?
Age?
Experience necessary?
Nature of work expected of man?
Number of men to be handled?
What does the plant produce?
What is the size of the plant?
Location of plant?
Rate of pay?
Advantages offered?

When these, or similar questions have been replied to, the writer should embody his answers in the advertisement. After following such a plan, an announcement for a foreman would read something like the following:

> "FOREMAN; experienced in manufacture of machine tools; married man preferred; age, 35-50; to handle 60 men making jigs and fixtures. Large plant near prominent Ohio city. Pay, 90 cents an hour, with possible advancement."

Contrast the foregoing with the "general" advertisement calling for the same man:

> "FOREMAN wanted by a large machine tool plant; must be thoroughly experienced in the manufacture of jigs and fixtures and know how to handle men. Write stating age, experience, references, and salary desired."

The difference in the number of words in the two advertisements is three; yet there is a great difference in what the ads convey. The first announcement states specifically that the successful applicant will undoubtedly be a married man between the given ages; that he must be capable of handling 60 men; that he must be thoroughly experienced in the manufacture of machine tools, especially of jigs and fixtures. It also tells the reader that the plant is located in Ohio, near a large city where he can find suitable quarters for his family. Also, it states the rate of pay and the possibility of advancement. Such an advertisement automatically "rules out" a large field of applicants.

The second announcement appeals to every foreman and "would-be" foreman, with experience in the manufacture of jigs and fixtures—and the advertiser is sure to hear from a large number of them. It gives no idea as to the location of the plant, the number of men to be handled, whether a married man is wanted or not, or any advantages a man might have if he were the successful applicant.

From the mass of replies to the second advertisement the right man may be located, but a great deal of time must be wasted by reading the letters of unqualified men, to say nothing of the time that has already been wasted by those who have answered the announcement.

The best written and most carefully thought out advertisement will not entirely eliminate answers from unqualified men. It will, however, minimize the number of such answers, and that is all that anyone can hope to do. Don't write just words; make them say something—be specific.

Trepanning Tools for Locomotive Main and Side-Rod Forgings

Ingenious Tools in Use at Three Large Shops—Toolbits Used in Trepanning Tools for Cutting Holes in the Ends of Side-Rod Forgings

By J. V. HUNTER
Western Editor, *American Machinist*

THERE seems to be little similarity in the general design of trepanning tools made by railroad shop toolmakers for cutting the core from the bearings of locomotive main and side-rod forgings. Three shops successively visited recently, yielded three types of these tools, of entirely dissimilar appearance. Each of the tools doubtless had its good points and probably all were built with some consideration of the general factors involved in the shop machining methods.

The tools shown in Fig. 1 were found in the Beech Grove shops of the Big Four Railroad at Indianapolis. They have the general appearance of huge hollow mills with only two cutting teeth which are inserted tool-steel bits. The bodies were forged from axle steel, hollow bored and machined to finish. The drill hole marks still remaining on the edges of the huge chip clearance notches indicate how this section of the shell was removed.



FIG. 1. GROUP OF HEAVY TREPANNING TOOLS

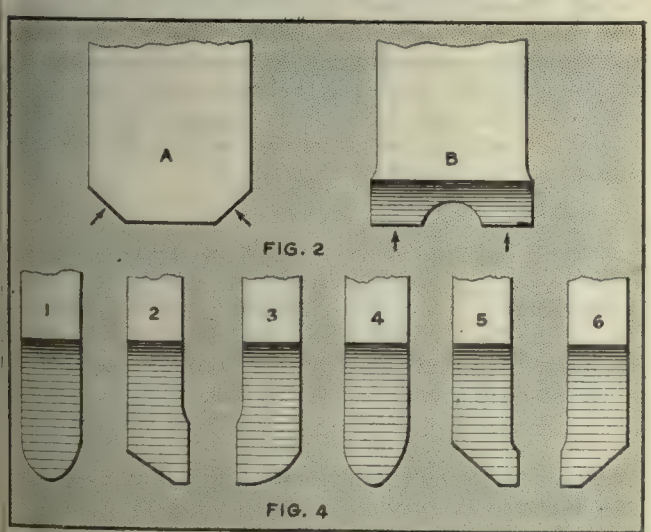


FIG. 2. TOOLBITS ON TREPANNING TOOL
FIG. 4. SEQUENCE OF TOOLBITS USED IN SIDE-ROD TOOL

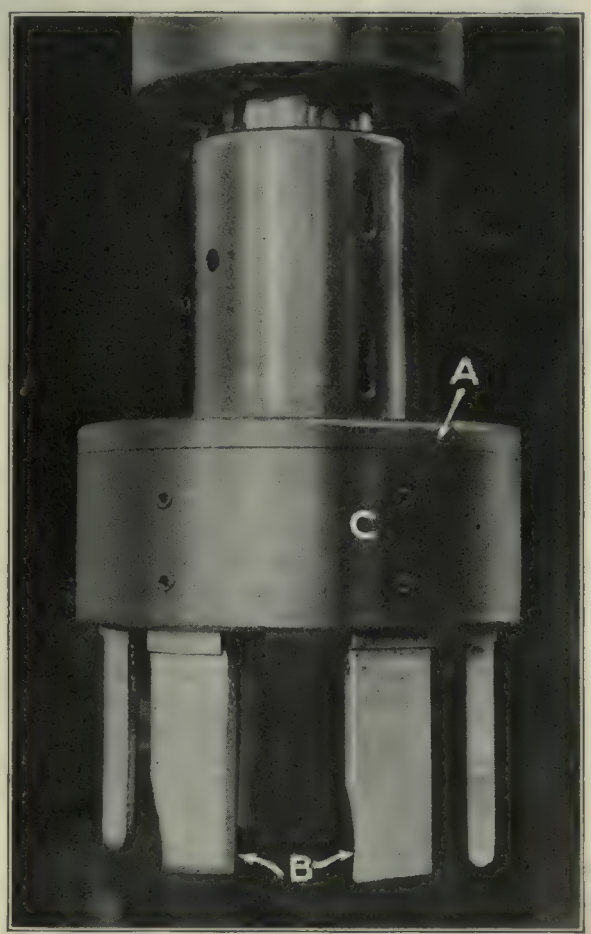


FIG. 3. TOOL USED FOR SIDE-RODS IN WABASH SHOPS

Each toolbit has a key milled on its rear face that fits in a longitudinal groove in the body at *A*, and is held in place by a capscrew. The short strap that extends parallel with the cutting face affords an additional means of support. A different tool is required for each size of hole it is desired to cut. The tool has a taper shank to fit in a drilling machine spindle.

The manner in which the key holds the toolbits fixed in position makes possible the removal of the bits for grinding on the lower cutting edge and replacement without altering the size of hole that will be cut. The design of the toolbit cutting edges is shown in Fig. 2. Bit *A* must precede the cut of bit *B* to remove the stock from the center of the groove while the bit *B* follows to cut side clearance and size the hole.

At the Decatur shops of the Wabash Railway Co. trepanning tools of the type shown in Fig. 3 are used. The tool is driven by a sleeve fitting over the drilling machine spindle with a key through the drift pin slot.



FIG. 5. ADJUSTABLE TREPANNING TOOL WITH THREE CUTTERS

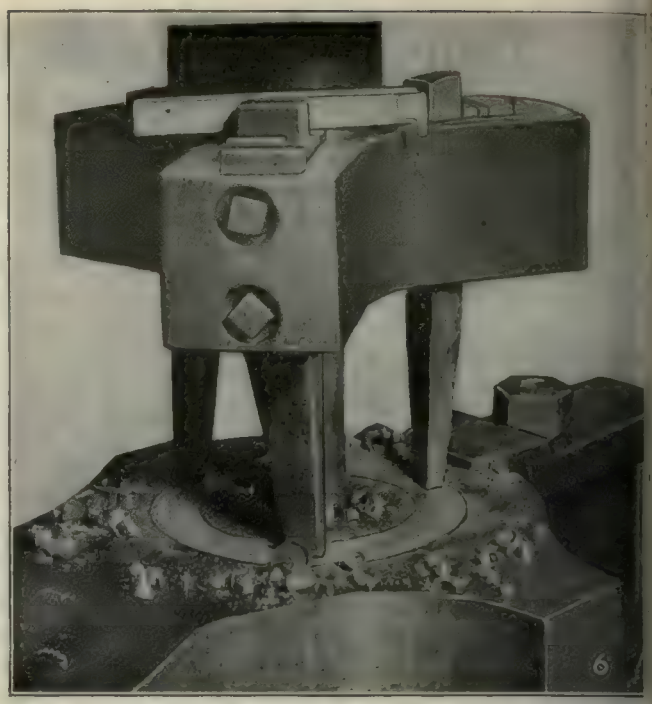


FIG. 6. TREPANNING TOOL CUTTING CORE FROM SIDE ROD FORGINGS

The body *A* has been milled with slots to receive the high-speed steel tools *B*. The latter are held in place both by a ring *C* and by two hollow-head setscrews clamping on each tool. The tools are stocky and will stand a heavy cut. As in the case of the Big Four shop's tools, a different size must be built for each diameter of hole to be cut. The arrangement of the tools' cutting faces varies from the preceding by utilizing the six tools so that they form two sets. The tools are outlined in Fig. 4 which shows how the sets have their work distributed to cut a center groove with the tools 1 and 4, and side wall clearance with tools 2 and 5, and 3 and 6 respectively.

The adjustable trepanning tool shown in Fig. 5 has several points of decided merit. It is used in the Bloomington locomotive shops of the Chicago and Alton Railroad Co. It has one feature not possessed by the others described: Adjustability. The toolbits can be set so that any diameter of hole ranging from 6½ to 11 in. can be cut. In the second place it is driven and guided by a pilot bar that steadies it while cutting.

The tool was shaped out of a solid steel forging. The slotted holes are of sufficient depth so the bits may be adjusted for cutting holes within the limits specified. Three sets of uniform spacing blocks are provided for adjusting the bits. Setscrews hold the bits in place and their holes are counterbored so that their heads come flush with the outside of the body.

A study of the cutting action of the bits shows that they are very similar to bits 1, 2 and 3 in Fig. 4. The groove cut is fairly wide and each fit makes a clean path, as can be seen in Fig. 6, where the tools are shown at work.

General Dawes on Taxes

The following is an abstract from an address by General Charles G. Dawes in the *Journal of the American Bankers Association.*

The Secretary of the Treasury, for the fiscal year 1921 estimated that the ordinary expenditures of the government would be $4,851,000,000. In that estimate he includes, for the Post Office Department only, a deficiency of about $36,800,000. In other words, there is not included in that figure of $4,851,000,000 that part of the expenses of the Post Office Department which would be covered by the revenues of the Postal Department, which amount to about $467,000,000. Adding that $467,000,000 to the $4,851,000,000, you have the estimated expenditures for the fiscal year 1921 of about $5,300,000,000.

If we subtract from that sum the amount of money which we expend in matters not of administration—for instance, our delectable experience in connection with the government operation of railroads will cost the people this year only the small sum of $1,032,000,000 besides what it cost us in the past. Then we have the interest on the public debt of about $975,000,000, and pensions of about $375,000,000. But adding those expenditures which are not related to administration and which amount to about $2,700,000,000, there remains the tremendous sum of $2,600,000,000 for the ordinary administrative expenditures of government—and that is the sum out of which the reductions must chiefly come to reduce the taxation of the government, which today is throttling the industries and the commerce and the labor of our country.

One of the best known Bulgarian economists, Professor Jekoff of the University of Sophia, in a recent newspaper article, calls attention to the fact that Bulgaria offers a good market for all kinds of machinery. He says that the following class of machines and tools will find a ready market in his country: Machine tools, woodworking machinery, including saw mills, mining machinery including motors and pumps, agricultural machines and implements of all kinds, looms for mechanical weaving mills, brickmaking machinery and stone working machines, automobiles and cycles, typewriters, sewing machines, builders' hardware and small tools of every description.



The Foreman and His Job

Suggestions for live foremen who wish to go up the ladder, and for firms who want better shop executives

By FRED H. COLVIN
Editor, American Machinist

ALTHOUGH the foreman may have nothing to do with the selection of the method of wage payments, he should be familiar with them all if he is looking for that bigger and better job, higher up. For this is one of the important questions and he should be posted as to the advantages and disadvantages of each. But it should be thoroughly realized that no special plan of wage payment, or any other detail of that kind, will solve the industrial problems or keep production up where it belongs. For, in addition to the best wage payment plan, there must be confidence and absolute fairness on both sides, and this is where the personality of the management, which includes all from the top down, counts most.

The progressive foreman will want to know about time study, motion study, apprenticeship systems, shop committees and many other phases of modern management and production. He must not however get the idea that any of these are *panaceas* for all the industrial ills, as such is not the case. They all play their part but their success depends upon the way in which they are applied. And none of them will succeed unless there is confidence and fairness on both sides.

We must remember that no iron clad rule will fit all cases and that the successful manager is the one who can know when to modify rules to secure the best results in the particular case in hand. He must not lose sight of the fact that the average man is square if he is made to understand the rules of the game. The trouble has been that there has been too little attempt to have men understand the various conditions which surround the running of a large factory.

All Men Not Alike

The foreman who studies the individual characteristics of his men and who treats them as distinct individuals, always gets the best results. The men know that for time keeping purposes it is necessary to have numbers but no man likes to be considered solely as a number, without personality. He prefers to be called "Bill" or "Shorty" and be talked to as man to man, just as any of us do.

Some men require scolding but of different variety, while others resent such methods and do not respond to them. Many can be jollied into doing good work and plenty of it, in other cases we can appeal to pride, either in personal performance or in the shop product. Then too the group spirit can be appealed to in many cases with good results. But all methods must be considered and applied when conditions warrant.

One of the greatest mistakes is to try and make all men alike, or to expect exact uniformity in the human equation. It is neither possible nor desirable. The old idea of some systematizers that there is only one right way to do all jobs is a great mistake. It has antagonized many excellent workers and has killed initiative in hundreds of plants. It originated with the false notion that all the brains of the shop were concentrated in the office planning department and that the only function of the worker was to follow instructions as to every movement used in doing the work.

Bringing Out Individuality

This does not mean that every man should be left to his own devices as to the way work should be done.



THE AVERAGE MAN IS SQUARE

Unfortunately we have not enough thoroughly trained mechanics for this even if it were desirable. But, given the shop equipment, the tools and the time in which the work should be done, as much leeway as possible

should be given as to the actual methods used. We might say something like this:

"Here is a job which takes an hour on the average. Here are the machine and tools which we have available for doing it. By following this sequence of operations our men find it easier and quicker than any other way



NO MAN LIKES TO BE CONSIDERED SOLELY AS A NUMBER

we know. Better try this way and see how it goes. Then if you find any other way, using our tools and equipment by which you can do it easier or faster, quality always being what it should, we shall be glad to see your way. It may or may not be better for others, but if it is better for you, we want you to use it."

This of course is not a usual procedure and is not always necessary but it gives a good man the feeling of individuality, the feeling that he is credited with having brains of his own, and it pleases us all.

Encouraging Men to Think

There are many men who are not sufficiently trained to undertake work in their own way. But in most cases it will pay to encourage them to think about their



ALL MEN ARE NOT ALIKE

work, to give them all the opportunities possible for learning more, as it makes them more valuable to the department and to the firm, as well as to themselves. And nothing should give a foreman greater pride tha to think of the men whom he has helped to become mor valuable to themselves and to the country.

The many complications of the large modern sho make it impossible for the foreman to act as the instruc tor as in the old days. Many consider this as a calamit and feel that instruction should be his main functio The tendency however, is to make the foreman's chie duty that of an executive, and to have the training don elsewhere. Some plants find a preliminary trainin school of great value and are using it to bring men u to higher production, even after they have worked i the shop with fair satisfaction. Where the trainin school is in use it is evident that the foreman shoul co-operate with it in every way possible. If the student or learners do not give satisfaction, or if they seem t lack certain qualities, the foreman should frankly te the instructors, in as nice a way as possible, and e deavor to have the instruction made more practica This not only benefits the foreman but the firm and th men themselves.

A little judicious study of the men and the sho conditions will enable the progressive foreman to e courage his men in many ways.

Cost of Changing to the Metric System

A close study of costs involved in changing fro our established system to the metric system in a manu facturing concern does as a rule furnish surprises.

To a letter recently received by the American Inst tute of Weights and Measures from a prominen Cincinnati firm was attached a comprehensive repo giving a cost estimate covering such a change. Fro this letter, written by the president of the compan we quote the following:

"This report was made up very carefully, and th result is simply astounding. The cost would amou to confiscation of profits for many years to come, if the were years of normal profits."

From the report, which it took weeks to prepare, w quote these figures:

The Cost Estimate Is as Follows

Remaking all drawings	$36,0
Changing of patterns	12,0
Cost of new metric small tools and measuring tools	27,5
Cost of changing jigs and fixtures (about 75 per cent of the cost of these if they were all to be made new)	130,5
Change in machine-tool equipment	19,0
Cost of training employees to use metric measuring tools	15,0
Cost of extra spoiled work from change	
First year	20,0
Second year	10,0
Additional labor required due to reduction in efficiency	
First year	40,0
Second year	20,0
Changing production and stockroom records to conform with metric units	11,0
	$341,0

"The changes in jigs and fixtures would cover th full line of machines produced. The figures given cov only the engineering and production expense, no est mate of the cost to the accounting and selling depar ments has been made. No charge has been made f extra room to carry additional tools and repair par built to the present system."

Production of Accurate Cams

Making the Patterns—Laying Out the Model Cams—Attachment for Cutting Master and Work Cams—A Sensitive Follower Roll Mounted in Ball Bearings

By E. A. DIXIE

AN INTERESTING job has just gone through the shop. It involved the making of some very accurate cams and after the model cams were completed the building of a special cam-cutting fixture to assure the exact reproduction from the model cams of master cams to be used in the fixture when working cams are being cut.

As the drawings of the cams are of minor interest I have omitted to show them, but as a description of the molding of the cams may possibly furnish information which will be of value to those contemplating similar work I show the patterns for the model, master, and working cams.

In Figs. 1 and 2 are shown the patterns and corebox for two of the model cams. As the other model cams were similar to these the two examples selected will be sufficient to show the methods employed on the whole lot. These model cams are of the "shell" type. The pattern is solid and molded on end. The corebox makes half core only, so that two half cores can be made by the coremaker and pasted together.

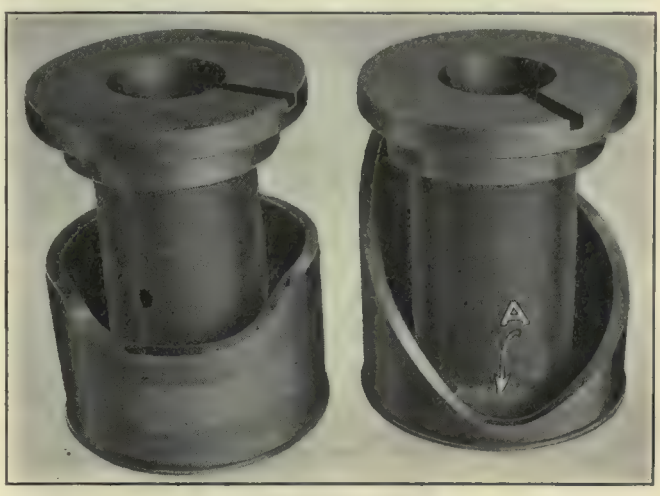


FIG. 4. TWO MODEL CAMS

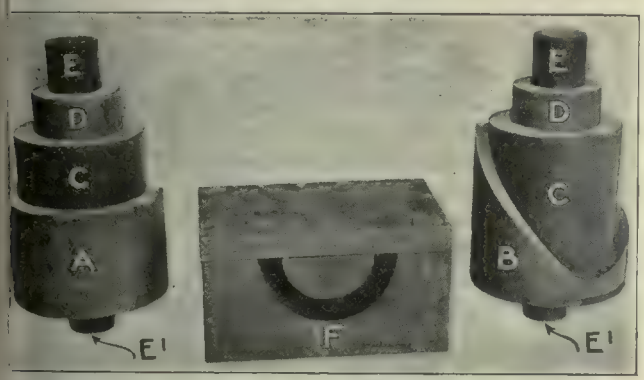


FIG. 1. MODEL CAM PATTERNS WITH CLOSED COREBOX

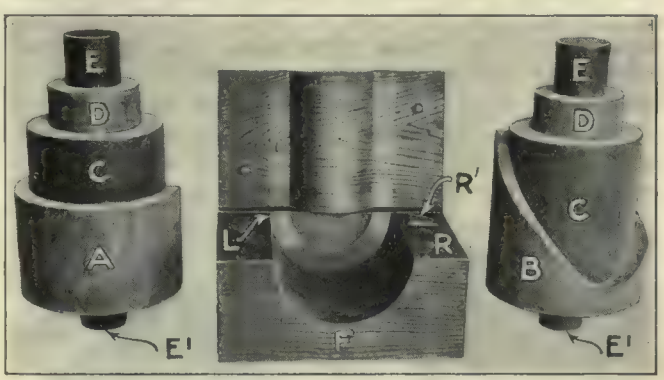


FIG. 2. MODEL CAM PATTERNS WITH COREBOX OPEN

It will be observed at *A* in Fig. 4 that the core should be below the working face of the cam so as to provide clearance for the milling cutter and the file which are used to finish the cam back. This clearance is arranged for in the corebox in a very simple and effective manner.

It will be noted by referring to Fig. 2 that there are two depressions, *L* and *R*, on each side of the corebox at the parting line. These depressions are wedge-shaped about in. deep at the parting line and curving to nothing at about 1 in. from that point. In width they are the same as the opening in the corebox. Two small wooden fillers, one of which is shown at R^1, are provided so that either of the depressions *L* or *R* can be stopped off. For instance, when the coremaker is making one half of the core he would use the corebox, as shown in Fig. 2, with one of the filler pieces in place in the depression *L*, while at the same time the other filling piece would be left out of the depression marked *R*. Thus the sand will fill the depression *R*, leaving a hump the same shape as the depression *R* on the half core. As the depression *L* is stopped off by one filler, that side of the core will be flat and level with the rest of the edge of the core.

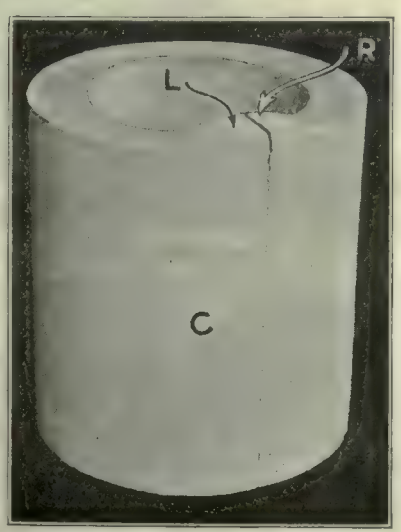


FIG. 3. CORE FOR MODEL CAMS

When making the other half of the core the preceding method would be reversed, leaving a hump at *L* in the core. When the two half cores are pasted together the result is as shown in Fig. 3, where the projections *L* and *R* show the hump in the core which provides clearance for the milling cutter.

As shown in Figs. 1 and 2, the patterns *A* and *B* are upside down to the position in which they will be molded. They are plain straight patterns except for the necessary draft, the small end of the taper being towards *E* and the large end at *E1*.

The two prints *E* and *E1* locate the central core. The section *D* is the sleeve around the central core. The section *C* is the print for the core *G* shown in Fig. 3.

The only difference in the molding of the two cams is in the cores. The core for cam *A* is made in the box with both filling pieces in place, thus producing a plain cylindrical core when the two half cores are pasted together.

When taking the photograph for Fig. 3 the two half

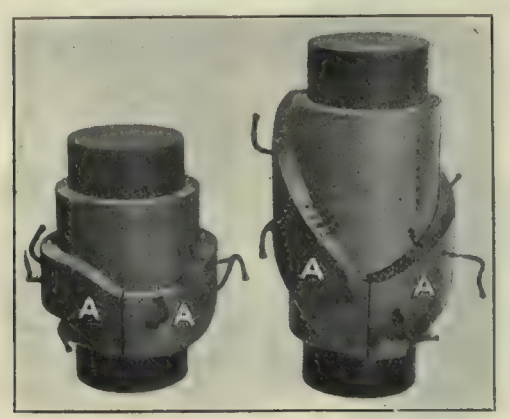


FIG. 5. PATTERNS FOR MASTER AND WORKING CAMS

cores were purposely left unjoined so that the parting line would show.

The master and working cams are plain barrel cams and are cast from the same patterns, two of which are shown in Fig. 5. These patterns are also made solid with the exception that the track is made up of a number of loose pieces *A* which are pinned, as shown, to the pattern proper. The molding of these as well as that of the model cams is done in green sand. When the molder has one of the master cam patterns firmly tucked in

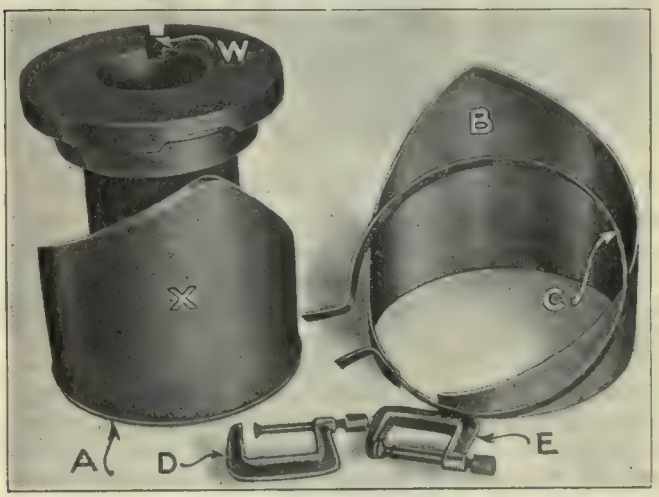


FIG. 6. MODEL-CAM, TEMPLET AND CLAMPS



FIG. 7. VARIOUS CAM TEMPLETS MADE OF THIN ZINC

place in the mold he removes the pins which hold the loose pieces *A* of the cam track, finishes tucking the sand in and then draws the central part of the pattern.

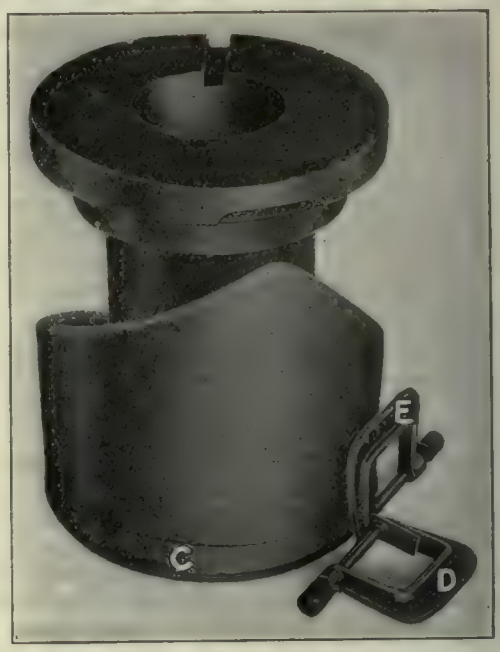


FIG. 8. MODEL CAM WITH TEMPLET CLAMPED IN PLACE

This comes away quite easily, leaving the loose cam track pieces *A* in the mold. Two of these pieces are "key" pieces, they draw straight in towards the center and must be drawn before the other pieces are removed. Obviously if the joints of the pieces *A* were radial none of the pieces could be drawn towards the center. For this reason the key pieces are made with their joints parallel.

The model cam castings were turned and otherwise machined as shown in Fig. 6. It will be noted that there is a small flange *A* at the bottom of the cam. This flange projects about $\frac{1}{8}$ in. beyond the surface and is

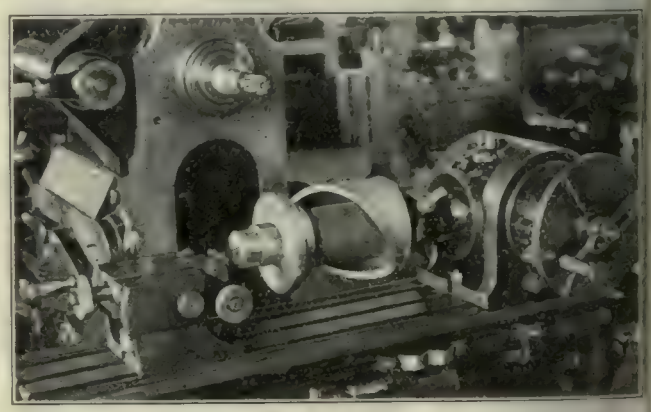


FIG. 9. ROUGH MILLING THE MODEL-CAM TRACK



FIG. 10. FRONT VIEW OF CAM-CUTTING FIXTURE

bout ⅛ in. thick. Its upper surface serves as a location or the cam templet *B*, the use and application of which as follows:

At the right in Fig. 6 are the templet *B* and band *C*, he latter being made of a strip of sheet zinc about ⅝ in. ide. The two small clamps *D* and *E* are used for ecuring the band *C* and templet *B* in place on the model am *X*. However, before describing this it would be well o describe the making of the model cam templets shown n Fig. 7.

The templets are sheet zinc about ₁₆ in. thick and ade of smooth, flat stock. One edge of the blank for he templet is first made as straight as possible. In his case after the edge was straightened the blank was nt over to the drawing office and one of the draftsmen id out the shape of the cam very carefully with relaon to the true edge. After being laid out and checked was sent to the toolroom and cut and filed accurately split the lines drawn by the draftsman.

The templet was then ready to be applied to the model am blank, which had, of course, been coppered to show he scriber marks.

As the metal from which the templet is made is so in there is no difficulty in bending it around the model m blank. The straight bottom edge of the templet is

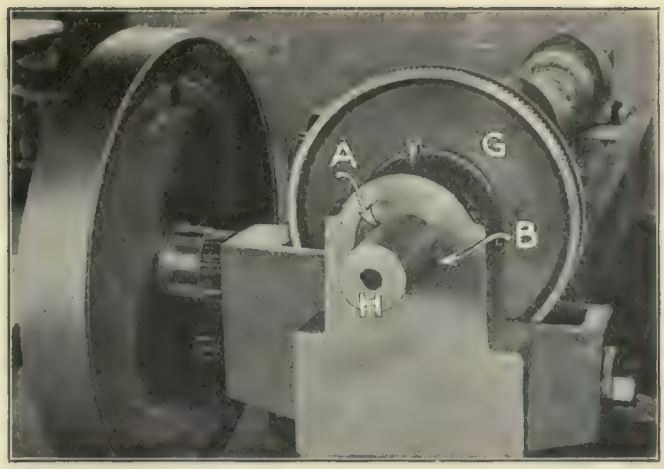


FIG. 12. END VIEW OF CAM-CUTTING FIXTURE

in the line cuts, Figs. 13 and 14. It will be noted that the fixture as shown by the halftones does not agree with the one shown by the line cuts. It was at first intended to have the cam roller on the side shown in the line cuts but later the change was made to the other side as shown in the halftones.

With the exception of the bearing *A*, Fig. 10, which

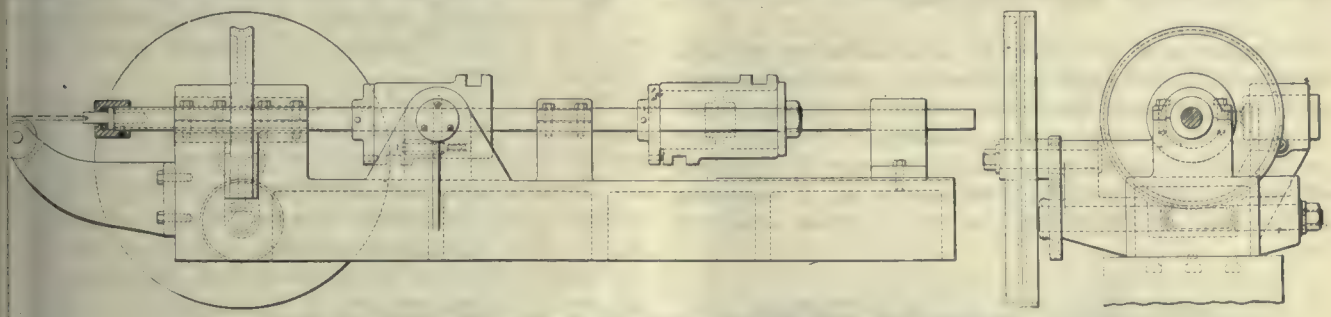


FIG. 13. SIDE AND END ELEVATIONS OF CAM-CUTTING FIXTURE

pt in contact with the face of the small flange *A*, ig. 6. A piece of string or a rubber band may be ound around the templet to hold it while the band *C* adjusted. In Fig. 8 the model cam is shown with the mplet held by the band *C*, which in turn is gripped by e two clamps *D* and *E*.

When applying the band *C* the outer clamp *D* is first osed on *C* at a point about ⅝ in. from the templet. he inner clamp *E* is then applied between the clamp *D* d the templet. This takes up the slack and tightens e band *C* and holds the templet securely in contact th the cam block. The toolmaker then takes a sharp riber (with smooth sides so that it will not cut and stroy the accuracy of the templet) and scribes the ntour of the templet on the model cam blank.

After removing the templet the cam track is milled to thin filing distance of the scribed line as shown in g. 9. After milling as shown, the templet is again mped in place and a good and careful workman files e track down to the templet, applying a square freently to check his work. After being filed the model ms were carefully inspected. As a tribute to the aftsman who laid out the templets and the man who ed them I may mention that no changes were necesry.

As the master and working cams for this particular e of machinery are required to be as nearly perfect productions of the model cams as it is possible to ake them, a special cam cutting fixture was designed. his is shown in the halftones, Figs. 10, 11 and 12, and must be removed in order to place and take the work out, and the caps of the other bearings the whole body of the fixture is cast in one piece; that is to say the lower halves of the bearings *B*, *C*, and *D* and the cam follower bracket *E*, Fig. 11, are all cast integral with the base. This gives exceptional rigidity and makes for good work.

The cam follower is different from the usual follower. Instead of a thin-walled narrow-faced roller mounted on a pin (to which it usually freezes hard unless it is very carefully watched and lubricated) there is a solid roller 6 in. in length mounted on ball bearings 3½ in. apart. This follower has been found to roll perfectly under all conditions of pressure.

The shaft has a balanced drive from the wormwheel. The wormwheel has a long journal on each side cast integral with it. These journals have bearings in the boxes *B* and *C*, Fig. 10. Two keyways *A* and *B*, Fig. 12, are cut from end to end through the central hole in the



FIG. 11. BACK VIEW OF CAM-CUTTING FIXTURE

hub of the worm gear *G*. The shaft *H* is a sliding fit in this hole. The keyways are 180 deg. apart and the shaft is provided with two feathers similarly spaced

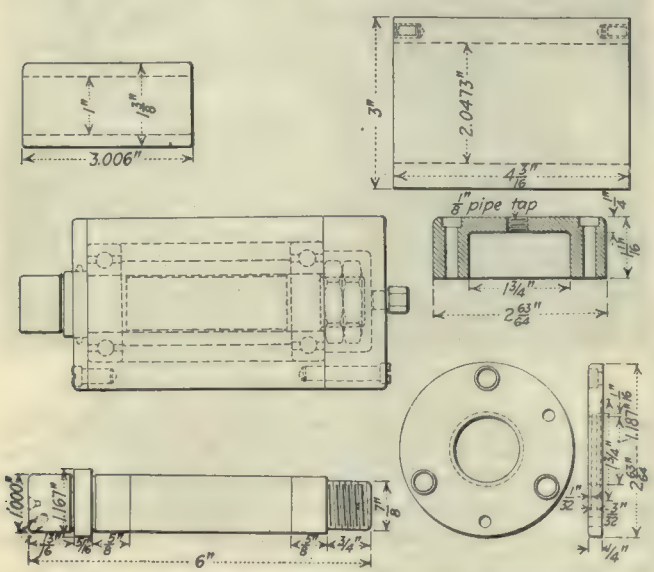


FIG. 14. DETAILS OF CAM FOLLOWER MOUNTED ON BALL BEARINGS

which slide in the two keyways, thus balancing the drive of the shaft. The shaft is subjected to sliding wear only and the bearings of the wormwheel to rotary wear only.

The locating of the model, master and working cams is simple and positive. A radial keyway *W* is cut as shown in Figs. 6 and 15; it engages a key in the collar on the shaft of the cam-milling fixture. The same key-

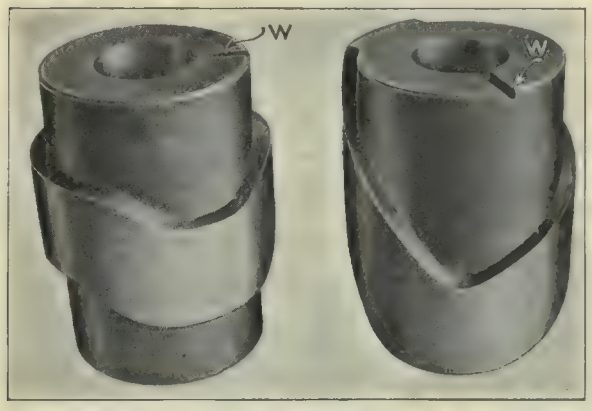


FIG. 15. MASTER OR WORKING-CAM CASTINGS

ways are also used to locate the working cams in the machines in which they are used.

In Figs. 10 and 11 the model cams are shown at *J* and the master cams which have not yet been cut are shown at *K*.

Since writing the above the master cams have been cut, checked up with the model cams and found correct.

The Spanish Tax Law and American Trade

That the new tax law of Spain is an almost insurmountable barrier to the continuance or development of American business in Spain is stated by the National Foreign Trade Council in a letter requesting the assistance of the United States Department of State in obtaining the revision of certain sections of this law.

The Foreign Trade Council summarizes the features of the law peculiarly harmful to American trade with Spain as follows:

"The provision that managers of branches of American companies shall be taxed at a higher rate than similar officials of Spanish companies.

"The provision that an American company shall be understood to 'transact business in Spain,' when it has merely 'representations authorized to contract in the name and for the account of the company.'

"The provision whereby the operation in Spain of American companies organized merely to effect sales or centralize orders renders the American companies which do business through such separate sales organizations, liable to taxation regardless of the fact that the sales company may itself be subject to taxation under the law.

"The provision that foreign companies that supply goods in Spain by means of permanent installation shall be taxed, even though they have no representation established in Spain, and even though the 'installation' may not belong to them.

"The provision taxing the part of the profits of an American company operating in Spain, corresponding to that part of the capital of the company assigned to the company's business in Spain, regardless of whether or not any profits were actually earned on the Spanish business.

"The provision that taxes levied as above shall in no case be less than one-tenth of the total profits of the company earned in all parts of the world.

"The provision that American banks doing business in Spain shall be taxed at the rate of one per thousand of the total capital and surplus of the banking institution, plus two per thousand of that part of the capital and surplus assigned to Spain, which part shall in no case be less than one-tenth of the total capital of the organization.

"The provision that the figures relative to the operations in Spain of American companies shall remain in force for triennial periods; and, while subject to revision, shall not be altered if on revision the variation does not exceed 20 per cent.

"Those provisions which place the determination of the portion assigned to Spain of the total capital of American organizations in a committee on profits which includes other than government officials in its membership.

"The provision requiring American organizations transacting business in Spain to declare the total amount of their business done in Spain, and also in all other parts of the world where the organization may transact business.

"Not only is the letter of the law a burden to Spanish-American trade," says the National Foreign Trade Council, "but its provisions for the interpretation of the law, through the committee on profits and various local functionaries, must lead inevitably to arbitrary decisions, not unconnected with the personal relationship which may be established between the American trader and the foreign official.

"The disastrous effects of this law are already becoming evident. Important American commercial organizations and banking interests have been forced to withdraw their branches from Spain, and many American concerns find it impossible now to do business, even through authorized agents."

The Trend of Industrial Management

The Kind of Leadership Demanded by Industrial Change—Activities of Early Manufacturing Industries—Maintenance of Labor—Paths of Approach to the Employee

By ERWIN H. SCHELL

TO THE business administrator, the ability to foresee and predict with relative accuracy, is of immediate assistance, if not essential to his success. The industrial change through which the world has been passing, demands a leadership which constantly focusses its attention upon the future, keenly watchful of every sign or circumstance which helps determine a policy of progress in accord with the demands of present and future industrial conditions.

A comprehensive view of the past is essential if the student of industrial management is to look with confidence into the future. If he can chart this history in simple terms he can view its trend, visualize its growth, and with increasing sureness, tell of its probable course.

There is now a sufficient background of contemporary history to give a clear idea of the progress of management. Contrary to the natural assumption, development is found to have taken place along simple, straightforward lines clearly indicating the new demands for improvement upon which attention will soon be concentrated.

The early manufacturing industries included the same activities as those of the present day, namely, the use by management of capital, labor and material in the making of a salable product. The fundamental activity was the transformation of raw material into finished product through the use of capital by labor, under the direction of management. This task may be termed operation, or direct production. The officials who were responsible for the proper conduct of the work may be termed production executives.

It was evident that operation as above defined could not occur unless other attendant activities were undertaken. For example, a constant supply of cash was necessary, records of business transactions had to be kept, and buildings and equipment had to be maintained. Originally, these auxiliary responsibilites which may be considered to be the work of maintenance were shouldered by the production executives. The trend of industrial management clearly shows that the work of maintenance has been gradually withdrawn from the control of the lesser executives directly in charge of operation, giving them opportunity to turn their entire attention to the problem of converting the raw material into the finished product. The official who undertook any given task of maintenance usually served in this capacity for all operations in the industry. For this reason his position was considered to be a functional one, in contrast to the so-called "line" organization of the production executives.

Departmentalizing Management

In order to sense clearly this increasing functionalization, some of the more important changes should be considered. Probably the earliest separation of responsibility was that of cash maintenance creating the office of treasurer. Record maintenance soon called for the secretary, comptroller, accountant, and bookkeeper. The responsibilities of the millwright, the electrician, the engineer, the watchman, the janitor, all were clearly defined in connection with the work of maintaining the required buildings, power, light and heat. Material maintenance necessitated specialists whom we know as the purchasing agent, the traffic manager, the receiving clerk, the inspector, the storekeeper and the move boss, to safeguard and assure the flow of suitable substance into the fabricating processes.

Machinery and tool maintenance when properly functionalized, relieved the workmen as well as the production executives of unwelcome activities. Through the efforts of the repair boss and the toolroom foreman, breakdowns of productive equipment were prevented and suitable tools kept in good order and readily available. Standardization, the great contribution of scientific management to industry, again sought the services of individuals to act in behalf of its maintenance. Standards of design and of quality were formulated by the chief engineer, the designer, and the draftsman, and the chief inspector undertook to maintain quality in the product. Standards of procedure, of place, of time, of responsibility of manufacture were developed by the industrial engineer, and comparative records of actual progress maintained by the industrial statistician.

Early in this period of transition, industry felt the need of competent persons to maintain a demand for the product. The sales manager, and advertising manager undertook this task, and the credit manager assumed the responsibility of inspecting and maintaining the required standards of quality demand.

These functions of maintenance may be tabulated for purposes of clearness:

Maintenance	Functional Official
Cash	Treasurer.
Records	Comptroller, Accountant, Bookkeeper.
Building and Equipment	Millwright, Electrician, Watchman, Janitor, Engineer.
Machinery and Tools	Repair Boss, Tool Boss.
Materials and Supplies	Purchasing Agent, Traffic Manager, Receiving Clerk, Storekeeper, Move Boss.
Methods and Procedure	Industrial Engineer, Planning Department.
Design of Product	Chief Engineer, Designer, Draftsman.
Quality of Product	Inspector.
Quality of Product Demand	Credit Manager.
Statistics	Statistician.
Product Demand	Sales Manager, Advertising Manager.

This list, while incomplete, serves to emphasize the wide application of the policy of separation of maintenance from operation.

Labor Maintenance

The so-called "employment management" movement which has gained such headway during recent years becomes far more comprehensible when the trend of management has thus been considered. The establishment of the profession of industrial relations or personnel work evidences the placing of another task of maintenance—that of labor maintenance—in the hands of qualified specialists. Those activities in industry which are rightly grouped under this function have undoubtedly proved their economic worth in the eyes of the business man. During the war period centralized recruiting and selection of new employees have enabled American mills and factories to maintain a larger working force than would have been the case had the production executives undertaken the task. The acci-

dent prevention movement which endeavors to maintain the employee in a safe working environment and which in reality preceded employment management, has shown a definite return in the reduction of compensation insurance rates. The value of the company doctor, the industrial dentist, the visiting nurse, and the first-aid equipment has been measured definitely in the reduction of absenteeism. The favorable results obtained from good lighting, heating and ventilation and from wholesome foods served in company restaurants and lunch rooms has been reflected in terms of shop production. The solution of transportation and housing problems, the development of shop publications, the introduction of group insurance and mutual benefit plans have proved their worth in many cases by the attending reduction of labor turnover. The separation of labor maintenance from the task of operation has also made clear the true relationship of education and training to industry.

In all relations with the employee whether of maintenance or operation there are two paths of approach, one through technical, and the other through educational channels. The safety engineer in his campaign to prevent accidents, educates the employee to the need of caution as well as guards the unsafe machinery. The dentist and physician counsel hygiene in addition to the technical service which they render the patient. Education and training are bound up with every activity which relates to labor, and each official or executive group will assume the responsibility for this method of industrial improvement in his own particular field of work.

Education or training by functional officials of employees engaged in operation does not require that these specialists be vested with any executive authority in order to become effective. The task of the staff official is that of counsel which is a form of education, and his position is rarely one of control. Owing to the fact that instructions are often found combined with orders the employee has assumed that they are one and the same. He has therefore, looked upon the advisor as a person of authority who was not included in the "line" control structure, and from whom he should take orders in addition to those of the foreman or other authorized executive. This misunderstanding weakens the effectiveness of labor management, and every effort should be made to corret it.

Inter-Department Relations

The relationship between the functional official, the production executive, and the employee on operation may be summed up by the statement that the functional official should deal with the employee on matters of technique, such as the guarding of machinery, the treatment of injuries, etc., *through* the authority of the production executive, and should educate and train the employee by means of advice or counsel presented individually or collectively, but never to be interpreted in the light of an expression of authority. The exercise of all forms of control over the employee should rest completely in the hands of the production executives who also find in education and training, apart from their authority, a powerful agency.

In reviewing the trend of management, it appears that with the functionalization of labor maintenance, the production executives are at last completely freed of all the auxiliary activities necessary to operation. Prior to the coming of the employment manager, the manifold tasks pertaining to the maintenance of funds, of buildings and equipment, of machinery and tools, of materials and supplies, of standards, of records and statistics, and of product demand were given to trained experts for accomplishment. These duties deal with things. The function of labor maintenance deals with men and is therefore, the only activity which, when improperly conducted, weakens and endangers the control structure of the production executives who conduct the fundamental activity of the industry.

What, then, is the nature of this task of operation? All of the necessary aids have been provided. All of the activities of a technical nature have been withdrawn. Is the executive to have nothing to do? Is it reasonable to assume that in a completely functionalized industry in which there is perfect correlation, he has no legitimate place? Is he only of value when there are activities of maintenance which have not been transferred, or when there are difficulties of operation which require his remedial influence?

Referring to the fundamental activity for which the production executive is responsible, it is evident that the success of his task of converting raw material into finished product may be measured in terms of the quantity and quality of the work done. The use of building, machinery and equipment in operation is only possible under the direction of labor. In order, then, to perform his task, the production executive must arouse in the workmen the same spirit of accomplishment with regard to the work at hand as he himself feels. His major task lies in the organization of the will of the employees, which is defined by E. D. Jones as ". . . the means by which you provide in a group of men for harmony of mood, harmony of attitude, or the desire of all to accomplish the same thing. This is what we call co-operation, or the right mental attitude toward the project in hand."

Labor Efficiency Governed by Executives

With this statement the scope of effort which lies rightly within the province of the production executive becomes clearly defined. It is plain to see that these men are, in truth, the real managers of labor, that labor management is their great responsibility, and that their success or failure in accomplishing the work which they are to do will not be measured in terms of their technical knowledge, nor in terms of their technical skill but rather in terms of their proficiency in organizing the will of the employees—in handling men and women.

Turning from this study of the paths of past progress it seems inevitable that the art, the technique of administration in industry is the subject upon which future attention will be concentrated. The demand for enlightened and effective methods of man-management is already an insistent one. A call for real man-leaders men who will organize and motivate rather than repress or crush the wills of the employees is being heard on every hand and it is the production executives, the real labor managers, who must answer. The need of great advances in the technique of labor management and control will be more fully appreciated, the art of handling men, so long fostered in the realm of the intuitive, will be viewed objectively and its governing laws and principles made generally known.

The study of the art of man-management, the determination of the principles which underlie the technique of administration, the ascertaining of the bases of real leadership is the next step in industrial management.

Angles of Approach, Recess and Contact of Involute Gears

Elimination of Guesswork and Empirical Formulas From Gear Design—Derivation of a Formula for the Involute—Calculation of Angles of Approach, Recess and Contact

By A. B. COX

THE equations of the involute are so complex, $x = R(\cos\theta + \theta\sin\theta)$ and $y = R(\sin\theta - \theta\cos\theta)$, that before the angles of approach, recess and ontact of a pair of gears can be calculated, a new

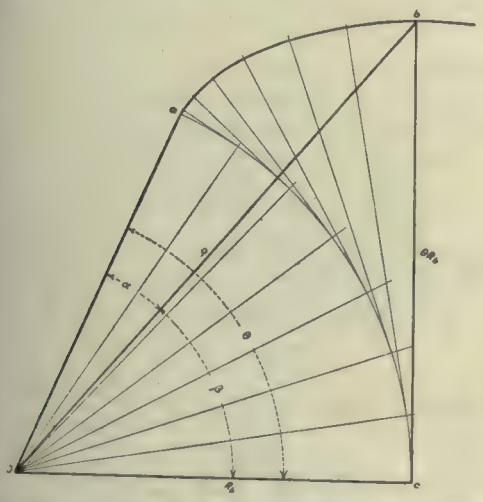


FIG. 1. DIAGRAM FOR DERIVATION OF A FORMULA FOR THE INVOLUTE

rmula for the involute must be derived. Referring to g. 1, this is done as follows:

The length of line bc = length of arc $ac = \theta R_b$. Then $\rho_b^2 = \rho^2 - R_b^2$, and

$$\theta = \sqrt{\frac{\rho^2 - R_b^2}{R_b^2}}. \qquad (1)$$

Now if the value of ρ can be found in terms of R_b, as usually can be, the value of θ can be determined for at value of ρ. Let ρ be expressed therefore as HR_b, here H is any whole or fractional number. H is then e ratio of the length of ρ to the length of R_b, or $= \rho \div R_b$, and $\rho = HR_b$. Substituting this value of in (1), we have

$$\theta = \sqrt{H^2 - 1}. \qquad (2)$$

dealing with gears, R_b is the radius of the base circle. $= R\cos\phi$. If ρ be expressed in terms of the pitch dius R, as is usually most convenient, (2) becomes

$$\theta = \sqrt{H^2\sec^2\theta - 1}. \qquad (3)$$

Also from Fig. 1 it is seen that $\tan\beta = \frac{\theta R}{R} = \theta$, $\beta = \tan^{-1}\theta$,

$$\text{and } \alpha = \theta - \beta = \theta - \tan^{-1}\theta. \qquad (4)$$

r the theoretical involute

$$\alpha = \sqrt{H^2 - 1} - \tan^{-1}\sqrt{H^2 - 1}. \qquad (5)$$

d for the practical gear

$$\alpha = \sqrt{H^2\sec^2\phi - 1} - \tan^{-1}\sqrt{H^2\sec^2\phi - 1}. \qquad (6)$$

Referring to Fig. 2, angles A_V and R_V have been cled the "apparent" or "virtual" angles of approach and recess. It is easily seen that the actual angle of approach

$$A_A = A_V - \alpha_A + \alpha_O, \qquad (7)$$

and the actual angle of recess

$$R_A = R_V + \alpha_R - \alpha_O. \qquad (8)$$

The actual angle of contact, C_A, is, of course, the sum of the angles of approach and recess.

$$C_A = A_A + R_A. \qquad (9)$$

By means of the ordinary trigonometric formulas for the solution of triangles and the formulas derived here, all of the above angles can be calculated for various gear ratios and numbers of teeth and curves drawn as in Figs. 3, 4 and 5.

Referring to Fig. 2, the angles of recess, R_V and R_A are calculated as follows:

$$\rho = r + \frac{1}{P} = r + \frac{2r}{n} = \frac{r(n+2)}{n}.$$

$$\sin B = \frac{r\sin(90+\phi)}{\rho} = \frac{n\cos\phi}{n+2}.$$

$$B = \sin^{-1}\frac{n\cos\phi}{n+2},$$

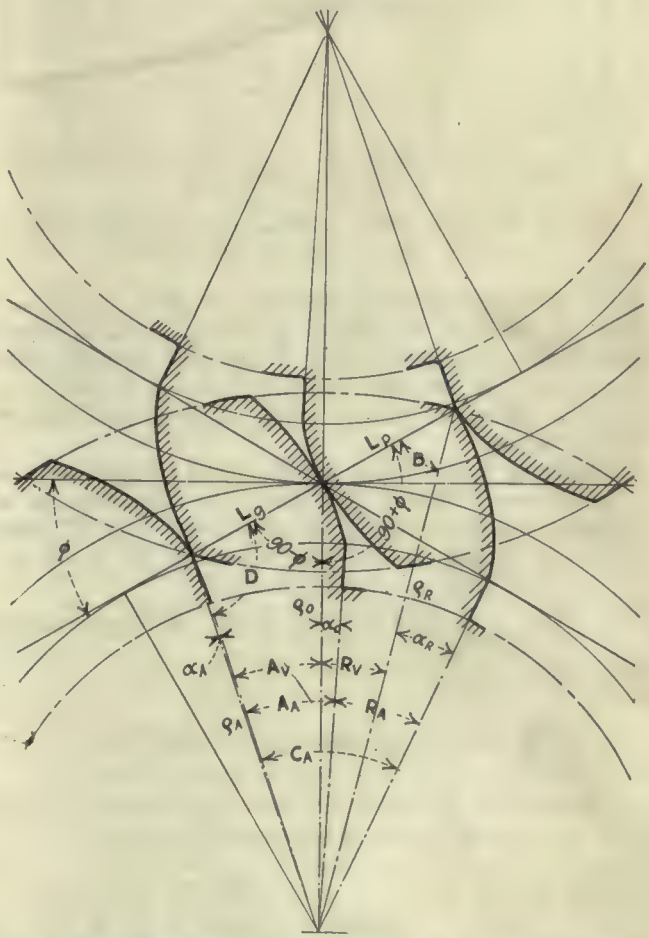


FIG. 2. DIAGRAM FOR CALCULATION OF FORMULAS FOR ANGLES OF APPROACH AND RECESS

and

$$R_V = 180 - (90+\phi) - B = 90 - \phi - \sin^{-1}\frac{n\cos\phi}{n+2}. \quad (10)$$

$$H_r = \rho_r \div r = \frac{r\,(n+2)}{n} \div r = \frac{n+2}{n}.$$

Substituting in (6), we have

$$\alpha_R = \left[\sqrt{\left(\frac{n+2}{n}\right)^2 \sec^2\phi - 1} - \tan^{-1}\sqrt{\left(\frac{n+2}{n}\right)^2 \sec^2\phi - 1}\right]. \quad (11)$$

$$\rho_O = r. \quad H_O = \frac{\rho_O}{r} = \frac{r}{r} = 1.$$

$$\alpha_O = \sqrt{\sec^2\phi - 1} - \tan^{-1}\sqrt{\sec^2\phi - 1}.$$

$$\alpha_O = \tan\phi - \phi. \quad (12)$$

The apparent angle of recess, R_V, is found by formula (10). The actual angle of recess, R_A, can now be calculated from (8) by using the results of (10), (11)

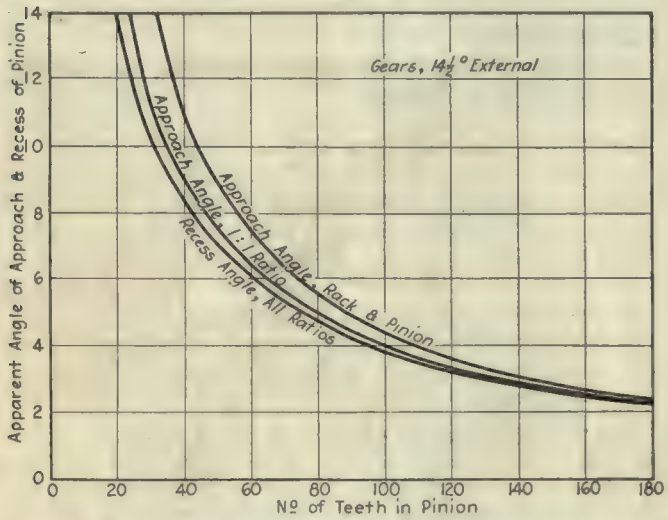


FIG. 3. GRAPHIC REPRESENTATION OF APPARENT ANGLES OF APPROACH AND RECESS

and (12). It will be noted from these formulas and from Fig. 2 that the angles of recess—both apparent and actual—are independent of the gear meshing with the pinion. It will also be noted from (12) that α_O is constant for gears of any given angle of obliquity of line of action.

Referring again to Fig. 2, the angles of approach, A_V and A_A, are calculated as follows: In "Interference of Involute Gears"—(*American Machinist*, Vol. 53, page 707) the length of L_g was found to be equal to: $R\left[-\sin\phi + \sqrt{\sin^2\phi + \frac{4}{N^2}(N+1)}\right]$. Solving triangle, therefore

$$\cot A_V = \frac{r}{L_g \sin(90-\phi)} - \cot(90-\phi).$$

$$\cot A_V = \frac{r}{R\cos\phi\left[-\sin\phi + \sqrt{\sin^2\phi + \frac{4}{N^2}(N+1)}\right]} - \tan\phi.$$

$$A_V = \cot^{-1}\frac{n}{N} \times \frac{\sec\phi}{-\sin\phi + \sqrt{\sin^2\phi + \frac{4}{N^2}(N+1)}} - \tan\phi \quad (13)$$

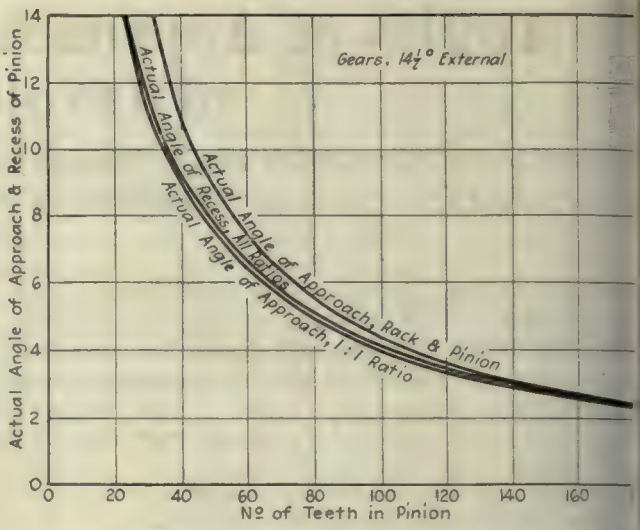


FIG. 4. GRAPHIC REPRESENTATION OF ACTUAL ANGLES OF APPROACH AND RECESS

$$D = 180 - (90-\phi) - A_V = 90 + \phi - A_V. \quad (14)$$

$$\rho_A = \frac{r\sin A_V}{\sin D} = \frac{r\sin A_V}{\sin[90+(\phi-A_V)]} = \frac{r\sin A_V}{\cos(\phi-A_V)} \quad (15)$$

$$H_A = \frac{\rho_A}{r} = \frac{r\sin A_V}{r\cos(\phi-A_V)} = \frac{\sin A_V}{\cos(\phi-A_V)} \quad (16)$$

From (6) and (16), $\alpha_A = \sqrt{\frac{\sin^2 A_V \sec^2\phi}{\cos^2(\phi-A_V)}} - 1 - \tan^{-1}\sqrt{\frac{\sin^2 A_V \sec^2\phi - 1}{\cos^2(\phi-A_V)}}$ (17)

The apparent angle of approach is found by formu (13). The actual angle of approach can now be ca culated by formula (7), using the results of (12), (13 and (17). Both the apparent and actual angles approach are thus seen to vary with the gear ratio well as with the number of teeth of the pinion.

Formula (13) becomes indeterminate for the case rack and pinion, and therefore it becomes necessary derive a new formula for this case. Referring to Fi 6, the procedure is as follows: With the center of t pinion as origin, the equation of the line of action ab $y = x\tan\phi + r$, and that of the rack addendum line is $y = r - \frac{1}{P} = \frac{r}{n}(n-2)$. Equating values of y,

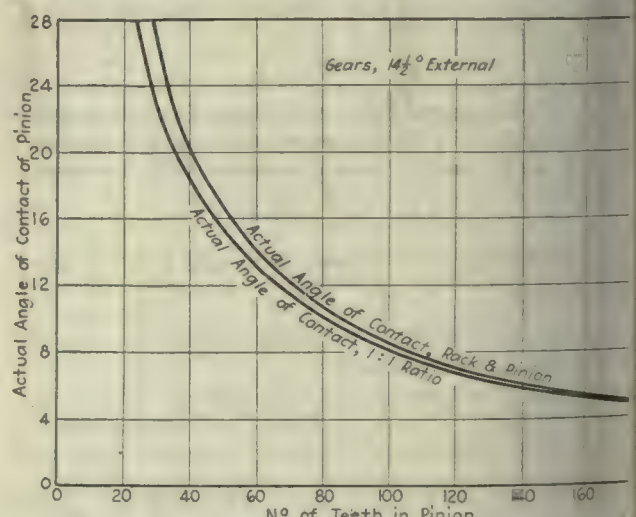


FIG. 5. GRAPHIC REPRESENTATION OF ANGLES OF CO TACT, PLOTTED FROM FIGS 3 AND 4

have, $\frac{r}{n}(n-2) = x\tan\phi + r$. Reducing and solving for x, $x = -\frac{2r}{n\tan\phi}$.

Length of line $Lg = \frac{x}{\cos\phi} = \frac{2r}{n\tan\phi\cos\phi} = \frac{2r}{n\sin\phi}$.

$$\cot A_V = \frac{r}{L_g \sin(90-\phi)} - \cot(90-\phi)$$

$$= \frac{r}{\frac{2r}{n\sin\phi}\cos\phi} - \tan\phi = \frac{n\sin\phi}{2\cos\phi} - \tan\phi$$

$$= \tan\phi\left(\frac{n}{2} - 1\right).$$

$$A_V = \cot^{-1}\left[\frac{n-2}{2}\tan\phi\right]. \qquad (18)$$

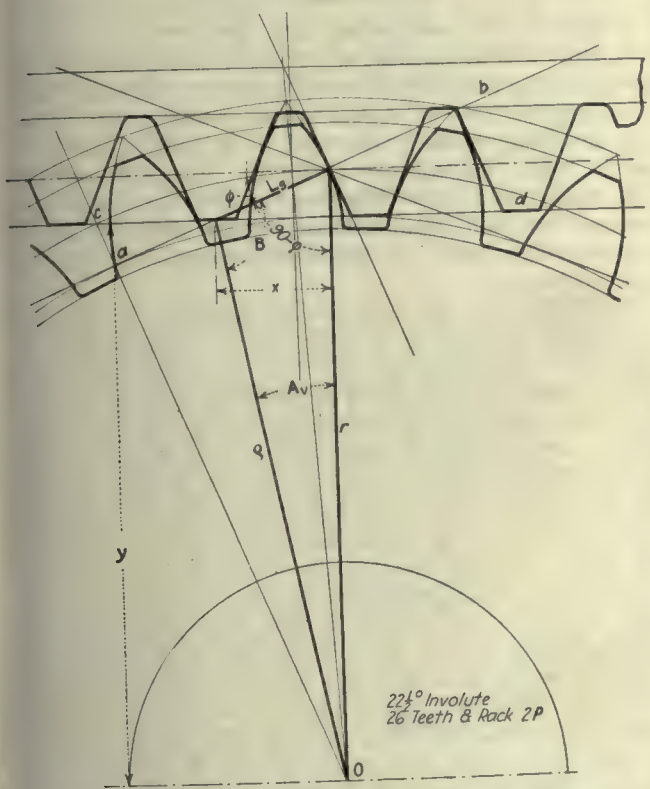


FIG. 6. DIAGRAM FOR DERIVATION OF A_V FOR RACK AND PINION

Both the virtual and the actual angles of approach have been plotted in Figs. 3 and 4 for the conditions of 1 to 1 ratio of gears and for rack and pinion. Fig. 5, showing angle of contact, was plotted from Figs. 3 and 4.

All of the above, as will be noted from the curve sheets, has been calculated only for the 14½ deg. standard tooth. The idea, is, of course, applicable to involute gear teeth of any obliquity and length of addendum. For teeth with an addendum different from the standard $\frac{1}{P}$ it is only necessary to substitute for $\frac{1}{P}$ in the formulas, $\frac{2\pi qr}{n}$, which is the expression of the addendum in terms of the circular pitch which is in turn expressed in terms of pitch radius and number of teeth.

The angle of approach, either apparent or actual, cannot be greater than the angle ϕ of the line of action without causing interference.

Distribution of Overhead Expense

"How to Distribute Overhead Expense in Good and Bad Times" is the subject of a bulletin recently issued by the Fabricated Production Department of the Chamber of Commerce of the United States.

"Our cost systems are too inflexible," the bulletin says. "Under ordinary cost methods, still largely in use, overhead expenses are spread too thin in times of forced production and massed too heavily in periods of slight demand and output, giving in the latter case costs that are artifically high and unfair to the public and moreover costs which the market will not generally sustain.

"Cost systems should provide that these expenses usually designated as overhead expenses should be prorated on the basis of a normal year—the 100 per cent mark on the business thermometer. Thus in time of unusual production, production exceeding normal, the overhead should be more than used up in costs, and a surplus out of overhead cost created to take care of those times when the output is below normal, and the overhead charges not fully cared for in the costs of that year.

"To take a very simple illustration: Let us assume the normal output of a department is 100 pieces and the overhead $100, or an overhead charge of $1 per item. If the department produces 150 pieces at a normal overhead charge of $1 per item not only will the $100 overhead be used up, but there will be an additional $50 as a reserve. When the output of the department drops to 50 pieces only $50 overhead will be applied to this reduced production, and the difference made up from the reserve established during unusual production.

"The determining of a normal year is not an easy matter. It requires a long look behind, not forgetting also to look ahead. It is by no means sufficient to accept the operations of the preceding year as the sole standard. The normal year is different for a new organization or industry from what it is for one long established.

"The setting up of estimated overhead charges based on a normal year does not mean the abandonment or compromising of actual overhead costs.

"It is not the intention to forego or wipe out a single dollar of overhead expense that can be legitimately and fairly charged to operation, sales or administration."

In conclusion the bulletin says that "the treatment of overhead in the way indicated is not a panacea for all our industrial ills. The control of overhead in a manner fair to the business men as well as the consumer is one step and only one step toward realizing more stable prices and eliminating those wild fluctuations that culminate in industrial depressions. Such a consideration also points out the moral that the hope of permanent reduction of costs rests in the greater, more continuous and more regular use of our industrial facilities.

"Thousands of firms went through the recent years of full blast operation upon a basis of overhead distribution essentially unfair to them. A start in the right direction must be made, and upon such firms is urged a consideration of adjusting overhead charges on the basis of a normal year, and it is so advised both as an advance in sound cost accounting and as a measure to facilitate that business revival we all desire, need and anticipate."

Washington vs. Business, H. C. L. et al.

By Entropy

If there is a subject on which all parties associations and individuals agree, it is that there is something the matter with Washington. The only exceptions are those who think that everything is the matter.

Leaving out all matters political there is no doubt but that it costs this great and free country many more dollars to conduct its business affairs than it would any corporation. Moreover it will undoubtedly continue to be that way until certain precedents are smashed to smithereens. Washington is just one vast bundle of precedents. Everything that is done has been done before and in precisely that same way. During the excitement of the war a great many men, inexperienced in methods of government, but fully experienced in getting things done outside, butted their heads against a stone wall. Some of them found the system to their liking and stayed through. Some found that they were accomplishing more than the regular members of the government and stayed because they thought it was right to do so. Some had enlisted and had to stay.

The troubles can mostly be classified under two heads, one that it is impossible to get subordinates to do any work, the second that it seemed to be futile to try to do anything themselves. A story is told which seems to sum up the situation in a few words, as follows:

A newly appointed Captain issued an order to his Adjutant. It was something regarding methods of keeping camp clean, and he regarded it as important. Three days passed and he saw no improvement, so he asked his Adjutant what seemed to be the matter, to which the latter replied that he had not yet issued the order. The Captain became quite angry, as befitted a man only recently a superintendent in a large shop. He expostulated and demanded to know by what right his orders were held up. "Well, Captain," was the reply, "In the regular army we always held up an order five days. If it is not rescinded or changed in that time it is pretty safe to let it go through."

That seems to be a part of the spirit of Washington. Hold everything up in hopes that it will be rescinded or modified before any work is done on it. Clerks do not do the work assigned to them because they are quite certain that if they do it at once it will be work thrown away only to be done over again.

Red Tape on the Purse Strings

The root of all this trouble is in sight of everyone, though no one seems to hit on it when writing about Washington. Almost everything sensible can be done and done promptly up to the point where it becomes necessary to get it paid for. Then there is an absolute dead wall. No money can be paid out from the United States Treasury except under regulations which have been accumulating moss ever since Alexander Hamilton was Secretary of the Treasury and probably before that. In order to get money from the Treasury it is necessary to prove beyond peradventure of a doubt that it is absolutely necessary to the public welfare to spend the money, that the work done, or the goods bought have been delivered and that all inspections have been performed. There appears to be no provision for honesty on the part of the one to whom money is paid. He is not presumed to be wise enough to make a refund of any overpayment, there is no chance to advance money to enable a contractor to take advantage of the market and the red tape in which the proof of delivery of goods is wrapped takes a long time to unwrap. The mere fact that Congress has passed a law plainly intended to order the doing of some thing does not for a moment interest the Treasury if it is not so worded as to allow them to do their part of it in their own way.

More than that, it is absolutely impossible for a government official to make good any promise that a thing will be paid for at any given time. The money will come after all formalities have been complied with, but *when* it will come is entirely unascertainable. Many men during the war lost valuable connections because as officers of the government they were unable to get bills paid within a reasonable time to men whom they had beseeched to come to the rescue of the government.

The Endless Payroll

There is just one thing that the treasury will do and do promptly and that is pay small salaries to government employees. This probably comes about through the large number of small salaried people in the Treasury department itself, who wish to be able to pay themselves their own salaries promptly. The net result of this condition is that Washington and the rest of the country are full of underpaid officials who are not in a position to really do anything because they have no real authority.

Just why are all these clerks kept on the pay roll long after the war is in effect over? Simply because there is a great deal of work yet to be done and will be for many years to come as an aftermath of the war. The government has promised its soldiers certain things which will require a great amount of work. It has promised compensation for injuries and ill health caused by the war, it has promised medical treatment and education and training to all who are unable to do their old work. At the time of the armistice we were told fairy tales of the small number of men injured. At that time the total wounded, ever so slightly, was only about 200,000 and of those it was said that 80 per cent were returned to duty in the service. Now it develops that there are many more cases of men suffering from diseases contracted in the service than were estimated at that time. We have many thousands of tubercular cases. Men who were slightly gassed returned to duty, because it was a duty, or were sent back because their officers thought that a little gas would do no harm. Many of these men did not have proper care in the service and took no care of themselves after discharge and in this way the ranks of men who will have the paternal care of the government for years to come is greatly enhanced and the departments at Washington that are charged with this work cannot relax their efforts. Since they are limited by the customs of the Treasury they have to employ large numbers of low-priced men where the work should be much more efficiently done by a few high-grade men authorized to make final and permanent decisions. As it is the majority of the men in government employ simply write memorandums and pass things along interminably until they reach an official who finally determines what should be done, far from the human being whose case he is deciding, making it purely a "paper case."

If this country really wants to get down to a business basis it is only necessary to conform to business practice, but that can never be done without some means of modernizing the hands that hold the purse strings.

Peculiar Lathe Jobs

Ingenious Operations in Sawing and Grinding—Cutting Odd-Shaped Pieces—Graduating Round Rods—Lathe Used as Screw Machine

BY JOHN T. SLOCOMB

IN SOME small shops there is often a great deal of ingenuity displayed in devising ways of doing work with the limited equipment at hand. Some years ago I had to make one thousand pieces as shown at *A*

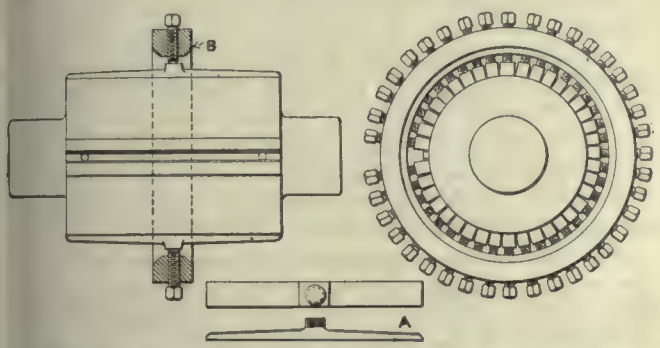


FIG. 1. QUANTITY PRODUCTION OF A PECULIARLY SHAPED PIECE

in Fig. 1. These pieces were made of machinery steel and finished all over. I used ⅜-in. square black stock and cut the pieces to length on a hack-sawing machine, holding about eight bars together with a wood clamp close to the vise and cutting off eight pieces at a time.

The pieces were straightened and ground on three sides, using an inexpensive home-made surface grinder, and then clamped to the turning arbor with the black side up. This arbor was about 3½ in. in diameter with milled flats on its surface. The pieces were held in place by setscrews in the ring *B*, one setscrew to each piece. The flats were not milled to space exactly around the arbor, but left an odd space in which two pins were inserted to serve as drivers and also to align the pieces on the arbor. The arbor was made of such a size that the pieces would bear against each other and the driving would be done by the pins.

It will be noted that the work is tapered each way to the center. The tops of the pieces are finished to a circle, leaving a square hub in the center. The tailstock of the lathe was set over (a taper attachment might be used) to turn this taper on each end of all the pieces at once; turning off the stock, finishing the ends, and filing and polishing the tops of the pieces at one setting. Afterwards, they are held in a special chuck in a turret lathe and the hubs turned, threaded and drilled through the center.

It will be noted that by this method a great variety of work can be done. I understand that in making toys it is customary to clamp a wooden blank to the face-plate of a lathe and bore and turn the profile. For horses' heads, etc., perhaps a 10 or 12-in. circle is turned in the wood, then it is cut up into narrow pieces, making a great many heads from one circle. Afterward, these pieces are shaped as required.

Another peculiar thing I remember doing was graduating steel rods in ¼-in. divisions as shown (enlarged) at *A*, Fig. 2. The work had to be done very accurately, and was accomplished by using an arbor about 2¼ in. in diameter. These pieces were made of ⅝-in. drill rods in lengths from 6 to 12 in. The rods were clamped about the arbor with the ring clamps as shown. For the 12-in. rods I used three rings. When the rods were firmly clamped to the arbor three or more rows of solder were carried clear around, soldering the rods together and to the arbor, which was provided with pins to line the rods and drive them. After the soldering was done the ring clamps were removed.

A light cut was taken over the rods in exactly the same way as over a solid piece, flatting all of them slightly. The lines were cut by using a very keen V-tool similar to a threading tool, but ground to about a 50-deg. angle.

The spacing was done by using the lathe lead screw, which in this case was 8 pitch. A tooth was marked on the large gear on the lead screw and used for an index by making two turns of the screw for each space on the work. To check the lead screw the bar of a vernier caliper was clamped to the lathe bed and a plate, with line to match the vernier, attached to the carriage. At each setting of the lead screw a magnifying glass was used on the vernier bar to verify the adjustment. While these adjustments were made rather slowly the work was carrried on quite expeditiously, for the reason that a great number of pieces were graduated at the same time.

After the lathe work was finished the solder was melted off and each rod wiped, while hot, with a piece of waste to remove the solder. For the purpose these rods were used, this manner of graduating was very satisfactory. The ends of the lines where they extend over the round of the rod show a sharp point, as illustrated in the enlarged view, making it very easy to match lines because the center of each line is very clearly defined at its ends. The rods were also numbered on the flats.

A small lathe was converted into a very efficient screw machine with the device illustrated in Fig. 3, which consisted of a knee that clamped to the cross-slide of the carriage and carried a bushing to guide the work and also a lever in which was mounted the cutting tools.

One job we did with this device was to make a large number of steel balls, the outside diameter of which was ⅞ in., from ⅞-in. round cold drawn steel.

A bar of the stock was passed through the hollow spindle of the lathe and held by the chuck, with perhaps 3 in. extending through; the outer end running in the bushing in the knee. A forming tool, shown at *A*, is used to form the balls by simply pressing down on

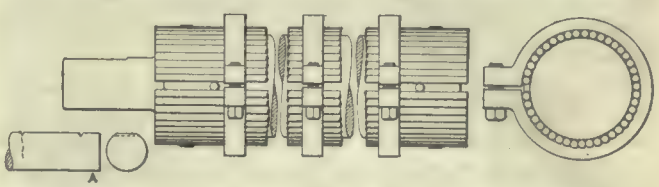


FIG. 2. GRADUATING ROUND RODS IN A LATHE

the lever, and a cut-off tool *B* cuts the pieces off by lifting up the lever. A power pump conveyed oil into a small reservoir at *C*, from which it flowed through the aperture *D* to the forming tool. Two stop screws shown at

E and *F* limited the movement of the tools and served to make adjustments for size.

We made a turret head for the tailstock to carry five tools. A flat bar of machinery steel ¼ by 1 in. was drilled with spacing holes along its center, the holes for making the steel balls being a distance apart equal to the length of the ball plus the thickness of the cutting-off tool. The bar was used as a link to connect

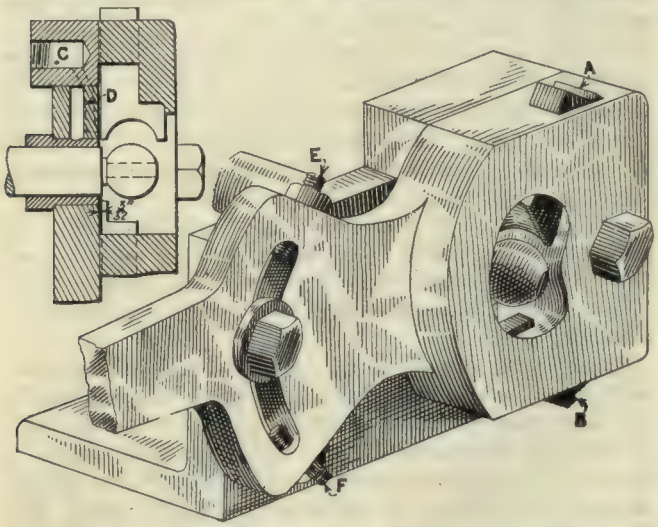


FIG. 3. DEVICE APPLIED TO LATHE CARRIAGE

the operating lever with a pin attached to the lathe bed back of the tailstock. After each piece was cut off the bar was set ahead one hole, thus setting the turret ahead that much. A stop applied between the lever and the tailstock limited its forward motion, and, as I remember, we used a toggle, attached to the tailstock to adjust the carriage at every set. By this method, we set the stock out of the chuck 36 in. at the beginning, and, with a spacing bar 36 in. long, we could work it up to the chuck without resetting. The changes were made very quickly and without stopping the lathe.

We made a great variety of screw machine work with this device. The work was held very rigidly so that heavy cuts could be taken, and the cutting was done very smoothly and accurately. In making various kinds of screws, different shaped forming tools were used. Sometimes we cut the body size, head size and thread size at once, using a die in the turret for threading.

This device was also used in turning long taper rods. In one case a lot was made ¼ in. in diameter at the large end and tapered down nearly to a point, the taper being over 16 in. long. In this case the stock had to be removed at one cut, but as it was supported in the bushing just back of the cutter, this could easily be done. To turn the taper a guide bar was placed for the lever to bear against and a weight attached to the lever to hold it down on the bar. The regular turning feed of the lathe was used and with a stream of oil on the cutter the work was done very nicely and quite rapidly.

We also knurled rods as small as $\frac{1}{16}$ in. in diameter for a distance of 3 ft. continuously by using a double knurl in the lever instead of a cutting tool and applying a weight to the outer end of the lever to hold the knurls in contact with the work. Using a coarse carriage feed we could run the whole length of the rod. Care must be exercised to see that the knurling is good as it goes along, as it cannot be gone over again because knurling swells the stock so much that it will not run through the bushing.

What Shall the School Shop Produce?

By Maximillian Komow
Bureau of Vocational Activities

A perusal of W. D. Forbes' article, "What Shall the School Shop Produce?" on page 486, Vol. 53, of the *American Machinist*, gives rise to reflections on the indifference of the technical world toward machine-shop instruction. An examination of the machinery periodicals will bear out this statement. Take as an example the issue in question of the *American Machinist*, which carries fifty-four pages of reading matter of which only a little more than one page is devoted to educational matters.

Machine-shop practice is one of the first subjects introduced in vocational and trade schools. Reams upon reams of paper have been covered with the subject. Yet the courses of study, subject matter and methods of teaching are as varied as the number of teachers of the subject. This condition is largely due to the indifference of the technical world.

Why should not a periodical with the sterling qualities of the *American Machinist* regularly devote a section of each issue to machine shop education. Discussions should be encouraged on courses of study, types of projects, and kindred topics. This could be made a meeting place for the ideas of the practical man and the pedagogue and would tend to lessen the contempt with which these two classes now regard each other.

Three Ideas on Instruction

The writer has a few ideas which may be of interest to those engaged in the many departments of machine-shop practice.

The pedagogues of the machine-shop world are divided into two camps. In the one camp are the graybearded conservatives who assert that a trade subject can be taught only by means of a series of graded exercises which need have no practical value except to instill in the student a knowledge of the fundamental operations of the trade. I received my training at the feet of one of these graybeards and I still have bitter memories of the cast-iron block upon which I wasted three months of my life in chipping and filing. In the other camp are the wild-eyed radicals who insist that the graded series of exercises should be buried in the sands of the sea and that they should be replaced by such intensely practical and simple jobs as the construction of milling machines, universal grinders and precision lathes.

And, steering a course between the two camps will be found a few real teachers who agree with the conservatives that a trade subject should be taught by means of a series of graded exercises but insist that these exercises can be made practical. They do not attempt the construction of milling machines but they agree that some of the simpler machines are within the limitations of the schoolboy's ability. These men are doing real educational, and at the same time, practical work and the results they have attained substantiate their theories.

Work For Advanced Pupils

There is no such thing as a dearth of work for the school shop. There is an abundance of valuable education for the elementary class pupils in making hand tools for themselves—such things as calipers, center punches, hammers, surface gages, universal dividers, chisels, etc. The more advanced pupils may be em-

ployed in repairing shop equipment and building machine tools for use in the shop.

The last mentioned work presents a problem which has had little or no attention from the machine-tool manufacturers. The problem of constructing machine tools in the school shop is one that not many teachers have succeeded in solving. Few machine shop instructors are qualified to design machine tools and furthermore few schools are equipped to make large patterns and castings. The machine-tool manufacturers can render a great service here by presenting or selling to the schools at a nominal cost, blueprints and sets of castings of their simpler machines. The field here is almost unlimited. Such projects as bench vises, machine vises, sensitive drilling machines, speed lathes, small engine lathes, arbor presses, tapping machines, small shapers, grinders, bench filing machines and a wealth of similar material can be constructed. The machine-tool manufacturers will profit from this service by the invaluable advertising their products will receive with the future generation of machine builders and designers.

Selling the School Product

No school should attempt to place the products of its shops in the open market for sale. Such competition with the industry tends to antagonize the manufacturers and trade unions. It is not the purpose of a vocational school to turn out finished mechanics. Any attempt to sell the products of the school shops will give the technical world the mistaken impression that the school does profess to turn out finished mechanics. Those who are acquainted with the limitations of school training know that this is beyond the scope of the vocational school.

Repetition work is very valuable for imparting skill but if one harks back to his school days he will realize how irksome this work can become. The fact that some teachers use repetition work as a form of punishment is an indication of the aversion of school children towards this method of instruction. Repetition work should be given in sugar-coated doses if the interest of the pupil is to be maintained. Let us take as an example the requirement of skill in taper turning. The first exercise may be a center punch. Then instead of repeating the operation of making a center punch the student might be required to make a taper reamer or any other similar object, and so on. In this way the student gets all the advantages of repetition work without any of its disadvantages.

Building Complete Machines

The building of a complete machine is a valuable exercise, but such work must be assigned as a community problem. Otherwise the time required to complete the machine will be so great that the student will lose interest in the work. The problem selected must be within the limitations of the shop equipment to avoid the necessity of having some of the work done outside. The students should be permitted the feeling of pride that the machine was made entirely by themselves.

It is to be hoped that discussion on this subject will be continued by others. The shop man's ideas are sometimes more valuable than the school man's, as the former's nose is not so close to the grindstone as the latter's and he may therefore have a better perspective of the subject. Shop teachers very often lose contact with the industry and fail to keep in touch with progress. The shop man can help by supplying this deficiency. In any event both should benefit by further discussion.

Know Why You Do Things

By John Brent

Under the above title on page 72 of the *American Machinist* A. W. Forbes starts in to tell why he sets his lathe tool below the center, and I think he explains it absolutely when he says he is not a machinist. If Mr. Forbes sets a tool below the center and it cuts well, he will find if he looks at the cutting edge, that he has so ground his tool that the edge points right to, or a little above the center of the work. In other words the tool, while below the center, is acting just as if it was set on the center, only instead of being set in a horizontal plane it is pointing toward the center in a plane set at an angle. If the tool digs in Mr. Forbes will find that either the cut is too heavy for the tool or the lathe is too light to do the work, or the man who set the tool was careless.

The placing of a tool is an art which is learned by long experience and a true machinist does not have to think it out but knows what the piece of work he is working on requires. The tool should never be set below the center; it can be and should be above the center. A spring tool which Mr. Forbes writes about is not a tool at all in my mind; it is just a scraper having its place, of course, among tools but it is not a tool for removing stock like a diamond point. I am a machinist and I don't want anybody to grind my tools. Knowing how to do this is a part of the machinist's trade, as well as to know how to set them. I would not work in a shop where the lathe and planer tools are ground for me. The machine for grinding tools is of no use to a real machinist. It is all right for a crowd of machine tenders who do the same job every day and are simply manufacturing, but not for a man who is able to take his job and carry it through in good time and right up to size all through.

Speaking of machinists, Mr. Raught, on page 42, gives his idea of what one should be, but I think he is wrong. No machinist, save in small country shops, is ever asked to figure line-shaft pulleys or gear diameters. Setting up machine tools and figuring pulleys is the job of a millwright, not a machinist, and gear diameters or the pitch lines are always given to the machinist by the draftsman. To work the simple problems of gears needs about the ability necessary to feed corn to chickens. The idea that the form of a tool to make a gear tooth can be properly produced by a machinist is all bosh. If he could lay out the form he could not file up a template and a tool from it and get a result that would be worth a whoop. A gear that turns around once a day in a shop where all the men are deaf might answer if made in a shaper with tools filed up by hand, but nowhere else. All the drawing a machinist wants to know is to be able to make a sketch on which he can put figures to work to and get the over-all length of the piece and its greatest diameter. Making drawings is a draftsman's job while a machinist's job is to be able to read them and make chips.

Now, Mr. Editor, your 35 years' experience has taught you aright and the real machinist will not set his tool below the center.

When all is said and done no one now knows how we remove metal; whether we wedge it, push it, or tear it off, or what, and all we can do is to let the experienced machinist get it off and it is safe to say he is doing it well today, with his tool set on the center, or perhaps a little above it.



Special Nut Ratchet Wrench

By Charles H. Willey

In my spare time I have made a set of tool steel wrenches of the design shown in Fig. 1. I call them star-tooth or ratchet wrenches. I worked on the assembly floor of a machine shop and very often had to resort to this type of wrench to tighten nuts in difficult places with a hammer and drift, as shown in Fig. 2. These wrenches should prove very handy to a repair mechanic, for they save abuse of the nut.

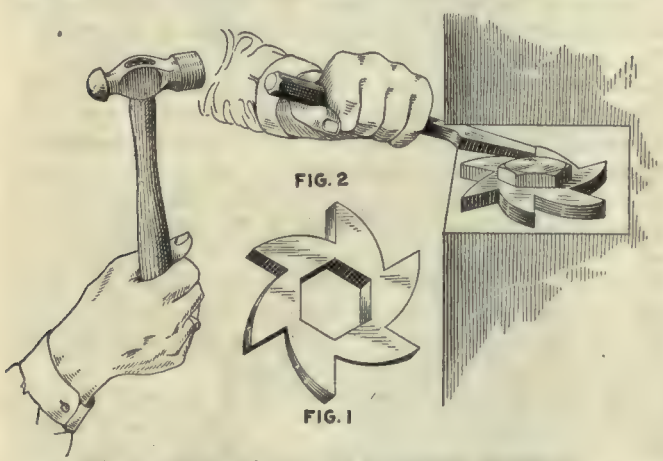


FIG. 1. STAR TOOTH OR RATCHET WRENCH
FIG. 2. METHOD OF USING WRENCH ON NUTS IN AWKWARD PLACES

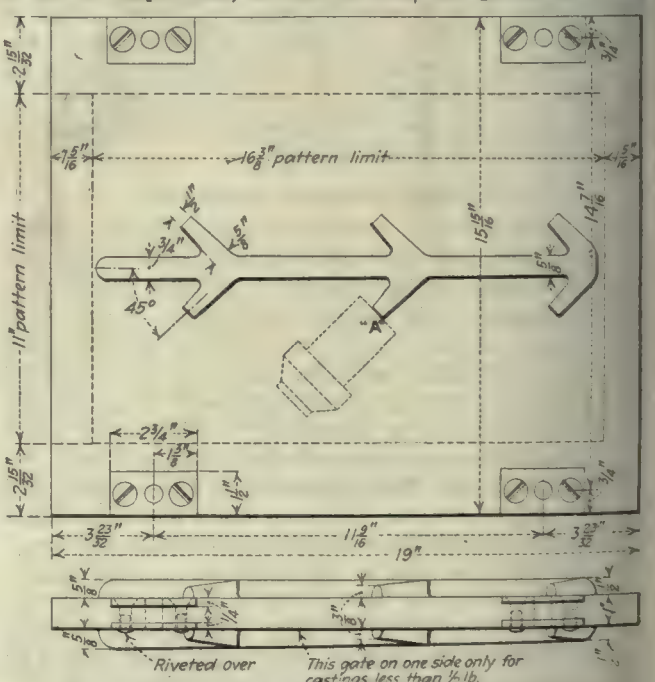
Matchboard Pattern Work

By R. Kraus

Many machine shops have their patterns and castings made in job shops and thereby lose the advantage which is derived by the co-operation of a closely associated machine shop, pattern shop, and foundry. These circumstances lead to patterns, which are unsatisfactory and sometimes even unprofitable for a foundry to handle. One of the common errors in the making of patterns is the unsuitable way a "matchboard" is made, which is frequently done without knowledge of the size of the flask or any consideration of a suitable thickness. For smaller work most foundries use iron flasks which are standardized with steel pins of suitable length in the drag that match with the holes in the lugs of the cope. The matchboard can be only of a limited thickness or the lugs of the cope are either entirely disengaged or are loose on the tapered end of the pins. Then the relation of the cope and drag is no longer positive. This explains why sometimes the part of the casting made in the drag is shifted in relation to the part made in the cope. If a matchboard is used frequently it is worthwhile to eliminate the wear in the holes by reinforcing them with ¼-in. plates as shown in the drawing. If the over-all size of the flask is also considered, then a suitable number of patterns can be put on the board and thereby more castings can be had from one mold.

Another frequent source of trouble for the foundry is the too scant size of the gates and the leads which carry the metal to the mold. (See drawing at *A*.) This causes too rapid cooling of the metal, resulting in shrinking strains and spoiled castings. For castings weighing over one-half pound it is advisable to make the gate on each side of the matchboard ⅝ in. high and ⅝ to ¾ in. wide. The dimensions and the sections of the leads are shown in the drawing for convenience. The inside lines of the matchboard are shown by the dot and dash lines 11 x 16⅜ in.

There is some diversity of opinion about the way the leads should be joined to the gate. Some foundries favor the arrangement shown in the drawing but this is not so important, as the molder can place the riser



SHOWING GATING AND DETAILS OF A TYPICAL MATCHBOARD PATTERN

on either end of the gate, if he gets better results one way or the other.

Some pattern makers will consider the gates as shown on the drawing far too large; however it is well to keep in mind that the machine shop pays only for the castings delivered and if the foundry does not object to the use of larger gates the machine shop should be willing to assist in an effort to make good castings, as the labor is the main factor in determining the cost.

Finding Dimensions of Profile Gages

By W. G. Holmes

In the design of some types of profile gages the tool designer lays out, with the aid of geometrical construction, dimensions which must be exact. This is especially true in cases where the side of an angle joins a circular arc.

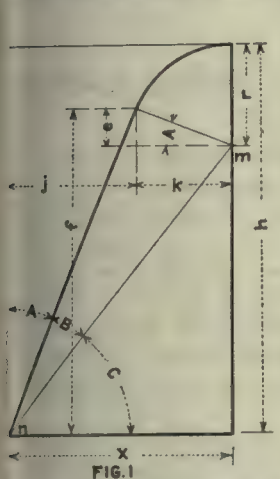


FIG. 1

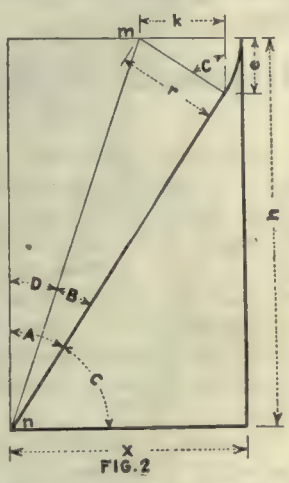


FIG. 2

FIG. 1. PROFILE GAGE WITH CONVEX ARC. FIG. 2. PROFILE GAGE WITH CONCAVE ARC

The formulas given in this article are for the purpose of finding any one dimension, the three other dimensions necessary being given. It is hoped that they will be of value to designers as well as to those who are mainly of mechanical skill.

Given a gage, Fig. 1, two sides of which are made up of an arc and a tangent to the arc, the arc convex in contour. When A, h and r are known, find x:

$$k = r \cos A$$
$$e = r \sin A$$
$$f = h - r + e$$
$$j = f \tan A$$
$$x = j + k$$
$$x = f \tan A + r \cos A$$
$$x = (h - r + e) \tan A + r \cos A$$
$$x = (h - r + r \sin A) \tan A + r \cos A \quad (1)$$

When A, h and x are known, find r:

From (1) $$r = \frac{x - h \tan A}{\sin A \tan A + \cos A - \tan A} \quad (2)$$

When A, r and x are known, find h:

From (1)

$$h = \frac{x + r \tan A - r \sin A \tan A - r \cos A}{\tan A} \quad (3)$$

When h, r and x are known, find A:

$$A = 90° - (B + C) \quad (4)$$

$$\frac{h - r}{x} = \tan C$$

$$\frac{x}{h - r} = \cot C$$

$$mn = \sqrt{x^2 + (h - r)^2}$$

$$\frac{mn}{r} = \operatorname{cosec} B$$

$$\frac{r}{mn} = \sin B$$

Formula (4) may be expressed:

$$A = 90° - \left(\sin^{-1}\frac{r}{mn} + \tan^{-1}\frac{h - r}{x}\right)$$

or $$A = 90° - \left(\operatorname{cosec}^{-1}\frac{mn}{r} + \tan^{-1}\frac{h - r}{x}\right).$$

Given a gage, Fig. 2, two sides of which are made up of an arc and a tangent to the arc, the arc concave in contour.

When A, h and r are known, find x:

$$C = 90° - A$$
$$k = r \sin C$$
$$e = r \cos C$$
$$x - (r - k) = (h - e) \cot C$$
$$x = (h - e) \cot C + (r - k)$$
$$x = (h - r \cos C) \cot C + r - r \sin C \quad (5)$$

When A, h and x are known, find r:

From (5) $$r = \frac{x - h \cot C}{1 - \cos C \cot C - \sin C} \quad (6)$$

When A, r and x are known, find h:

From (5) $$h = \frac{r - r \cos C \cot C - r \sin C - x}{\cot C} \quad (7)$$

When h, r and x are known, find A:

$$A = D + B \quad (8)$$

$$\frac{x - r}{h} = \tan D$$

$$\frac{h}{x - r} = \cot D$$

$$mn = \sqrt{h^2 - (x - r)^2}$$

$$\frac{r}{mn} = \sin B$$

$$\frac{mn}{r} = \operatorname{cosec} B$$

Formula (8) may be expressed

$$A = \tan^{-1}\frac{x - r}{h} + \sin^{-1}\frac{r}{mn}$$

or $$A = \tan^{-1}\frac{x - r}{h} + \operatorname{cosec}^{-1}\frac{mn}{r}.$$

Setting a Lathe Tool to Close Measurements

By C. Ray Haynes

In setting a lathe tool to very close measurements, it is a distinct advantage to turn the compound rest to an angle of 14½ deg. from the center line of the lathe before starting operations; in which position the tool may be adjusted to and from the center line by moving the compound, instead of the cross-slide. At the above angle, the proportion of the in and out movement to the total movement of the compound slide is, practically, as 1 to 4; therefore, to move the tool one thousandth of an inch with respect to the diameter of the work it is necessary to move the dial of the compound screw four one-thousandth graduations. This amplification enables the operator to make minute adjustments with less liability to error.

IN THIS ISSUE

METHODS used by automobile transmission specialists are explained by Editor Colvin in the leading article. He details the machining operations on the frame case and bell case types of transmissions and describes special tools, fixtures and methods for economical production. This article is the second of a small group on the general subject of transmissions and will be found to tie up with the article on the Franklin transmission case that was published in the issue of Nov. 11, 1920, and with the article "Gears for Motor Transmissions" that will appear at an early date.

The seventh of DeLeeuw's series on metal cutting tools begins the treatment of milling cutters, a subject with which Mr. DeLeeuw is thoroughly familiar. As is to be expected a portion of the article is given over to a general consideration of milling cutters. It is followed by a treatment of the subjects of feeds and revolutions of cutters and causes of chatter and remedies. Page 541.

We intended to run ere this the second of Sheldon's articles on the use of special fixtures in grinding, but could not find space. It is presented herewith, beginning on page 545. Finish grinding the bores of gears, the use of a gear to chuck a gear and the grinding of tapers without traverse are some of the subjects treated. Fixtures of course receive primary consideration.

We should naturally incline to the belief that there must be one design of trepanning tools that is the best. Either Western Editor Hunter is giving us some evidence to the contrary, or the facts he presents indicate that the work of standardizing trepanning tools remains to be done. He recently visited three railroad shops and discovered three dissimilar types of tools. He is passing along his information and illustrations of the three types, so that a chance for comparison is given, and a basis for work toward standardization is furnished. Page 549.

We told you last week that Colvin, in "The Foreman and His Job," would dwell upon the value of individuality and the importance of being able to think. We take the liberty to quote a paragraph, knowing that it is a good way to indicate the trend of the thought expressed: "The progressive foreman will want to know about time study, motion study, apprenticeship systems, shop committees and many other phases of modern manageme and production. He must not however get the id that any of these are panaceas for all the industrial il as such is not the case. They all play their part b their success depends upon the way in which they a applied." The article begins on page 551.

If we remember correctly we have commented at oth times on the interesting shop that Dixie must ha He continues his very good policy of not being niggar about letting *American Machinist* readers in on various jobs and clever methods. This week, page 5 he tells us how some accurate cams were produced his shop. He explains the making of the patterns, laying out of the mo cams and the cutting master and works cams.

The third and last Schell's industrial mana ment articles begins page 557. His statemei indicate some very care thought, for example: "I ferring to the fundamen activity for which the p duction executive is sponsible, it is evident th the success of his ta of converting raw mater into finished product m be measured in terms the quantity and quality the work done. The u of building, machinery, a equipment in operation possible only under the rection of labor. In ord then, to perform his ta the production executi must arouse in the wor man the same spirit of a complishment with rega to the work at hand th he himself feels. His maj task lies in the organiz tion of the will of the e ployees."

An interesting treatise indeed is that of A. B. Cox gear design, page 559. A formula for the involute derived and the angles of approach, recess and conta are calculated. It's no mean job to follow through this article.

Entropy has a few things to say concerning the effe of Washington on business. We shall not emphasize h article because all of us are looking for improvement the conditions which he decries. It serves to remind that improvements are needed. Page 562.

In an article on peculiar lathe jobs, page 563, John Slocomb tells of some ingenious operations in sawing a grinding, cutting odd-shaped pieces, graduating rou rods, and other special work.

Coming Features

The first April number will contain a three-part combination article on bearing practice as exemplified in the Chicago & Alton, Big Four and Wabash Railroad Shops. The article comprises a comparison of the practices of the three shops. It was written by Western Editor Hunter.

Basset will be with us next week, presenting an article on "How Do You Make Your Profits?" He compares small profit on large turnover to large profit on small turnover; tells what the average return to a well-managed company should be, and makes some very valuable general statements about manufacture.

"Gears for Motor Transmissions," by Colvin, the third of his transmission group, will be one of the general articles.

Sheldon's fifth magnetic chuck article, dealing with the Blanchard chuck, is scheduled for the next issue. It is well illustrated and contains a goodly amount of information.

"Press Tools for a Typewriter Part," by Stanley, is an article dealing with tool design, that will appear next week.

EDITORIALS

"Our Business Has Increased—"

HAVE we passed the bottom of the depression? This question is heard on all sides. Until the middle of arch there was considerable doubt as to whether the ttom had really been reached, but since that time gns of improvement are showing in widely separated ots.

We have mentioned several in recent issues to indicate e trend of affairs. Not that we expect a sudden sumption of activity that will carry business forward another boom, for we anticipate no such result. The esent awakening in certain lines will very likely be cceeded by slight set-backs before a continued rise in e curve of business sets in. This has always been e case in previous depressions and there seems to be reason why this one should act differently.

Not long ago we sent out a request for information several large automobile plants. In this morning's ail came a delayed answer from the master mechanic a factory in the East. He says, "I simply wish to ke this opportunity of apologizing for the delay, and rther state that *our business has increased to such extent* that it will be impossible to find any time to mply with your kind request." It may not be out the way to say that his product has been cleverly d widely advertised.

This is only one instance of returning business and ay be an exception, but if we have a few more such ceptions their combined effect upon the general situaon will be appreciable.

Hand Versus Machine Finished Bearings

T WAS not so many years ago when all good mechanics believed that the only way to secure a good running aft bearing was to scrape it. The advance in automobile building, the demand for large production and e shortage of men who knew how to scrape properly, rced us to better machining methods. The result is at not a single maker of the highest grade cars uches a scraper to its motor bearings today. As the actory manager of one of the best-known and highestrade cars says, "We don't want anyone digging holes a perfectly good bearing surface."

We have not made the same advance in machining at surfaces and the scraper is still too much in evience in most shops. Many attempts have been made finish lathe, planer and other beds without the use f the scraper. Some of the best-known machine builders have succeeded admirably and the scraper is never sed except to take the "fuzz" off the surface of the on. But for the most part we are still scraping flat rfaces, and we can hardly help but consider it a eflection on our advancement in machining methods.

Advances are being made in a number of shops where liding surfaces are now being finished by grinding in arious ways. This is a field for the careful study of rinding machine builders and designers. Co-operation ith makers of machines having flat sliding surfaces will go a long way toward securing the desired results. Scraping on large machines is a hard job at best. And while it requires skill, it also takes a lot of muscle and is very tiresome. Scraping machines, designed to relieve the man of the laborious part of the work, have not been successful in most cases. The elimination of scraping will leave the good mechanics it releases free for some other and less laborious work.

Getting Ready for Business

IT IS gratifying to find that a number of shop managers are taking advantage of the lessened demand for product to improve their shops and shop methods. Among the lines of activity we find:

Rearrangement of machines for more economical production.

Improved tool storage facilities and systems.

Overhauling machines to put them in first-class condition.

Rearrangement of casting storage, stockrooms, etc.

Cleaning up the shop, painting side walls and ceilings white. Painting machinery, lining up line shafting, etc.

So far as possible the regular men are being employed, which not only helps to maintain the organization but also gives the men a personal interest in the plant.

The wisdom of such a course can hardly be overestimated. For when demand begins to be in evidence some of the concerns which are hard pressed are apt to quote prices below those at which a fair profit can be made. Immediate delivery will also be demanded in many cases. In either instance the shop which has improved its methods so as to secure more economical production, will be in the best position to secure the new business.

Putting Machines in First-Class Shape

THE stress of the past few years not only taxed our machine equipment to the limit, but the demand for production gave little time to watch the upkeep of our machines. As a result there were many cases where the assembly showed a shaft a little out of line, gears that did not give quite a perfect bearing on the teeth and other little things which had to be corrected if we maintained our quality.

This is the time to trace these little discrepancies down to their source, to find why they are not quite standard. In one case the cause of a pair of bevel gears not meshing just as they should was found to be in the bevel gear planer itself. Hard usage had caused the slides to wear a little out of line which gave a heel and toe bearing of the teeth. A little careful work here corrected this difficulty, brought the tooth bearing clear across the tooth face and gave quiet running gears.

Lathe spindles, carriage ways, planer V's and other guiding and cutting members should be looked over carefully while the opportunity exists. It will well repay the expenditure in time saved in assembly and in the satisfaction of turning out better work.

SHOP EQUIPMENT NEWS

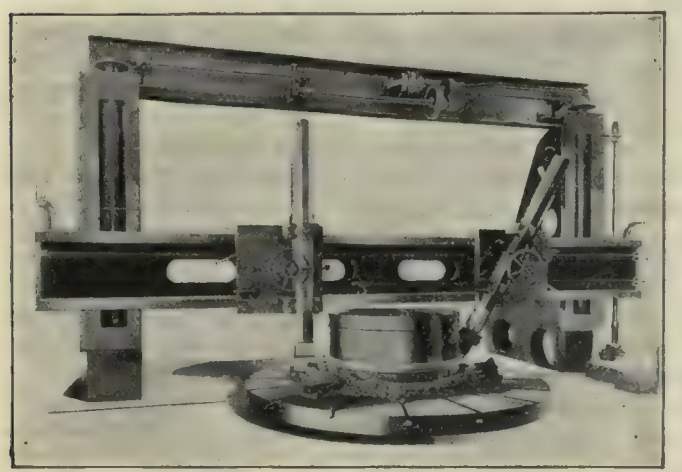
SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and • equipment •

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs • and equipment •

Pulaski 20-Ft. Boring Mill

The Pulaski Foundry and Manufacturing Corporation, 2422 Euclid Ave., Cleveland, Ohio, announces a new line of vertical boring and turning mills built in four sizes,



PULASKI 20-FT. BORING MILL

Specifications: Rated size; 16 ft., 18 ft., 20 ft., 22 ft. Dimension between housing centers; 18 ft., 20 ft., 22 ft., 24 ft. Actual swing; 16 ft. 5 in., 18 ft. 4 in., 20 ft. 4 in., 22 ft. 4 in. Maximum height under tool holders; 9 ft. 3 in. Maximum height under cross-rail; 10 ft. Bars; length, 9 ft., 10 ft., 11 ft., 12 ft.; travel, 5 ft. 4½ in., 6 ft. 4½ in., 7 ft. 4½ in., 8 ft. 4½ in.; smallest hole each will enter, 12½ in.; minimum distance between centers, 38 in.; toolholders—diameter of shank, 4½ in.; maximum tool size, 2¾ in. Feeds; minimum per revolution of table, 0; maximum per revolution of table, ¾ in. Table speeds: number, 9. Approximate r.p.m. minimum, 0.3. Approximate r.p.m. maximum, 8. Main motor—horsepower, 40. Approximate r.p.m., 700. Elevating motor horsepower, 10. Approximate r.p.m., 850.

from 16 to 22-ft. swing. The 20-ft. size, which has a swing of 20 ft. 4 in., is shown with a 12-ft. table, although a larger table can be provided if desired. Extension arms are also provided to carry work larger than the table. The table is driven through an external gear of large diameter and is supported by a step bearing and a large diameter annular bearing running in oil. The table spindle runs in upper and lower bearings of large size, both of which are adjustable for wear.

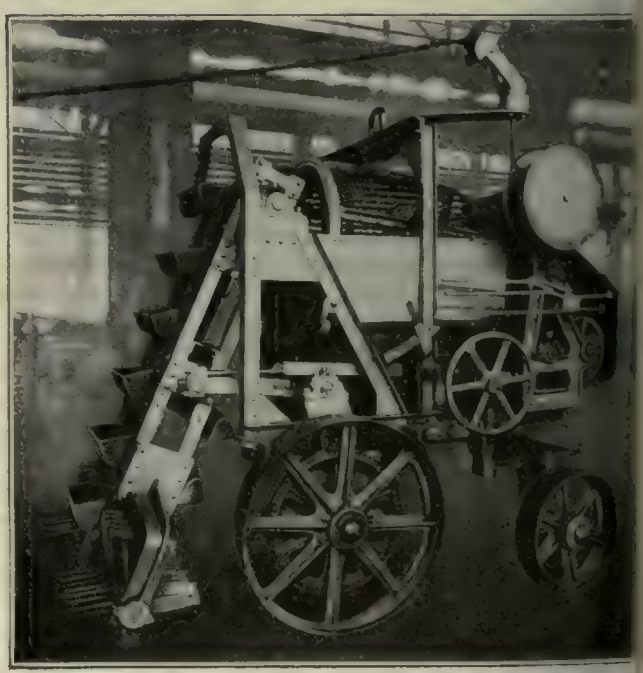
The boring bars are carried by heavy saddles and can be set at angles of 90 deg. in one direction and 45 deg. in the other. The feeds are variable from 0 to ¾ in. per table revolution and provision is made for independent vertical, cross, and angular feed, independent for each head. Nine table speeds are available with a constant speed driving motor, and more speeds can be obtained by using a variable speed driving motor. The cross-rail is elevated and lowered by a separate motor. The illustration shows the mill set with the table just above the floor level, although the machine may be set at any desired height.

Whiting Sand Cutting and Screening Machine

The Whiting Corporation, Harvey, Ill., has recen completed the construction of a sand cutting and scre ing machine which is designed to cut, aërate, scre and temper molding sand at one operation. After t flasks have been shaken out and the castings remov the sand is wet down and allowed to cool and temp Then the machine is started across the floor, cutti and screening the sand as it goes, handling, under av age conditions, one cubic yard of sand per minute, shaken from the flask.

Rapidly revolving blades cut and aërate the sand a at the same time throw it toward the center of t machine, where it is gathered by the bucket elevat and conveyed to the revolving screen. This scre mixes and aërates the sand and removes all refu such as gaggers, wedges, runouts, broken cores, et the clean sand being deposited in a windrow benea the machine where it is immediately ready for t molder's use.

The machine is entirely automatic, power being fu



WHITING SAND-CUTTING AND SCREENING MACHINE

nished either by electric motor or gasoline engine. T cutting speeds are available, selectively engaged by jaw clutch. The steering mechanism will allow turning in very narrow quarters.

Bickford-Switzer Drill-Grinding Machine

The Bickford-Switzer Co., 50 Norwood St., Greenfield, Mass., has recently placed upon the market the drill-grinding machine shown in the illustration. The machine is intended for the sharpening of twist drills from ⅛ to ¾ in. in diameter, it being claimed that the drills can be ground commercially perfect with considerable speed, that is, a drill ground on the machine will not cut more than 0.002 in. larger than its own size, and that only one minute is required for the setting up and grinding of a drill. The drill is held in a chuck, and by the turning of a crank, it is given a combined rotative, eccentric and swinging motion. The two lips are brought consecutively in contact with the grinding wheel, with the result that when one lip is sharpened or ground to a certain point, the other is also. The grinding is said to be always central and true with the axis of the drill. The shank end of the drill is held by means of a cup center, while the front end is held by two jaws which locate and grip the body of the drill.



BICKFORD-SWITZER DRILL-GRINDING MACHINE

The abrasive wheel is enclosed in a guard, and driven directly by means of a small electric motor, which can be furnished for either direct or alternating current. It can be fed towards the drill, being sharpened by means of a small handwheel.

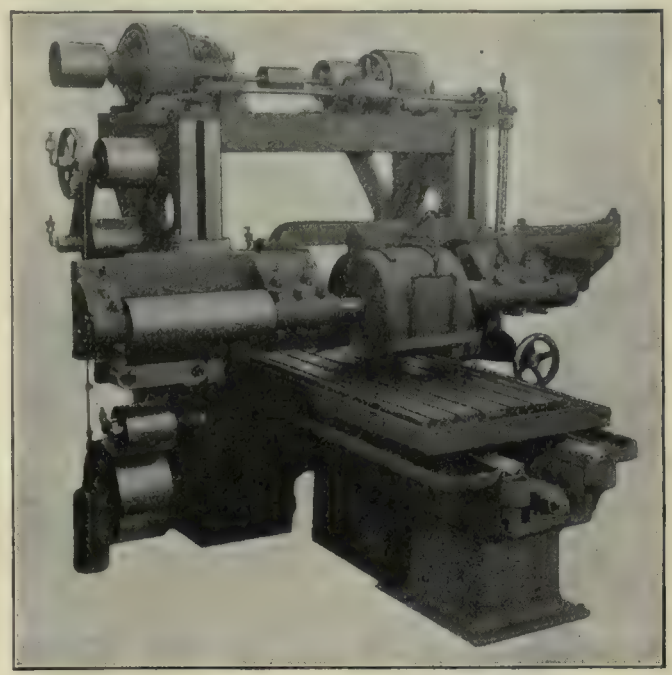
After clamping the drill in place in the chuck, the carriage on which it is mounted can be moved toward the wheel by means of a hand-lever moving horizontally. The crank at the left is then turned, so as to produce the necessary motion of the drill. In this way the point of the drill is ground and sharpened. The mechanism is arranged so that it is also possible to bevel off the center corners of the cutting lips. It is stated that by this means the endurance of the drill can be greatly increased.

Springfield Oscillating Surface Grinding Machine

The Springfield Manufacturing Co., Bridgeport, Conn., has recently placed on the market the heavy-duty, self-contained, motor-driven, oscillating surface-grinding machine shown in the illustration. The machine is of heavy, substantial construction, carrying two wheels each 20 in. in diameter and 6½ in. wide on a spindle of 4 in. diameter operating in bearings 18 in. long. The spindle is driven direct from the motor, the belt running over a drum pulley connected directly to the spindle.

One of the features of this machine is the oscillating motion of the spindle, produced by means of a crank on the right-hand end of the cross-rail.

The machine shown has capacity to grind 5 ft. long,



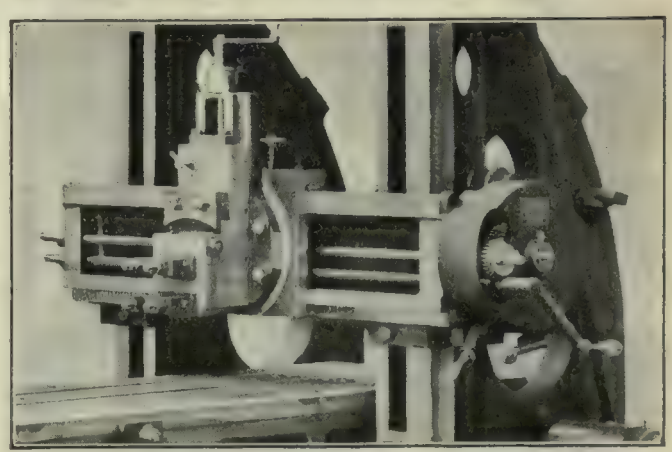
SPRINGFIELD HEAVY-DUTY SELF CONTAINED MOTOR-DRIVEN OSCILLATING SURFACE-GRINDING MACHINE

30 in. wide, 18 in. high, and takes 52 in. between uprights. The weight of the machine as shown is 15,645 pounds.

Rapid Power Traverse for Cincinnati Planers

The Cincinnati Planer Co., Cincinnati, Ohio, has provided its 24 x 24-in. heavy pattern planers with a power device for rapidly traversing the head on the cross-rail, as shown in the illustration herewith.

The device is so arranged that it can be put in operation instantly and when in operation the crank handle

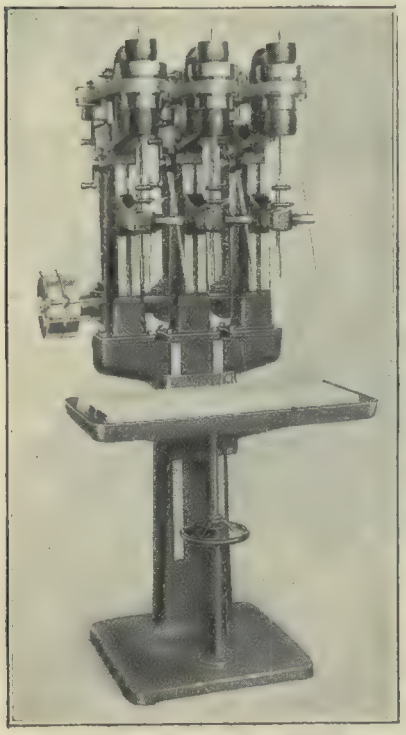


RAPID POWER TRAVERSE ON CINCINNATI PLANER

does not revolve. It is furnished on planers having either one or two heads and in the latter case either head can be moved independently or both heads can be moved simultaneously in either direction. All gearing is completely enclosed.

Edlund Sensitive Drilling Machine

The Edlund Machinery Co., Inc., Cortland, N. Y., has recently placed on the market the No. 1-B sensitive drilling machine shown in the illustration. This machine is built on the same general lines as the other Edlund types and is furnished in combinations of from one to four spindles. Power is transmitted from the drive pulley through two bevel gears and a vertical shaft to the rear three-step cone pulley, from which it is carried by a straight endless belt to the cone on the spindle, eliminating a quarter-turn belt. The gears are pack-hardened and are lubricated by the splash system. The machine is equipped throughout with ball bearings. The belt can be shifted from either side of the machine.

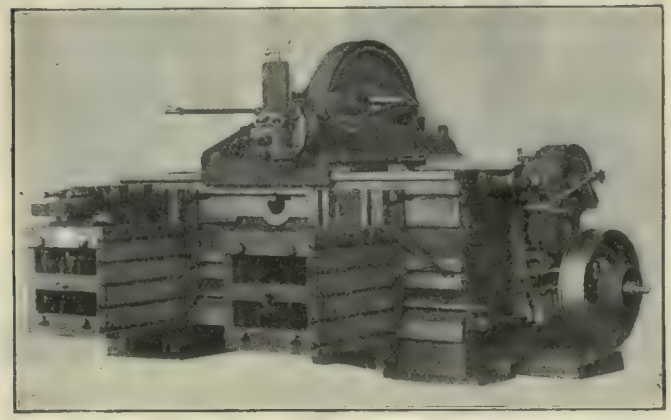


EDLUND SENSITIVE DRILLING MACHINE

Specifications: Face of column to center of spindle, 7 in. Maximum distance, spindle nose to table, 30 in. Diameter of spindle, ¾ in. Taper, Morse No. 1. Vertical traverse of spindle, 3½ in. Vertical traverse of arm, 10 in. Vertical traverse of table, 17 in. Working surface of table, 12¾ x 13 in. to 12¾ x 37 in., according to number of spindles. Largest drill machine will drive effectively, ½ in. Weight, 430 to 1,115 lb., acording to number of spindles.

Putnam 26-In. Traverse-Head Shaper

The Putnam Machine Works of Manning, Maxwell and Moore, Inc., Fitchburg, Mass., has recently added to its line the 26-in. traverse-head shaper shown in the illustration. The principal features of this machine are said to be its generally heavy proportions and ability to transmit the power required for heavy cuts at high speeds. The head is gibbed for taking up wear a wipers keep the surfaces in contact free from dirt.



PUTNAM 26-IN. TRAVERSE-HEAD SHAPER

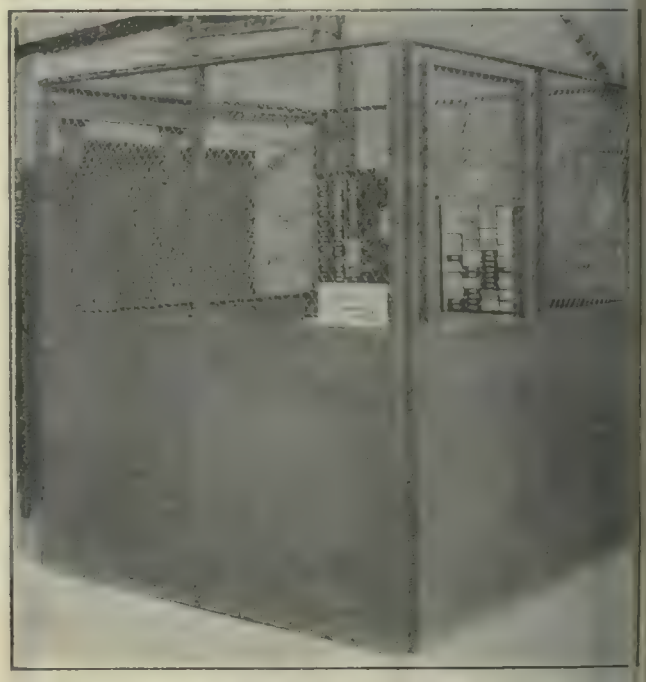
Power feed is provided for moving the head along t bed and an open and shut nut in the head provi means for disengagement with the feed screw when is desired to feed it by hand. The ram is operated the McCord quick return motion and facilities are p vided for setting the ram to any stroke or positi desired.

The tables are mounted on individual saddles a can be adjusted both vertically and longitudinally. Spe changes are obtainable through a selective type ge box. A friction clutch is used, which can be operat from either end of the machine, and the act of d engaging the clutch applies a brake for stopping ram. Drive by variable speed motor is arranged w sufficient speed changes by gearing to give suita speeds to the ram.

The machine with an 8-ft. bed weighs 18,000 pour

Lyon Time Booth

One of the late developments of the Lyon Meta Manufacturing Co., Aurora, Ill., is a time booth for by factory timekeepers, department foremen and othe



LYON METAL TIME BOOTH

This booth is built from standardized sectional pan is provided with a sliding window and can be furnish with practically any arrangement required in the way drawers, compartments and the like.

Detroit No. 4 Heavy-Duty Centerless Grinding Machine

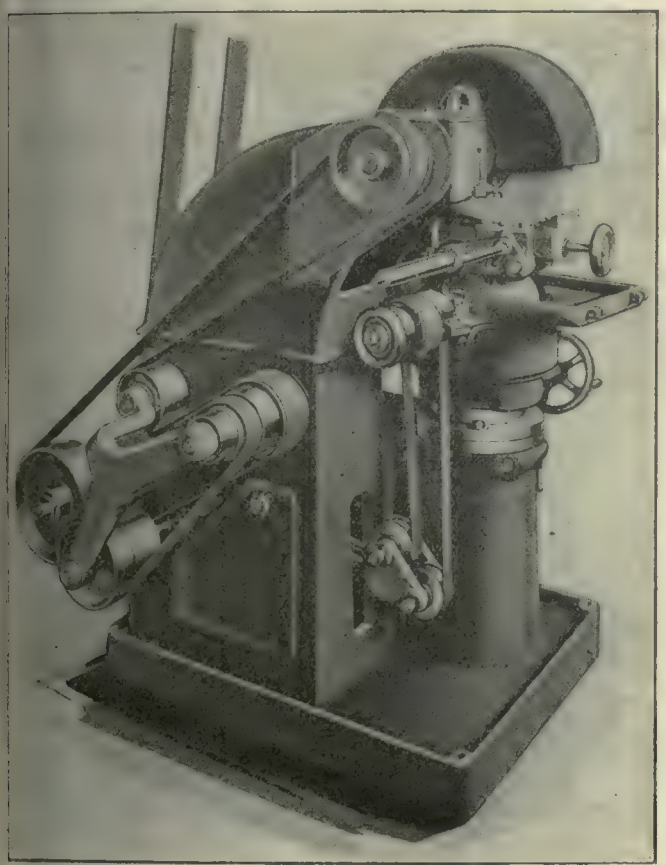
The Detroit Machine Tool Co., 6545 St. Antoine Detroit, Mich., has added to its line the heavy-d centerless grinding machine shown in the accompany illustration.

In this machine two abrasive wheels are used, upper one for grinding and the lower one for rotat and feeding the work. The work is rotated by plac it on top of the rotating wheel, which when swu around at a slight angle also feeds the work past grinding wheel. When set at an angle of 6 deg.

work will travel endwise at the rate of 100 in. per minute. The rotating wheel has three speeds, any one of which is available through a cone pulley. Work less than 4 in. long can be fed to the machine by placing the pieces end to end in a gravity chute, making the feeding practically continuous. Pieces longer than 4 in. are fed to the machine one after the other and after being ground are rolled through an opening onto an inclined floor and returned to the operator's side of the machine.

Work from ¼ to 3 in. in diameter and from ¼ to 16 in. in length can be ground, and cuts from 0.0001 to 0.015 in. can be taken, depending on whether the work is hard or soft. A wheel truing device accompanies each machine and is also used to dress the rotating wheel so that the line of contact with the work will insure feeding in a straight line.

The grinding wheel is driven by a 4-in. belt from a jack shaft at the rear of the machine and the rotating

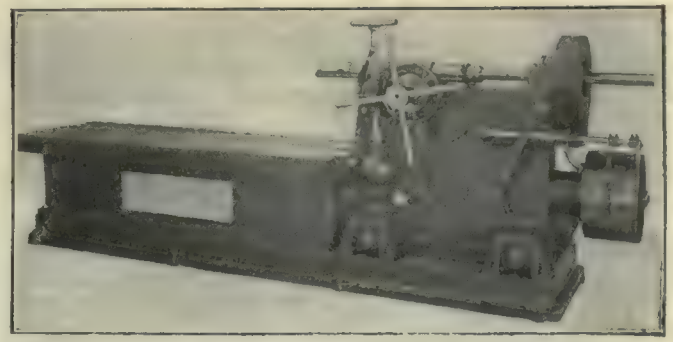


DETROIT NO. 4 CENTERLESS GRINDING MACHINE

wheel receives power from a small gear box. Generous bearings of phosphor bronze are provided for the grinding wheel and oil is supplied from a 4-qt. reservoir located between the bearings. The bearings of the rotating-wheel shaft are also of phosphor bronze while the jack shaft and countershaft are provided with anti-friction ball bearings.

Baker Horizontal Boring and Drilling Machine No. 217-H

The machine shown in the accompanying illustration is the No. 217-H horizontal boring and drilling machine, a single-purpose tool which has been developed recently by Baker Brothers, Toledo, Ohio. This machine is of an extra-heavy pattern, being designed primarily for the machining of crankcases, large transmission-cases, rear-



BAKER HORIZONTAL BORING AND DRILLING MACHINE NO. 217-H

axle housings and other work of the heavier class. It is built to drive a 2-in. high-speed drill in steel.

Speed and feed changes are obtained by change gears, by means of which practically any desired speed or feed can be obtained. A vertical adjustment is provided to take care of any discrepancy in castings or fixtures.

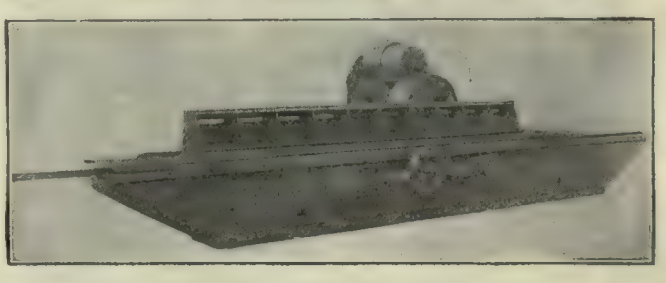
The table is 75 in. long and the spindle will feed 16 in. The spindle, which is made to take a Morse No. 5 taper, is set at a maximum height of 16⅛ in. from the table, the minimum being 15⅜ in. The machine is 11 ft. 4 in. long overall by 25¼ in. wide, and weighs 4,750 lb. The pulley is made for a 4-in. belt.

Springfield Shear Blade and Face-Grinding Machine

The illustration shows a heavy-duty reversing motor shear-blade and face-grinding machine recently placed on the market by the Springfield Manufacturing Co., Bridgeport, Conn. The machine is entirely self contained and is operated by three motors, one of 15-hp. for driving the wheel, one variable-speed 5-hp. reversing motor for driving the table traversing mechanism, and one ½-hp. motor for driving the pump. Table speeds of from 7 to 27 ft. per minute may be obtained, and the reversing feature of the motor dispenses with all belting. The operation of the machine is controlled from either front or rear by mechanical means, push buttons being provided for controlling the motors. The machines are made in different sizes, to handle work varying in lengths from 6 to 17 ft.

The machine can also be furnished with a swivel knife bar, making it suitable for grinding large paper and veneer knives, and by removing the angle bar shown it becomes a standard face grinding machine and can be used for all kinds of face grinding within its capacity.

The bearings are of the sleeve flange type, which can very easily be replaced in case of wear without disturbing the original alignment of the machine. The machine as shown is arranged for wet grinding. Provision is made for taking care of the spray and

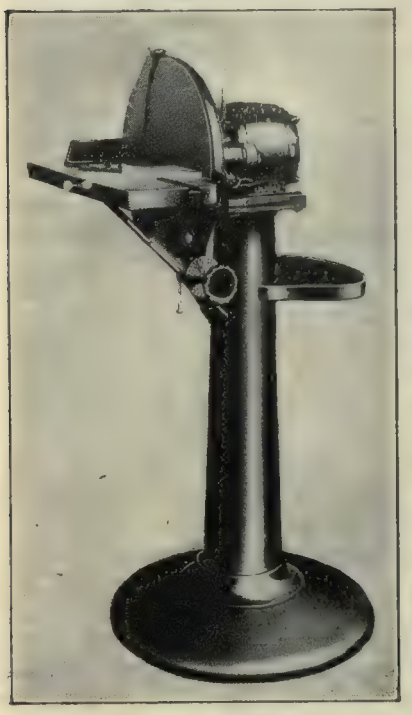


SPRINGFIELD HEAVY-DUTY REVERSING MOTOR SHEAR BLADE AND FACE-GRINDING MACHINE

drainage. Provision is also made for swiveling the wheelhead by means of rack and pinion, so as to permit of grinding either straight or concaved as may be desired. The weight of a machine of 12 ft. capacity is 14,750 pounds.

Syracuse Type D-2 Disk-Sanding Machine

The illustration shows the Type D-2 disk-sanding machine built by the Syracuse Sander Manufacturing Co., Inc., Syracuse, N. Y. The machine is intended for use in wood shops, particularly the pattern shop, although it may also be used for disk-grinding small metal parts, especially brass and aluminum. The disk is 15 in. in diameter. Garnet paper disks are used when working on wood, and Aloxite or emery cloth disks for metal grinding.

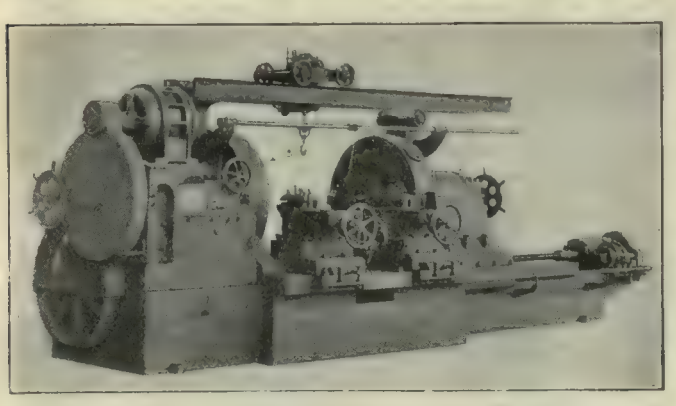


SYRACUSE TYPE D-2 DISK-SANDING MACHINE

A feature of the machine is the vacuum system which is said to collect at least 90 per cent of the dust. The dust is carried to the floor through the post of the pedestal. The table, which has an angle gage graduated in degrees, may be tilted by a hand adjustment to either 35 deg. down or 10 deg. up. The motor is built especially for the machine and is totally inclosed. The speed is 1,725 r.p.m. The overall dimensions of the machine are 25 x 25 x 47 in., and the weight is 300 lb.

Putnam 54-In. Tire Turning Lathe

The Putnam Machine Works, of Manning, Maxwell & Moore, Inc., Fitchburg, Mass., has recently placed on the market a 54-in. tire turning lathe, as shown in the illustration. This machine is said to have a capacity for turning car and engine truck wheels from 30 to 52 in. in diameter, and can be adjusted to take wheels for narrow gage tracks. An important feature is said to be the combination toolslide which carries both roughing and finishing tools so arranged that when once set they do not have to be moved except for grinding.

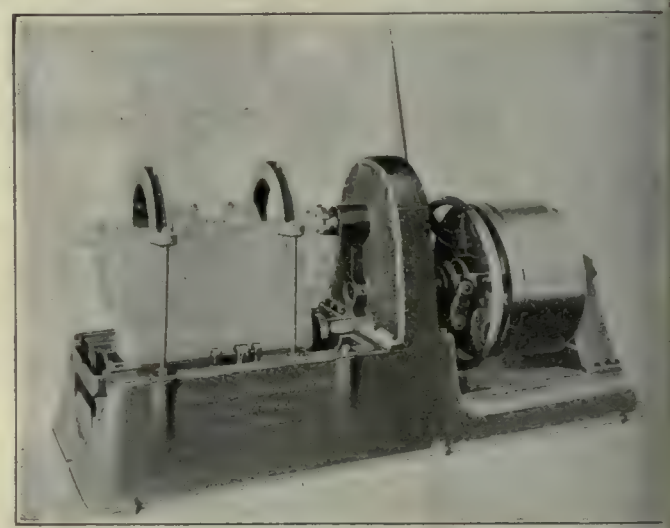


PUTNAM 54-IN. TIRE TURNING LATHE

The tailstock is moved along the bed by power, either an auxiliary 7½-hp. motor or an individual countershaft being used, the power being transmitted through a friction clutch. Both the headstock and tailstock main spindle bearings are bushed to facilitate maintaining original accuracy of spindle adjustment. The end thrust of the internal spindles is taken by thrust collars located on the external spindles and running in a bath of oil. Spindles and faceplates are made in one piece. The maximum distance between faceplates is 10 ft. 9⅞ in. Gear changes are made by individual steel beveled jaw clutches and sliding gears. All gears are made of steel excepting the motor pinion and gear. The motor pinion is non-metallic, and the gear is of iron. The faceplate gears are of the herringbone type. The bed of the machine is 23 ft. 3 in. long 6 ft. 6½ in. wide, and has a solid top. The machine weighs 86,000 pounds.

Detroit Burning-In and Running-In Machine

The machine shown in the illustration has been recently developed by the Detroit Garage and Equipment Co., 268 Jefferson Ave., Detroit, Mich., and is intended



DETROIT BURNING-IN AND RUNNING-IN MACHINE FOR MOTOR BEARINGS

for use in service stations, garages, and smaller motor plants that wish to employ the burning-in method of finishing motor-bearings to size, to save having to scrap them. This machine serves both for burning-in bearings and for a running-in test, the illustration showing the machine set up for burning-in the bearings of a Fordson tractor engine. After the bearings have been burnt-in, the engine is turned over and connected for the running-in test.

The machine has two spindles geared in train with the main drive shaft. The upper spindle is used for the burning-in operation and is geared to run at 200 r.p.m. The lower spindle is connected to the crankshaft for running-in and runs at 600 r.p.m.

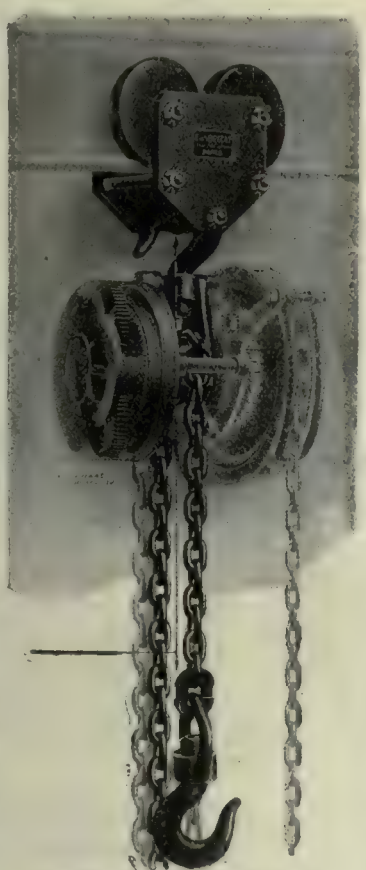
The motor is mounted on a saddle that fits in the bed of the machine, this saddle being special for each size and make of motor handled. It holds the motor block at the correct height to align the crankshaft with

ne upper spindle during the burning-in operation. For ne running-in operation the saddle is inverted on the ed and is so shaped that it serves as a crankcase and il pan for the motor. During both operations the otor is secured by heavy clamps that pass over it and e held down by bolts attached to the bed.

The machine is driven by an 8-in. belt, and for motor-ive, a 20-hp. motor is recommended. The clutch, hich is in the flywheel, is operated by a conveniently-aced lever. A ringwheel on the free side of the clutch ermits turning over the shafts by hand while setting o work. The mainshaft is mounted on S. K. F. ball earings and the spindles run in bronze bearings. The ear train runs in a bath of oil.

"G. B." Spur Geared Chain Block

The accompanying illustration shows a chain block ade in France by George Beccat and marketed by ndré Weill & Co., Inc., 149 Broadway, New York, . Y., exclusive agents r the United States d Canada.



"G. B" SPUR GEARED CHAIN BLOCK

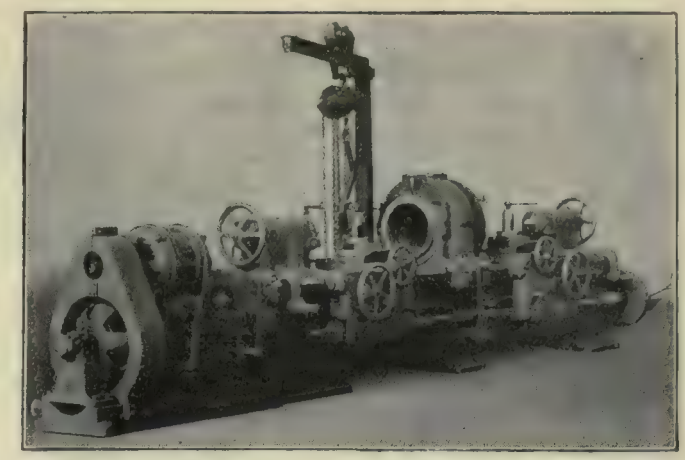
This chain block is ade entirely of drop-rged steel and the ains are electrically elded. The load sheave accurately machined fit the chain links d each block is fitted th two chain guides hinged that the hoist-g chain can be pulled om any angle without terference.

It is claimed that by e use of steel in the tire block, the weight s been kept down to e minimum without crificing the strength d that each block is sted by an overload 50 per cent at the ctory.

The blocks are made fourteen sizes with ting capacity of from to 20 metric tons ,205 lb.), and weigh-g from 62 to 1,036 unds. The pull on e hand chain required tlift the rated load varies from 61 to 127 lb. Lubrica-in is accomplished through oil holes, without the ecessity of opening the box.

Putnam Heavy Double Axle Lathe

The Putnam Machine Works, of Manning, Maxwell & Moore, Inc., Fitchburg, Mass., has recently placed on e market the heavy-duty double axle lathe shown in e illustration. The outstanding feature of this achine is said to be its ability to take heavy cuts with-ut vibration. The machine is built with two tailstocks nd a central driving head, the driving head being iven by means of a broad-faced herringbone gear and inion running in an oil bath. Both tailstocks are

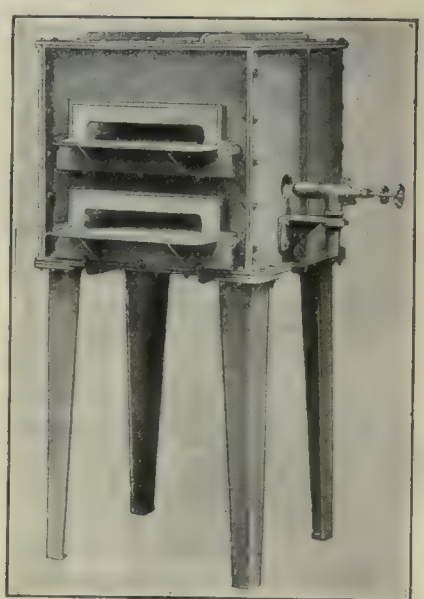


PUTNAM HEAVY DOUBLE AXLE LATHE

adjustable along the bed by means of racks and pinions. Both have large adjustable spindles which can be adjusted for alignment by means of taper gibs. Four speeds are obtainable through a gear-box and these speeds may be supplemented by the use of a variable speed motor. When belt driven, power is transmitted through a single pulley of large diameter and wide face, running constantly. For starting and stopping a friction clutch is employed, which, when disengaged, automatically applies a friction brake, stopping the machine almost instantly. A 1-ton quick acting crane is supplied with the machine when ordered. The machine weighs, with crane, 18,900 lb. Weight boxed for export, 22,950 lb., made up in three boxes totalling approximately 375 cubic feet.

Bellevue High-Speed Forging Furnace with Preheating Oven

The forging furnace shown in the illustration is made by the Bellevue Industrial Furnace Co., Detroit, Mich. It is especially intended for use in forging such work as high-speed-steel drills and reamers, and is provided with a preheating chamber in which the work can be slowly brought up to a heat before inserting it into the high-temperature chamber. The preheating oven is heated by the gases from the high-temperature chamber. When oil is used as fuel, the furnace is equipped with the Bellevue fuel-oil burner. The furnace is built in three sizes, to suit various jobs.



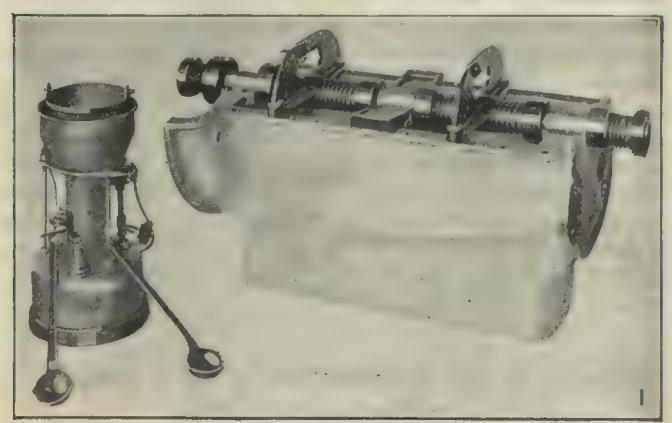
BELLEVUE HIGH-SPEED FORGING FURNACE WITH PREHEATING OVEN

Specifications: Built in three sizes—No. 220: muffle, 20 in. wide, 12 in. deep; opening, 16 in. wide, 2½ in. high. No. 221: muffle, 20 in. wide, 16 in. deep; opening, 16 in. wide, 2½ in. high. No. 223: muffle, 9 in. wide, 12 in. deep; opening, 9 in. wide, 3 in. high.

Detroit Rebabbitting and Reboring Outfits for Gas-Engine Bearings

A line of equipment for rebabbitting and reboring the main crankshaft bearings of automobile motors and gas engines is made by the Detroit Garage Equipment Co., 268 Jefferson Ave., Detroit, Mich. The equipment consists of a rebabbitting and a reboring outfit for each style of motor, the rebabbitting outfit for each motor being similar to the one shown in Fig. 1. It has a rebabbitting bar that is supported and aligned in the motor block by frames that are located by pins from the holes in the crankcase flange. Babbitt retaining collars are held against the ends of the bearings by compression springs. A two-quart combination blowtorch and melting pot is included.

The reboring bar for the Fordson Tractor Engine is located by means of a line bar placed through the camshaft holes, as shown in Fig. 2, in what is claimed to be the same method as that employed in the factory. The clamps are stated to have long bearing surfaces, to insure rigidity and accuracy in boring. A setscrew is



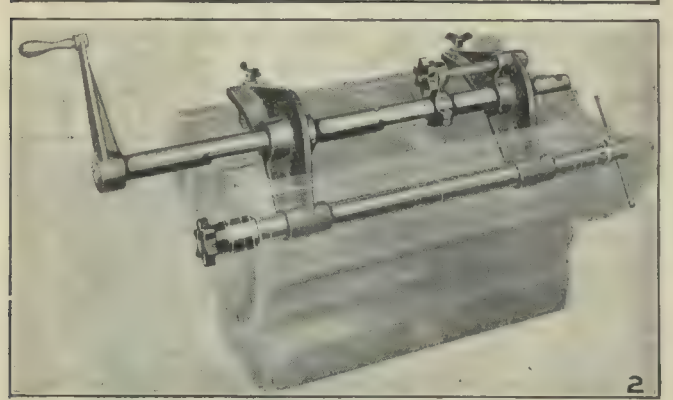


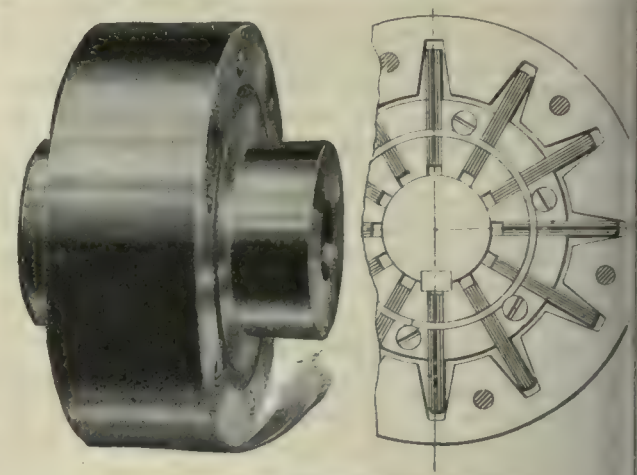
FIG. 1. DETROIT REBABBITTING OUTFIT FOR MOTOR BEARING. FIG. 2. DETROIT REBORING OUTFIT ON A FORDSON ENGINE

located back of each cutter for adjustment and replacement. A feed screw is provided for the bar, this screw being operated by a pin in the boring bar turning the star wheel as the boring bar is turned

"Kantilever Spring" Coupling

The Brown Engineering Co., Reading, Pa., has recently placed on the market a flexible end-to-end shaft coupling intended for use in power transmission, as on motors, dynamos, engines, turbines, pumps, compressors and fans. It is known as the "Kantilever Spring" coupling on account of the construction, which is shown in the accompanying illustration

No leather, rope or rubber is used in the coupli it being made entirely of metal. The coupling is c pletely inclosed and the interior parts run in oil.



"KANTILEVER SPRING" COUPLING

inner member carries laminated leaf springs pl radially and fitted into grooves in the rim of the c ling. The springs bear on the rim at their outer e the sides of the grooves being tapered, so that springs can bend as the load is applied. As the spri bend, the area of contact on the sides of the groo increases, thus increasing the rigidity.

The size and strength of the springs should be p portioned to the load to be transmitted, so that proper resiliency can be obtained. Both angular alignment, due to having the connected shafts parallel, and parallel mis-alignment due to having shafts at different heights are corrected, provided the misalignment is not too great. The springs act as shock absorbers, it is stated, smoothing out the po impulses and relieving the shocks on the driven sh A slight axial movement, such as due to the end of an armature, is allowed.

The coupling is made in a range of sizes from 25½ in. in outside diameter, and for shaft sizes as l as 10 in. The maximum speed obtainable for cast couplings ranges from 5,500 r.p.m. for the smallest to 800 r.p.m. for the largest, although higher speeds be obtained with steel couplings. The weights from 3 to 1,580 pounds.

Bath Internal Micrometer and Master Ring Gages

The illustrations show an internal micrometer gage and a ring gage, lately placed on the market John Bath & Co., Inc., 8 Grafton St., Worcester, M

The micrometer plug gage, Fig. 1, is provided four jaws fitted to inclined dovetail grooves in the and movement of the jaws is controlled by an accu micrometer screw. The inclination of the groove such that the lateral movement of the jaws in rela to changes in diameter of the gage is 5 to 1. divisions on the body of the plug each represe change in diameter of 0.010 in. while the graduation the collar each represent a like change of 0.0001 The gage can be set to a predetermined size either a or below the nominal size and the graduated ring to read zero by means of serrations on the upper of the graduated collar and a locking device, so the limits above or below the size to which the gag

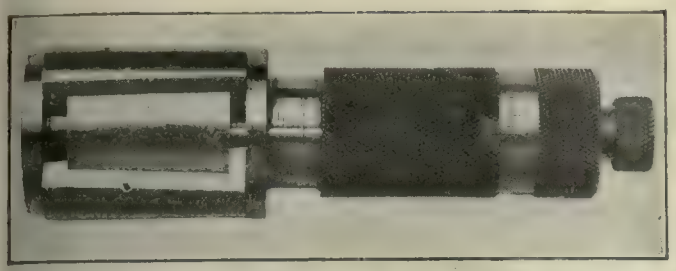


FIG. 1. BATH INTERNAL MICROMETER GAGE

set can be read with ease and without danger of error. This adjustment which can be made to 0.0001 in. can also be used to compensate for wear. When the gage is once set it can be clamped in its adjustment by a knurled headed screw at the top.

In measuring the diameter of a hole it is only necessary to collapse the jaws of the gage sufficiently to enter it and to then expand them until contact is secured, when the size can be read from the graduated collar.

It is claimed that during the manufacture and in the final inspection of these gages they are tested by means of light wave measurement, by gages certified by the U. S. Bureau of Standards to within a few millionths of an inch.

The ring gage, Fig. 2, is made narrow so that surface depressions in the piece being gaged can be more readily detected. Its outside diameter is unusually large to provide for rigidity and its surface is perforated with



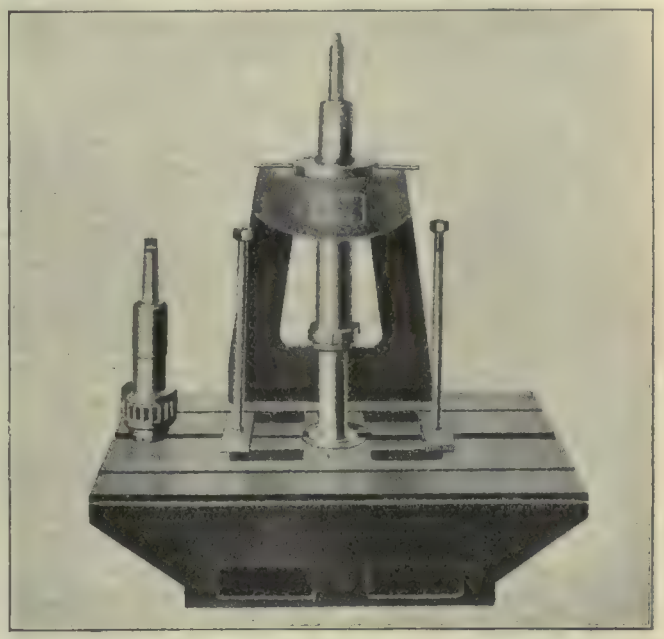
FIG. 2. BATH MASTER RING GAGE

a series of concentric holes to lessen the weight; also to provide for air circulation so that it will more quickly return to room temperature after it has been heated or cooled.

Detroit Reboring Outfit for Cylinders

The illustration shows a reboring outfit for gas-engine cylinders, that is made by the Detroit Garage Equipment Co., Detroit, Mich. The complete outfit is intended for use on, and has all necessary tools for reboring and burnishing the cylinders of Fordson and Ford model "T" motors. The jig is intended for use beneath any upright drill of adequate capacity. It consists of a heavy iron casting carrying a boring bar with pilot bushings at the top and bottom. The cylinder is located from the crankshaft flange and is clamped down by T-bolts. The boring bar and burnishing tool are both provided with floating shanks, to take care of any misalignment between the bar and the machine spindle.

The boring bar, shown in the jig bushings, is made of 0.4 per cent carbon steel and holds inserted high-speed-steel cutters. The burnishing tool is shown

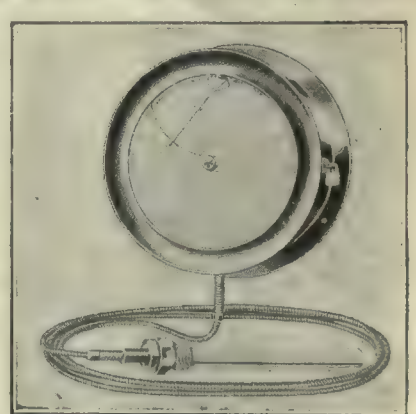


DETROIT REBORING OUTFIT FOR GAS-ENGINE CYLINDERS

standing on the left end of the jig. In operating this tool, the power feed is not necessary, as the rollers feed the tool automatically.

Brown Recording Thermometer

The accompanying illustration shows the Brown long distance recording thermometer of the latest type which has recently been placed on the market by the Brown Instrument Co., Wayne Junction, Pa. This machine incorporates a number of features not contained in the older types of Brown instruments, and is said to be especially adapted for measuring temperatures of quenching baths, oil tempering baths, and core ovens. Among other features, this thermometer is provided with means for adjusting the pen arm for "set" and "tension," and the helix is also adjustable for calibrating. The pen is inverted so that the ink cannot run down on the arm, and lifts automatically when the door is opened, resting on the paper again when the door is closed.



BROWN RECORDING THERMOMETER

Comparisons of Employment and Unemployment Figures

For purposes of comparison and record, the Government Bureau of Labor Statistics sent out questionnaires to representative establishments in thirteen manufacturing industries, late in 1920, asking for figures relating to employees and earnings for the payroll period ending nearest the fifteenth of the month, and requesting a report of any changes in rates of wages which occurred between November 15, 1920, and December 15, 1920.

The information contained in these questionnaires has been analyzed and tabulated in a comprehensive report, the substance of which follows:

Comparison of the figures of December, 1920, with those for identical establishments for December, 1919, shows that in four industries there was an increase in the number of persons employed, while in ten there was a decrease.

The largest increase, 41.2 per cent, is shown in coal mining, which is mainly due to the strike conditions of a year ago. Car building and repairing shows an increase of 13.8 per cent, and paper-making an increase of 0.9 per cent. The largest decreases, 52.4 per cent and 51.4 per cent, appear in woolen and in hosiery and underwear, respectively. The smallest decrease, 6.9 per cent, appears in cigar manufacturing.

Four of the fourteen industries show increases in the total amount of the payroll for December, 1920, as compared with December, 1919. The most important percentage increase, 220.3 per cent, is shown in coal mining, which is explained above. Respective increases of 34.6 per cent, 14 per cent, and 6.8 per cent appear in car building and repairing, iron and steel, and paper. Decreases of 55.6 per cent, 54.1 per cent, and 50.4 per cent are shown in woolen, hosiery and underwear, and men's readymade clothing. A decrease of 10.8 per cent is reported in cigars. Comparative data for December, 1920, and November, 1920, show that in two industries there was an increase in the number of persons on the payroll in December as compared with November, and in twelve a decrease. The increases are 2.1 per cent in boots and shoes and 0.6 per cent in coal mining. The largest decrease, 22.2 per cent, occurs in hosiery and underwear, while both woolen and men's readymade clothing show a decrease of 18.8 per cent. A decrease of 0.3 per cent is reported in cigars.

In comparing December with November of this year, four industries show an increase in the amount of money paid to employees, and ten a decrease. The most important increase is 12 per cent in cotton finishing. In coal mining an increase of 5.3 per cent appears. The smallest increase, 1.4 per cent, is shown in the boot and shoe industry. Percentage decreases of 18.7, 17.8, and 16.6 appear in hosiery and underwear, men's readymade clothing, and woolen, respectively. A decrease of 1 per cent appears in car building and repairing.

In addition to the foregoing data eighty-two plants in the iron and steel industry reported 106,020 employees as actually working on the last full day of the pay period reported for December, 1920, as against 105,922 for the reported payroll period in December, 1919, an increase of less than one-tenth of 1 per cent. Figures given by eighty establishments in the iron and steel industry show that 102,703 employees were actually working on the last full day of the pay period reported for December, 1920, as against 112,702 for the period in November, 1920, a decrease of 8.9 per cent.

Should Jigs and Fixtures Be "Designed"?

By Raymond Grant

Experience of many years in jig and fixture making convinces me of the truth of P. A. Fredericks conclusion on page 26 of *American Machinist*, namely, that the proper place to design jigs is not in the shop. But to what length the drafting room should go in designing jigs is a question that may well be given careful thought, for it is easily possible to spend an excessive amount of money in detailing "to the last screw" and in the end not do much if anything to assist the shop in producing the jig.

There can be no question that given a draftsman who is competent to design jigs, a more satisfactory result will be achieved from his design than if the average experienced toolmaker is turned loose on the job. The idea of letting the jig be designed while it is being built has no appeal in it for me. Either draftsman or toolmaker will make mistakes but those of the draftsman are much easier and cheaper to correct than those that occur in jigs that "just grow" a la Topsy. I also concur with Mr. Fredericks in his belief that personnel looms large when considering the scheme of having the patternmaker originate the jig by building a pattern around the sample piece of work. I believe few patternmakers are capable of jig design that would be acceptable to the shop.

My idea of a tool designer is an all-around toolmaker of long experience, who has pep, ambition, imagination and a little training in drafting, rather than a draftsman who is lacking in practical experience in shop work. The amount of drafting needed may be acquired by correspondence or night school, but alas, not the shop experience. The slow and painful process required to get the latter accounts for the paucity of real tool designers. However, assuming a designer whose aim is to place upon paper enough information to convey to the toolmaker his conception of the jig that his mature judgment dictates, rather than to engross the sheet with limitless details of painful (and needless) accuracy, we may expect in most cases a single sheet assembly drawing of the jig. Quite likely the piece of work will be dotted in. There may be three views of the jig, if it is more than usually complex, but more often but two and frequently only one view. It may be necessary to give a detailed sketch of some parts not clearly shown by the assembly, but usually this can be done more quickly if made freehand. Another way to save time on the designing is to use longhand writing for all notes instead of the customary and supposedly more legible printing.

The greater part of my experience having been gained without the assistance of a drafting room, I am convinced from having worked with both systems that it is desirable to have jigs thought out with care and the results recorded in a scale drawing. Patternmakers capable of jig design are about as scarce as draftsmen capable or willing to make drawings along the lines indicated. The approved custom of regarding the toolroom as a distinct though unnecessary evil might be ameliorated, if such "short-cut" designers and toolmakers were the rule rather than the exception and it would seem from the present outlook that such methods must more and more displace the good old technique of immaculate drawings with all the frills and fixings, and jigs with polished and damaskened faces, if we are to meet the keen competition so freely predicted as being just ahead.

German Machine Trade Conditions

Uncertainty of Reparations Weighing Heavily on Business Life — Great Need Is for Business Efficiency—A Future Demand for American Machine Tools—Prices Still High

BY OUR BERLIN CORRESPONDENT

BERLIN, March 12, 1921.

THE coming settlement of the reparation is at present putting all other matters in the background. This settlement will, of course, be one of the hardest ordeals Germany has gone through in many years, but it will at least remove the uncertainty which has been weighing so heavily on Germany's business life. Germany would be much farther on the road to normal conditions, if this most important item of the Peace Treaty had not been left in suspense for nearly two years. It may be expected that the strong efforts of thought now directed toward obtaining the best possible terms, will, immediately after they are finally settled upon, be concentrated toward carrying them out.

The latter task will have a decisive influence on Germany's economic life. What these consequences will be and what development they will cause is at present an object of excited discussion on the side of the general public, and of close research by all men holding responsible positions in business life. The views of the latter diverge widely, but they are unanimous in one opinion, which has recently been voiced by Dr. Simons, the German foreign minister, that the reparation is eminently a problem of production. The present production of the country is considered inadequate. With the number of workmen and the resources of raw material left to the country she cannot sufficiently produce to pay for her own needs and to make good the claims of the reparation debt, is the opinion of the leaders of finance and industry. The conclusion drawn therefrom finds expression in the brief word "impossible," an attitude which will no doubt give place later to earnest endeavors toward higher efficiency. To gain the latter is Germany's great problem of the future. Manufacturers and engineers have not yet come to close grips with this problem. It is not even recognized as a problem at all by many manufacturers who have not given much thought to the question, whether and by what means the present standard of efficiency can be raised. Far-sighted engineers however are convinced that the German manufacturing practice is far from perfection. This is noticeable from the otherwise excellent work initiated by the Society of German Engineers with regard to standardization, specialization and economical production.

NEED FOR BUSINESS EFFICIENCY

If the efficiency movement is not in a more advanced state, it is, of course, on account of the real incentive having been missing up to now. The hard necessity by which Germany's industry is faced now will no doubt carry it ahead. In the first instance it will have to break the greatest resistance which has stood in its way—the averse attitude of the workmen.

The latter forms however only one part of the great problem. Time will play a much more important part than ever before in the manufacturing process, and the whole business life calls for an adjustment.

To begin with, very little has been done during the past seven years toward keeping equipment up-to-date. The tendency was to follow the line of least resistance. Under ordinary conditions this state of things would probably have continued. When the industry will, however, once be started on the wide and long avenue which has been mapped out for it by the course of events, hard necessity will override short-sighted economy, and break down obstacles, probably even that of machine-tool imports from America.

A POSSIBLE DEMAND FOR AMERICAN TOOLS

The introduction of American efficiency methods is imperative and it is very likely that American machine tools will come with them. The German machine building industry—if efficiency is to be raised to the standard required—needs American machine tools of the most advanced design. This demand is now suppressed by monetary considerations and by official import restrictions, but it exists. German machinery manufacturers—not only producers but also consumers of machine tools—are eagerly scanning the advertising pages of the American publications, foremost among them the *American Machinist*, for new makes and designs. (A fact of which the writer found ample proof when visiting German factories on a recent tour through Germany.) Some of them are closely figuring on the purchase of American machine tools, and a few orders have actually been given.

If a certain share of the American machine-tool industry in the future re-equipment of German plants is assured, it will be restricted to designs and makes which the German machine-tool industry cannot supply. The main bulk of the business will naturally fall to the home industry. The latter in fact stands in urgent need of such business. The situation at present is far from satisfactory, and market conditions may be said to be exceedingly dull. The slight improvement noticeable toward the end of last year has, at the opening of the new year, given place to a regrading tendency. This applies to the home market as well as to the foreign trade. Holland and Scandinavia are still swamped with machine tools from the early rush on the German market. Of these countries Sweden is still the best buyer, while business with Holland, Denmark and Norway is exceedingly flat. The brisk demand which Finland showed during the second half of last year has subsided. Fairly good business is done with Belgium. The Polish manufacturers are anxious to place orders for machine tools, but they find it very difficult to finance them owing to the bad Polish exchange. It is perhaps for this reason that Poland's purchasing gravitates more toward Vienna than to Germany. The impression is received that buyers are still expecting a breakdown of prices and are holding back their orders for this reason. This opinion prevails abroad and at home. The activity of the home market finds its main expression in inquiries, only a small percentage of which materializes into orders. The

second-hand market is making itself felt stronger than ever before. Shops working on railroad equipment, railroad repair shops, locomotive and car factories are the most prominent buyers in the market.

Large Machines Not in Demand

Manufacturers of lathes still continue to be hit hardest by the slump, milling machines coming next, especially the larger types. Many manufacturers are just keeping within close range of shutting down, but manage to worry along with reduced working time. It can be observed that foreign and home buyers are buying sizes which frequently are below the required working range. On the other hand the preference for quality machine tools and small tools becomes marked more and more. This explains the fact that the best makes still enjoy fairly good business, while the staple makes are having an exceedingly quiet time.

Specialized machinery finds the readiest interest. Schuchardt & Schütte, for instance, are doing their best business by equipping standard machines with special fixtures and selling them as single purpose tools. Ludwig Loewe A.-G. are fairly well employed in their small tool department, while the machine-tool business is very slack. At Reineker's the demand for backing-off lathes is far ahead of that for any other tool. Pittler's are well employed in their automatic department, while their turret lathe business is dull. Fairly good business is done by manufacturers of cylindrical grinding machines, as more manufacturers are doing their finishing by grinding instead of by turning. The Zimmermann works in Chemnitz have lately received an order for two large boring mills for shipment to foreign customers.

This factory has taken up the manufacture of razor blades, thus giving its already extensive list of products a touch of variety, which is yet without a parallel in Germany. A tendency toward branching out in other directions is noticeable with quite a number of machine-tool firms.

A similar decline of business has made itself felt in almost all branches of the machine building industry. In some of them the export business has remained stationary, while in others it has dropped. No improvement has become noticeable in any line, except agricultural machinery industry, where a revival of the business set in, but only on foreign demand. The employment of the large electric machinery concerns and that of the motor car industry has slightly fallen off. The shipyards have sufficient orders on hand, but are not working at full capacity.

Unemployment Increasing

The depression, which has set in although slight, finds expression in the number of unemployed. Between December 15 and January 15 the number increased by 43,000 to 409,000, of which 333,000 are male workmen.

The immediate outlook is, in the general opinion, very gloomy. As long as the universal depression of business prevails it is expected that market conditions cannot materially improve. The fluctuations of the exchange are still causing great uneasiness, and manufacturers as a rule are viewing the possible rise of the exchange with mixed feelings. The strong hopes which were built upon Russia gradually coming in on the market again have mostly been disappointed. Of the huge orders which have been expected from inquiries and negotiations so far only a contract for 100 locomotives has actually been placed. Hopes for a betterment on the home market are entertained on the ground that many of the industrial companies have in the course of the last half year raised their capital, often doubling or even multiplying it. How large this financial re-inforcement is becomes apparent from the fact that the increase of the capital stock of the joint stock companies alone was in October 591 millions, in November 1,474 millions, in December 1,790 and in January 1,155 million marks, that is in four months nearly 5 billion marks. Manufacturers are convinced that this money must flow back to the market in the shape of orders for material and equipment. Such huge capital cannot remain idle for long, and, although the retarding influence of an all-round fall of prices is still very strong, the opinion is that the reticence of buyers must eventually break down, especially if business received an impetus from a reviving export.

Prices Not Going Down

Such impetus appears the more necessary as a strong reduction of prices in Germany is generally declared to be out of the question. The reduction of prices which has taken place has been made on the strength of better and cheaper supply of raw material, or was caused by financial necessities. A reduction of cost of labor and overhead, which alone could cheapen the production to a material extent, seems highly improbable. While cost of labor has remained stationary for some time, overhead charges are in fact still increasing. Manufacturers of finished articles are therefore watching with keen anxiety the falling market in England and America, convinced that if this tendency were to continue and even be aggravated by a rising German exchange, they would be put out of competition altogether. While the better supply of material is felt as a relief, and manufacturers can now, without difficulty, obtain all castings, bars and shapes which they require, from stock or on short delivery, it is not considered that this satisfactory state of affairs would outlast the present business depression. The reduced cost of material does not make itself felt very much in the case of finished articles, although it has been quite considerable. The present price of iron and steel, which is settled up to February 28, is being underbidden by 200 to 300 marks per ton. This is taken as an indication that a reduction is imminent, which is endorsed by the declining prices of ores. Eighty per cent ferro-manganese, for instance, has lately been reduced from 7,180 to 6,000 per ton; cast-iron scrap, which was 1,600 a short while ago, has dropped to 1,250 marks. In the case of most other metals strong reductions of prices have already taken place. Electrolytic copper, for instance, has within the month of January dropped from 2,210 to 1,650; zinc from 6,700 to 5,000, and soft lead from 6,000 to 4,700 marks.

On the other hand the manufacturers are threatened with additional burdens, which will more than outweigh the relief afforded by the decreased cost of raw materials. A considerable increase of the freight-rates is impending, and will soon be announced. The reparation will result in a more severe taxation, and the question of coal supply still causes anxiety. In the latter respect the situation is at present somewhat eased by the increasing output and the declining consumption. Apart from this the drop in the prices of English and American coal has brought imports of such coal well within the realm of possibility.



NEWS SECTION

European Countries in Market for Rolling Stock

The Royal Bulgarian Railways (Direction Générale des Chemins de Fer et des Ports de l'Etat Bulgare à Sofia) are inviting bids for the following rolling stock: 10 locomotives (760 millimeter gage), 75 open freight cars same gage, 75 cars for coal transportation, same gage; furthermore, for 600 millimeter gage: 15 locomotives, 100 cars for coal transportation and 40 bogie trucks for lumber transportation. Offers should include time of delivery and terms of payment.

* * *

The Roumanian Official Gazette *Monitorul* publishes a report according to which the government has authorized the Ministry of Railways to order from German Locomotive Works 70 locomotives of the Prussian type at the price of from 2,100,000 lei to 2,500,000 lei per locomotive, the total amount not exceeding 160,000,000 lei. Furthermore, the *Gazette* publishes a contract referring to the repair of 570 passenger and 8,000 freight cars for the Roumanian Railways, the cost for this work being fixed at no more than 207,000,000 lei. The repair work will be executed by German and Czecho-Slovakian establishments.

* * *

The Soviet Government at Moscow publishes a communication according to which it is about to enter into contracts for the purchase of a large number of locomotives. The special Soviet representative now in Stockholm, Sweden, is said to have been instructed to place orders for 2,000 locomotives, which are to be paid for in cash at the rate of 5 millions Swedish crowns gold. One thousand engines are to be ordered in Sweden and 1,000 in Germany. Orders for repair work on 5,000 locomotives have also been placed. The well-known firm of Armstrong, in England, has received an order for the repair of 1,500 locomotives, while the rest of the order has been placed with Norwegian, Swedish and German works. A report from Berlin is to the effect that the German Government contemplates the erection of a State Locomotive Works in order to cut off the high profits of the private industry.

National Safety Code for the Protection of the Heads and Eyes of Industrial Workers

Three years ago the Bureau of Standards, Washington, D. C., cooperated with the War and Navy Departments in preparing a set of safety standards to be applied in government establishments. Among these standards was one for head and eye protection and this has formed the basis of the code mentioned in the title. The rules originally laid down have been further developed by study and experimental work at the Bureau, and conferences have been held with many individuals and firms who have had experience in protection of this sort.

Nine Hazard Groups

Preliminary drafts have been issued and comments received from all sections of the country, so that the present code may be said to incorporate the latest and best ideas on this important question. No attempt has been made to specify any particular style or strength of safety goggles or other appliances, but rather to indicate and classify the character of the hazards which exist in the different industries, leaving each employer or officer in charge of safety work to assign to these different groups his particular industrial operation. The various processes have been divided into nine groups according to the degree of hazard, or because the peculiarities of the work require a protecting device having certain distinct properties. These groups cover many different hazards, from the handling of molten metal to injury from exposure to harmful radiations.

German Locomotive Works at Java

A report from Amsterdam is to the effect that a German industrial concern has acquired a concession for the construction of extensive car works in the north of the island of Java in the Dutch East Indies. It is stated that several hundred men will find employment in these establishments which will chiefly supply rolling stock for the Dutch East Indian Colonies.

Traffic Through Panama Canal in 1920 Exceeds All Records

According to the latest statistics published in the *Panama Canal Record*, the official publication of the Panama Canal, traffic through the canal during year 1920 exceeded any previous twelve-month period.

A total of 2,814 ships, representing 11,236,119 tons of cargo, passed through the waterway during that time, this being about four million tons more than in 1919 and almost three times the tonnage for 1915, the first full year of operation.

Most of the ships passing through the canal were westbound and were destined for ports on the west coast of South America. Of the ships passing through the canal 45.5 per cent were registered United States vessels, British ships being second.

Fuel oil holds first place in the line of commodities carried in cargoes from the Atlantic to the Pacific; nitrate is first of those shipped from the Pacific to the Atlantic. Steel and iron rank fourth in shipments from east to west.

During January of the present year all traffic records were broken in the amount of ships and cargo passing through the canal, and if the gain continues this will be the biggest year in the history of the great canal.

Steel Treaters Will Convene at Indianapolis

The board of directors of the American Society for Steel Treating has decided to hold the third annual convention and exhibition of the society at Indianapolis, during the week of Sept. 19 to 24 inclusive.

Indianapolis is fortunate in having buildings large enough to accommodate the exhibition, having, at the State Fair Grounds the Manufacturers' Building which is 360 ft. in length by 220 ft. in width, the total floor area being 78,000 square feet. Booths will be supplied with gas, electricity and compressed air for the operation of the live exhibits.

The requests that have been coming into the national office at 400 Prospect Ave., Cleveland, for information as to reservations and floor plans indicate that the attendance will reach approximately 15,000 people.

Business Conditions as the Big Banks of the Country See Them

First National Bank of Boston Predicts Cut in Steel Prices—Money Market Relaxing, but Still Firm

There has been no appreciable change during the month in the credit strain. While the Federal Reserve percentage, now above 50, indicates a tendency toward relaxation in money, the movement is exceedingly slow, although favorably affected by our importations of gold, as well as by a small shrinkage in loans. In as much as deposits have likewise dwindled, member bank borrowings still stand at high figures and money rates remain firm. Current operations, as evidenced by bank clearings, are 20 to 25 per cent less than a year ago, but nearly half the decrease is accounted for by lower prices of goods. There is still much unemployment, but the amount is not materially increasing and the situation in New England in this respect has improved since the first of the year, largely owing to increased activity in textiles. It must be admitted that the rush of business in cotton goods and the larger business in woolens, which began earlier in the year, were not of a permanent nature. The mills are again beginning to curtail production sharply as their forward orders are falling off rapidly. Hopes of a quick recovery in the deflated industries have given way to a sober realization that the upbuilding of business to normal proportions is likely to be a slow and gradual process, held back by the expected deflation in important industries scarcely affected as yet. Chief among the latter is steel and its allied lines, which are experiencing a marked lack of demand. The independent operators, having enjoyed for many months prices in excess of those of the steel corporation, have been obliged to cut well below the latter to keep operating, and have reduced wages as well. The corporation's unfilled orders have been falling rapidly, now being under 7,000,000 tons, as compared with over 11,000,000 last August. Not only that, but it is reported buyers are not specifying against scheduled orders, so that the showing is less favorable than indicated by the foregoing figures. With plant operations probably not above 50 per cent of capacity and orders diminishing, a material cut in steel prices, accompanied by reductions in wages—said to constitute 80 to 90 per cent of the steel costs—seems imminent. Perhaps the most noticeable feature of the month has been the almost daily announcements of lowering of wages in many industries, including finally the railroads. The logic of the situation is forcing these downward revisions, and broadly speaking is being recognized by labor as inevitable. Reductions in wages which seemed difficult, almost impossible, a few months ago are being accomplished with surprising ease. The trend of commodity prices is distinctly downward, variously estimated in the United States as from 35 to 45 per cent below the high point of May, 1920. Japan and the Netherlands show about the same decrease; Great Britain shows a decline of from 25 to 32 per cent; France 30 per cent; while Germany reports 9 per cent and Italy but 6 per cent.

Iron and Steel Going Down

Iron and steel prices have tended steadily downward during the past month, without stimulating buying. The market situation has been complicated by the action of the United States Steel Corporation in maintaining its prices unchanged since March, 1919. Independent mills have been making such price concessions as have been necessary to hold their own trade. In general, the markets have been drifting, awaiting developments. Because of their lower prices the independent mills have been getting most of the new business and in some cases their operations have improved, while the steel corporation's operations have been steadily declining. Its unfilled orders declined 639,297 tons in Febr ary, to a total of 6,933,867 tons, whi compares with 11,118,468 tons Augu 1. The corporation blew out seven blast furnaces in February and steel works operations have declined 50 to 60 per cent. Steel ingot produ tion for the entire industry declin about 20 per cent in February from t January figures, being 1,749,477 to as against 2,203,186 tons. Pig ir output in February was 1,927,088 to the smallest of any month since F ruary, 1915, with the exception October, 1919, when many furna were banked because of the steel stri Costs have been receiving increased tention in the industry, as prices n are around the costs of independ mills. The freight rate increases recent years, higher wages, and creased costs of raw materials h more than doubled iron and steel co A move to reduce these costs throu lower wages has been made by in pendent interests, but not by the st corporation. Another move towa lower costs awaits revision of l shipping rates which would perm lower lake iron ore prices. A tender toward lower fuel costs is indicated a wage reduction of 18 per cent post by one independent coke operator the Connellsville coke field.

Italy's Trade Balance Growing as Conditions Improve—America Meets German Competition

The following is an abstract from the statement issued by the Italian Discount and Trust Co. of New York, giving a brief résumé of conditions in the Latin country as recently surveyed.

An encouraging improvement in Italy's foreign trade position is evident from the figures recently made public by the Italian Ambassador at Washington. From Jan. 1 to Nov. 30, 1920, imports to Italy were valued at 14,273,000,000 lire—a decrease of 688,000,000 lire as compared with the corresponding period in 1919; and exports from Italy were valued at 6,950,000,000, which represents an increase over the first eleven months of 1919 of 1,017,000,000 lire.

The kingdom's trade balance with the United States likewise is steadily getting better. For the twelve months ended Dec. 31, 1920, Italy exported to the United States merchandise valued at 75,357,579 lire, as compared with 59,060,065 lire in 1919; and during 1920, Italy's imports from the United States were valued at 371,767,274 lire as against 442,676,842 lire in 1919—a decrease of nearly 71,000,000 lire.

Germany is actively competing with American manufacturers in the Italian agricultural machinery markets. American prices, under present conditions, are prohibitive. With the rise in dol exchange, German makers have recen been able to reduce their prices m below those at which deliveries can made from the United States. As example of their thoroughness, a G man manufacturer has distributed Italy a 600-page catalog, covering sp parts for American agricultural m chines. The catalog is entirely Itali lists all the parts of the princi machines, gives prices, and makes easy for the Italians to purchase Germany, rather than in the Uni States.

The recent increase in Italian dut has raised American prices on fa tractors to the point where an Ital farmer can buy two tractors of local make for the price of American machine of a popular mo Unless there is a radical improvem in the exchange situation, the outl for the sale of American farm mach ery is not favorable.

Automobile tire chains are needed Naples where 5,000 motor cars are use. The chains now most in use th are said to be inferior in quality those of American manufacture.

There also is a good market in It for spark plugs but the competition very keen.

U. S. C. of C. Offers Check for Cancellation Evil

Cancellation of contracts is one of the contributory causes for the present slump in business, according to a statement issued today by the Fabricated Production Department of the Chamber of Commerce of the United States. This conclusion was reached by the department after a six months' study of the cancellation evil.

The influence of early repudiation of orders, it is pointed out, spread rapidly and brought about a creeping paralysis of industry. In a number of lines, partly because of cancellations, plants were reduced from overtime production schedule to three days a week and in some instances to a complete shut-down. Legal remedies have been of little avail, for the ailment has shaken confidence, which must be restored before better times can be looked for, according to the department.

The investigation of cancellations showed that there were plenty of cancellations mutually arranged which were beneficial to both parties, but there were many others which worked a hardship on either the buyer or seller. Of the latter type the number of sellers who violated their contracts was about equal to the number of buyers who cancelled orders. The investigation also disclosed that a large number of business men took losses rather than repudiate contracts which they made in better times.

In an effort to restore confidence and avoid future misunderstandings these proposals are put forth by the department:

Draw contracts in conformity with the law of the state in which they are completed or accepted—making the obligations of both the seller and buyer equitable.

Provide in them for arbitration in case of dispute either under the State law, rules of trade organizations, or other adequate agency.

Incorporate questions in your credit inquiries, the answer to which will establish the applicants' cancellation record.

Consider it a duty and a privilege in protection to American business standards to report on inquiry those who unjustly and habitually disregard their contract obligations.

Establish an Honor Roll of those who have dealt with you for a term of years according to contract or terms—and let them know why.

Where transactions cannot be covered by written agreements find means for putting a premium on good faith and insist on your employees living up to it also.

Stand for "Golden Rule" policy throughout your business, taking loss if necessary to demonstrate you mean it.

Without preaching, keep before your employees and your trade continuously the value of good will built on kept promises.

Industrial Cost Association Effects Re-organization

The New York Section of the Industrial Cost Association held a meeting Thursday evening, March 24, at which a re-organization of the association was effected and plans formulated for attaining the best results from the organization. The Industrial Cost Association is a national organization with sections in all the larger cities and is growing rapidly. The purpose of the association is to standardize cost and accounting terminology, educate the members as to what the various elements are that enter into costs, and to simplify cost accounting.

Peru Offers Market for Farm Machinery

Modern methods of agriculture have come into use in Peru because of the world-wide demand for food during the war and subsequently. The Peruvian farmer is introducing labor and time-saving machinery in his hacienda. The varied climate conditions in Peru make it possible to produce every kind of agricultural product, and the output of the plantations could be doubled by the use of tractors and other agricultural machinery.

An opportunity for American manufacturers to exploit the Peruvian market for machinery is offered in the Peruvian Centennial Exposition in Lima, beginning July 28. The government has agreed to admit free of customs duty all machinery and products which are displayed in the exposition.

The Government has granted a concession to Dr. Rosendo Badani for the use of certain prominent buildings in Lima, in which to display products and machinery of American manufacture. Humberto Arias, at No. 44 Whitehall St., is the United States representative of the concessionaire.

Export of American Automobiles Almost Doubled in 1920

Exports of commercial automobiles continue to mount. Figures just made public by the Bureau of Foreign and Domestic Commerce show that 29,126 commercial automobiles were exported in 1920. Their value was $46,765,781. This compares with 15,585 commercial cars in 1919 and 10,308 commercial cars in 1918.

Due to the disposition made of war surpluses, France, who was our best customer in 1919, bought few cars in 1920. In 1919 France purchased 3.521 commercial cars in the United States, but took only 135 in 1920. On the other hand, the United Kingdom was the destination of 5,202 cars exported in 1920 as compared with 907 cars in 1919. Canada occupied second place in the matter of purchases of American commercial automobiles. She took 2,149 cars in 1920 as compared with 1,858 in 1919. The British East Indies was a close contestant for second place as those islands took 2,128 cars in 1920.

Government Opens New Foreign Trade Office in Shanghai

The opening of a new office of the Bureau of Foreign and Domestic Commerce in Shanghai provides American foreign traders with another source of information, and supplies an additional medium through which Chinese buyers can be reached.

American manufacturers, merchants and business organizations are urged by the National Foreign Trade Council to place this Shanghai office on their mailing list for catalogs, journals, and other commercial publications. Shanghai is one of the most important and lively entreports in the Far East, and every effort is being made to build up a good American commercial library in the bureau's new office.

The Bureau of Foreign and Domestic Commerce is planning to provide in Shanghai files of information on Far Eastern trade, so that American business men, on landing in Shanghai, may have a place to go and get first hand, reliable information on conditions and possibilities in China, thereby saving great expense and unnecessary travel.

Communications should be addressed to the Bureau of Foreign and Domestic Commerce, Chinese-American Bank of Commerce Building, Shanghai, China.

Reports Increase in Tool Sales

The Chicago Pneumatic Tool Co., Chicago, Ill., reports for 1920 a net income after depreciation, taxes and charges, of $1,273,061, as compared with $657,051 in 1919.

Net sales, while suffering from the depression, first felt about the middle of the year, slightly exceeded those for the preceding year. While net earnings show a decrease from the previous year, the discrepancy is accounted for by the continued increase in the cost of manufacture, and the larger proportionate sales of the less profitable varieties of the company's product.

The company's capital stock was increased during the year to $13,000,000. The proceeds were used to refund the company's debt, and for improvements which are now complete.

H. A. Jackson, president of the company, says that earnings of subsidiary companies were materially reduced because of the unsatisfactory conditions of foreign exchange.

Bacharach Co. Established in New Home

In a new building which affords some 18,000 sq.ft. of floor space and all modern equipment, the Bacharach Industrial Instrument Co., has taken up its home at Homewood Station, Pittsburgh, Pa.

The company has added two more to its line of measuring instruments—the manometer and the engine indicator. Other Bacharach products are hydro-pressure recorders, hydro gas meters, flowmeters, orifices, indicators and tachometers. Catalogs on the new products are ready for distribution.

U. S. Chamber of Commerce on Business Reconstruction

Valuable information as to how merchants of the country are cutting down their expenses to meet the present slump in business is being received by the Domestic Distribution Department of the Chamber of Commerce of the United States. More than fifteen thousand letters of inquiry were sent out to wholesalers, jobbers, commission merchants and retailers asking them certain questions regarding their present overhead expenses and what they are doing to reduce them.

Already a multitude of replies have been received at the headquarters of the National Chamber and in almost every answer the merchant is reducing his operating expenses so that he can meet the pressure of the public for lower prices.

Workmen More Efficient

Most of the answers report that workmen are more efficient than they were this time last year, when there was plenty of work to be had. Some firms have eliminated pay for overtime, while others state that the salaries of their officers have been lowered from 25 to 50 per cent.

"We are weeding out the drones and keeping our efficient men" is a typical answer to the question, "Are you reducing the number of your employees?" In this connection one man told of cutting down his force 44 per cent and his production increased 25 per cent. Originally, he employed 25 men. When the first depression in busniess affected him, he cut down his force to twenty-two, and his output remained the same. He reduced his force a second time to 14 men, and his production went up 25 per cent. At the same time he reported a wage reduction of 30 per cent.

Some firms replied that they were not reducing wages of their old employees, but that they were hiring new men for less money. Others said they would not reduce wages until the cost of living dropped appreciably. "We are reducing the amount of our bonuses by 50 per cent, and we are cutting down our commissions on sales," is quite a common reply.

Makes Lower Prices Possible

This is the way in which one merchant explained the manner in which he handled his wage problem when the present business depression set in: "We called our men together and laid our cards on the table. We had nothing to withhold. We told them that we could not continue to do business with the present wage scale unless they became more efficient. By increasing their efficiency they made it possible for us to reduce our prices."

Everywhere the replies indicate that there is a tightening of credit, without any general reduction of volume. New accounts are being more closely scrutinized, and bills are reaching the hands of collectors a little sooner than when business was brisk.

The replies are about evenly divided on the question: "Have you reduced your advertising space?" A number of merchants report a reduction, while some say they are a bit more careful in their advertising. A surprisingly large number of merchants report they have increased their advertising appropriations. They point out that advertising is a means of sales promotion, which should be pushed at this time, especially.

These answers are being collected in digest form by the National Chamber for the purpose of disseminating this important information to business men.

Price Guarantees To Stand on Own Merits

The Federal Trade Commission has officially announced that it does not intend any blanket action against the practice of guaranteeing against price decline, but will consider each complaint upon the facts shown in the specific case.

The official announcement of the commission is in full, as follows:

"The commission received so many complaints about the practice of manufacturers in guranteeing commodities in the hands of wholesalers, against decline in price, that an extensive inquiry was made, resulting in expressions from more than three hundred fifty manufacturing and selling concerns including trade associations whose represented membership must be more than double the number of individual statements. From the scope of the inquiry and the number and variety of replies, the result shown must be taken to be fairly representative of the difference in business opinion on this subject.

"The Federal Trade Commission, therefore, will consider each case of complaint of this character upon the facts shown in the specific case, applying the legal tests thereto.

"This action involves neither approval nor disapproval of the economic soundness of the arguments advanced before the commission for and against this practice."

British Buy Old German Liners

Quite a number of British shipbuilding yards have been obliged to discharge a large percentage of their workmen. This is chiefly due to the fact that nearly all of the great steamship lines are canceling their orders for new vessels and this again is due to the steadily decreasing ocean freight rates. German ships are being sold in England at rates equal to those prevailing in war times. Thus, the former German steamer *Sofia*, of 6,050 tons register, was recently sold at the rate of £8 per ton. The German steamer *Elbe*, built in 1905, was sold at the rate of only £6 per ton. The former Hamburgh-American liner *Ninive*, built in London in 1911, of 7,160 tons, brought at the auction £8 per ton. These sales speak for themselves.

The Cost of Changing to the Metric System

The statement that the compulsor introduction of the metric system asid from other considerations, would b very costly is always a painful subje to those urging its adoption. The wave it aside as irrelevant.

To show however its seriousness ar importance we need only quote fro the report of the American Institu of Weights and Measures concernin statements made by men competent t judge this subject: F. C. Biggert, Jr president, United Engineering ar Foundry Co. writes: "Without attemp ing to make any exact estimate of th cost of these changes (to the metr system) we would put it at close $1,000,000. . . . From this you c see that the cost to the country large would be an enormous sum money and that the loss of effecti production would be corresponding great."

W. M. McFarland, manager Mari Department, Babcock & Wilcox C writes:

"While I was with the Westinghou Electric and Manufacturing Co., w made a careful estimate about fifte years ago, when the business of th company was much smaller than present, that the direct and immedia cost of the change to the company wou be between $500,000 and $750,000 wit out allowing for the loss due to inco venience and reduced efficiency duri the period of change."

C. V. Morse, president and gener manager, Dependable Truck and Tra tor Co., writes:

"The writer had occasion to make change in the system of measuremen while connected with the American L comotive Co. at Providence, R. I., whi manufactured the Alco Pleasure c and truck. . . . They took over t Bleroit, a French product, using t metric system, and incorporated san in their own pleasure cars and truc but finally decided to change from t metric to English system . . t tools, jigs, fixtures for this alterati cost approximately $90,000."

The Cleveland Report

The Cleveland Chamber of Commer in its report against the adoption the metric system, approved by i Board of Directors, June 16, 1920, giv an elaborate and detailed estimate the cost of such a change as appli to a prominent Cleveland manufactu ing concern.

From this report we quote the follo ing figures:

Expenditures incurred BUT ONCE:	
1. In Engineering Department	$ 16,0
2. In Factory Office equipment	4,3
3. In Production Department	218,2
4 In Sales and General Office	142,0
	$380,5
Expenditures incurred ANNUALLY due to the persistence of the use of old standards and the carrying in stock of old and new dimensioned pieces	93,0
Total expenditures	$473,5

Business Items

At a recent meeting of the Frick Co., Inc., Waynesboro, Pa., the following officers were elected: President, A. O. Frick; vice-president and general manager, Ezra Frick; secretary, W. R. Snively; assistant secretary, G. H. Kuhn; treasurer, G. Norris Benedict; assistant treasurer, D. B. Snively. To finance the erection of plant extensions and purchase of equipment, this company recently increased its capital stock from $2,000,000 to $5,000,000. No definite plans have been made for the extensions, but one of the first projects to be undertaken will be the construction of a new iron foundry, and the purchase of equipment.

The Baechtel Co., Inc., First National Bank Building, Hagerstown, Md., has been incorporated with $200,000 capital stock by W. Murray, Myrtle I. and Charles W. Baechtel, Jr. The company will manufacture and deal in machinery, tools, equipment, etc. At the present time plans for the establishment of a plant are indefinite.

It is reported that the Western Reserve Motor Co., Warren, Ohio, is now building a model car and that it proposes to erect a monitor type building 80 x 400 ft. on a plot of 5½ acres at Leavittsburg, a suburb of Warren. No factory construction is contemplated before the middle of summer.

The following men constitute the board of directors of this company: R. K. Johnson, S. T. Balltrip, K. B. Lyder, L. C. Heckel F. D. Templeton, Frank Bernard and A. E. Szczytkowski; and from the above board the following officers have been elected, R. K. Johnson, president; S. T. Balltrip, first vice-president; K. B. Lyder, second vice-president; L. C. Heckel, secretary and treasurer.

The Baron de Hirsch Trade School, 222 East Sixty-Fourth St., New York, recently gave an exhibition of work of its fifty-first class. All instruction is free. The courses are five and a half months long and provide day classes only.

The announcement is made by Peter A. Frasse & Co., Inc., New York, that the machine-tool department of Patterson, Gottfried & Hunter, of New York, and the various machine-tool agencies held by that company, have been taken over entirely and are now combined with the machine-tool department of Peter A. Frasse & Co., Inc. Charles O. Dowding, who for the last eight years has been connected with Patterson, Gottfried & Hunter, as manager of the machine-tool department, has accepted a position in a similar capacity with Peter A. Frasse & Co., Inc., and brings with him his staff of machine-tool salesmen.

The Garrison Co. of Bridgeport, Conn., machinery and tool manufacturing engineers, has recently filed a certificate for an increase in the capital stock of the company from $50,000 to $150,000.

At the annual meeting of Churchill-Morgan-Crittsinger, Inc., Worcester, Mass., maker of grinding machinery, etc., held at the company's offices on March 11, the following officers were elected for the ensuing year: President, Ralph L. Morgan; treasurer, Lewis M. Crittsinger; secretary, Clyde L. Newell; counsel, George R. Stobbs; directors, Ralph L. Morgan, Lewis M. Crittsinger, George R. Stobbs, Charles E. Hildreth and Walter C. Rice.

The Laminated Products Co., 2210 Dana Ave., Cincinnati, Ohio, has recently organized with a capital of $500,000. The following officers were elected at a meeting held Saturday, March 29: President, Edward C. Kline; vice-president, George B. Richard; treasurer, D. L. Kline; secretary, L. A. Kahn. The company will manufacture safe vaults and safety deposit boxes, and automobile parts of sheet iron. Machinery is now being installed.

The E. Horton & Son Co., Windsor Locks, Conn., maker of Horton chucks, has taken over the equipment, tools, jigs, etc., of the American Machine Co., Hartford, Conn., maker of the Ellison chuck. The Ellison chuck will be manufactured at Windsor Locks, but the name Ellison will be dropped. This acquisition by the Horton Co. enables it to add to its line a geared screw chuck, and assists it in its stated aim to be able to supply the proper chuck for any purpose.

At the annual meeting of stockholders of the Lang Body Co., Cleveland, Ohio, Charles E. J. Lang was elected president and treasurer; E. J. Lang, vice-president and general manager; Robert J. Dawson, secretary. J. C. Hipp, president of the Pennsylvania Rubber Supply Co.; E. J. Heinsohn, president and general manager of the U. S. Copper Products Co.; E. A. Noll, president of the National Tool Co.; E. E. Quirk, president and general manager of the Amazon Tire and Rubber Co., and S. W. Whitmore, president of the Whitmore Manufacturing Co., comprise the directorate. Despite reverses in business generally the Lang Body Corporation made a commendable showing in 1920 the annual report shows.

The Utica Drop Forge and Tool Co., Utica, N. Y., has received and is now working on large orders from Suyehiro-Shosha No. 9, Rokuchome, Osaka, Japan, and Murakami & Co., Osaka, Japan; also on several Australian orders.

The United States Sheet Metal Works, Inc., Wilmington, Del., has been incorporated with a capital of $50,000 by George L. Townsend, Jr., 500 Ford Building, Edmund P. Moody and D. L. Broughton, to manufacture metal goods.

Personals

E. L. Beisel, formerly Chicago manager of the Gardiner Machine Co., has resigned to open an office at 15 South Clinton St., Chicago, Ill., where he will handle grey iron and malleable castings, and drop forgings.

George E. Merryweather, president of the Motch & Merryweather Machinery Co., Rochester, N. Y., has recently become a member of the board of directors of the Davenport Machine Tool Co., Inc., Rochester, N. Y.

Hon. Martin Behrman has just been elected vice-president of Stern's Foundry and Machine Co., of New Orleans, La., with which he will be now identified. The plant is located at Annunciation and Market Sts., New Orleans.

Robert Campbell, of Gadsden, Ala., prominent in the foundry and machine-shop industry in the Southeast, returned recently from Scotland where he has spent the past two years constructing two large soil pipe plants at Berwick - on - Tweed. Mr. Campbell is now purchasing machinery and equipment in the Gadsden and Birmingham district for other plants he is to construct under the American model for a number of British concerns. One or more of these is to be constructed in the colonies.

H. W. Maxham has recently taken charge of the maintenance department of the Amesbury, Mass., plant of Gray & Davis, Inc. Mr. Maxham, was formerly connected with the American Bosch Co., at Springfield, Mass.

Harry Hamlin, T. E. Hamlin and G. I. Hamlin, all of Indianapolis, Ind., have organized the Twentieth Century Manufacturing Co., for the purpose of manufacturing mechanical and electrical devices. The company has a capital stock of $100,000.

Arthur M. Fraser, formerly connected with the Warren F. Fraser Co., of Westboro, Mass., manufacturer of grinders, etc., has recently taken a position as salesman for the Federal Machinery Sales Co., of Chicago, Ill.

Warren G. Hannum, formerly with the Gisholt Machine Co., has been appointed general manager of the W. K. Millholland Machine Co., Indianapolis, Ind., manufacturer of screw machines and turret lathes.

M. C. Summers, late of the sales department of the Canton Sheet Steel Co., Canton, Ohio, has been appointed head sales manager of the Superior Sheet Steel Co. He was formerly with the De-Forrest Sheet and Tin Plate Co.

E. B. Burritt has resigned as secretary and treasurer of the American Electric Railway Association. J. W. Welsh has been appointed to fill the position temporarily, pending further action by the executive committee.

New Publications

1920 Year Book of the National Association of Cost Accountants. One hundred seventy-four 6 x 9-in. pages. Published by the Association, 2546-2548 Broadway, New York City.

This book should prove of real value to all men interested in cost work. In addition to the reports of the various officers and committees and a list of members of the association, it contains a complete report of all the papers delivered at the annual convention at Atlantic City, together with the discussions which followed each of these papers. It includes papers on Uniform Cost Accounting from the Standpoint of the Trade Associations; "The Relation of Cost Accounting to Business Management" from the standpoint of the professional accountant and from the standpoint of the business executive; "Some Special Aspects of the Problem of Overhead Distribution and Application"; "Under What Conditions Should Schedule Costs Be Used and How Should They Be Proved?" and "Some Questions in the Determination of Lumber Costs." The Year Book is distributed to all members of the association and may be secured by others interested in cost questions.

Foundry Molding Machines and Pattern Equipment. By Edwin S. Carman. Second Edition. Two hundred twenty 6 x 9-in. pages; 220 reproductions from photographs and line drawings.

An excellent treatise on the methods of mounting patterns and making molds by machine power, which explains the different types of molding machines and the pattern and flask equipment necessary for their use. The book is intended for colleges, institutes and technical and trade schools as well as for manufacturers. Chapter I, dealing with general molding principles, has been added in the second edition with the view of supplying data on which to base courses of study. Illustrations are particularly well chosen and executed. Chapter headings are: General Molding Principles; The Theory of Jolt Ramming; Roll-Over Jolt Molding Machines; Roll-Over Jolt Molding Machines for large Size Molds; Roll-Over Jolt Machine for Medium Size Molds; Roll-Over Jolt Machines for Small Size Molds; Jolt Molding Machines in Brass and Aluminum Foundries; Plain Jolt Molding Machines; Air Operated Squeezer Machines; Jolt Stripper Molding Machines; Pattern Equipment; Flask Equipment; Machine Molded Cores; Foundations for Jolt Ramming Molding Machines.

Export Packing. By C. C. Martin, with chapters by D. T. Abercrombie, formerly Lt. Col. Quartermaster Corps, U. S. Army; H. N. Knowlton, formerly Captain, Ordnance Department, U. S. Army; M. C. Fitzgerald, Manager of Transportation, General Electric Co. Seven hundred ten 6 x 9-in. pages; 350 reproductions from photographs with many diagrams and line drawings. Published by the American Exporter, the Johnston Export Publishing Co., Penn Terminal Bldg., 370 Seventh Ave., New York City.

A practical treatise on the methods of preparing and packing goods for export shipment, including details of dimensions and construction. Of especial interest are the chapters on packing machinery, selecting wood, marking, bracing and nailing, making cases watertight, customs regulations and packing. Other chapters are devoted to the packing methods employed in shipping all classes of goods over-seas. Automobiles, textiles, shoes, hardware and tools, glass and fragile goods, furniture and office supplies, bulky cargo and miscellaneous commodities are treated. Photographs showing successful and proved methods of packing have been furnished by many important and experienced exporting manufacturers in the country and are reproduced in this volume. A chapter deals with climatic and port conditions as affecting packing and covers such questions as packing for tropical climates, for interior transportation by mule back and for special conditions which apply to various ports throughout the world. Chapters are devoted to the principles underlying the use of each type of container, such as cases, crates, bales, barrels, bundles, cartons, tins, etc. The contents are well arranged for reference.

Elements of Mechanism. By Peter Schwamb, professor of machine design (retired) Massachusetts Institute of Technology; Allyne L. Merrill, professor of mechanism, Massachusetts Institute of Technology and Walter H. James, assistant professor of mechanical engineering drawing, Massachusetts Institute of Technology; third edition rewritten and enlarged; three hundred sixty-six 6 x 9-in. pages, 427 line drawings, 152 problems. Published by John Wiley & Sons, Inc. New York City.

The third edition embodied many changes suggested by instructors who have used the second edition. The main subject matter was written during 1885, by Peter Schwamb, and has been used since then at the Massachusetts Institute of Technology as a basis for instruction in mechanics. The authors make very little claim for originality of the subject matter, basing their claim for consideration chiefly on the manner of presentation, which is clear and systematic. They follow a sequence that leads from the definitions of the terms connected with mechanism through the simpler to the more complex mechanisms. Some of the chapter headings are: Revolving and Oscillating Bodies; Belt, Ropes and Chains; Gears and Gear Teeth; Wheels in Trains; Four-Bar Linkage, Relative Velocities of Rigidly Connected Points; Straight-Line Mechanisms, Aggregate Mechanisms, Aggregate Combinations, Pulley Blocks, Intermittent Motion.

Cams, Elementary and Advanced. By Franklin DeR. Furman, Professor of Mechanics and Machine Design, Stevens Institute of Technology. John Wiley & Sons, Inc., New York and Chapman & Hall, London. 229 pp., 182 illustrations.

This book contains much new and original matter on cams of all types together with rules for their design. The design of cams is a subject on which there is but little authoritative literature and is one that is thoroughly understood by comparatively few engineers.

One of the stumbling blocks in the design of cams has been the lack of knowledge of how small a given cam can be made and yet keep the angle of pressure within the limits of smooth running at a given speed. This matter has been taken up by the author and thoroughly explained. The material given also includes the comparisons of the characteristic results obtained from all base curves in which the relative size of each cam, and the relative velocity and acceleration produced by each is shown graphically in one combined group of illustrations. This enables the designer to glance over the entire field of theoretical cam design and quickly select the type that is best adapted for the work in hand.

While the book is primarily intended for use as a text book for students in mechanical engineering, it will be found most valuable to engineers and others who have to do with the design of machinery in which cams are used. With the increasing use of automatic machines, cams are coming into more extended service and it is getting to be more of a necessity that designers should have a fuller understanding of their principles. Prof. Furman is to be congratulated on having written a book in which the principles of cam design have been made so thoroughly clear.

Fire Tests of Building Columns. By the Associated Factory Mutual Fire Insurance Companies, The National Board of Fire Underwriters and the Bureau of Standards, Department of Commerce. 389 pp., 171 illustrations, 40 tables.

An experimental investigation of the resistance of columns loaded and exposed to fire or fire and water together with a record of characteristic effects, jointly conducted at the Underwriter's Laboratories, Chicago, Ill. The book contains an enormous amount of data that could only have been compiled after a series of thorough and exhaustive experiments. It is of exceptional value to architects and builders and should be studied by everyone responsible for the construction of fire resisting buildings.

Practical Locomotive Running and Management. By W. G. Knight, published by the author at Medford, Mass. 519 pp., 169 illustrations.

Commencing with a chapter defining the constituents of coal and water; heat units, horsepower, etc., the book branches out to instructions on firing and running. Considerable space is given to the description and use of auxilliary equipment, such as injectors, lubricators, steam gages, safety valves, air pumps and brakes. The different kinds of valve gears are explained and instructions given for setting them. Simple formulas are given for calculating tractive power, steam temperatures, strength of boilers, etc.

Export Opportunities

The Bureau of Foreign and Domes Commerce, Department of Commer Washington, D. C., has inquiries for t agencies of machinery and machine too Any information desired regarding th opportunities can be secured from the abo address by referring to the number follo ing each item.

The representative of a firm in Denma is in the United States and desires to s cure agencies from manufacturers for t sale of valves, separators, traps, injecto gages, meters, recorders, stokers, grat oil burners, lubricators, filters, evaporato feed-water heaters, air washers, pumps, e and other steam specialties and contracto equipment, such as shovels, dredges, hois cranes, excavators, hoisting engines, c crete mixers, air drills, carriers, and e vators. No. 34563.

An importing firm in Spain desires purchase and secure an agency for the s of industrial machinery of all classes, r chine tools, oils, greases, etc., nitrates, che icals, automobiles and trucks. Quotatic should be given c. i. f. Spanish po Correspondence should be in French Spanish. No. 34556.

A manufacturing company in Norw desires to secure an agency and purch industrial transportation machinery, che ical plant equipment, structural steel a boiler supplies. Quotations should be gi f. o. b. New York, Philadelphia, or Bost Terms: Payment in New York against d uments. No. 34558.

The Langelier Manufacturing Co., Arli ton, Cranston, R. I., would be pleased to s cure catalogs, circulars or other informati from manufacturers of wire bending a forming machines.

Forthcoming Meetings

The National Metal Trades Associati will hold its annual convention at the Ho Astor, New York, on April 18, 19, 20. Homer D. Sayre, Peoples Gas Buildi Chicago, Ill., is secretary.

The fifth annual convention of the Ame can Gear Manufacturers Association w be held in Cincinnati, Ohio, April 27, 28, and 30.

The ninth annual meeting of the Chamb of Commerce of the United States w be held at Atlantic City, April 27 to with headquarters at the Traymore Ho

The annual meeting of the Americ Welding Society will be held in the En neering Societies Building, 29 West 3 St., New York, on April 28.

The Society of Industrial Engineers w hold its national convention in Milwauk Wis., on April 27, 28 and 29. Geo. C. De 327 So. La Salle St., is business manag

The National Foreign Trade Council w hold its eighth annual convention in Cle land, Ohio, on May 4, 5, 6 and 7. J Hammond, care of the Council, 409 P Bldg., Cleveland, is secretary.

A triple convention of the National S ply and Machinery Dealers' Associati the Southern Supply and Machinery De ers' Association and the American Sup and Machinery Manufacturers' Associat will be held in Atlantic City, N. J., May 17 and 18, 1921, with headquarters for three associations at the Marlborough-Bl heim. F. D. Mitchell, 4106 Woolwo Building, New York, is secretary of t last-named association.

The spring meeting of the American So ety of Mechanical Engineers will be h at the Congress Hotel, Chicago, May 23- Calvin W. Rice, Engineering Societies Bl 29 West 39th St., New York, is secretary

The Society of Automotive Engineers, West 39th St., New York announces that summer meeting will be held at W Baden, Ind., on May 24 to 28 inclusive.

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Mass., Boston—E. Kreevoy, 56 Poplar St., anufacturer of sheet metal products—eet metal tool machines. (State make.)

Mass., Roxbury (Boston P. O.) — The land Laundry Machinery Co., 47 Kemble , G. E. Carr, Purch. Agt.—used gear tting machines that will cut gear 48 in. diameter.

Mass., South Boston (Boston P. O.)—E. Knott Machinery Co., 1 Ellery St., manacturer of confectionery machinery, E. R. nott, Purch. Agt.—good shaper.

Conn., Burnside — The Taylor-Atkins aper Co.—a Tatum multiple spindle drill.

Md., Baltimore—The Supt. of Lighthouses ill receive bids until April 14 for a 3 step ne double back geared engine lathe, for azaretto Lighthouse Depot.

Md., Govans (Baltimore P. O.) — The illiamson Products Co., Box No. 3, J. S. illiamson, Purch Agt.—worm gears, 30 to reduction, ½ in. face, ⅛ in. bore; sprock-s, ⅛ in. face, 8, 9, 12 and 16 teeth, ⅛ . bore, with steel chain to match; flexible ass wire conveyor, ½ in. mesh; brass ball arings; sheet metal presses, punches and rming machinery.

N. J., Camden—The Bd. Educ., City Hall -$50,000 worth of manual training ma-inery for machine, forge and wood shops high school.

N. Y., Buffalo — Sheet Metal Wks., 799 orthampton St., J. Sanders, owner—ma-inery, rolls, presses, punches, etc.

N. C., Greensboro—The Caroline Steel & on Co., Jackson St., J. W. McClennan, cy.-Treas.—20 or 22 in. shaper and a the with 20 to 22 in. swing and 10 to 12 bed, (used and in good condition).

Tenn., Knoxville—J. G. Duncan Co., 101 ast Jackson St., manufacturer of ma-inery, J. G. Duncan, Purch. Agt.—24 or in. circular resawing machine, 42 in. nd resawing machine and 7½ x 10 double ylinder, double drum hoisting engine, undy make preferred, or something about at size, with or without boiler.

Va., Richmond—The Advance Realty Co., overnor and Ross Sts., J. G. Worsham, res.—complete mechanical outfit for large arage.

Va., Richmond—The Elsop Motor Corp., ine and Broad Sts.—lathe, drill press and nery wheel.

Va., Richmond—The Hines Motor Co., 711 West Broad St. — auto cylinder grinder, iston grinder and lathe.

Va., Richmond—L. R. Kelly Auto Service tation, 215 East Broad St., L. R. Kelly, urch. Agt.—lathe and drill press.

W. Va., Ellenboro — E. J. White, manu-acturer of rubber products, etc.—upright rills, power saw, universal millers, surface rinder, shapers, lathes, bench lathe, elec-ric grinding attachment for lathes, screw press, 2 rubber grinders or mills, buffing machines, tables with steam jackets and tables with water jackets, etc.

Mich., Detroit — The Building Service Bureau, 1336 Brush St.—small equipment for proposed service station.

O., Cincinnati—The Buckeye Boiler Repair & Welding Co., 447 East 2d St., C. Dorma, Purch. Agt.—52 in. rolls for sheets of 10 gauge.

O., Cleveland—The Cleveland Armature Wks. Co., 4732 St. Clair Ave.—universal grinder (used) and wood band saw.

Wis., Janesville—The Globe Sheet Metal Wks., 212 Wall St.—sheet metal working machinery.

Wis., Okauchee—W. Schrodenbach—drill press for automobile repair dept.

Wis., Schleisingerville—The Wickert Sheet Metal Wks., A. Wickert, Purch. Agt.—drill press and other machinery for repairing auto radiators.

Tex., Houston—The Kreitler Machine Co., 205 San Jacinto St.—one 20 in. short bed heavy duty lathe for turning automobile fly wheels.

Machinery Wanted

Mass., Meford—The Toppan Boat Co., 125 Riverside Ave., A Piggott, Purch. Agt.—small single surface panel planer.

Mass., Russell—H. T. Boynton, coal and grain dealer—one 18 in. 20 or 24 in .planer, (used), one 12 in. edge planer and one buck-saw with cut-off and rip gages.

Fla., Tallahassee—The Tallahassee Lumber Co.—machinery and other equipment for sawmill, planing mill, etc.

Wis., Beaver Dam—The Bell Mfg. Co., c/o C. S. Knapp, 200 Burnett St.—woodworking machinery for novelty factory.

Wis., Ft. Atkinson—The Creamery Package Mfg. Co., manufacturer of creamery equipment, H. Curtis, Purch. Agt.—traveling crane.

Wis., Milwaukee—H. E. Jewett, 1304 9th St. — one portable saw for woodworking plant.

Wis., Milwaukee—E. C. Uihlein, Station C, manufacturer of food products—one 20 in. diameter, 8 ft centers roller grinder, the rolls to be supported in bearings while being ground. Rolls to be used in sugar machinery.

Wis., Wauwatosa—The Modern Builders, Inc., 60th and Vliet Sts., W. Wagner, Purch. Agt.—additional wood-working machinery.

Mo., Joplin—The Joplin Steel & Malleable Co., W. S. Sohosky, Pres.—one 5 ton 3 motor 500 volts d.c. overhead traveling crane, 32 ft. 10 in. span only.

Tex., San Antonio — The Gebhardt Chili Powder Co.—refrigerating machinery, also modern machinery for process room and kitchen, etc.

Que., St. Anne de Bellvue—The Industrial and Educational Publishing Co.—paper machine for making trimmed sheets, 78 in. wide, 25 tons daily capacity.

Metal Working

NEW ENGLAND STATES

Conn., New Haven—N. E. Skinner, 194 Beacon Ave., has awarded the contract for the construction of a 1 story, 48 x 104 ft. garage on Townsend Ave. Estimated cost, $20,000.

Me., Auburn—The Darling Auto Co., 15 Turner St., is receiving bids for the construction of a 2 story, 80 x 100 ft. garage and service station on Franklin St. Estimated cost, $50,000. H. S. Coombs, 11 Lisbon St., Lewiston, archt.

Me., Bar Harbor—The Bureau of Yards & Docks, Navy Dept., Wash., D. C., has awarded the contract for remodeling the guardhouse and building a garage and repair shop, at Otter Cliffs, here. Estimated cost, $12,300.

Mass., Brockton—A. Oppenheim, c/o Tuck & Gilman, archts., 34 School St., Boston, will soon award the contract for the construction of a 1 story garage. Estimated cost, $30,000.

Mass., Waltham—The O'Hara-Waltham Dial Co. Inc., Rumford Ave., has awarded the contract for the construction of a 1 story, 50 x 60 ft. addition to its plant. Estimated cost, $15,000.

Mass., Worcester—The Worcester Buick Co., 803 Main St., will soon award the contract for the construction of a 1 story, 150 x 315 ft. sales and service station on Shrewsbury St. Estimated cost, $250,000. A. H. Bowditch, 44 Bromfield St., Boston, archt.

R. I., Pawtucket—G. V. Morin, Broad and Barton Sts., plans to build a 2 story, 38 x 61 ft. garage and repair station. Estimated cost, $25,000. Private plans.

R. I., Pawtucket—E. Pigeon, River St., plans to build a 1 story, 50 x 150 ft. garage. Private plans.

R. I., Pawtucket — The Pleasant View Realty Co., 400 Bway., plans to build a 1 story, 40 x 150 ft. addition to its garage, on Bway and Lupine St. Estimated cost, $30,000. Private plans.

R. I., Providence—P. O'Reilly, 92 Olney St., will build a 1 story garage to cover about 10,000 sq.ft. of floor space. Estimated cost, $45,000.

MIDDLE ATLANTIC STATES

Md., Baltimore—Dukehart-Denise Co., 641 Light St., has awarded the contract for the construction of a 1 story, 40 x 82 ft. machine shop on Race and McCormick Sts. Estimated cost, $12,000.

N. J., Florence—The Florence Pipe Fdry. & Machine Co. is having plans prepared for the construction of a 1 story, 60 x 200 ft. machine shop. Estimated cost, $35,000. C. D. Green, Florence, archt. and engr.

N. Y., Buffalo—J. Sanders, 799 Northampton St., plans to build a 1 story, 80 x 125 ft. sheet metal works at 115-117 Lathrope St.

THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$30.50
Northern Basic	27.52
Southern Ohio No. 2	30.50
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	36.51
BIRMINGHAM	
No. 2 Foundry	26.50
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75 sil.	27.00
Virginia No. 2	*28.00
Basic	†26.25
Grey Forge	*27.00
CHICAGO	
No. 2 Foundry local	26.00
No. 2 Foundry, Southern, sil 2.25@2.75	33.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26.96
Basic	26.86
Bessemer	27.00

*F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse	New York Delivered	Cleveland	Chicago
Structural shapes	$3.58	$3.68	$3.58	$3.58
Soft steel bars	3.48	3.88	3.34	3.48
Soft steel bar shape	3.48	3.58	3.48	3.48
Soft steel bands	4.18	4.28	6.25	....
Tank plates	3.78	4.78	3.78	3.78

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.25@$2.35
Warehouse, New York	3.48
Warehouse, Cleveland	3.52
Warehouse, Chicago	4.12

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.20@3.55	4.50	4.00	4.8
No. 12	3.25@3.60	4.55	4.05	4.73
No. 14	3.30@3.65	4.60	4.10	4.78
No. 16	3.40@3.75	4.70	4.20	4.88
Black				
Nos. 17 and 21	3.75@4.15	4.80	4.70	5.55
Nos. 22 and 24	3.85@4.20	4.85	4.85	5.60
No. 25 and 26	3.90@4.25	4.90	4.90	5.65
No. 28	4.00@4.35	5.00	5.00	5.75
Galvanized				
No. 10 and 11	4.25@4.70	5.05	5.00	6.10
No. 12 to 14	4.35@4.80	5.15	5.10	6.20
Nos. 17 and 21	4.65@5.15	5.45	5.40	6.50
Nos. 22 and 24	4.80@5.25	5.60	5.55	6.65
No. 26	4.95@5.40	5.75	5.70	6.80
No. 28	5.25@5.70	6.00	6.00	7.10

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$5.50	$5.25	$4.84
Flats, squares and hexagons, per 100 lb.	6.00	5.75	5.34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	50%
Cleveland	50%
Chicago	50%

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	
Ingots	38	Cold rolled rods (base)	
Sheet bars	40	Hot rolled sheets (base)	

Special Nickel and Alloys	
Malleable nickel ingots	
Malleable nickel sheet bars	
Hot rolled rods, Grades "A" and "C" (base	
Cold drawn rods, Grade "A" and "C" (base)	
Copper nickel ingots	
Hot rolled copper nickel rods (base)	
Manganese nickel hot rolled (base) rods, "D"—low manganese	
Manganese nickel hot rolled (base) rods "D"—high manganese	

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o. New York: 3/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per l

MISCELLANEOUS STEEL—The following quotations in cents per pou are from warehouse at the places named:

	New York	Cleveland	Chica
Openhearth spring steel (heavy)	6.00	8.00	9.0
Spring steel (light)	8.00	7.00	12.0
Coppered Bessemer rods	8.50	8.00	7.0
Hoop steel	4.58	4.04	4.1
Cold rolled strip steel	9.00	8.25	9.2
Floor plates	5.75	4.00	6.0

WROUGHT PIPE—The following discounts are to jobbers for carload l on the Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Galvanized	Inches	Iron Black	Galvaniz
⅜ to 3	57½%	44%	⅛	15½–16½%	+10½–11
			¼	19½–20½%	1 2
			⅜ to 1½	24½–25½%	8 9

LAP WELD

2	50½%	38%	2	20½–21%	6½–7
2½ to 6	53½%	41%	2½ to 6	22½–23%	9½–10
7 to 12	50½%	37%	7 to 12	19½–20%	6½–7
13 to 14	41%	....			
15	38½%				

BUTT WELD, EXTRA STRONG PLAIN ENDS

¼ to 1½	55½%	43%	⅜ to 1½	24½–25½%	9½–10½
2 to 3	56½%	44%			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	48½%	37%	2	21½–22½%	8½
2½ to 4	51½%	40%	2½ to 4	23½–24%	11½ 1
4½ to 6	50½%	39%	4½ to 6	22½–23%	10½ 1
7 to 8	46½%	33%	7 to 8	14½–15%	2½
9 to 12	41½%	28%	9 to 12	9½–10%	2–2½

Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Ga
⅜ to 3 in. steel butt welded	44%	28%	42½%	33½%	57½%	44
2½ to 6 in. steel lap welded	39%	24%	44½%	29½%	53½%	41

Malleable fittings, Classes B and C, Banded, from New York stock sell plus 6%. Cast iron, standard sizes, 15% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13
Tin in 5-ton lots	29
Lead	4
Zinc	5

ST. LOUIS

Lead	4
Zinc	5

At the places named, the following prices in cents per pound prevail, for 1 t or more:

	New York	Cleveland	Chic
Copper sheets, base	20.25	20.00	19
Copper wire (carload lots)	15.00	17.50	16
Brass sheets	17.25	24.00	22
Brass pipe	21.00	22.00	19
Solder (half and half) (case lots)	19.00	20.50	17

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heav add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over in., 7½c.

BRASS RODS—The following quotations are in cents per pound at wa house:

New York	15
Cleveland	19
Chicago	19

SHOP MATERIALS & SUPPLIES

NC SHEETS—The following prices in cents per pound are f. o. b. mill + 8% for carload lots 11.50

	Warehouse	
	In Casks	Broken Lots
w York	12.50	13.50
eveland	13.70	14.30
icago	13.50	13.95

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for ot delivery, duty paid:

w York	6.00
icago	6.25
eveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per und:

	New York	Cleveland	Chicago
pper, heavy, and crucible	10.00	10.00	10.00
pper, heavy, and wire	9.00	9.50	9.00
pper, light, and bottoms	8.00	9.00	8.00
nd, heavy	3.25	4.00	3.50
nd, tea	2.00	3.00	3.00
ass, heavy	6.00	7.00	9.00
ass, light	4.50	5.00	5.00
. 1 yellow brass turnings	5.00	5.50	5.50
nc	3.00	3.00	3.10

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
o. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.1@28.2	24.50	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton s and over:

	Current
w York (round)	22.00
icago	20.00
eveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
st grade	70.00	46.00	35.00
mmercial	30.00	16.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the st two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following mount is deducted from list:

	New York	Cleveland	Chicago
ot pressed square	List	$1.00	+1.15
ot pressed hexagon	List	1.00	+1.15
old punches hexagon	List	1.00	+1.15
old punched square	List	1.00	+1.15

Semi-finished nuts, $\frac{7}{16}$ and smaller, sell at the following discounts from list price:

	Current
ew York	60%
hicago	70%
leveland	70%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
ll sizes up to 1 by 30 in	45%	60%	50%
and 1½ in. by 3 in. up to 12 in	25%	50%	45%

WASHERS—From warehouses at the places named the following amount is educted from list price:

For wrought-iron washers:
ew York..... $2.00 Cleveland..... $3.50 Chicago..... $2.50
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
ew York..... $4.50 Cleveland..... $4.00 Chicago..... $4.50

CARRIAGE BOLTS—From warehouses at the places named the following iscounts from list are in effect:

	New York	Cleveland	Chicago
by 6 in. and smaller	40%	50%	40%
arger and longer up to 1 in. by 30 in	40%	40%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
leveland	35%	10%
hicago	net	net
ew York	50%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅛ and smaller	45%	50%	45%
Tinned	45%	50%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$5.08 Cleveland...$5.00 Chicago....$5.08 Pittsburgh..$3.90

Boiler, same sizes:
New York...$5.30 Cleveland...$5.10 Chicago....$5.13 Pittsburgh..$4.00

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	29.00
Brass	21.00	24.00	28.00

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼-2 in., inclusive in rounds, and ½-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.50 per 100 lb. In Cleveland—$8.50 per 100 lb.; New York price is 8c.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	10.00@13.00	13.00	14.25
Colored mixed	7.00@11.50	10.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl.)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$4.50
Prompt foundry	5.50@6.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	0.85

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.73	$0.90	$0.82
5-gal. cans	.76*	1.15	1.07

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

N. Y., New York—(Borough of Bronx) M. Blossom, c/o A. Farber, archt. and engr., 1746 Pitkin Ave., Brooklyn, is having plans prepared for the construction of a 1 story, 100 x 115 ft. garage on Tinton Ave. and 151st St. Estimated cost, $65,000.

N. Y., New York—(Borough of Bronx) J. Buckley, 2233 Creston Ave., will build a 1 story, 50 x 125 ft. garage on Morris Ave. and 183d St. Estimated cost, $45,000.

N. Y., New York—(Borough of Bronx) A. Cuneo, 1565 Southern Blvd., will build a 1 story, 50 x 75 ft. garage on 173d St. and Southern Blvd. Estimated cost, $35,000.

N. Y., New York—(Borough of Bronx) The Keisler Realty Co., 1790 Marion Ave., will build a 1 story, 100 x 100 ft. garage on Southern Blvd. near Willis Ave. Estimated cost, $35,000.

N. Y. New York—(Borough of Bronx) M. Smolloroff, 1500 Boston Rd., is having plans prepared for the construction of a 1 story, 100 x 100 ft. garage on Barrett St. and Whitlock Ave. Estimated cost, $60,000. I. Margon, 355 East 149th St., archt. and engr.

N. Y., New York—(Borough of Manhattan) W. L. Byrnes, 446 East 134th St., will build a 2 story, 50 x 100 ft. garage at 447 East 133d St. Estimated cost, $30,000.

N. Y., New York (Borough of Manhattan) The 233 Spring St. Holding Co., c/o L. A. Sheinart, archt. and engr., 194 Bowery, is having plans prepared for the construction of a 2 story, 115 x 150 ft. garage. Estimated cost, $60,000.

N. Y., New York—(Borough of Manhattan) S. Wachatinsky, 308 East Bway., plans to build a 3 story, 148 x 250 ft. garage on Broome and Tompkins Sts. Estimated cost, $350,000. Architect not selected.

N. Y., New York—(Borough of Queens) The Schildwechter Auto Co., 2287 Park Ave., New York City, will build a 2 story, 100 x 120 ft. factory in Long Island City for the manufacture of automobile bodies.

Pa., Johnstown—The Galliker Ice Cream Co. has awarded the contract for the construction of a 2 story, 60 x 70 ft. garage and storage building. Estimated cost, $150,000. Noted March 24.

Pa., Pittsburgh—The West Co., 4017 Liberty Ave., has awarded the contract for the construction of a 2 story, 80 x 120 ft. garage on Liberty and Millvale Aves. Estimated cost, $60,000.

Pa., Williamsport — G. F. Meade and J. M. Goodrich, Ford agts., plan to build a 2 story, 72 x 160 ft. garage on 3d and Elmira Sts. Estimated cost, $150,000.

MIDDLE WEST STATES

Ill., Quincy—The Michleman Steel Constr. Co., 137 North 2d St., will soon award the contract for the construction of a 2 story, 100 x 140 ft. manufacturing plant. Estimated cost, $500,000. W. S. Gerdes, c/o owner, engr.

Ind., Jeffersonville—The Cleveland, Cincinnati, Chicago & St. Louis R.R., Big Four Bldg., Cincinnati, O., plans to build a 1 story round house and repair shops, here. Estimated cost, $60,000. Private plans.

Mich., Detroit — The Building Service Bureau, 1336 Brush St. (Owner and Archt.), is preparing plans for the construction of a 1 story 65 x 200 ft. service station on Adair and Leib Sts. Estimated cost, $40,000.

Mich., Detroit—The Michigan Stamping Co., 3171 Bellevue Ave., has awarded the contract for the construction of a 1 story, 60 x 480 ft. addition to its sheet metal plant.

O., Cleveland — M. Feader Garage, 4410 Denison Ave., has awarded the contract for the construction of a 2 story, 40 x 80 ft. garage. Estimated cost, $40,000.

O., Cleveland—The Sterns Conveyor Co., 6523 Euclid Ave., has awarded the contract for the construction of a 1 story, 50 x 150 ft. factory on Cut Rd. Estimated cost, $60,000. E. D. Sterns, pres.

Wis., Ft. Atkinson—The Creamery Package Mfg. Co. is having sketches made for the construction of a 1 story, 200 x 700 ft. brass foundry on Main St. Estimated cost, $100,000. H. H. Curtis, mgr. M. Tullgren & Sons Co., 425 East Water St., Milwaukee, archts.

STATES WEST OF THE MISSISSIPPI

Mo., St. Louis—The Vesper Buick Auto Co., 3550 Lindell Ave., will build a 1 story, 100 x 210 ft. garage and repair shop on Vandeventer and Pine Sts. Estimated cost, $75,000.

WESTERN STATES

Mont. Red Lodge—The Auto Safety Brake Co. plans to build a 2 story, 100 x 130 ft. manufacturing plant. Estimated cost, $100,000. J. J. Kellum, secy.

FOREIGN

T. H., Pearl Harbor — The Bureau of Yards & Docks, Navy Dept., Wash., D. C., will receive bids until May 11 for the construction of 2 shops, 2 pump houses and storehouse, all 1 story, at the Naval Air Station, here.

General Manufacturing

NEW ENGLAND STATES

Conn., Hartford—A. and S. Hartman, 231 State St., manufacturers of tobacco, have awarded the contract for altering present plant and constructing a 2 story, 30 x 30 ft. addition to same. Estimated cost, $30,000.

Me., Lincoln—The Lincoln Worsted Co., 97 Exch. St., Portland, plans to build a 2 story, 40 x 180 ft. worsted mill, 1 story, 30 x 40 ft. dyehouse and a 1 story, 40 x 60 ft. finishing room, here. Estimated cost, $100,000.

Mass., North Dighton—The Mt. Hope Finishing Co. will soon award the contract for the construction of a 1 and 4 story textile manufacturing and storage building, to cover 81,000 sq.ft. of floor space, on Spring St. Estimated cost, $250,000. H. M. Burke, c/o owner, engr.

Mass., Southbridge—Xannos Bros., Blanchard Theater Bldg., plans to build a 3 story, 55 x 60 ft. candy factory on Main St. Estimated cost, $40,000. Private plans.

R. I., Providence—The Grocers Baking Co., North Main St., is having plans prepared for the construction of a 1 and 2 story, 28 x 77 ft. and 20 x 20 ft. additions to its factory. Estimated cost, $20,000. McCormick Co., Century Bldg., Pittsburgh, archts.

R. I., Providence — The Hovey Lumber Co., 599 South Main St., will build a 1 and 2 story lumber plant, to include an office, garage, mill, sheds, etc. Estimated cost, between $30,000 and $40,000.

MIDDLE ATLANTIC STATES

Md., Baltimore—Dietrick Bros., Pleasant and Davis Sts., will open bids about April 10 for the construction of a 1 story, 190 x 330 ft. fabricating shop on Waverly St. Estimated cost, $350,000.

N. J., Bayonne—A. H. Gibson, 501 5th Ave., New York City, manufacturer of oil products, has awarded the contract for the construction of a 1 story, 160 x 200 ft. factory on 2d and Gertrude Sts., here. Estimated cost, $80,000.

N. J., Manumuskin (Ormond P. O.)—E. I. DuPont DeNemours & Co., DuPont Bldg., Wilmington, Del., plans to build a 1 story plant, here, for the manufacture of black powder. DuPont Eng. Co., DuPont Bldg., Wilmington, Del., engrs.

N. J., Millville—The Millville Pulp & Pine Products Corp. is having plans prepared for the construction of a wood pulp and marine products plant, consisting of 1 and 2 story buildings. J. W. Arthur, Millville, engr.

N. J., Trenton—The Star Porcelain Co., Muirhead Ave., has awarded the contract for the construction of a 2 story, 30 x 103 ft. addition to its factory, for the manufacture of plumbing goods. Estimated cost, $9,000.

N. J., Trenton—The Trenton Poster Advertising Co. is having plans prepared for the construction of a 3 story, 40 x 80 ft. factory. Estimated cost, $15,000. W. A. Klemann, 1st Natl. Bank Bldg., archt.

N. Y., Mt. Vernon—The Willow Brook Dairy Co. is having plans prepared for the construction of a dairy plant, to include a garage, power plant, etc. Estimated cost, $250,000. McCormick Co., Century Bldg., Pittsburgh, Pa., archts.

Pa., Hughesville—J. H. and C. K. Eagle Inc., Shamokin, have purchased a site here along the tracks of the Williamsport & North Branch R.R., opposite the station and plan to construct a 1 story, 58 x 175 f silk throwing plant. Estimated cost, $50,00

Pa., Pittsburgh—The Methodist Episcopal Church Union of Pittsburgh, 6th and Smithfield Sts., has awarded the contract for the construction of a 2 story, 47 x 100 ft. gar will industrial building, on 28th St. and Liberty Ave. Estimated cost, $100,00 Noted Feb. 24.

Pa., Wilmerding—The Thatcher Ice Cream Co. has awarded the contract for alterations and building additions, including a new refrigeration plant. Estmated cost, $25,00 Noted Feb. 10.

SOUTHERN STATES

Fla., Lake Helen—The E. W. Bond Lumber Co. plans to rebuild its saw-mill and plant which was destroyed by fire. Estimated cost, $50,000.

Fla., Tallahassee—The Tallahassee Lumber Co. plans to rebuild its saw-mill and planing mill, etc., which were recently destroyed by fire. Estimated cost, $35,000.

La., St. Rose—The Petroleum Import and Export Corp. Inc., a subsidary of the Carib Petroleum Co., has awarded the contract for the construct.on of a 60 x 150 ft. warehouse, 60 x 175 ft. canning factory, e Estimated cost, $200,000.

S. C., Spartanburg—The Bd. Educ. has awarded the contract for the construction of a high school, to include a manual training room, etc. Estimated cost, $213,125.

MIDDLE WEST STATES

Ill., Rock Island—Cervin & Horn, archts Rock Island, will open bids about April for the construction of a 3 story, 40 x 1 ft. factory and office on 4th Ave. and 24 St., for the Illinois Oil Co. Estimat cost, $135,000.

Ind., Indianapolis—The Polar Ice & Fu Co., 20th St. and Northwestern Ave., pla to build a 1 story, 35 x 70 ft. ice plant West 20th St. Estimated cost, $40,00 Private plans.

O., Bedford—The B. L. Marble Chair C is having plans prepared for the construction of a 3 story addition to its factor Estimated cost, $100,000. H. K. Ferguson Co., 6523 Euclid Ave., Cleveland, archt. a engr..

O., Pleasantville — The Pleasantvi Window Glass Co. is having plans prepared for the reconstruction of its 2 sto plant which was recently destroyed by fi Estimated cost, $100,000. H. S. Warric Genl. Mgr.

Wis., Fond du Lac—The Dunn Cheese C c/o H. Dunn, is having plans prepared f the construction of a 2 story, 60 x 125 cheese factory and office building. Estimated cost, $75,000. Private plans.

Wis., Milwaukee—The Wisconsin Ice Coal Co., 216 West Water St., will rece bids in summer for the construction of 1 and 2 story, 120 x 134 ft. ice manufacturing plant on Cambridge St. C. Ring & Son, 432 Bway., Archts.

Wis., Randolph—The Randolph Wag Co., c/o W. Gossink, Secy., has awarded t contract for the construction of a 2 sto 100 x 120 ft. factory on Main St. Estimated cost, $35,000.

Wis., Reeseville—The Reeseville Canni Co. has awarded the contract for the construction of a 3 and 4 story, 60 x 144 canning plant. Estimated cost, $175,0 Noted Jan. 6.

STATES WEST OF THE MISSISSIPPI

Ia., Waterloo—The York Service Co. will soon award the contract for the construction of a 2 story, 60 x 140 ft. tire shop East 5th St. Estimated cost, $60,000. Nolcott & Netcott, 517 Black Bldg., archts.

Minn., St. Paul—The Hennepin Atomic Fuel Co., 520 Security Bldg., Minneapol is preparing plans for the construction of 1 story, 60 x 150 ft. fuel crushing pla Estimated cost, $150,000. J. Pears, Se C. L. Bohannon, Ch. Engr.

Mo., Osage City—The J. M. Hays E vator Co. has awarded the contract for t construction of a flour mill, warehouse a grain elevator, to have 60,000 bu. capacity. Estimated cost, $100,000.

Okla., Miami—The Natl. Tripoli Co., Lincolnville, plans to build a cleaning pla and factory, here. Estimated cost, $30,0

American Machinist

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Rockford No. 3 "High-Power" Milling Machine

Evolved From Earlier Models—Rectangular Overarm Moved by Rack and Pinion—Universal Joints Eliminated—Single Control for Feed and Quick Return

By J. V. HUNTER
Western Editor, *American Machinist*

MILLING machines formerly built by the Rockford Milling Machine Co., Rockford, Ill., have undergone extensive changes in design, the result being the No. 3 "high-power" all-geared, single pulley drive machine shown in Fig. 1. A number of the special features in the earlier models have been retained and many others have been added, noticeable among which is the method of transmitting the feed drive to the saddle and table mechanism, as shown in Fig. 2, eliminating the use of a telescopic feed shaft and universal joints. Refinements have been made in the overarm, thus adding to the advantages claimed for the rectangular type. The feed and speed gear change mechanism has been entirely redesigned and employs sliding gears for changing the feeds instead of the tumbling gear previously used. A control box on the right side of the machine permits the feed and quick return in either direction to be started or reversed at the will of the operator by the movement of a single lever. Other details will be mentioned in connection with the general description of the machine.

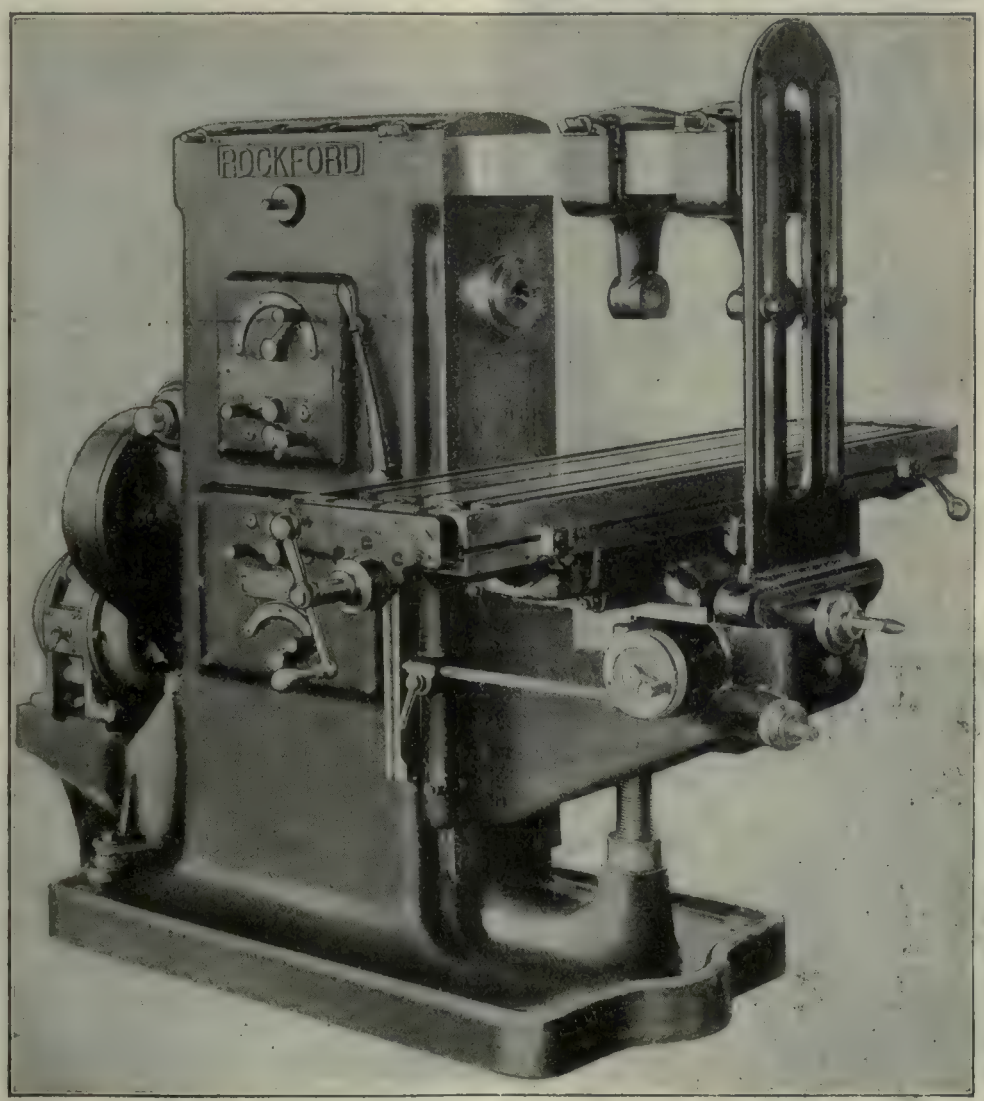


FIG. 1. ROCKFORD NO. 3 ALL-GEARED MILLING MACHINE

The column is of the conventional box form and is used to inclose a large portion of the working mechanism. The column is stiffened by internal ribs and is divided internally into three compartments, the upper one comprising an oil chamber in which is mounted the spindle gear units. The middle compartment contains the mechanism of the feed gears, which run in an oil bath. The lower compartment serves as a reservoir for the supply of coolant. The levers for operating the speed and feed gear change mechanism are located on the left-hand side of the column, as shown in Fig. 1. The overarm is rectangular in form with a cross-section of 4½ x 9 in. It is of cast iron, planed and scraped and fits in a similarly finished groove or slot across the top of the column. It is held down by a broad flat cap rabbetted so that dependence is not placed in the bolts alone for holding it in position.

The overarm is moved by means of a rack and pinion and is clamped in position by two eccentrics operated through quills extending from the cap on the left side of the machine.

The overarm can be moved as shown in Fig. 3 for

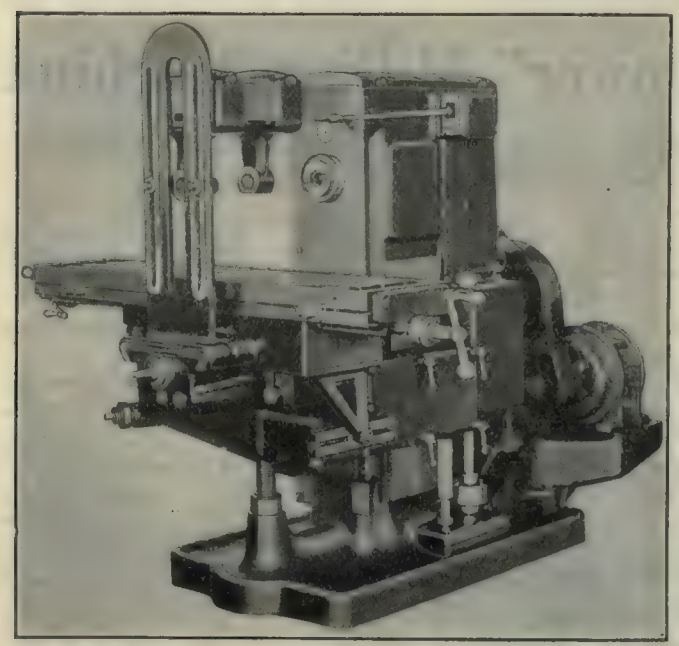


FIG. 2. RIGHT SIDE OF MACHINE SHOWING FEED CONTROL BOX

removing work from the table or for changing cutters without removing the brackets. To do this it is only necessary to loosen the eccentrics, remove the nut from the end of the cutter arbor and loosen the two bolts that hold the overarm brace to the knee, when the overarm can be moved out until all parts clear the arbor. This arbor support is also provided with an eccentric clamping device. The distance from the center of the spindle to the under side of the overarm is 7¼ inches.

Since the overarm must be in alignment with the

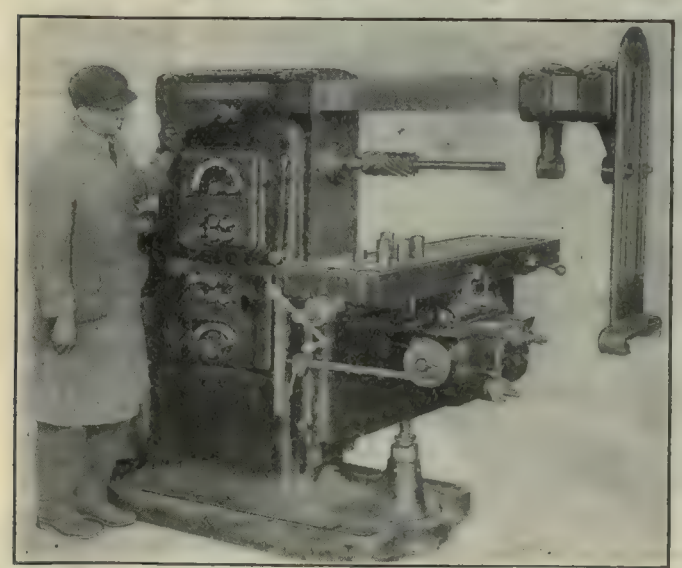


FIG. 3. OVERARM EXTENDED TO PERMIT REMOVAL OF CUTTERS

spindle it may be used in a number of ways for setting up and aligning work. In Fig. 4 is shown how it may be used with a test indicator mounted on a gage block abutting against the side of the overarm to determi whether the face of the work is parallel with the spind

The spindle has been designed so that all wear m be taken up by a single nut located at the rear end. T arbor is driven by two hardened steel keys which fit keyways in the nose of the spindle. A reverse for t spindle drive is provided by a shifting mechanism cated in a gear box on the rear of the machine.

The speed gears slide into mesh and are controlled three levers mounted on the coverplate of the gear co partment. The position of the levers for the differe speeds is clearly indicated by an index plate.

The knee has been designed with the idea of givi it ample bearing surface on the face of the colum Additional bearing surface is provided by a wide fa *A*, Fig. 5, on the side of the column, and to this t extension arm or brace *B* from the side of the knee m be clamped when it is desired to secure the knee w greater rigidity. The extension arm is locked in pl by means of four bolts *C* that clamp beneath flang on the sides of the surface *A*.

The saddle is held to its bearing on the top of t knee by adjustable taper gibs. When taking hea cuts the saddle can be clamped to the knee by means the bracket *D* and bolt *E* so as to obtain additio rigidity.

The table has three T-slots and is provided wi grooves along its sides and pockets at the ends collect the coolant. The longitudinal feed is controll by a lever on the front of the saddle. The vertical, cr and longitudinal feed screws are all fitted with e thrust bearings; and the two latter have take-up nu for adjusting wear. The feed screws have adjustab micrometer dials graduated to 0.001 inch.

The feed gears are a separate unit housed in t middle compartment of the column. Three levers a used to shift the feed gears which give a total of twel feeds ranging from ½ to 16 in. per minute. On t left-hand side of the knee, Fig. 1, is a feed control b that determines whether the transverse or vertical fe is being engaged. It has a circular top with a rotati lever pivoted in its center, and when this lever is in t right-hand notch, by depressing the lever *G*, Fig. 5, t transverse feed is engaged. The vertical feed is engag by rotating the control levers to the left and again d pressing the lever *G*. The vertical and transver feeds can also be controlled by a lever on the left si of the knee near the column and in convenient reach the operator, who may stand back of the table for su operations as boring. The bar that connects this lev with the feed control box passes through the back flan of the knee and projects to a point where it reach the dogs of the automatic stop mechanism. There a long vertical boss on the side of column on whi dogs may be adjusted to contact with the feed bar a stop the vertical feed at any predetermined point. T boss also has permanent safety stops to stop the fe within safety limits.

Another feature is the power quick return and fe control box. This is the box with a long lever extendi toward the front of the machine, located on the upp right-hand side of the column, Fig. 2. The lever m be shifted to any one of four stations and the static are in pairs, one pair controlling the feed in eith direction and the other pair the power rapid trave in either direction. To feed the table toward the l the lever is moved from the central position toward t column and into the lower left-hand notch. To reve

he feed the shifter lever is raised to the notch directly above. Correspondingly the notches on the right indicate the direction of travel of the power rapid traverse. The feed control box operates either the longitudinal,

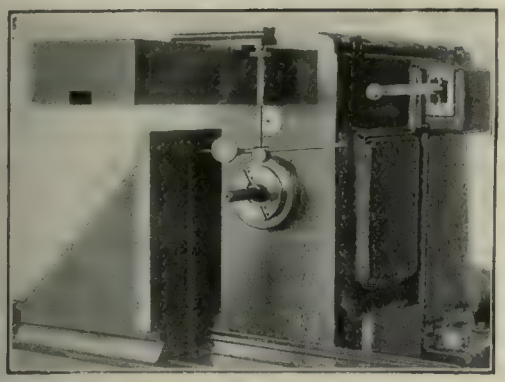


FIG. 4. USING OVERARM TO ALIGN WORK PARALLEL TO SPINDLE

ransverse or vertical feed and quick return, whichever machine movement is engaged with the feed gears at he time.

Feed Drive to the Table

The feed reverse and quick return gears are located in he larger of the boxes on the right-hand side and near ne rear of the column. This gear box is connected by uitable mechanism with the feed control box described n the preceding paragraph. From this gear box the rive shaft *F*, Fig. 5, extends to a second gear box *I*, cated on the base of the machine. At *J* is a shock bsorber that can release the feed drive in case of any ccident or carelessness on the part of the operator. rom the gear box the feed is engaged through the vercal splined shaft *K* that connects through a pair of evel gears with the drive shafts in the knee. This ethod of conveying the feed eliminates the use of uniersal joints.

The vertical milling attachment clamps onto the overrm and to the face of the column. A plug on the face f the column directly under the overarm is removed nd the drive shaft of the attachment is inserted. The haft is driven directly from a gear mounted between

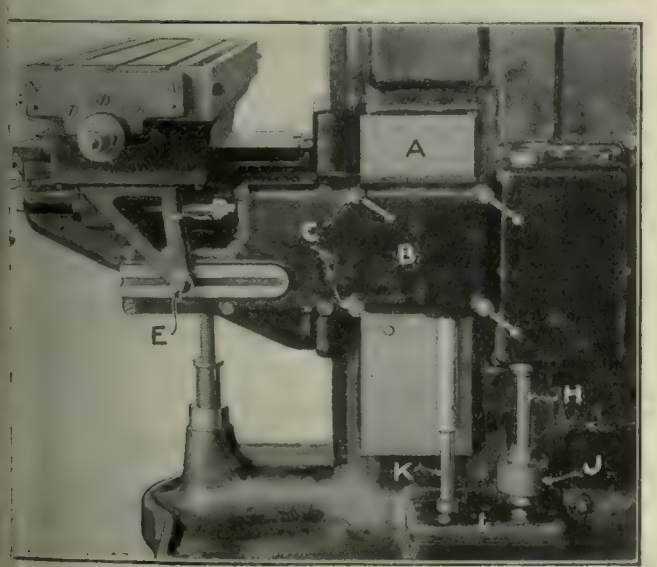


FIG. 5. KNEE AND SADDLE BRACING AND FEED DRIVE SHAFTING

bearings at the forward end of the spindle close to the front wall of the column. This arrangement permits the use of the vertical attachment without removing the overarm.

All gears are hardened and ground and the shafts are similarly treated. The gears all run in a bath of oil which is supplied through six oiling stations.

Method of Drive

The machine can be furnished with either belt or motor drive. When belt driven the drive is through a single constant speed pulley mounted on roller bearings. A Johnson friction clutch has been incorporated in the pulley with adjustment at the back of the machine where it is easily accessible.

When motor driven the motor is mounted on a heavy pedestal bolted to the rear of the column and base. A 10-hp. motor is recommended. The motor drives through a high-speed silent-link chain covered by safety guards.

The coolant pump is mounted on the rear of the feed change gear box, and draws the coolant from the reservoir in the base of the column. The coolant is delivered to the cutters through a flexible pipe extending along the side of the overarm.

The length of floor space required by the machine is 126 in. parallel with the spindle, allowing for the extension of the overarm to the limit at both extremities.

Specifications: Table: working surface. 15 x 55 in.; travel, longitudinal, 34 in.; transverse, 12 in.; vertical, 20 in. Twelve feeds ranging from ⅛ to 16 in. per minute. Sixteen speeds ranging from 15 to 422 r.p.m. Feed and quick return controlled by single lever. Spindle bored for No. 11 B & S taper, with ¾-in. hole clear through. Overarm section, 4½ x 9 in. Distance from center of spindle to under side of overarm, 7¼ in. Face of column to overarm brace, 25½ in. Pulley, 16 x 4 in. Motor recommended, 10 hp. Floor space, 126 x 116 in. Net weight, 7,270 pounds.

Storage Facilities Project for American Firms in Paris

Many American firms doing business in Paris, and especially those that are obliged to carry stocks of merchandise, are vitally interested in the question of warehousing and storage space. One of the first problems that confronts the American company beginning in France is that of stock storage and delivery. Most of them, when they first enter the field, are uncertain as to the ultimate volume of their business and consequently as to the amount of stock they must carry. Accordingly, in many instances, they are forced to carry small stocks in public warehouses of all kinds, incurring delays and difficulties—if not high prices—and are not able to use their warehouses as proper stockrooms.

The American Chamber of Commerce in France reports that it is in receipt of an interesting suggestion from Col. W. N. Taylor, European sales manager of the E. I. DuPont de Nemours Export Co., 282 Boulevard Saint-Germain, Paris, who says: "To solve this problem the only method at present is for each individual to undertake the maintenance of a storehouse, but in many cases the overhead involved is prohibitive. It would be of interest for members of the chamber to consider the possibility of a number of American houses forming a small company to maintain a warehouse, with a truck or trucks, for deliveries and for handling the stocks of the member companies. This would permit companies carrying a moderate-sized stock, or who are uncertain as to their proper stock volume, to enjoy the facilities of a stockroom, with access to and control of their merchandise in a manner more satisfactory than as at present in public warehouses."

How Do You Make Your Profits?

Small Profit on Large Turnover Easier To Get than Large Profit on Small Turnover—Average Return Is 15 to 20 Per Cent in Well-Managed Company

By W. R. BASSET
Miller, Franklin, Basset & Co.

THE most difficult part of formulating a business policy is to think straight and to discard the unessential. As the policy unfolds, we come upon branches and side issues which lead us astray. These ramifications of policy must of course be settled, but they can ordinarily be handled by the lesser executives of a business. The chief executive should quickly jerk himself back on to the main line if the resulting policy is to be clean-cut and profitable.

I therefore believe in first stating a problem in "words of one syllable" and then as the problem is attacked, checking myself to see that I do not stray. That is my excuse for making the trite remark that manufacturers are interested in getting the maximum percentage of profit on a given invested capital. It is astonishing how a man, unless he checks himself occasionally with this statament, will find himself judging his prosperity by some other test, such, for instance, as the percentage of net profit he is making on his sales. Though, of course, unless the sales price of a manufacturer's product carries an ample margin of profit, it is impossible for him to get a satisfactory return on his capital invested.

Average Return is Small

You may think that my statement that manufacturers want to get a high rate of income on invested capital is naïve; that it is too obvious to require stating. It has been my privilege to have quite an intimate knowledge of the affairs of something over 1,500 manufacturing enterprises, large, small and medium sized. I have more than once been surprised at the large number of these which return to their owners an income much less than the savings bank interest on the money invested. Even during the war years, there are hundreds of concerns which have returned less than 7 per cent on the invested capital. In other words, the owners of these concerns who had put from a few hundred thousand to a few million dollars into them, got less income than they would have had they put their money into bonds. I need not point out that the bond investment would have been better, for it would have cut the risk to practically nothing and would have enabled these hard-working business men to take it easy in some more pleasant climate.

In order to get vivid examples of how profits are made and are not made, I tabulated the affairs of fifty of my clients, representing thirty-five lines of industry, covering the years 1917, 1918 and 1919. As these were taken at random, including concerns which I know to be ably managed, others which are poorly managed, but the majority of which are run by manufacturers of average ability, it furnishes an interesting cross-section of the manufacturing industry. Of these fifty, seven in the year 1919 returned less income than could easily have been obtained had the money been invested in seasoned securities. On the other hand, there were two which returned more than 50 per cent on the investment. The average for the fifty showed an income of 18.55 per cent on the invested capital.

On this page is a tabulation showing the totals and averages for the fifty concerns. The individual figures bring out some very interesting points as to how the profits are made. Without exception, those concerns which show a high return on invested capital show a low percentage of income to total sales. In other words, the unusually high earnings are achieved by those concerns which take a moderate profit on each sale, but turn their entire capital rapidly. The highest turnover of capital shown on this tabulation is that of a concern having about half a million dollars invested, which took a profit of 3⅛ per cent on its sales in 1918, and 8½ per cent on its sales in 1919. In 1918 it made in round figures 30 per cent on its invested capital, and in 1919 85 per cent on its invested capital, which means that it turned its entire capital ten times in both of those years. Another concern achieved a turnover of ten with a profit of 3.6 per cent on the dollar of sale.

The Other Extreme in Turnover

At the other extreme are several concerns which do not make one complete turn of their capital per year. Every one of them takes a higher than the average profit on its sales but, because of the slow turnover, does not get a satisfactory return on the capital invested.

For ten years or more, retailers have been urged to increase their rate of turnover. It has been very thoroughly drummed into them that to be successful merchandisers they must take small profit per sale, but must turn their capital often. I think that, without exception, all notably successful retailers have built their business on this policy. Manufacturers have been slow to see the bearing of the same teaching on their business, although it is just as applicable. I do not mean by this that it is possible for all manufacturers to get as many turnovers of their capital as a retailer can. It is impossible in the machine tool business, for instance, where the average turnover, in normal times, of the most progressive manufacturers is seldom greater than one. You cannot turn over the money tied up in bricks, mortar and machinery. As a rule, the retailer has the bulk of his capital in liquid form. Most of his money is working capital rather than fixed capital. A great many retailers, in fact, have practically nothing in fixed

	1917	1918	1919
1. Invested capital	$97,173,127.10	$113,143,136.82	$127,690,357.4
2. Net sales	138,737,778.43	189,390,415.32	156,639,847.1
3. Turnovers	1.43	1.67	1.2
4. Per cent taxable income to sales	17.98	13.08	15.1
5. Per cent taxable income to invested capital	25.67	21.90	18.5
6. Per cent tax paid to taxable income	24.71	46.48	23.7
7. Per cent tax paid to sales	4.44	6.10	3.6
8. Per cent officers' salaries to gross income before deducting salaries	6.03	7.28	8.0

NOTE.—Items 1 and 2 are the total figures for fifty corporations in thirty-five industries. The rest of the items are averages for the fifty corporations. Items 6, 7 and 8 have no bearing on the subject discussed in this article, but are added because they may have an interest to executives who wish to compare the figures for their own business with those which are cross-sectioned through many industries.

assets. They rent their stores and their fixed assets consist solely of fixtures, ordinarily a small investment.

The manufacturer must of course have a plant and machinery. Inasmuch as this part of his capital is not in the cycle of trade, he must use every effort to get a rapid turnover of his working capital so that the return on his entire invested capital may be satisfactory. It goes without saying that in some lines of manufacturing an exceedingly large proportion of the total invested capital must be in plant and equipment. In other industries, much less need be tied up permanently. On the whole, machine shops require a heavier fixed investment than do most other industries.

The figures which I have tabulated show that, as a rule, the concerns with a low rate of turnover are those having a large investment in plant and equipment. Many of them have, to my certain knowledge, entirely too much tied up. Unfortunately, most manufacturers do not themselves pick their industry and start a brand new business with their own money. They are, in a manner of speaking, dumped into an existing business. A few inherit the business. More work up to the ownership from far down the scale. Usually, it is mere chance that starts them in one industry rather than another. They therefore have to accept certain adverse conditions ready-made. Were they to start a brand new business, many of them would mold it to better advantage, but in discussing policies we must assume that the conditions are very much ready-made. It therefore is not much help to tell a man that he has too much money invested in his plant and equipment. To help him, we must show him how he can earn larger profits with what he has.

Two Ways to Get Satisfactory Percentage of Return on Income

Now, there are only two ways in which a manufacturer can get a satisfactory percentage of return on his invested capital. The first and most desirable from all points of view is to take a fairly small margin of profit on each sale and to get a great many sales, that is, a high rate of turnover on his capital. The other way is to be content with a small number of turnovers and get an unusually high margin of profit on each sale.

First, let us decide upon what we shall consider to be a fair return upon invested capital. Those men who are in a settled, year-in-and-year-out business supplying articles of common consumption, such, say, as textiles, clothes and food products, are as a rule, well satisfied if they can make, year-in-and-year-out, from 10 to 12 per cent on the amount invested. In the machine-shop industry—and that of course covers a wide variety of products—most of the men I know feel that they should get from 20 to 25 per cent on the money they have invested. This is because it is much easier to have the entire investment wiped out by adverse circumstances and because the business is subject to more marked periods of depression.

Now, the figures I have tabulated show that the great majority of the fifty corporations had a rate of turnover which hovered fairly closely around 1 to 1½. That means that to get 25 per cent on the invested capital, each sale must carry profit of from 16 to 25 per cent. Probably 20 per cent would cover most cases. Unless a concern is in the fortunate position of having a monopoly of its market, it is not often able to make 20 per cent net on its gross sales. Competition takes care of that. In a competitive business, the only possible way that I can see by which anything like so high a profit on sales could be realized would be if every manufacturer accurately knew his costs and was determined to get a price which would return that profit. Unfortunately, there are but few manufacturers who get cost figures at all accurately, and a good many of those who do, do not put the trust in the cost figures which they should. Even though all the concerns in an industry operated under uniform and correct cost-finding methods, there would always be a few who would cut their prices below what would give them a fair return. Nevertheless, I believe that a long step toward proper profits is made when an industry adopts a uniform method of cost finding. When a manufacturer is once convinced that his costs are correct, he is less likely to sell at too small a profit. My experience shows me that price cutting is usually done by the man who is ignorant of his costs.

A 20 Per Cent Profit Is Exceedingly Difficult to Obtain in a Competitive Industry

On the whole, it is exceedingly difficult in a competitive industry to obtain a profit of 20 per cent on the sales. It is much easier to get a satisfactory return on invested capital by speeding up the turnover than by marking up the selling price. If a manufacturer has been making 24 per cent on his invested capital by turning his capital once a year and taking 24 per cent profit on his sales, he can get the same return on his investment with a 6 per cent profit on his sales if he is able to speed the rate of turnover up to 4. Difficult as that may seem, it has been done and I believe it is easier to do in most cases than to get, year-in-and-year-out, a 24 per cent profit on the sales.

There are several ways in which this can be done. I have said that many concerns have a disproportionate amount of their capital invested in bricks and mortar. It is my belief that most concerns are much overbuilt. In the first place, it is customary in building a plant to make it large and to supply capacity to handle 25 per cent in excess of the probable sales on a single shift. In other words, it is generally considered that machines will be active only about 80 per cent of the day shift. In those industries where it is possible to work two shifts, such a plant is twice too large. Many of the most profitable concerns I know designed their plants on the basis of handling their probable sales on 24 hours a day operation. That, you may say, offers a suggestion to the man starting in business and building a new plant, but is of no value to the man whose plant already exists. In individual instances that is true, but sometimes the manufacturer who is already in business will find that by added sales effort in normal times he can secure sufficient business to put his plant on two or three shifts. That will greatly increase his turnover. His sales problem of getting the additional business will be greatly simplified if he considers that on the increased turnover which he hopes to get, he will be able to take a smaller margin of profit. Speeding up the turnover reduces his costs and enables him to set a lower selling price in many ways. There is, first, this item of a smaller margin of profit per sale. There is also the fact that the fixed overhead charges of his plant will be less per unit of output as the activity of his plant increases.

A thorough study of manufacturing conditions within

the plant will frequently show ways in which the turnover of the working capital can be greatly increased. In one instance I know of, it was possible to increase the turnover of working capital of a machine shop manufacturing automotive parts from a rate of less than 4 to a rate of 15. The concern was selling about fifteen million dollars worth of its product a year. Its working capital had been $4,000,000, giving $3\frac{3}{4}$ turnovers of the working capital per year. By carefully planning the production so that the work in process was kept at a minimum, by cutting down the delays and increasing the output of machines and the machine activity this concern was able to get along on $1,000,000 working capital for the same amount of sales. In other words, by speeding up its production it got 15 turnovers of its working capital per year.

Lest you think that this is a case so unusual as to be not worth considering, I can say that I have seen the turnover rate increased three or four times in a dozen or more concerns. I have seen even greater increases in the turnover than this.

There are few factories in the machine-shop industry that could not greatly increase the speed with which work passes through. The manufacturer is too complacent about the slow movement of material. If one of his debtors takes thirty days too long to pay, he takes prompt action, but the same man will walk through his plant and see a truckload of parts worth $50 apiece sidetracked for no good reason, and will fail to realize that to all intents and purposes what he sees is a truckload of fifty-dollar-bills on vacation.

Every step in manufacturing needs attention if turnover is to be speeded up. The tools in the plant can be studied to see that they are in balance and that the progress of the work is not delayed by "bottle necks." The routing of the work can be studied in connection with the layout of machines so that time may not be wasted making unnecessarily long moves between machines and operations. Machines do not always operate at their maximum speed. Machines lie idle because it is not the business of someone having general supervision of production to see to it that work is available for that machine. It is not at all uncommon for one or two machines to be out of work while somewhere else in the plant there is work for those machines to do. Sometimes the individual workmen are not producing as rapidly as they should, because their operations have not been studied and proper standards of work set. Often proper jigs and fixtures can be provided which will enable workmen to increase the speed of production. There is no one point at which this problem can be attacked. The entire factory must be studied and betterments made wherever possible.

To my mind, the surest way to get a satisfactory return upon the invested capital is to speed up the turnover of capital. The possibility usually exists and the manufacturer who can get a satisfactory return on his capital on a narrow margin of profit has much less to fear from competition than the man who has to depend upon a wide margin of profit to offset his sluggish manufacturing.

Wide margins of profit invite competition, and potential competitors can smell wide margins as far as flies can smell molasses.

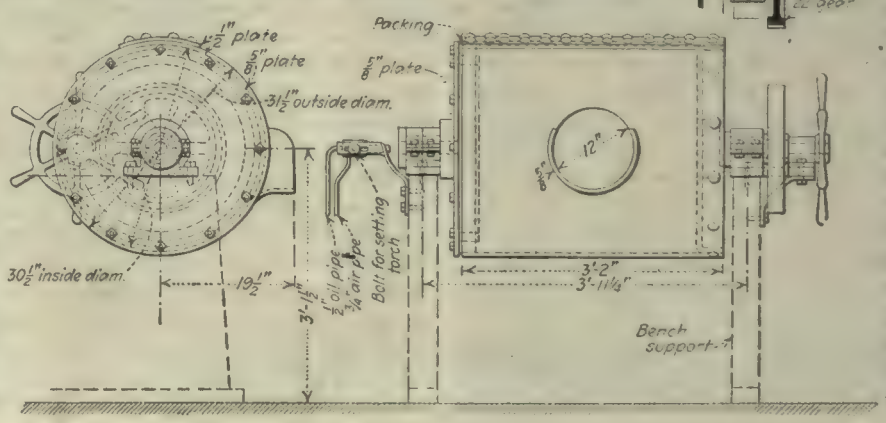
Shop Methods of Casting Locomotive Bearings

A Comparison of the Methods Used in Three Middle Western Railroad Shops—Wabash Methods Include Casting Hub Liners in Place

By J. V. HUNTER
Western Editor, *American Machinist*

THE design of locomotive bearings upon certain occasions may be influenced by shop methods employed in the renewal of worn parts. Different methods of handling certain details were found in a number of shops visited and an analysis of the various ideas seen shows that an interchange of views may be helpful to other railroad shopmen.

The construction of the locomotive driving boxes of the Wabash Railway is undoubtedly the controlling motive that causes certain differences in the method of casting bearings, at the Decatur shops, from the methods used on other railroad systems. Where hub-liners are used on the inside of drivers it is the practice in some railroad shops to attach these by countersunk - head screws. Opposed to this method is the Wabash practice of counter-boring the driver hubs and casting a bronze ring in place.



The bearing casting is done in a portion of the main shop building, adjoining the driving wheel department that is designated as the brass foundry. The bearing metal is melted in a horizontal tilting oil furnace, Fig. 1, which was built in the Wabash shops. The furnace has a steel shell with flanged steel end-plates and is detailed in Fig. 2. It has a gear drive for tilting it to the pouring position shown in Fig. 3. The shell is lined with fire-brick and

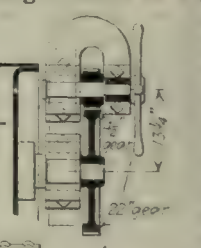


FIG. 2. CONSTRUCTION DETAILS OF BRASS MELTING FURNACE

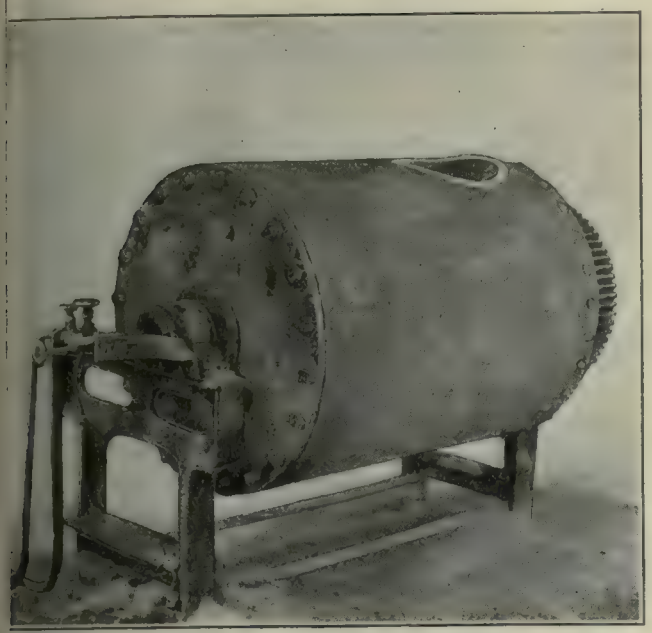


FIG. 1. OIL FURNACE FOR MELTING BEARING BRASS

ts nozzle is coated with a ganister compound of crushed rick and fireclay. A graphite crucible, preheated by tanding for a time in the flame from the furnace nozzle, s used for a pouring ladle.

A locomotive driving wheel prepared for pouring the rass hub-liners is shown in Fig. 4. The casting is ade in an open-top mold constructed by surrounding he hub liner recess by the piece of band-steel *A* that is eld together in circular form by the two spring clips *B*. he outside of the base of the band is daubed with reclay to prevent run-outs. The axle is wound with single layer of heavy asbestos yarn from the hub of he wheel to a point above that reached by the molten etal. The insulation serves in a measure to protect he micro-structure of the steel from the effects of the ocal application of heat. When the hub surface is usty it is smeared with oil to prevent spattering of he molten metal.



FIG. 3. FURNACE IN POURING POSITION WITH LADLE

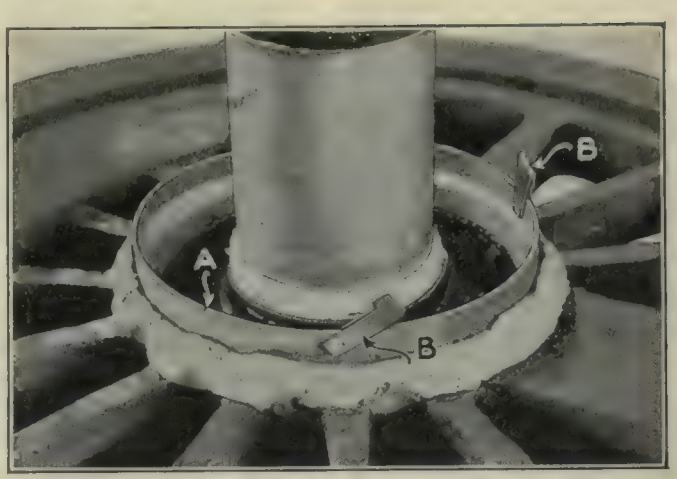


FIG. 4. DRIVING WHEEL WITH MOLD READY FOR CASTING HUB LINER

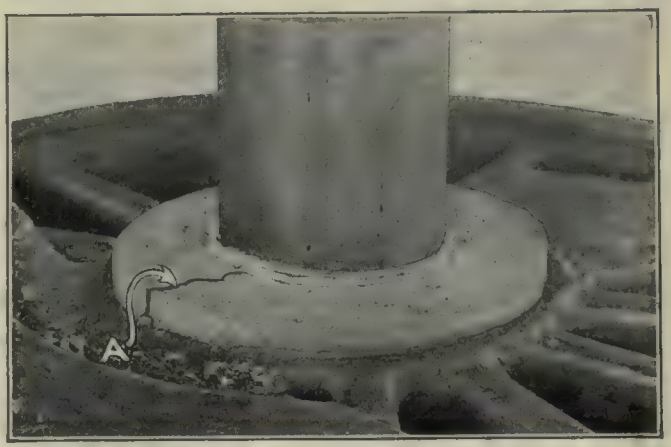


FIG. 5. CAST HUB LINER SHOWING SHRINKAGE CRACK

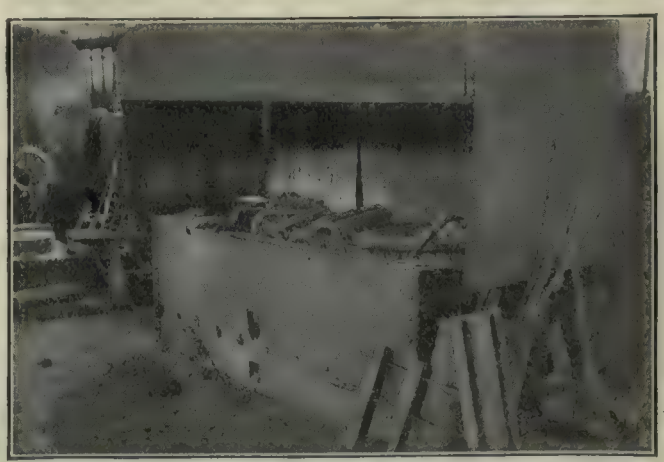


FIG. 6. BABBITT METAL MELTING FURNACE

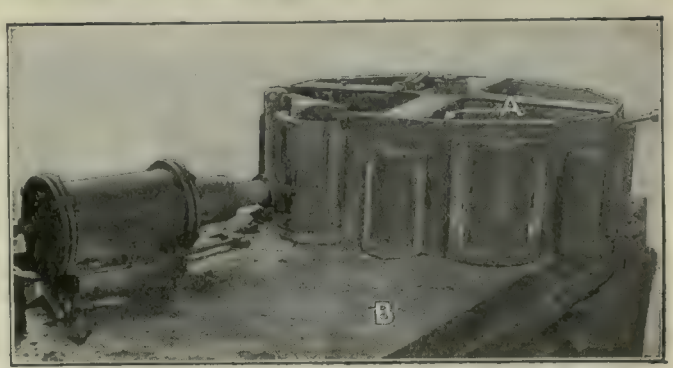


FIG. 7. REEL WITH BABBITTING MANDRELS AND PNEUMATIC CLAMP

The appearance of the cast hub liner after it has cooled is shown in Fig. 5. A shrinkage crack like the one shown at *A* occurs in all cast hub liners. The crack is taken care of by filling with babbitt so that after it has been machined off a smooth surface is left to run against the face of the bearing box.

The Babbitting Operation

Most of the babbitting is done in the same department, and this particularly includes journal brasses. The babbitt metal is melted in the furnace, shown in Fig. 6, which is heated by an oil burner. It has a melting pot at each end and a central pre-heating portion where the brasses are dried before melting off the old babbitt. The pot at the left is used for recovering old babbitt by dipping the worn brasses in the molten metal until the babbitt has melted off. The pot at the right is for melting the new and reclaimed metal for relining the brasses.

A labor-saving outfit, Fig. 7, has been devised for babbitting old brasses. Shops with many types of engines coming in for repairs have a large number of mandrels for rebabbitting the brasses. The mandrels are heavy and clumsy to handle and are apt to be m laid. This trouble cannot occur at the Decatur sho because all mandrels, or at least fourteen of them, a mounted on the large reel *A*. It rotates on a verti shaft held by the baseplate *B*. Each mandrel has a fl side that is bolted against the face of the reel by ca screws from the inside so that the mandrel face smooth and flawless.

Only one brass may be babbitted at a time. For th operation it is clamped against the proper mandrel the piston of the air-cylinder *C*, which in the illustr tion is shown holding a brass in position for babbittin When so placed the cracks between the brass a mandrel are daubed with fireclay to prevent run-ou When the babbitt has cooled the air pressure is releas from the cylinder and the brass is removed. The cylinder is radially in line with the center of the r so that the thrust of the piston is directly against t center shaft. The reel can be easily turned to bri any mandrel to face the clamping piston and redu the time lost in hunting mandrels in shops where t babbitting equipment is put away in odd corners a under work benches.

Methods at the Big Four Shops

Axle Bearings and Hub Plates Separate Pieces — Unusual Fixture Employing Double Air Cylinder

IN THE Beach Grove locomotive shops of the Big Four system at Indianapolis, Ind., variations from the methods of other shops are found in the practice of casting locomotive driver boxes. The axle bearing and hub-plate bearing are separate. The former is a finished casting that is pressed in its recess in the steel bearing-box. Later the hub plates are cast in place. The illustration, Fig. 1, shows at *A* an inside end of a driver box with the pressed-in insert *B* in place. The other two boxes *C* and *D* show the rough hub-plates as they appear after casting.



FIG. 1. DRIVING WHEEL BOXES WITH PRESSED-IN BUSHINGS AND CAST END PLATES

The axle bearings are pressed in under a pressure of from 20 to 30 tons by a special hydraulic press that was built in the Big Four shops.

The boxes are prepared for casting the end plates as shown in Fig. 2. The heavy steel ring *A* is laid on top, and daubed with fire-clay around the joints to prevent run-outs, thus forming a mold for the outside of t flange. Two pieces of sheet steel *B* on the inside, past up with fire clay, take care of the straight portio beyond the pressed-in bearing. The springs *C* hold t steel sheets in place. The face of the steel box grooved to provide an anchor for the brass and in so cases the grooving is augmented by drill holes. T bearing bronze is melted in a Rockwell double-chamb tilting oil furnace.

Sandblasting the Brasses

Special attention has been given to relining journ brasses. These are first sandblasted in the cabinet-ty sandblast device shown in Fig. 3. Sandblasting giv the inside of the bearing a thorough cleaning over t surface and in all retaining grooves and pockets a insures a firmer bond for the babbitt. Before san blasting was used it was the practice to rebore t inside and recut the grooves on a shaper in order to g a clean surface. The new method has reduced the clea ing cost to a mere fraction of what it was formerly.

The sandblast cabinet has a hopper bottom with chute *A* down which all the used sand falls into t bin *B* in the base of the frame. From the bin it m be replaced in the sand supply tank *C* located in a po tion some distance above the cabinet. The sand flo down the hose *D* to the blast nozzle *E* where it is caug by the jet of compressed air and blown into the cabin The exhaust air and dust can escape outdoors throu the vent pipe *F*.

The journal-brass babbitting mandrels are mount on a revolving reel in a manner similar to that noted another shop. This inexpensive reel is shown in Fig. it was made from an old iron pulley *A* with a flange bolted to its bottom edge on which the brasses m stand. The babbitting device is a double affair; t

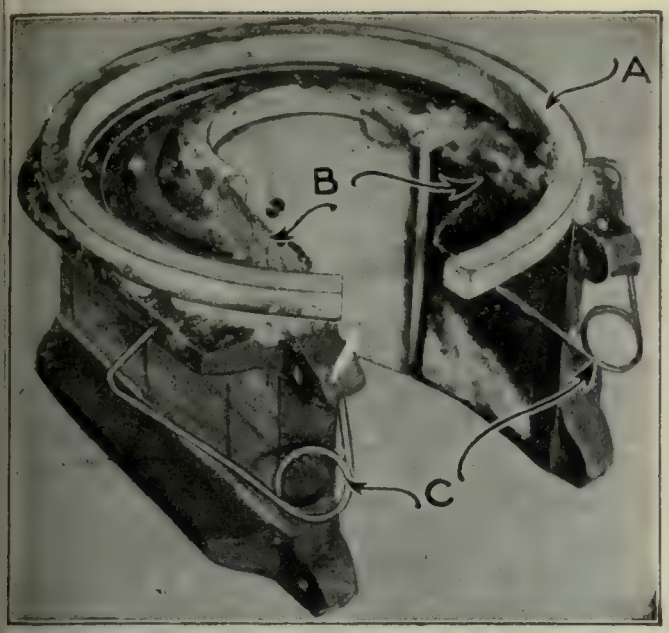


FIG. 2 BOX READY FOR CASTING BRASS HUB PLATE

large cast-iron reel *C* being provided for handling long mandrels. Midway between the two reels stands a double-end air-cylinder *D* with pistons at each end. A

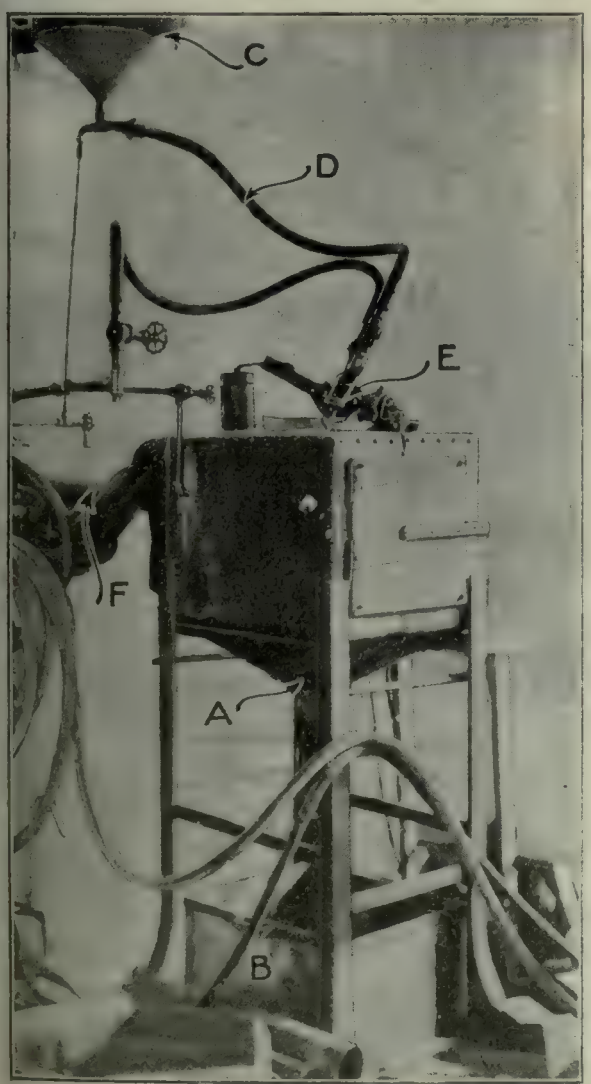


FIG. 3. SANDBLAST CABINET FOR CLEANING JOURNAL BRASSES

brass is clamped against the mandrel in the manner shown at *E*, while it is being poured.

In clamping the brass another unusual feature is



FIG. 4. REELS FOR CARRYING JOURNAL BRASS BABBITTING MANDRELS

employed because the bearing has two oil-holes drilled and countersunk in its back. It is desired to keep the holes clean from babbitt and avoid the necessity of redrilling and countersinking; and this is accomplished by the clamping head of the air-cylinder plunger shown in Fig. 5. The head consists of a slotted bar *A* in which two sliding screw-plugs can be adjusted and held by the thumbnuts *B*. The heads of the plugs are conical and can be adjusted to fit in the countersunk oil-holes. This provides two points of pressure for holding the brass firmly against the mandrel and also keeps the upper section of the oil-holes clear of babbitt. The oil holes are later pierced through the layer of babbitt by drilling.

The piston on the other end of the air-cylinder *E* is provided with a slotted bar for clamping in the same

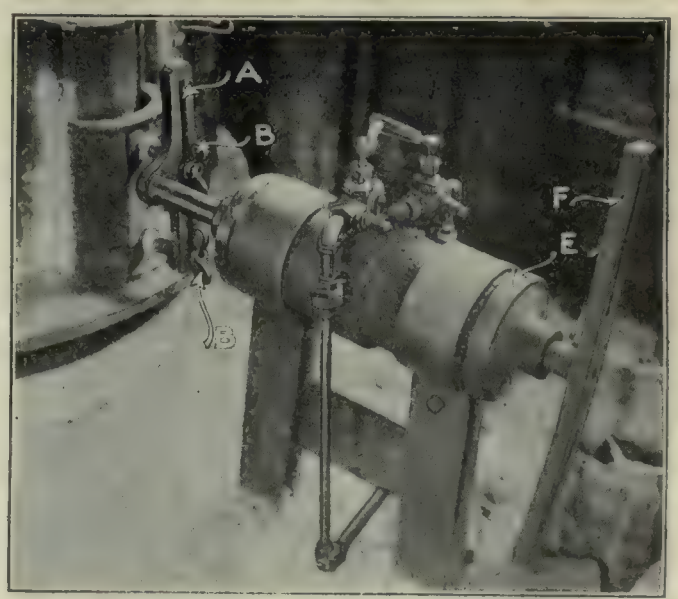


FIG. 5. AIR-CYLINDER AND CLAMPING HEADS FOR JOURNAL BRASSES

manner. The double air-cylinder is so constructed that air can be admitted to the cylinder at either end by means of the two air valves, and babbitting can be done on mandrels of both reels at the same time without interference.

Practice in the Chicago & Alton Shops

Gas Furnaces Used for Melting—Efficient Wire Mesh Anchor Spot Welded in Place

A NUMBER of novel features have been introduced in the practice of casting bearings in the locomotive shops of the Chicago & Alton Railroad Co. at Bloomington, Ill. In this shop city gas has replaced crude oil as the fuel for melting babbitt. The two gas-heated babbitt melting furnaces, shown in Fig. 1, have lately been installed, each with a capacity for 1,200 lb. of metal. Test runs made in the shop show that the furnaces can melt their full capacity of metal from the cold state in 23 minutes. This is a valuable feature as it enables the workman to start casting bearings earlier than customary in the morning. The furnace parts were designed and built in the shops and the gas burner installation was made by the local gas company.

Gas burners are also applied to the special device,



FIG. 1. GAS-HEATED BABBITT MELTING FURNACES

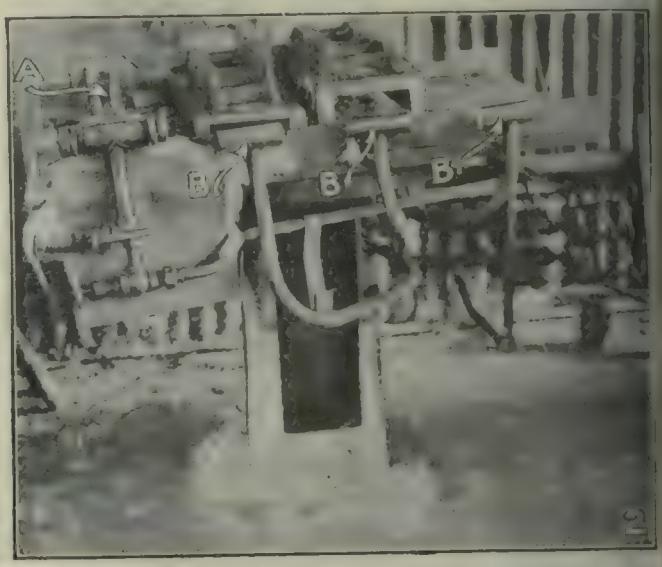


FIG. 2. TABLE FOR MELTING OLD BABBITT

shown in Fig. 2, used for melting the babbitt from crosshead shoes. This heating table was also designed and built in the shop. Two types of burners are used: The one at the left, *A*, consists of two lengths of pipe, drilled with suitable holes for gas jets, and extends clear across

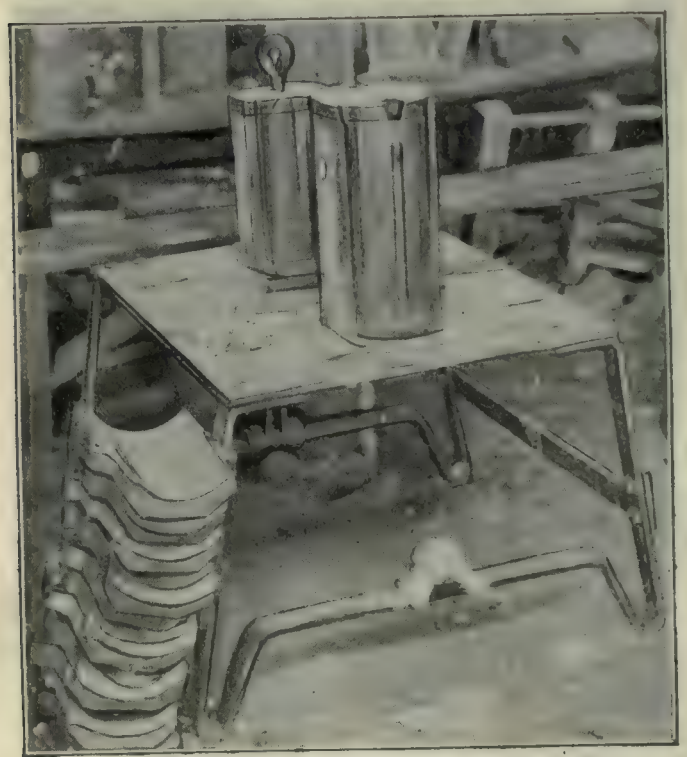


FIG. 3. STAND WITH MANDRELS FOR BABBITTING JOURNAL BRASSES

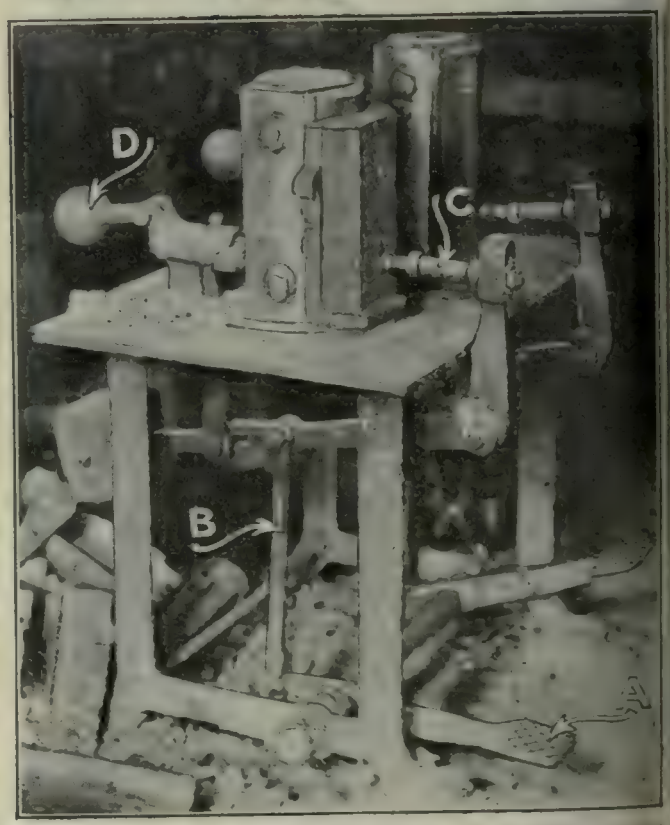


FIG. 4. JOURNAL BRASS BABBITTING MANDRELS WITH CLAMPING DEVICE

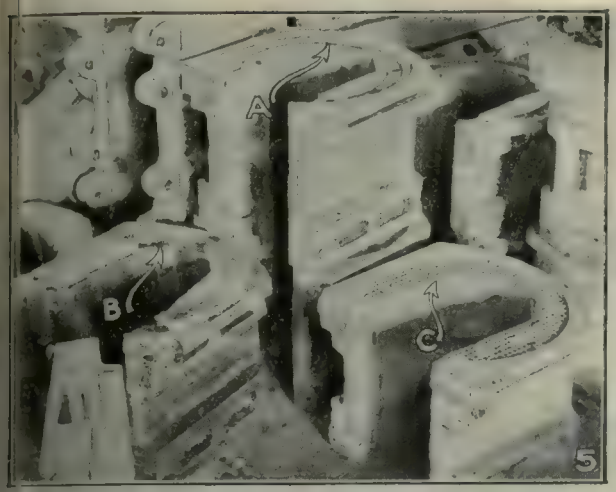


FIG. 5. GROUP OF BABBITT FACED DRIVING WHEEL BOXES

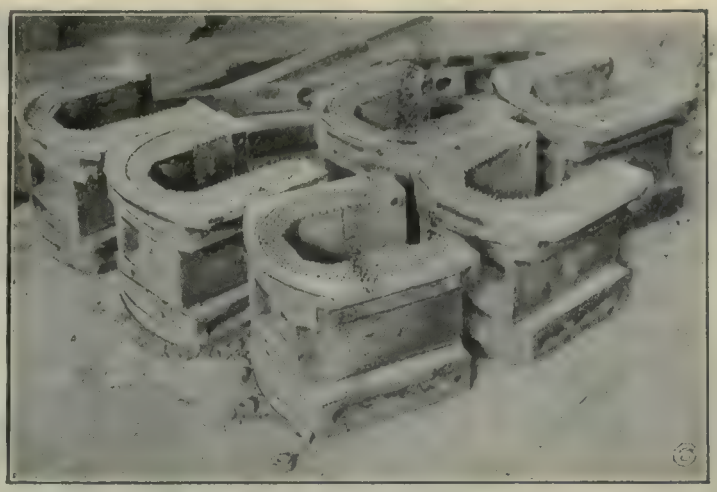


FIG. 6. DRIVER BOXES FACED WITH WIRE MESH READY FOR WELDING

table. The other type burners *B* have heads with ge gas holes that throw jets of flame across the table eath the crosshead shoes being heated. The latter angement avoids the possibility of molten babbitt ling into the gas holes and shutting off the flame. e table is covered with a heavy sheet of asbestos board t protects its top and reflects the heat. The table top s toward the left, so that the molten babbitt will run into a suitable receptacle.

Among the babbitting frames found in the shop is the e shown in Fig. 3. This has two solid iron mandrels unted on a steel table. Brasses to be babbitted are d against flanges on the mandrels by screw clamps.

Another babbitting frame, Fig. 4, is more convenient operate. Pushing down the foot lever *A* operates ough the connecting arms *B* to hold the brass in place the adjustable plunger *C*. The weighted lever arm *D* be turned down to hold the pressure pin *C* in place er the lever *A* is released.

Retainer for Driver Box Babbitt

A development that has been made for retaining bbitt on the hub face of driving wheel boxes shows sibilities of its application in other fields. A comison of the old and new methods of anchoring the bbitt to the box may be made from Fig. 5. The box *A* ws the old method of anchoring by cutting a dovetled groove in the face and drilling a number of holes additional security. This method has not proved secure, as is evidenced by the section of the hub plate that has broken away at *B*.

The new method of retaining the babbitt employs a section of heavy wire mesh as shown on the bearing box *C*. This wire mesh is of a grade and weight about equal to that used as a cinder screen in the smoke box. The face of the box has to be machined with a recess in which the screen can be inserted. The mesh is cut to the form indicated previously to being inserted. It is held in place by five or six spots where it is electrically welded to the steel box. The spots are each about $\frac{3}{4}$ in. in diameter and show distinctly in the illustration.

In preparing the boxes with the wire mesh the latter is cut from large sheets, and a full set of boxes is made up at one time, as shown in Fig. 6.

The special tables shown in Fig. 7 are used for the babbitting operation. An empty table is indicated at *A*, and two others at *B* have boxes in position ready for pouring the babbitt. A small pouring gate *C* is made of fireclay at the end of each box.

Two different practices of equipping driver boxes with bronze bearings were observed in this shop. One uses a pressed-in bronze journal bearing with bronze hub plates cast on the side of the steel box. This practice is seldom followed at the present time. The more common practice is to cast the bronze journal bearing and hub liner as one piece, and right in place in the box.

Before casting a mold is made up containing each box

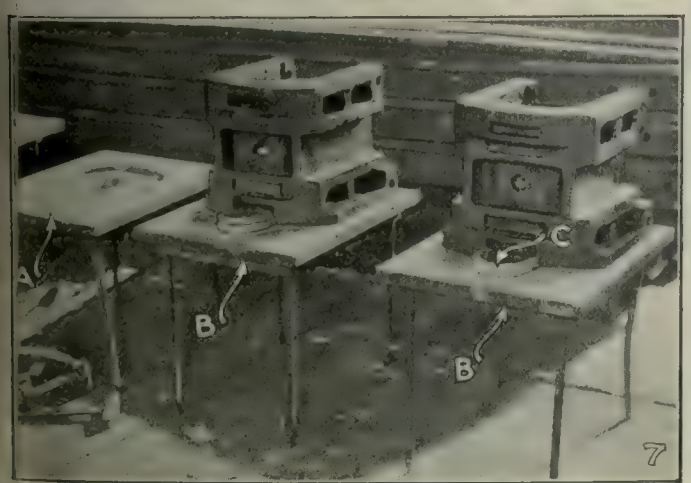


FIG. 7. BABBITTING STANDS FOR DRIVER BOXES.

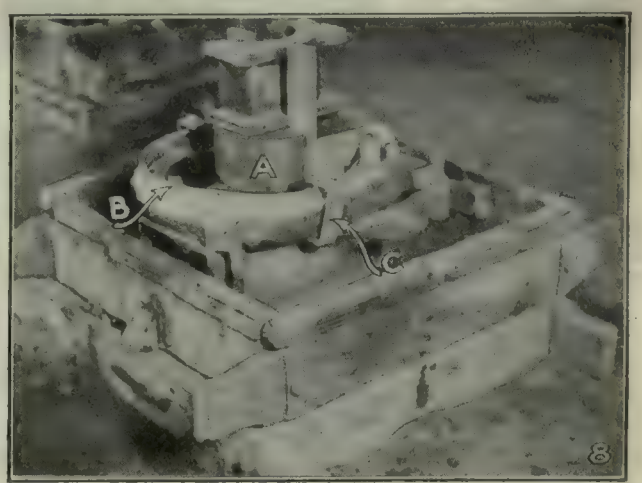


FIG. 8. DRIVER BOX IN MOLD FOR CASTING BRONZE BEARING



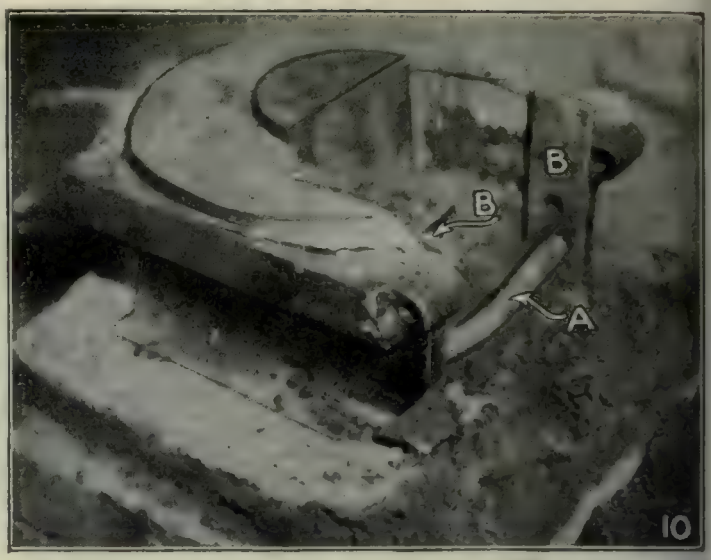


FIG. 9. POURING BRONZE BEARING IN DRIVER BOX, SUPPORTING THE LADLE ON TRESTLES. FIG. 10. BOX FITTED WITH SPACING BLOCKS TO CONTROL SHRINKAGE

and surrounded by an old foundry flask in the manner shown in Fig. 8. The steel bearing box rests on a sand slab-core, which makes the bottom surface of the bearing. Formerly an iron plate was used as a chill for the



FIG. 11. GROUP OF BRONZE LINED DRIVER BOXES

bottom surface but this was found objectionable because the molten metal cut into it while being poured. A dry sand core *A*, coated with plumbago wash, forms the inside of the journal bearing. It is held in place by molding sand rammed against its back face and weighted down to prevent it from floating up on the molten metal. Steel strips *B*, clamped to the box by small C-clamps *C*, form the edges of the open-top mold for the hub plate. The joints are daubed with fireclay to prevent run-outs.

The bearing bronze is melted in a tilting oil furnace built in the shop. It is dumped from the furnace into a double-shank ladle and carried to the mold. The pouring operation is shown in Fig. 9. Some bearings may require nearly 250 lb. of metal, so trestles are provided for sustaining the weight of the ladle while pouring.

Method of Correcting for Contraction

The expansion of the steel bearing boxes as they absorb the heat from the molten bronze causes the open sides to spread considerably apart. In some cases the spread amounts to as much as $\frac{3}{4}$ in. As the steel box contracts on cooling it compresses the slower cooling bronze interior and tends to put a permanent set in it. The effect of this is that after the steel box has finished contracting the bronze bearing casting still further contracts. The final contraction of the bronze has occasionally been found to leave a space between the steel box and the bronze casting after both are cold. The permanent compression of the hot bronze casting is prevented by the temporary insertion of a spacing block as shown at *A*, Fig. 10. All boxes are carefully measured before pouring casting, and a steel bar *A* together with the necessary spacing blocks *B* are selected to fit each job. The combined length of the bar with the spacing blocks on its end is $\frac{3}{16}$ in. greater than the space between the jaws of the cold box.

As soon as the bronze casting has set (and while it is still red hot) the mold is knocked away as shown in the illustration and the spacing bar and blocks are inserted. As the steel box contracts a point is reached where further closing of the jaws is prevented because the bar takes up this pressure. This permits considerable cooling of the bronze bearing without the compressive strains induced by the steel box. After 15 to 20 min. the steel bar is knocked out and the two parts are permitted to finish cooling together. By that time the spacing bar has done its work and the shrinkage of the two pieces is so uniform that no opening will appear between the two bodies. It is stated that the steel box shrinks sufficiently around the bronze bearing so that it is very tightly gripped. In this shop the spacing bar used is uniformly $\frac{3}{16}$ in. greater than the opening of the jaws when cold. A group of completed bearing boxes with cast bearings is shown in Fig. 11.

(Editor's Note: The foreman of another locomotive shop states that he has followed a very similar practice. However, he has found that the length of the spacing blocks, used between the jaws of steel driver boxes, must vary acording to the size of the box. This variation increases by one-sixteenth inch for each one inch increase in the diameter of the journal bearing.)

Press Tools for a Typewriter Part

Two-Stage Blanking Tools—Work Divided Between Two Sets of Tools—First Operation Provides Means for Accurate Location for Final Blanking

BY FRANK A. STANLEY

THE engravings illustrate a set of press tools used in the manufacture of a ball spacer for a typewriter and were made in the toolroom of the Smith Premier Typewriter Co., Syracuse, N. Y. A detail of the ball spacer is shown in Fig. 1 formed

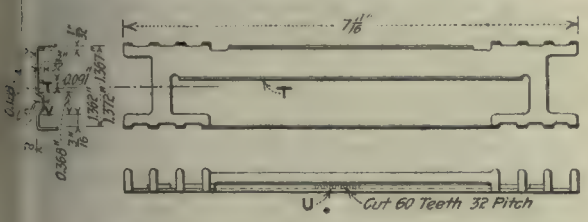


Fig. 1

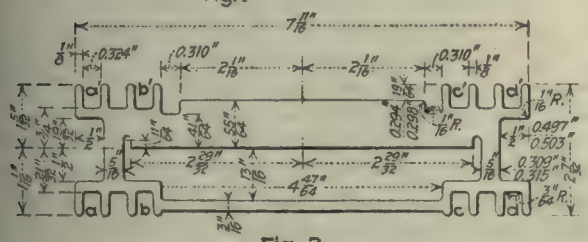


Fig. 2

FIG. 1. BALL SPACER COMPLETELY FORMED
FIG. 2. BLANK FOR BALL SPACER

an complete in respect to press operations. Fig. 2 shows the blank ready for forming. The blanking dies which perform the first operation of making the blank to the outline shown, but which do not pierce out the central rectangular opening, are illustrated in Fig. 3. These dies are really two-stage tools in that they are made to pierce out certain openings exterior to the blank itself before the stock feeds under the blanking punch proper, thus simplifying the character and work of the real blanking dies. Note that four piercing punches are located at *A*, *B*, *C*, *D*, and four corresponding die openings at *A′*, *B′*, *C′*, *D′*. Also that the round piercing punches at *E* and *F* and die openings *E′*, and *F′* for punching the two ⅜-in. holes by which the stock is located in its second position by pilots *G* for the punching out of the entire blank.

The four die openings *A′*, *B′*, *C′*, *D′*, are rectangular in form and of a width to suit the four outer notches in each group of six at the ends of the blank, Fig. 2. These notches are in Fig. 2 designated by the characters *a*, *b*, *c*, *d*, *a′*, *b′*, *c′*, *d′*. Referring to the sketch, Fig. 4, the operations on the sheet metal are shown in the two positions. First the four rectangular holes *A″*, *B″*

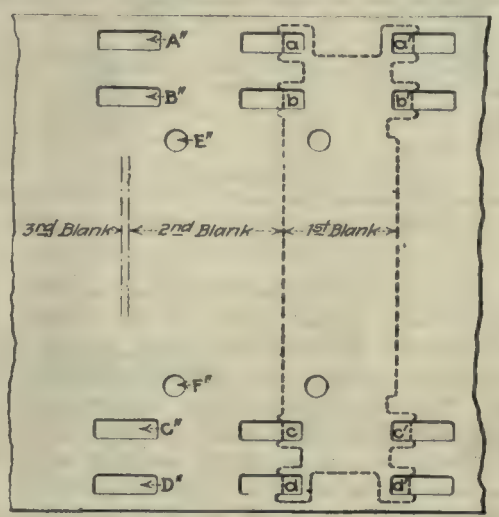


FIG. 4. DIAGRAM OF PIERCING OPERATIONS

C″, *D″*, and the two holes *E″*, *F″*, for the pilot pins are punched. The stock is fed forward one position and the blanking dies then cut out the blank to the outline indicated by the dotted lines. That is, this is the first blank. The same stroke of the press that blanks out this piece, also pierces the pilot holes and the four rectangular notches at the rear edge of the second blank. The rectangular punches at the same time pierce four rectangular notches for the front or leading edge of the third blank. Thus when the first blank is punched out the four notches at the leading edge of the second blank are cut across and left open, and so on with each step. Now the effect of the preliminary piercing out of the rectangular slots which form four of the openings or the inner edges of the prongs at each edge of the blank, is to reduce the work on the blanking die and to eliminate the long narrow die openings and punch sections that would otherwise be required to blank out the series of prongs on the work. The tools are thus simpler to make and keep in condition, and there is less likelihood of the blank edges dragging and becoming distorted in the dies. Examination of the die opening

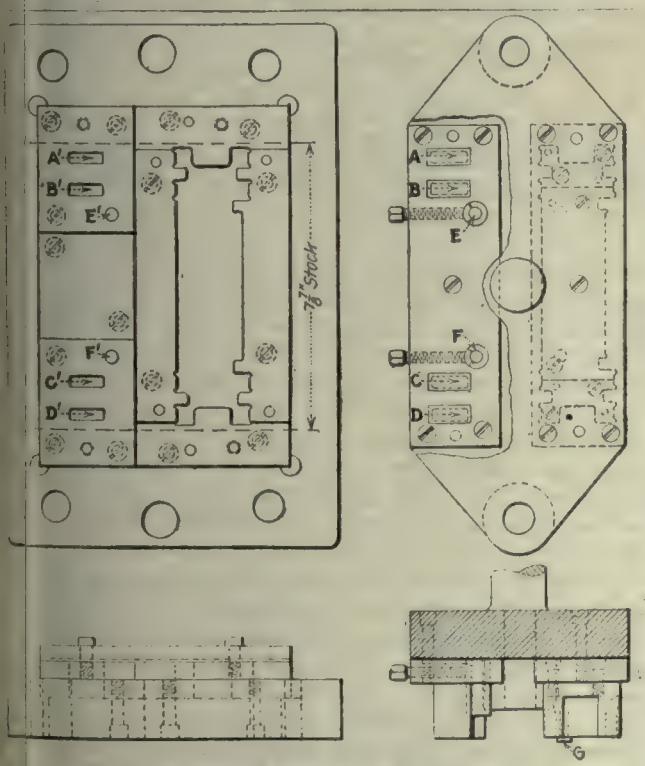


FIG. 3. LAYOUT FOR PIERCING TOOLS

in Fig. 3 will show at once how the outline is simplified by the addition of the rectangular piercing tools at *A, B, C, D.*

Reference has been made in other articles on press

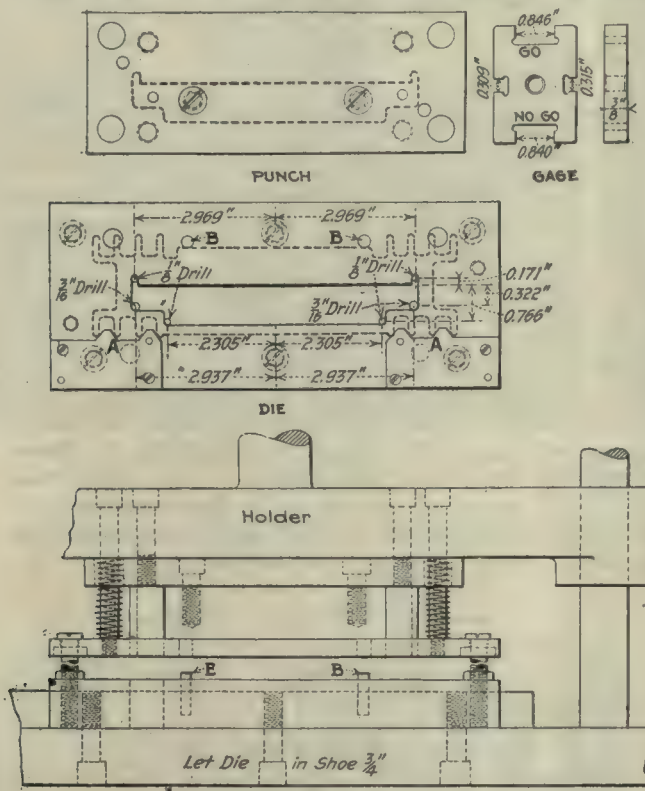


FIG. 5. PIERCING TOOLS FOR CENTRAL OPENING AND RACK SURFACE

tools to the practice in some shops of locating all die openings by small holes drilled at the corners, at the tops and bottoms of prongs and teeth, and so on; these holes defining accurately the general outline of the die opening. With the usual toolroom equipment, the milling machine with vernier attachments is used for getting the center distances for the holes or some method of using size blocks or other gages is applied. At the plant referred to a precision drilling machine is used

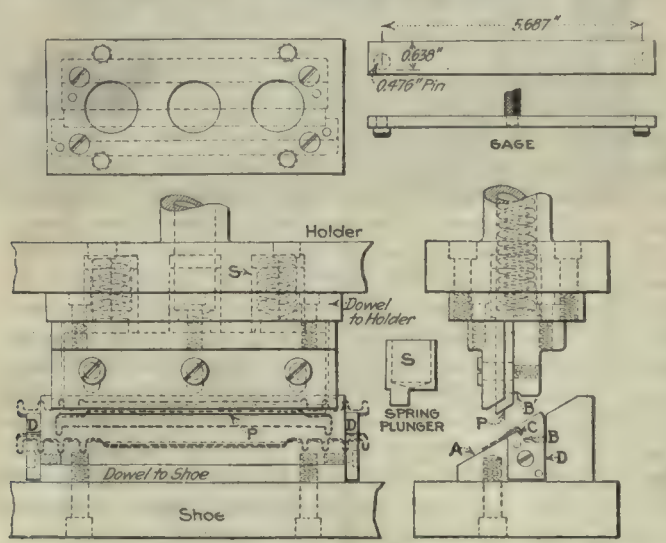


FIG. 6. FIRST OPERATION FORMING TOOLS

under which die layouts are very accurately handled. Thus in Fig. 3 a diagram is included at the right which is known as the precision layout. This gives the positions in two directions of all holes to be drilled in the die blank and with the work and machine once set, the positions for successive holes are quickly and accurately obtained by adjustment of the table slides in the required directions.

The dies shown in Fig. 5 are piercing tools for punching out the central opening and rack teeth surface in the spacing rack. Like the other dies in the equipment they are of the pillar type with two guide posts, one at each end, for aligning the punch head positively with the die shoe. The blank is nested against two steel blocks *A A* which have two V's each to enter between two pairs of prongs at each end of the blank, and there are two pins *B B* at the opposite side of the die to act as nesting pins for the straight surface along the other side of the blank.

The punch proper is secured to a steel base plate by two screws and two dowels and the latter plate is attached to the punch head or holder by four screws and two dowel pins. The combined pressure pad and stripper carried by the punch is held by four long screws on which pressure springs are mounted. The die is secured to its shoe by screws and dowels as indicated.

The limit snap gage at the right is a tool that should be used more commonly in press room work. With this gage the width of metal along the side and ends of the blank is tested and definite tolerances are thus provided so that the press work can be held within the prescribed limits, and wear on the dies can be permitted up to the point established by the gage dimensions when the press tools must be adjusted or replaced.

The first operation forming tools are illustrated in Fig. 6. These dies bend up the bar at *T*, Fig. 1, to a

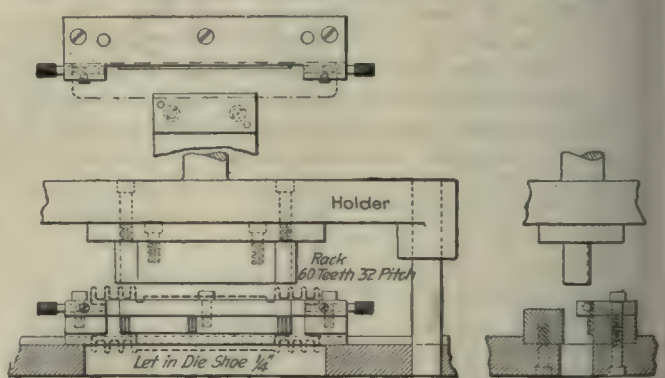


FIG. 7. TOOLS FOR RACK TEETH

right angle to the body of the blank and prepare this portion for the finishing of the rack teeth along its length. The die instead of being made with the customary flat face is provided with a 30-deg. sloping face *A* and the inner face over which the work is formed is made at a right angle to *A*, as shown at *B*. The forming portion of the punch as seen at *B'* is made at a corresponding angle. The bent down or formed portion of the work itself will be noticed at *C*. The work is located between end stops *D, D*, and rests upon the upper shoulders *E* of these stops.

There are various advantages in placing this die face at the angle shown instead of having it in a horizontal plane. In the first place the work drops naturally into place on the inclined face and rests against the stop surfaces *E* on *D, D*. Secondly, the punch and die faces for the forming operation being at an angle allow the work to be bent down naturally and the corner of the metal is not touched until the punch reaches its lower

position when it sets the corner and formed surface dead square to the body of the blank. Now, if the die face were flat as usual, and the forming portion of the

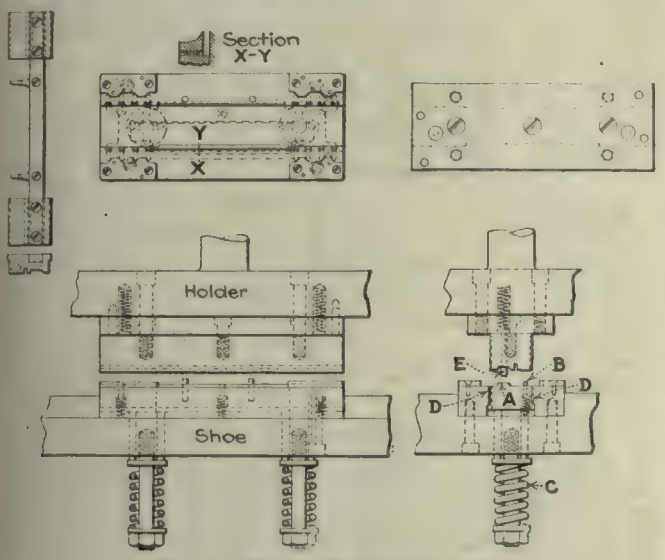


FIG. 8. FINAL FORMING TOOLS

punch perpendicular, the action of the punch would be to strike near the bending corner first and then in folding the metal down to a right angle there would be a tendency to stretch and draw it with possibility of slight distortion at least. This is avoided in the construction shown, and the forming face of the punch having the slope shown can force the work snugly down to the anvil-shaped portion of the die corner and "set" the metal accurately to form.

Then too, the sloping face of the die and the corresponding face of the pressure pad *P* assure the latter forcing the work down against the stop-shoulders and holding it there positively during the forming operation.

A detail of one of the spring plungers *S* of which there are three for the pressure pad *P*, is shown. These plungers are bored out from the top to receive the springs and the bottoms are milled off to form a tongue ⅜ in. thick which enters the opening in which the pad is carried and so acts upon the upper edge of that member. The pad is slotted through the body to allow three shoulder screws to pass through to retain the part in place and still provide for about ⅜ in. up and down movement in the punch body.

The dies shown in Fig. 7 are for the rack teeth *U*, Fig. 1. There are 60 of these teeth, 32 pitch. The narrow flange or ledge *T* has been bent up to a right angle as explained in connection with Fig. 6. In the dies shown in Fig. 7 the work rests on the flange *T* with the body of the piece in upright position as indicated by the front elevation.

The final or finish forming dies are shown in Fig. 8. These tools form up the right-angle flanges along the edges of the work and also form the V-shaped channels at *V*, Fig. 1. The drawing is in the main self explanatory. The work is nested between the V-shaped stops at the ends of the die proper and in operative position it rests upon the V-portion of the die at *A* and upon spring pins *B*. The die is of the compound order and as the punch descends the V-channel is formed over portion *A* of the die and continued downward pressure then causes die block *A* to descend against the action of pressure springs *C* and the flanged edges of the work are then formed up along edges *D* of the die proper. On the return stroke member *A* being forced upward by the under springs acts as an ejector and the spring pins *E* in the punch also act as stripper or shedder pins to clear the formed work from the punch.

Burnishing Broaches

How to Make and Use the Broaches—Kinds of Spoiled Work That May Be Reclaimed by Their Use—Turning Broached Work With a Diamond

BY E. A. DIXIE

IT IS SURPRISING how little knowledge there is among mechanics regarding burnishing broaches. Not only are they easy to make and use but a knowledge of their application often means the saving of a job which has been made too small or too large.

The use of burnishing—or as they are often termed "button" broaches is comparatively old. The writer used them nearly thirty years ago and their use at that time was old to the mechanic who showed him how to make them.

As far as known to the writer there are but two types, those with narrow "buttons" and those with wide ones. In Fig. 1 are given the dimensions for the narrow button type from ⅜ to 2 in. inclusive. And in Fig. 2 are given the dimensions for the wide bulb type from ⅜ in. in diameter upwards.

Burnishing broaches should be made of a good grade of carbon steel, hardened and drawn *slightly*. After hardening they should be ground and if a very fine surface is required on the work they may be lapped. While they should preferably be made of carbon steel, high-speed steel and also machine steel are suitable for this work. If made of the latter they should be carburized at least 1/16 in. deep.

The grinding may be done either with a formed wheel or by using a fixture whereby the wheel can be swung to the desired circle. When grinding them on the ordinary cylindrical grinder a formed wheel should be used and when grinding them on the bench lathe a small wheel may be used driven from over-head and held in a swiveling fixture to give the bulbs the correct curve.

When grinding on the cylindrical grinder a male broach is first ground in the same way that a plain cylindrical piece is ground. The two ends are ground 0.001 in. less than the size of the smallest bulb of broach. The four large bulbs are next ground all the same size and 0.002 in. larger than the nominal size of the broach. The bulbs which comprise the tapered length of the broach are then ground tapering just as a tapered mandrel would be ground.

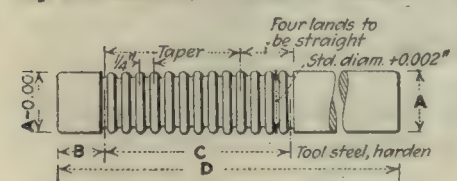
The form-grinding wheel for shaping the bulbs is now mounted on the spindle, trued up and dressed to the desired curve with the diamond. The corners are then rounded as shown in Fig. 3 so that the junction of the

bulbs will not be a sharply defined groove but a distinct curve. The reason for this is that cracks are very liable to develop if the grooves are not properly rounded.

With the wheel properly dressed to shape, the grinding machine operator starts at the first or smallest bulb and feeds the wheel into the work till he has almost removed the flat (left by the previous grinding) from the top of the bulb. He then moves the work or wheel to the next bulb and does the same thing, just leaving a narrow flat on top of each bulb untouched by the formed wheel. When all the bulbs have been form-ground in the same way the broach is in usable condition. If however a very fine smooth-working broach is desired he can go a step farther and lap it. This can be done with a lead lap cast on the broach or a piece of wood which makes a very good substitute. Fig. 4 shows an easily made wooden lap which gives good results. It must be remembered that only the *tops* of the bulbs are in contact with the work under working conditions; it is therefore not necessary to obtain a high polish on any other parts of the bulbs.

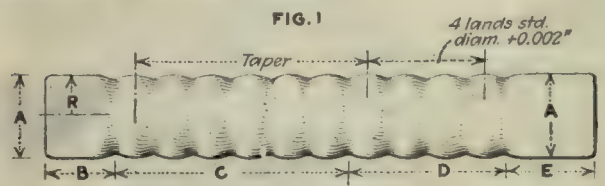
Referring to Fig. 4, *A* and *A* are two soft wood handles. To these, two *end-wood* pieces of hard maple *B* are attached by screws. A strap hinge *C* is secured about as shown. After the whole has been assembled a piece of wood about ¼ in. thick is placed between the hard wood pieces *B*, the handles *A* are tied together with a piece of string and a hole *D* about the diameter of the broach is drilled through the hard wood pieces. The insertion of the piece of ¼-in. wood between the hard wood pieces before drilling permits the two halves of the wooden lap to be closed on the broach during the lapping operation.

After the hole is drilled the two pieces of ¼-in. wood are removed. The ground broach with a dog on one end is now placed between centers in the lathe and the lap is closed in it while it rotates. This wears a series



A	B	C	D
¾ to 1	5/8"	2½"	5½"
1 to 2	¾	3½	7½

FIG. 1



A	B	C	D	E	R
Standard -0.001"	1"	4 to 6 bulbs in length	4 bulbs in length	To suit work	Radius of bulb = ½ diam. of broach

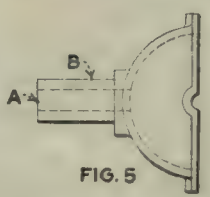
FIG. 2

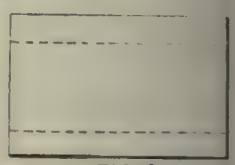
FIG. 1. DIMENSIONS OF BURNISHING BROACHES FROM ¾ IN. IN DIAMETER. FIG. 2. DIMENSIONS OF BURNISHING BROACHES FROM ¾ IN. IN DIAMETER UP

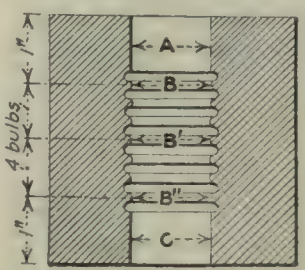
of grooves in the hard wood. These grooves for the reason previously given need not be very deep, ⅛ in. being quite enough for a start for they will soon wear deeper when the abrasive is applied. Almost anything in the way of an abrasive will do, emery, alundum or carborundum with oil, but it should be fine enough to give the required finish. If carborundum is used I would suggest nothing coarser than 15 minute. For producing a very fine finish 65-C alundum gives very fine results, but the lapper must always remember that he cannot start with a coarse abrasive on a lap and then use finer abrasive on the same lap and get good results.











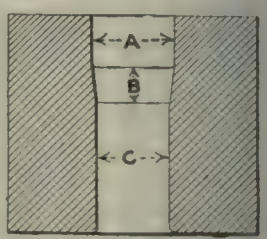


FIG. 7

FIG. 3. SECTION OF WHEEL FOR GRINDING BULBS. FIG. 4. LAP FOR BURNISHING BROACHES. FIG. 5. JOB TOO SMALL RECLAIMED BY BURNISHING BROACHES. FIG. 6. JOB TOO LARGE RECLAIMED BY BURNISHING BROACHES. FIG. 7. INTERNAL BROACH, WITH BULBS. FIG. 8. PLAIN BURNISHING DIE

He must keep his coarse laps for coarse abrasive and have fine laps for fine abrasive. A single grain of coarse abrasive on a fine lap will ruin the work of that lap.

When lapping the broaches the operator should keep his eye on the job and not run long without removing the lap, washing the broach with gasoline or kerosene and examining it very carefully to see that he has not lapped it too much. All it needs is to have the grinding marks removed and this only when an exceptionally fine broach is required. For the ordinary run of work the broach can be used just as it comes from the grinding machine.

And now a word on the uses of burnishing broaches.

Burnishing broaches can be used for reclaiming work which is too small in outside diameter providing the hole is also small; for reclaiming work which is too small in the hole providing the outside is over size but their greatest usefulness is in the production of work such as bushings of almost exactly uniform inside and outside dimensions.

Reclaiming work which is too small in outside dimensions is done as follows: As an example I have selected a job in the automobile industry. In Fig. 5 is shown a part of a differential of which many thousands are turned out in the United States each year. The limits on the stem *B* are pretty close and in the bustle of production a fairly large percentage of them are turned too small. There is however nothing very particular about the size of the hole *A*. This being the case a burnishing broach can be forced through *A* and if the broach is made large enough it will expand the stem *B* and make it large enough to finish to correct size.

Reclaiming a piece which is too large in the hole is

done as follows: As an example I have chosen a job, Fig. 6, of which about 300 had been reamed by a cub apprentice, with a reamer three or four thousandths over size, before someone noticed what was wrong. To avoid the expense of scrapping the lot the external burnishing broach, shown in Fig. 7, was made. Before putting the bushings through this broach they were turned five or six thousandths over size in diameter. The dimension *A* of the broach, Fig. 7, was made about 0.001 in. larger than the turned bushings. The dimension *B* was the same size as the bushings, and the diameters of the internal bulbs, if I may use the term, gradually decreased till at *B1* they were about 0.005 in. smaller than the required finished size of the bushings. From *B1* to *B2* at least four lands should be the same size. Pushing the bushings through this internal burnishing broach reduced the holes so that they could be finished with a standard reamer. It was found on pushing the bushings through the hole which was 0.005 in. smaller than the required size that when released from the internal broach they expanded enough to bring them about 0.001 in. smaller than standard size. Internal burnishing broaches need not have bulbs unless there is (as in this case there was) an excessive amount of closing to do. For the ordinary run of work where there is, say only two thousandths or so to contract, a plain die as shown in Fig. 8 will do the job all right. The dimension *A* is made about 0.001 in. smaller than the work; it is a receiver for the work that among die makers is termed a "set edge."

The part *B* is tapered from the dimension *A* to the dimension *C* which is the finished size of the work *less the amount the work expands after it is released from the die.* The amount of expansion will have to be ascertained by experiment for it will vary with the thickness of the wall and the material from which the work is made.

A die of this kind to produce nice smooth work should be finished to a high polish and the work should usually be well lubricated before it is pushed through.

As previously stated the greatest use for broaches of the types shown is for producing bushings of the highest accuracy and finish. I recently went over a plant in England where the product is bronze bushings. They were just plain cylindrical pieces of bronze with a hole through them, but the holes were straight and round and concentric with the outside, and the bushings were a drive fit for a standard size hole in a machine frame.

Let us take as an example a standard size made by this firm, 1⅛ in. outside diameter, 1⅛ in. long, with a standard ¾-in. hole from end to end.

The old method of making such bushings was as follows:

The bushing casting was held in a combination chuck in the lathe. The hole was drilled, bored and reamed, and the front end faced. The bored bushing was then pushed on a floating mandrel in another lathe and the other end faced and the outside turned 0.015 in. oversize for grinding. The last operation was to push the bushing on a floating mandrel in the grinding machine and grind the outside a grinding fit for the standard 1⅛-in. hole. The last operation requires not only skill but care and a fairly large percentage of bushings were scrapped from this operation.

The method now employed for producing these bushings is as follows:

The bushing is chucked as before in a combination chuck and the ¾-in. hole bored and reamed and the end of the bushing faced. The bushing is then transferred to the floating mandrel and turned about 0.002 in. over size and the other end faced. After the bushings have been brought to this stage of completion they are taken to the arbor press where they are pressed one at a time into a hardened and ground steel die similar to that shown in Fig. 8. The straight part of this die is about 1¼ in. long. Before they are pushed out of the other end of the die a burnishing broach ¾ in. in diameter, made like Figs. 1 or 2, is pushed through the hole in the center of the bushing. Pushing the 0.002-in. over size bush into the die closes the reamed hole nearly 0.002 in. and affords that amount of stock for the burnishing broach to work on. After the ¾-in. burnishing broach has been pushed through, the surface of the hole is very highly polished. The bushing is then pressed out through the other end of the die.

These two operations take considerably less time to perform than to describe.

If the burnishing die is made the same size as the holes in the machine frame which later are to receive the bushings one can rest assured that after the bushings have been forced through the die they will press snugly into the holes in the machine frame. The arbor press job is handled by an apprentice or a laborer, practically no skill is required and it is next to impossible for the operator to make a mistake. If the bushings are placed in the "set edge" and pushed through they can't help being perfect when they are ejected from the die.

Passing through the die so smooths all unevenness on the surface of the bushing that there is no seizing and "bugging up" when the bush is pushed home in the machine frame. This was a common source of annoyance and loss when the outsides of the bushings were ground.

I was told that the saving in time for the manufacturing end was between 25 and 30 per cent over the old way and that in assembling, taking into consideration the trouble with bugged-up bushings, a similar amount of time was saved. There was absolutely no comparison possible between the ground and the broached bushings so far as quality of work was concerned. The latter have the further advantage that the compressed surface wears much better than the reamed.

One little trick worthy of mention in that English factory is that the hard bronze played the dickens with the steel tools which had to be ground after every half dozen or so bushings were turned. The cut was very shallow, not more than 1/32 in., but much time was lost in resetting to depth. Various expedients were tried in the way of setting gages and grinding attachments secured to the lathes so that the tool could be ground without releasing it from the toolpost but the trouble was finally solved by the use of black diamond (carbon) tools. These would hold their size for weeks at a time and when too dull to cut properly they were easily resharpened on a diamond cutter's wheel. I was told by the management that the saving in grinding time, for steel tools whose life would be equivalent to the life of a diamond tool between resharpenings, more than paid for a new diamond tool.

The use of the diamond tools was comparatively new to them and at first they were used for turning only; however, while I was there they were experimenting on diamond boring tools and had obtained some fairly good results.

Magnetic Chucks



V. The Blanchard Chuck

Magnetic Chuck Necessary Part of Grinding Machine—Blanchard Chuck Made from Solid Steel Block—Unique Construction Methods Used

AN INTERESTING example of the magnetic chuck is that developed by the Blanchard Machine Co., Cambridge, Mass., as a part of their well-known surface-grinding machines. Being unhampered by the limitations that are imposed upon designers of tools intended for general utility, and having in mind only the serviceability of the device as a part of their machine the engineers of the Blanchard company were able to devote their attention to the production of a chuck that would at once provide maximum holding power and afford the greatest resistance to hard work and possible abuse without impairment of its accuracy or disarrangement of its electrical components. The makers of this device consider it as the work table of the machine and it is used in that capacity whether its magnetic properties are called into service or not. Provision is made for bolting work to it so that it may be used to hold pieces of non-magnetic material as well as iron or steel. Fixtures are designed to bolt to the table for the purpose of holding non-magnetic material or pieces that are of very irregular shape.



FIG. 72. UPPER SURFACE OF BLANCHARD CHUCK

Though magnetic chucks had been on the market for nearly twenty years when the Blanchard chuck was patented (Jan. 19, 1915), they had been generally considered an adjunct of the surface-grinding machine as used in toolrooms and classed as a toolmaker's device. Surface grinding as a manufacturing proposition was still in its experimental stages; indeed the Blanchard high-powered vertical-surface grinder may be considered as one of the pioneers in this field.

The successful development of the rotary grinding machine was almost dependent upon the magnetic chuck; without this quick, simple and sure method of clamping work upon the table, with its absolute freedom from interfering accessory parts, the introduction of the process of production grinding upon a multitude of small parts would have received a serious setback if it had not been entirely prevented. Even now it is necessary only to contemplate what would happen to a table full of small irregular-shaped and insecurely-held pieces of cast iron or steel if even one of the forest of small bolts .and clamps, that but for the magnetic chuck would be necessary to hold the work, should let go under the pressure of the grinding wheel, to conceive the difficulties against which the sponsors of such a method would have to contend.

Blanchard Makes Chucks Only for Blanchard Grinding Machines

The Blanchard Machine Co. makes chucks only for its own machines, and consequently only in the round form. Three sizes are made: 16 in., 26 in. and 30 in. in diameter. There are differences other than size between them but the difference is because of physical limitations and does not materially change the method of manufacture or alter the electrical characteristics.

In Fig. 72 may be seen a top view of the Blanchard

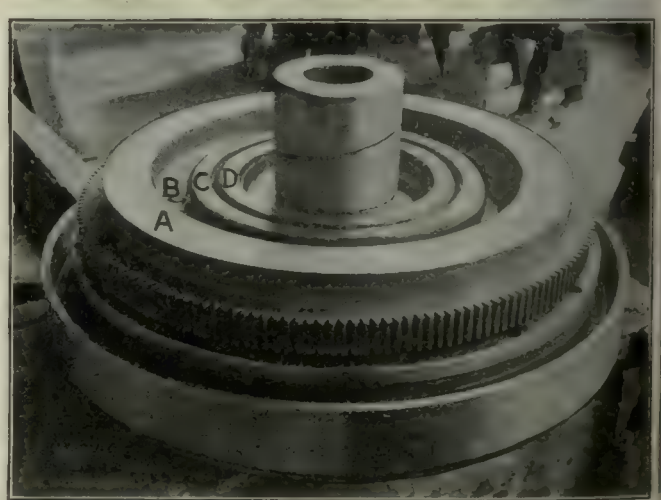


FIG. 73. CHUCK INVERTED TO SHOW MOUNTING

chuck displaying the characteristic circular zones of magnetic influence separated by unbroken dividing rings of brass, which distinguish this chuck from all others now on the market. Fig. 73 shows the reverse

side of the chuck with the bearing and driving ring upon which it is mounted.

Unlike other grinding machines of its class, the Blanchard has no spindle other than the one which carries the grinding wheel. Thus the chuck as seen in Fig. 73 is a complete machine table ready to take its place in the machine. The hollow stud in the center is the journal of the bearing in which the chuck turns, while the carefully scraped bearing surface *A* supports the weight of the chuck and work and takes the thrust of the grinding operation. Upon the periphery of this casting, which is nearly as large in diameter as the chuck itself, are the gear teeth that mesh with the driving pinion.

The Contact, or Collector Rings

A ring of bakelite, to be seen at *B*, is located concentrically upon the casting and fastened to it by fillister-head screws. Upon this insulating ring, the bronze contact rings *C* and *D*, constituting the means of electrical communication betwen the stationary machine frame and the revolving table, are mounted. The

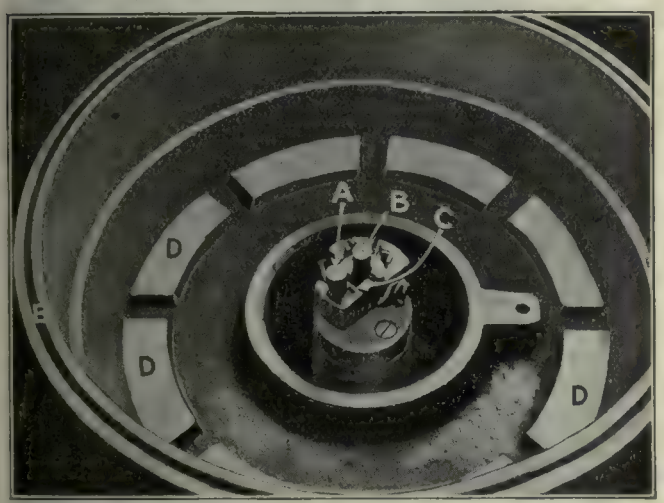


FIG. 74. BRUSHES IN PLACE ON GRINDING MACHINE, CHUCK REMOVED

construction of the smaller grinding machine is somewhat different in the manner of mounting and driving the chuck but the principles are the same.

In Fig. 74 is shown one of the smaller machines with the chuck removed. The brushes *A* and *B*, which carry the electric current to the contact rings, are round plugs of carbon resting upon coil springs contained within the bakelite mounting block *C* so that the electric contact is established under spring pressure and remains constant in despite of wear or changing conditions due to changes in temperature.

The bakelite block, or brush-holder, of the smaller machine is so placed inside the hollow central stud as to establish electrical contact with the chuck as nearly as possible to the center of its rotation. The brush *B* is at the exact center and there is no movement between it and the contact ring (which in this case is a button) except a rotative one; while the diameter of the ring in contact with brush *A* is not more than three inches; thus the wear upon the brushes is reduced to a minimum. The brushes for the 26-in. chuck are mounted outside the central stud and the contact rings are necessarily larger.

Front and back views of the insulating ring used on the larger chucks are shown respectively at *A* and *B*, Fig. 75, and at *C* is the corresponding part for the 16-in. size. The brush-holder and brushes are shown at *D* in the same illustration, while at *E* may

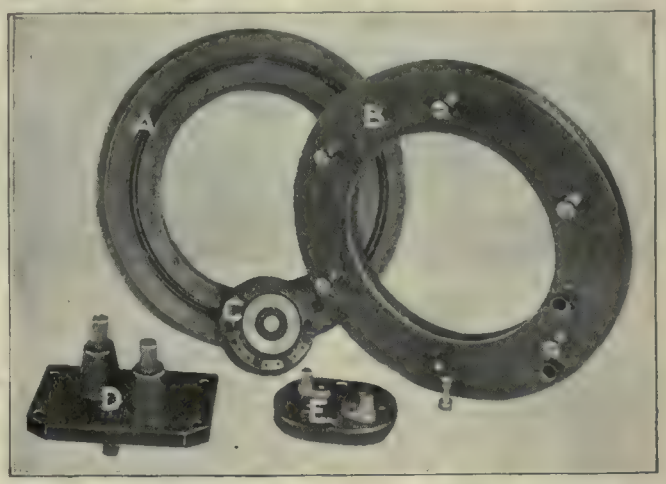


FIG. 75. CONTACT RINGS AND BRUSHES FOR CHUCKS

be seen the terminal block used on the 26-in. chuck to establish electrical connection between the contact rings and the wires of the coils.

Referring again to Fig. 74, *D* is the surface upon which the ring *A* in Fig. 73 bears. Both these surfaces are carefully scraped to the special surface plate shown in Fig. 76, which is made in the form of a ring. The surface *D*, Fig. 74, instead of being a continuous ring, is interrupted at intervals to facilitate lubrication.

Blanchard Chucks Made of Steel Forgings

The limitation in the matter of weight, which must ever be kept in mind by the designer of accessories, could be ignored by the Blanchard engineers for the reason that they were designing a machine table rather than a chuck. Instead of being built up from steel castings, the Blanchard chuck is "dug out" from a solid disk of forged steel weighing, in the 26-in. size, approximately 600 pounds. By using a forging the designers avoided trouble consequent upon the lack of homogeneity and the presence of blowholes that is characteristic of steel castings and which might result in leaks both of water and of magnetism; the first because of holes penetrating the structure and the second because of interruption of the magnetic currents where no interruption should exist. A section of the 26-in. chuck is shown in Fig. 77 and in Fig. 78 may be seen one of the blanks on a Bullard vertical turret lathe where the "digging out" is in progress. The grooves *A* (Fig. 77) are cut one at a time, two cuts to each groove, with a tool slightly less than half the width of the groove. This leaves a central wall while the second cut is being made that holds the tool against a tendency to "crawl" away from its work as would be the case were it cutting on



FIG. 76. SURFACE PLATE USED WHEN SCRAPING THE THRUST BEARINGS

one side only. The wall is easily broken out after both cuts are down to the required depth.

No attempt is made to secure a smooth surface on these cuts beyond that which results from keeping the

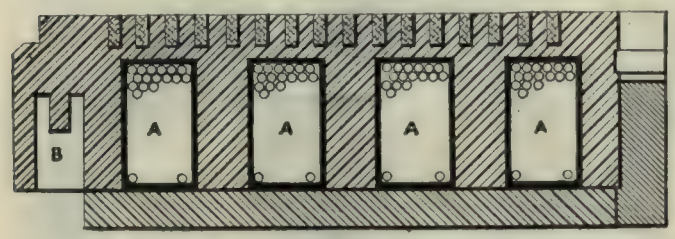


FIG. 77. SECTIONAL VIEW OF BLANCHARD CHUCK

tool properly ground for its work. The slight roughness gives a better hold to the insulating compound with which all otherwise vacant spaces in the chuck are filled before closing it up.

The chuck body shown on the table of the vertical lathe in Fig. 78 is nearing completion, so far as this operation is concerned. The outer grooves have already been cut, but as the tool works under a flood of cutting compound, the finished grooves are filled with the liquid and do not show to advantage in the picture.

The cutting is done at comparatively high speeds with strong feeds, and taxes the capacity of the machine and tools to the utmost. The broad surface of the cutting tool causes chatter despite the deep cross-section and the short distance the cutting portion projects from the holder. Though the cross-rail is brought as low as possible it is still necessary to provide additional support as nearly as may be in the direct line of thrust, and for that purpose a bar of steel suitably shaped is introduced between the toolholder and the saddle of the machine, being held by the C-clamp shown in the picture. The chatter is thus very much reduced but it is far from being eliminated.

Cutting the Small Grooves

The smaller grooves on the upper surface of the chuck, 15 in number on the 26-in. size, are cut with a gang tool holding 5 blades. These small grooves are for the purpose of breaking up or interrupting the flow of magnetic current and compelling the lines of force to pass through the work. Were it not for these grooves the current would find an easy path through the chuck body and would exert no holding power at the surface.

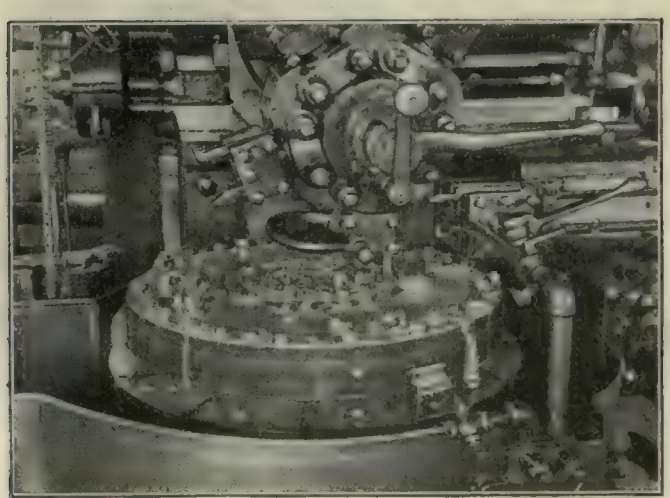


FIG. 78. "DIGGING OUT" A BLANK FOR 26-IN. CHUCK

As was explained in the introductory article, these grooves but partially interrupt the magnetic currents. There is an unbroken section of steel $\frac{7}{8}$ in. thick below the grooves in which the degree of magnetic "saturation" must approach the practical limit before the full value of the magnetizing influence is available at the surface.

In designing this chuck the engineers were obliged to choose between two evils: One being to make a composite chuck surface, that, however tight it might be when new, was open to the possibility of developing a leak after months of hard service and perhaps abuse; the other to make a chuck that should have no joints whatever in its upper surface, but that would, because of this condition, require a higher energizing current. Knowing that the chuck would be required to work



FIG. 79. BRASS DIVIDING RINGS AND TOOLS FOR STAKING THEM

continuously under a flood of strong alkaline solution that quickly would cut its way through the protective covering of the coils if allowed to reach it, they chose the latter alternative.

Knowing the area of the cross-section of material through which the magnetic currents would have uninterrupted flow, and knowing from the permeability chart the amount of current required to saturate that section, the engineers had only to provide the requisite number of ampere turns to bring about this condition and then build up from that point by adding a sufficient number of turns to produce the density of magnetic flux in the remaining parts that would insure satisfactory holding power at the surface of the chuck.

For this reason the energizing current required by the Blanchard chuck is somewhat in excess of the demands of other chucks; to offset which insignificant disadvantage there is a chuck body made of a single

piece of homogeneous material through which water cannot possibly penetrate.

Electrically, or rather magnetically, considered, the object sought in breaking up the surface of the chuck is attained in the cutting of the grooves. The chuck would be just as strong mechanically and as powerful magnetically if these grooves were left open, but in this condition they would become a settling basin for iron chips and sediment until the magnetic conductivity was at least partially restored, and the chuck would lose its grip to a corresponding degree. To prevent this condition as well as to present a smooth unbroken surface to the work these grooves are filled with brass.

The manner of setting in these brass rings is ingenious. Strips of sheet brass one or two thousandths thinner than the width of the grooves are cut and formed on a bending roll to circles of approximately the same diameters as the grooves. The ends are neatly butted together to make a complete circle.

The width of the brass strips is such that when they are driven into the grooves, the driving being accomplished by means of a mallet, the brass will project about $\frac{3}{32}$ in. above the surface of the steel. The chuck is then trued up on the table of an old boring mill in the tool bar of which is a pneumatic hammer fitted with a staking tool.

By means of the saddle and slide-rest, the staking tool is brought down on one of the brass rings, the mill table started and the air turned on the hammer. About two turns of the table to each ring is sufficient to spread or swage the metal so that it completely fills the grooves, closes all joints, and shows an apparently unbroken ring of brass.

Not a very good way to treat a boring mill? Perhaps not, but the mill in question is an old one that has been superseded in production work by a modern tool of the same class. It does neatly and quickly a job that would otherwise require a great deal of time, not to mention patience and back-breaking work; therefore it is earning its keep as surely as if it were cutting metal. Besides all this, the mill is as capable of "taking off the first cut" as it ever was.

After staking in the rings, the chuck is transferred to the vertical turret lathe and faced off flat, no attention being paid to fine finish, for all chucks are ground in place on the machine with which they are shipped. At the same setting the outside is finished and the center hole bored.

At the time of the writer's visit to the Blanchard plant, no staking was being done, but in Fig. 79 may be seen the mill, the hammer and a pile of brass rings ready for the next batch of chucks to come along.

As may be seen in Fig. 77, a groove *B* is cut at a point that is really outside the body of the finished chuck, to prevent water from getting to the only place where it would find a possible entrance to the interior.

The chuck body could not well be more completely water-tight than it is. There are no holes or openings of any kind communicating with or leading from the



FIG. 80. A 26-IN. CHUCK INVERTED: MACHINE WORK FINISHED

upper surfaces; none have ever been made. The coils of wire practically fill the space which they occupy: and to make assurance doubly sure the last operation before closing the chuck is to fill these spaces with a molten insulating compound which is hot enough to penetrate any minute space that may be left. The joint between the chuck body and the cover plate (which is on the bottom of the chuck instead of the top) is ground, and is therefore water-tight.

Not Much Chance for Leakage

Notwithstanding all these precautions against leakage to a point where the coils might be injured, the stop-water or "skirt" sets over a ring shown at *E*, Fig. 74, that is part of the machine frame casting and excludes water from any place where it could find entrance to the chuck if such entrance existed. The annular groove in this ring is provided with drain holes leading to the under-side of the machine frame so that if water could get by the first guard it could not fill the groove, and thus would not have a chance to pass the second.

A chuck body on which practically all machining has been done is shown in Fig. 80 on the table of a drill-press where it is being tapped for the screws that hold the cover plate. The four grooves for the coils are plainly shown, as is also the stop-water groove. The rectangular slot milled across the main divisions is to accommodate the cross-connections between the coils and before closing the chuck this groove will be filled with the insulating compound.

The cover plates are plain disks of steel ground on both sides, and having no holes that communicate with the interior of the chuck except the one that receives the terminal plate previously mentioned; which, when the chuck is finished, is sealed in with a special water-and-oil-proof insulating compound.

(Continued in next week's issue.)



Gears for Motor Transmissions

Machining Operations—Construction of an Unusual Gear Chuck—Finish Grinding the Sides of the Teeth on Spur Gears—Assembly of Gear Sets

By FRED H. COLVIN
Editor, *American Machinist*

BEGINNING with the countershaft drive gear which has 31 teeth of $\frac{8}{9}$ pitch (Fellow's stub tooth) and is in consequence a little less than $5\frac{1}{2}$ in. outside diameter, the first machining operation is to bore and face the first side. This work is done on a double-spindle Jones & Lamson machine in the usual manner, as in Fig. 1. Next comes the reversal of the piece and the turning and facing of the second side. The sides are then ground on the vertical spindle machine shown in Fig. 2, after which the hole is reamed, and the teeth are blocked out on a Barber-Coleman hobbing machine.

Finishing the teeth is done on a Fellow's gear shaper after which there is a small filing operation to remove burrs, after which the gear goes to a special rolling device mounted on the lathe carriage, as shown in Fig. 3. The gear *A* to be rolled is mounted on a suitable mandrel and run in mesh with the hardened gear *B* so as to bring out the bearing surface. This method has been very successful in maintaining a high quality of gears, because should they not show up well on the test, steps are immediately taken to find out the cause.

Every operation is inspected and there is a final inspection before going to the hardening department. The gear is then carbonized, brushed, re-heated, quenched and drawn to the proper temperature, after which it is brushed again and sand-blasted. It is then polished for Brinell testing, though the old-fashioned file test is still used, as is the case in so many other manufacturing plants.

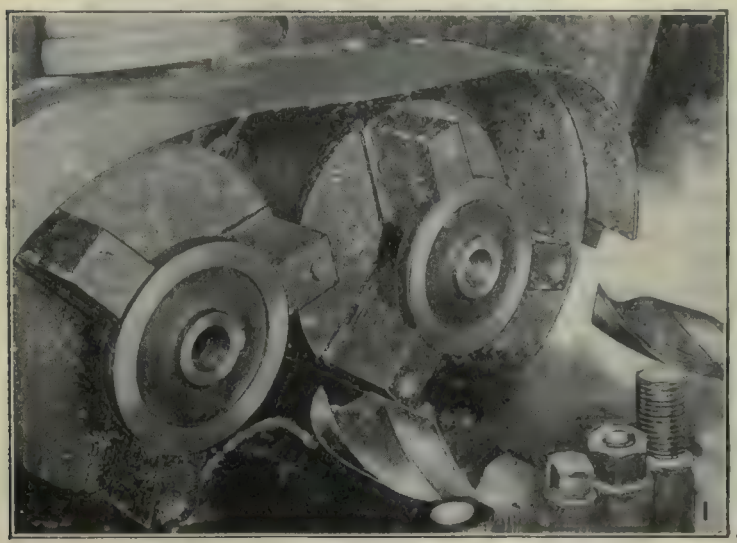


FIG. 1. BORING IN DOUBLE SPINDLE FLAT TURRET MACHINE

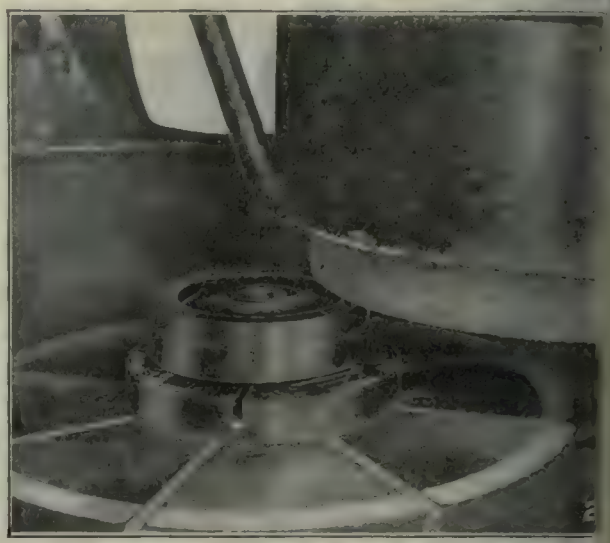


FIG. 2. GRINDING THE SIDES

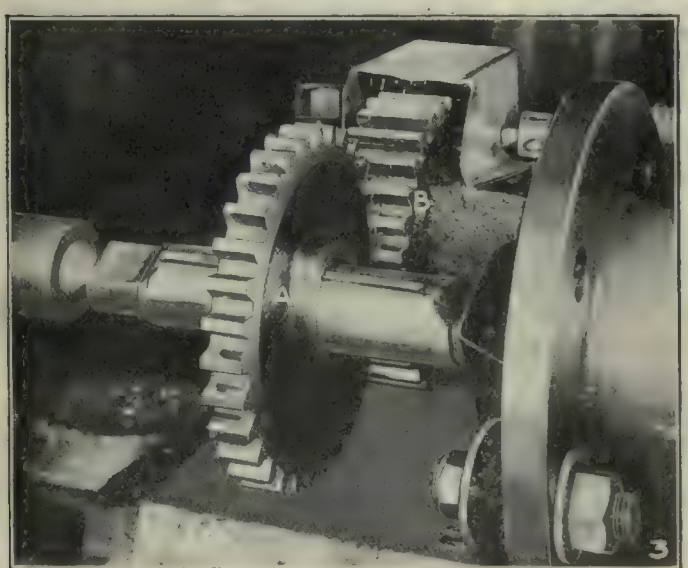


FIG. 3. ROLLING THE GEARS

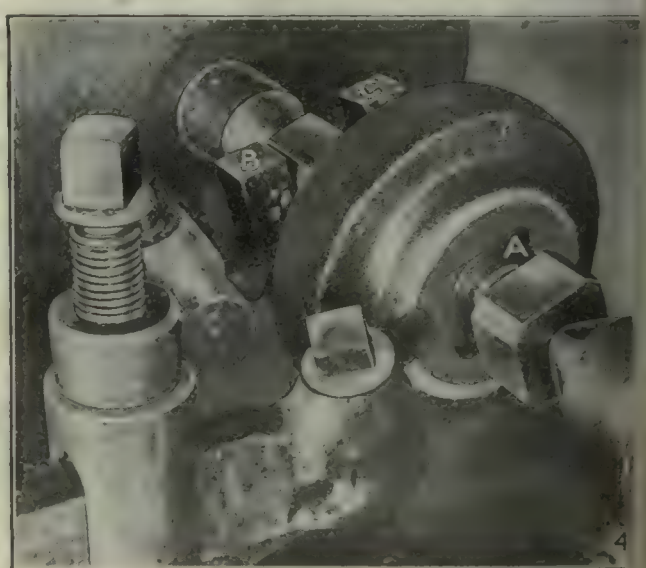


FIG. 4. STRADDLE FACING THE SIDES

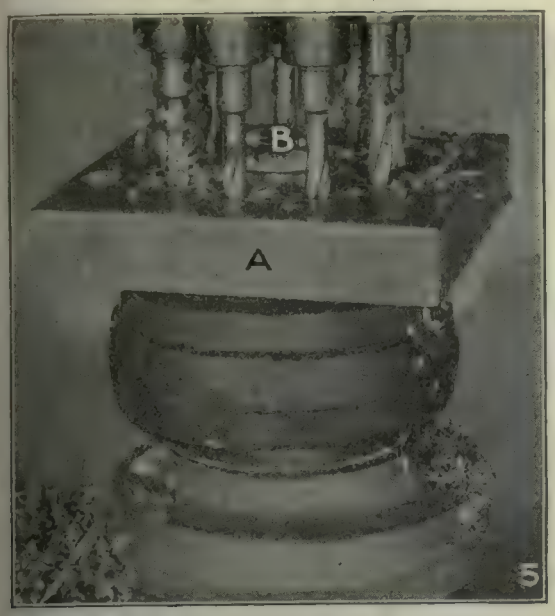


FIG. 5. DRILLING FOR CLUTCH

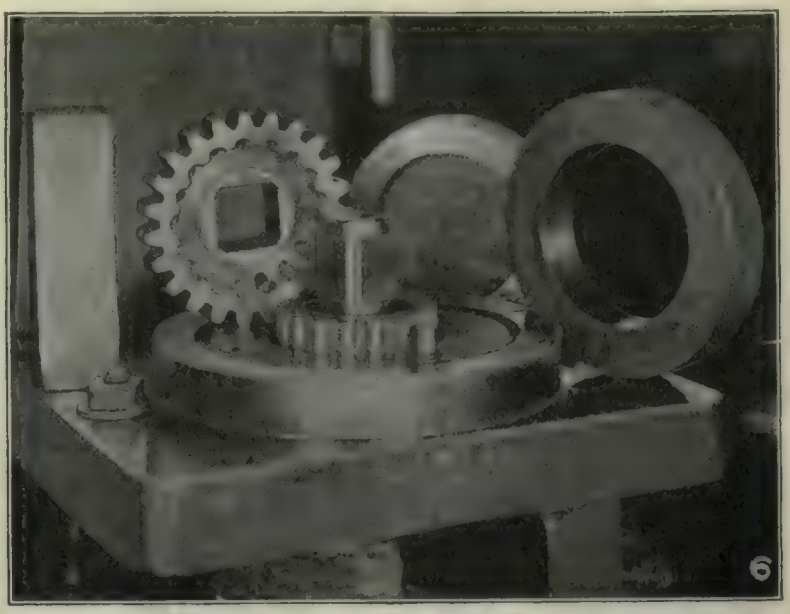


FIG. 6. SHAVING THE TEETH IN CLUTCH PIECE

The hole is then finish-ground on a Heald internal grinding machine after which the gear goes to final inspection and assembly.

The small sliding gear slides on a square shaft so that the first operation is to drill and broach the hole as a means of centering, and also of driving, for all future operations. It is then mounted on a square mandrel *A*, Fig. 4, which runs between the lathe centers and is driven by the forked dog shown at *B* and *C*. Both sides are faced by straddle tools in the toolpost after which the hole is chamfered as a bench operation.

As one side of this gear forms the internal member of a toothed clutch, it is necessary to drill holes something over half way through the blank, this being done in the simple fixture shown in Fig. 5. Here a multiple-spindle drill takes care of this operation; drilling alternate holes. By then turning the gear blank a single space the remaining holes are drilled with the same set-up. It will be noted that this fixture consists simply of the plate *A* carrying a hardened steel bushing and that it is held in contact with the gear being drilled by the nut *B* acting on a central stud fastened to the drilling machine table. Three of the holes are drilled through the gear as can be seen in Fig. 6.

The gear teeth are then blocked out on a hobbing machine and shaped to size after which they are pointed as will be seen in a later illustration. Corners are then filed and the teeth rolled as shown before in Fig. 3. Final inspection before hardening comes next, after which the same hardening processes, as before mentioned, are gone through with, including the testing of the teeth with a file.

The square hole is next ground with the interesting device shown in Fig. 7. The gear is mounted in the

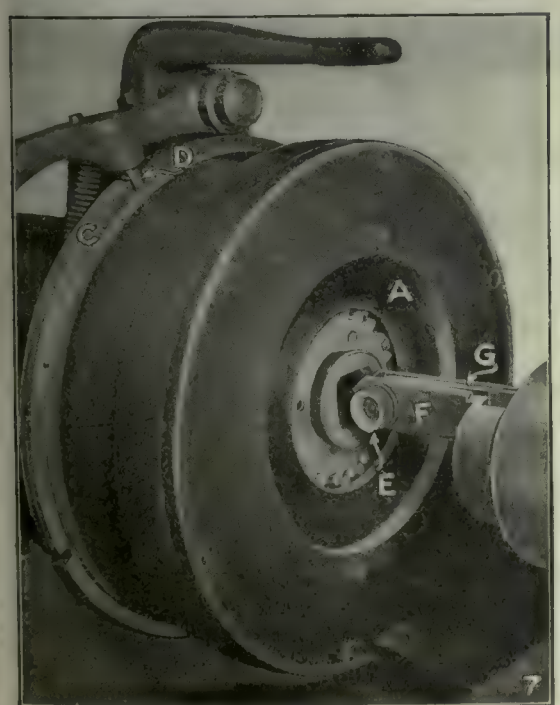


FIG. 7. GRINDING A SQUARE HOLE

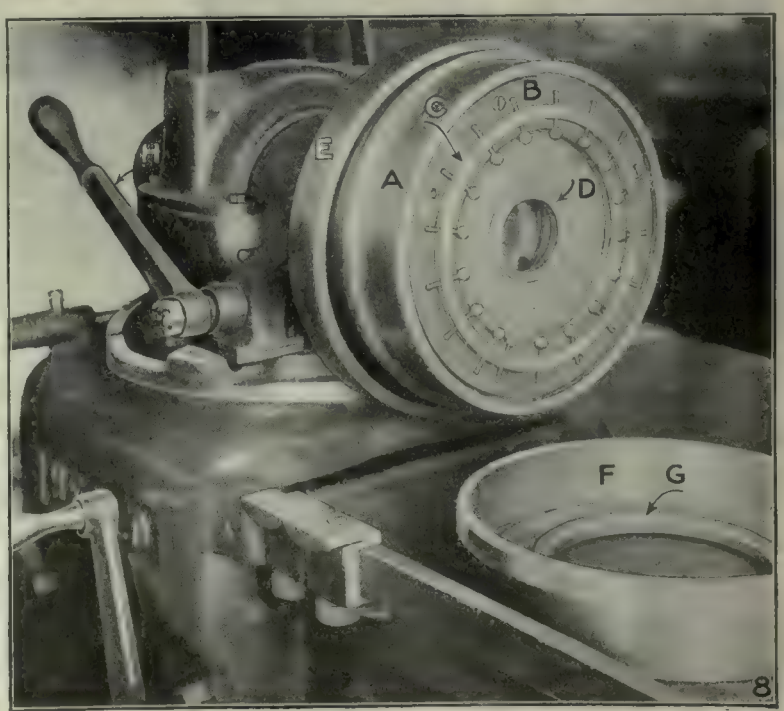


FIG. 8. DETAILS OF THE GEAR HOLDING CHUCK

special chuck shown at *A*, the gear being centered by means of the steel balls shown. It is indexed by the notches in the large ring *C* and the index pin *D*. The grinding is done by the small cup-wheel *E* mounted on a spindle in the end of the projecting arm *F* and is driven by an endless fabric belt at *G*. The grinding wheel is of the proper diameter to give the desired flat surface as it is traversed through the hole. This method insures the sides of the hole being concentric with the average pitch line of the gear, the ball chuck used being designed especially to give the best result possible in taking care of the small distortions of the hardening process. After grinding, the flange is polished and the gear is ready for assembling.

Before taking up the operations on the next gear it may be interesting to see the construction of the chuck shown in Fig. 7. Fig. 8 shows one of these chucks with the outer ring removed so that its construction can be clearly seen. The body of the chuck *A* carries the ring *B* on which is mounted another ring *C* carrying the numerous balls shown for holding the gear. These balls are mounted on steel stems with collars at the outer end to hold the springs which tend to keep them drawn up against the ring *C*. It will be noted that the inner edge of the ring *C* is beveled and that the larger diameter of the balls rests on this beveled surface. Furthermore, the surface *D* is ground square with the spindle of the machine forming a true surface against which the side of the gear to be ground can be located.

The large outer ring *E* is threaded on the inside to receive the outer portion of the chuck *F*. This portion also has a beveled surface at *G* corresponding to the inner beveled surface of the ring *C*, so that when it is screwed into ring *E* the beveled surface *G* comes in contact with the outside of the balls. The ring *E* is connected with the lever *H* by means of a suitable linkage so that it can move longitudinally with the spindle and move the ring *F* with it.

With the outer portions *E* and *F* moved forward, the operator inserts the gear in the chuck until it comes against the face *D*, the balls in the meantime finding their places in between the gear teeth. Drawing back the outer portions of the chuck *E* and *F* brings the beveled surfaces in contact with the balls and forces them all toward the center, gripping the gear on the pitch line at many points. It is, of course, necessary to have a chuck of this kind for each size of gear but when thousands of gears are being ground the cost is distributed so that it becomes almost negligible, while the results which have been secured make it an economical device from every point of view.

This is the gear that matches into the sliding gear which has just been described. After the inspection of the forging the gear end is centered and rough-turned. It is then chucked by the gear end and the stem finish-turned and threaded and the back of the gear finished. The next move is to hold the stem in a collet and finish-turn the gear and bore the taper in the end. The spline is then cut in a Pratt & Whitney machine, the hole for the cotter pin drilled and the stem rough-ground to 0.005 in. oversize.

Using the rough-ground stem to chuck by, the gear goes to the gear shaper in Fig. 9 and the teeth are cut as shown. The ends of the teeth are next rounded as shown in Fig. 10, the stem of the gear slipping inside the chuck and being held by a setscrew at *A*. The pin *B* provides additional resistance against turning. The method of rounding the teeth is simple and yet very effective, the main feature being the substantial supporting spindle which reduces chatter and vibration to a minimum. The outsides of two teeth are rounded at the same time, being of course equivalent to completing a tooth with each advance of the cutter *C*. The gear is rotated by a rapidly operated index, lubricant being supplied by a brush.

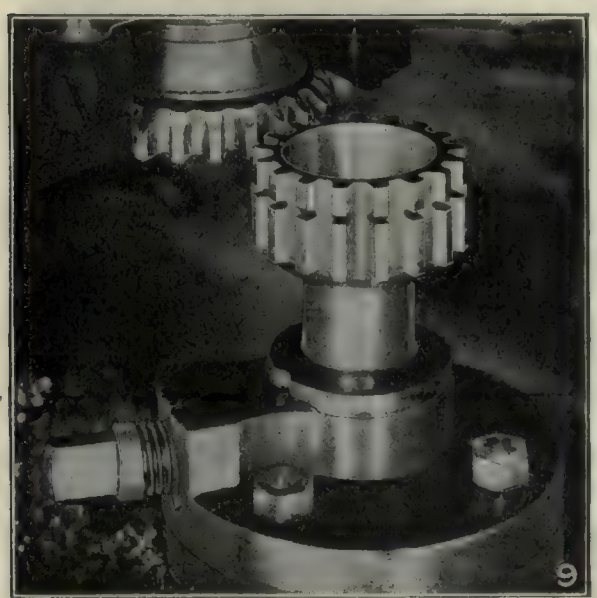


FIG. 9. SHAPING THE TEETH

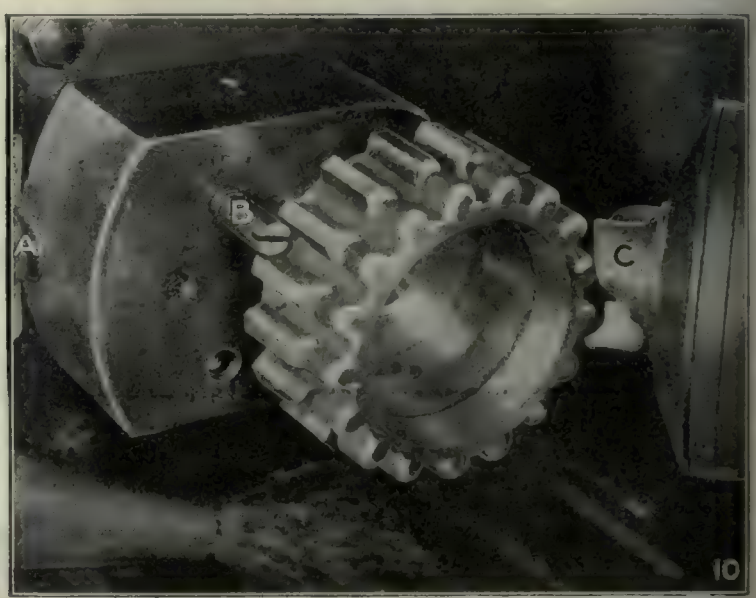


FIG. 10. ROUNDING TOOTH CORNERS

The groove cut around the gear end is for the purpose of making a clearance for the second tool in cutting the rounded teeth on the part which forms the male clutch member. Fig. 11 shows the use of double cutters on a Fellows gear shaper, these cutters being of different contour as can be seen. The first cutter finishes the teeth of the gear while the second cutter gives the rounded tooth form which makes the outer end portion into a clutch. The stem of the gear is held in the same kind of a chuck, as shown in Fig. 9.

The stem gear is now ready for the usual inspection and hardening.

One of the most interesting operations which has been

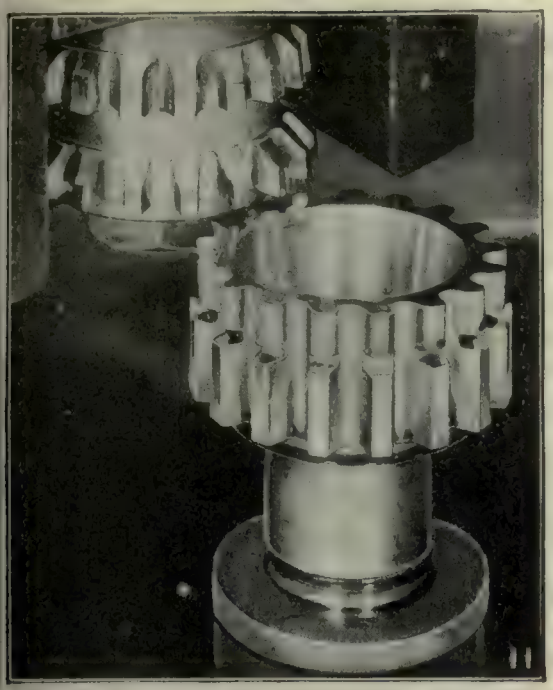


FIG. 11. CUTTING TWO FORMS OF TEETH AT ONCE

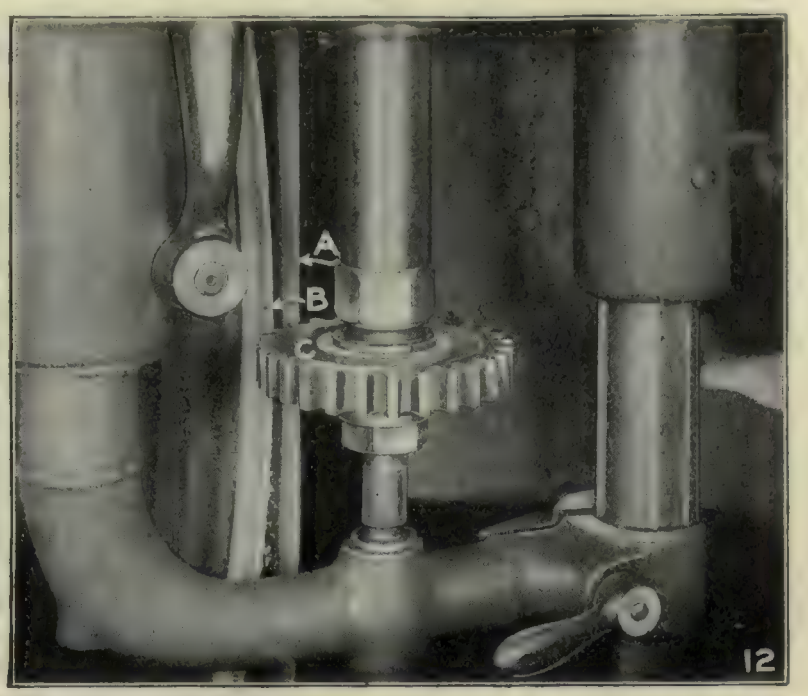


FIG. 12. CORRECTING TEETH AFTER HARDENING

developed in this factory is the method of finish-grinding the sides of the teeth on the spur gears used in the transmission. This operation is shown in Fig. 12, which, however, shows only a small portion of the special machine. This process is one of generating, in which the two grinding wheels *A* and *B* form the sides of a rack, the gear *C* being rolled past this rack so that its sides generate the tooth curve and so correct any small irregularities which might develop in the hardening process.

The grinding disks are approximately 6 ft. in diameter and are composed of thin segments of abrasive material suitably fastened to steel disks and their faces dressed to form the sides of a rack tooth. As in the case of the tooth rounding cutter, the wheels do not act on both sides of the same tooth at the same time, but are of course equivalent, in production, to grinding both sides at one operation. This is a most interesting machine in many ways.

Figs. 13 and 14 show two gear assembling operations which go to make up the complete gear sets for the transmission. Fig. 13 shows the assembling of the first and second gears on an arbor press. The assembling of the gears is guided by the pin *A*, suitable keys being inserted in the other keyways which can be seen in both of the larger gears.

In Fig. 14 the two center sliding gears are being assembled on a Lucas press which both forces them together and upsets the rivets as shown at the right. The gears rest on the block *A* and are forced down by the rings *B* and *C*. This makes a simple combination which has worked out very satisfactorily.

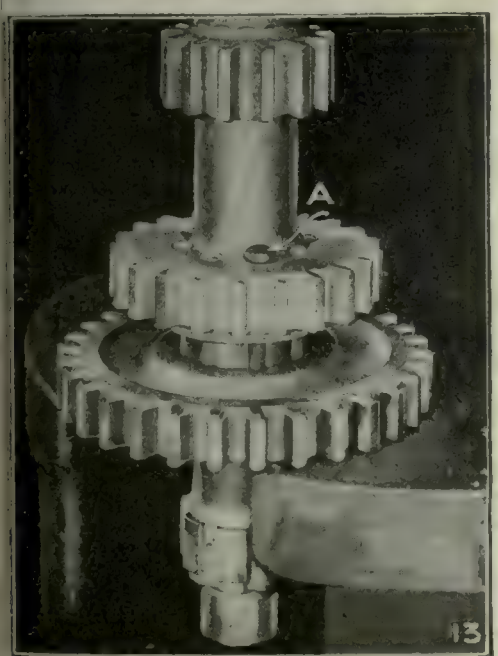


FIG. 13. ASSEMBLING FIRST AND SECOND GEARS

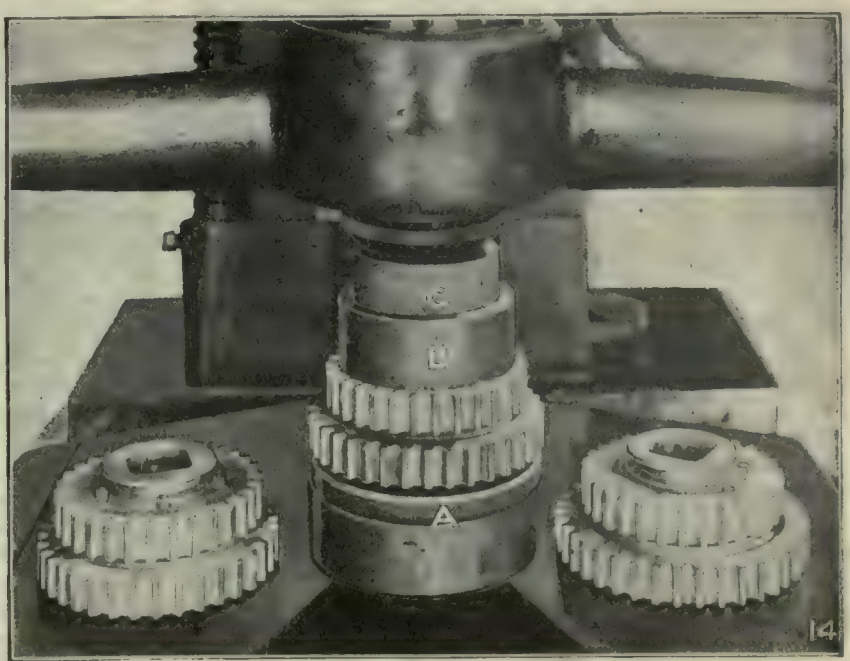


FIG. 14. ASSEMBLING THE TWO CENTER GEARS

Metal Cutting Tools—VII

By A. L. DeLeeuw

(Continued from last week's issue.)

THE fluctuations in pressure may be extreme and cause severe hammering. To overcome this effect cutters are made with spiral teeth, whenever practical. To study the effect of making the teeth spiral around the body, we will imagine that only one tooth is at work. This tooth is shown in Fig. 118. It is represented as made up of a number of very narrow sections.

In Fig. 118 is shown these imaginary sections of the tooth, and Fig. 119 shows some of them at work in the section of metal about to be removed. Fig. 119 shows clearly that while one section is just about to begin

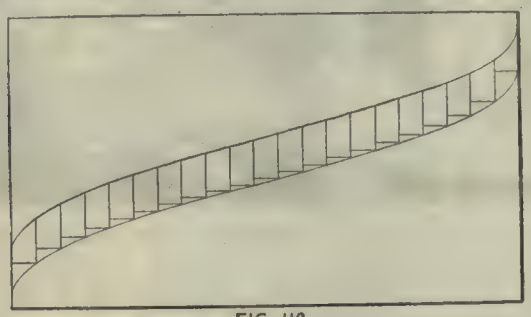


FIG. 118

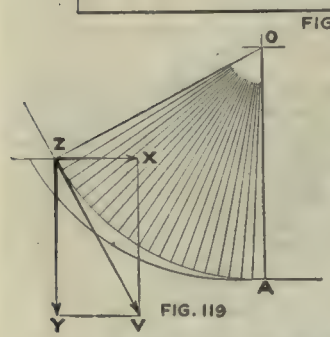


FIG. 119

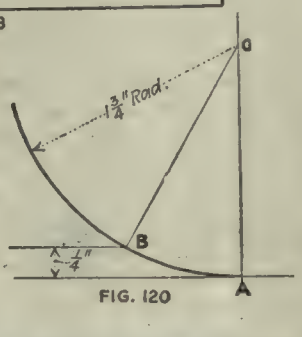


FIG. 120

FIG. 118. IMAGINARY SECTIONS OF SINGLE SPIRAL TOOTH.
FIG. 119. ACTION OF SPIRAL TOOTH SECTIONS.
FIG. 120. DIAGRAM TO SHOW EFFECT OF SPIRALITY ON PRESSURES

the cut and would have a tendency to slide over the metal, other sections are in the cut. Take the last sections engaged—*OZ*—and it will be readily seen that the resistance is in the direction *ZV*. This resistance causes a pressure in the direction *ZX*, which is overcome by the feed pressure and a pressure *ZY*, which has a tendency to pull cutter and arbor downward. This downward pressure is in direct opposition to the upward pressure, due to the inability of section *OA* to penetrate into the metal. To visualize still better how the spirality of the tooth affects the upward and downward pressures and their fluctuations, we will take a concrete example.

We will take a cutter 3½ in. in diameter with one tooth, making a spiral of 25 deg. with the axis. We will further assume that the piece of work is 5 in. wide and that the cut is ¼ in. deep. A single point of the cutter strikes the work at *A*, Fig. 120. At that moment an upward pressure is started, which, however, is infinitesimal, as only one point of the cutter strikes the work. As the cutter rotates, more and more elements come in contact with the work and the upward pressure caused by each element becomes greater and greater as the element slides further over the work. This upward pressure is shown in Diagram 121. We will assume that the cutter slides over the work until it is lifted 0.001 in., when it begins to penetrate. A simple calculation will show that the cutter has traveled through an angle of 1 deg. 56 min. when this happens. The lead of the spiral is $D\pi \times \cot g$ angle of spiral: in this case $3\frac{1}{2} \times \pi \times \cot g$ 25 deg. = 22.5533 in. This is the length the cutter would have to have if the spiral were to go once completely around the body. That portion of the spiral (tooth) which has not yet penetrated, goes around the body only through an angle of 1 deg. 56 min., so that only a small fraction of the spiral tooth is in action when it is about to start cutting (that is, when the sliding over the work is at an end and the tooth begins to penetrate). This fraction is $\frac{1°56'}{360} = \frac{116}{21600}$. The length of tooth in action is therefore $\frac{116}{21600} \times 22.5533$ in. = 0.121 in. This shows that when less than ⅛ in. length of tooth has started work, penetration begins. From that moment on this element of the cutter causes a downward pressure, at first very small, but gradually increasing as it goes deeper into the metal. Of course the next element is still sliding and the downward pressure of element No. 1 does not yet completely counteract the upward pressure of element No. 2, etc. It does show, however, that the curve will have the general shape of Diagram 121; upward pressure acceleratingly increasing for a certain period (for a length of cutter of 0.121 in.), then diminishingly increasing from *B* to *C*. At this point *C* the downward pressure caused by element No. 1 is greater than the additional upward pressure caused by the latest element coming into action and from that moment on, the upward pressure is no longer increased, while the downward pressure is, so that finally the upward pressure is completely counterbalanced (at point *D*). If a still greater part of the tooth comes into action before element No. 1 is entirely out of the cut, the downward pressure will predominate and the diagram will go on to point *E*. If the work is still wider, an element of the cutter will get out of the work while another gets in, and conditions will remain stationary (from *E* to *F*). Finally elements of the cutter will leave the work while no new element will enter. The upward pressures will therefore diminish while the downward pressures may either diminish also or remain stationary for a while, or even increase temporarily; but finally they will decrease as one element after another leaves the work until at least the entire tooth has left the work and the pressures vanish. The three possibilities are shown by the three curves between *F* and *G*.

The diagram shows that there are no sudden changes of conditions or violent fluctuations, except when the work is so narrow that the part *EF* does not come into play. However, there is still a changing over from upward to downward pressures.

We will now see what the effect is of additional teeth. In order to see clearly what happens, we will represent Diagram 121 in a little simpler form and forget, for the present, some of the details.

If the second tooth enters the work after the first

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tooth has reached *G*, there will be the modification of Diagram 122. If it enters somewhere between *F* and *G*, upward pressure will be added and the diagram will be like Fig. 123.

If the second tooth enters somewhere between *E* and *F*, the diagram will appear somewhat like Fig. 124.

The exact manner in which the diagram will be modified cannot be predicted, but this much will be seen: That the second tooth *may* make the diagram more abrupt in its changes, but that, as a rule, it will make the changes less abrupt and the fluctuations will be still gentler if more than two teeth are at work at the same time.

We will now consider the practical side of the foregoing. We will first take our example of a piece of work 5 in. wide. The cut is ¼ in. deep. A simple calculation shows that a single element of one tooth stays in the work during 31 deg. When the first element of the tooth is about to leave the work, $\frac{31}{360}$ of the circumference is engaged, so that this one tooth covers a width of $\frac{31}{360} \times 22.5533$ in. $= 1.94$ in.

Let us suppose that the cutter has eight teeth. Then the first element of the first tooth must rotate through 45 deg. before the first element of the second tooth enters. The length of tooth brought into play during these 45 deg. is $\frac{45}{360} \times 22.5533$ in. $= 2.82$ in. The second tooth enters now and two teeth will be in action until the last element of the first tooth leaves the work (see Fig. 125). The result will be this:

0 to 1.94 in.—changing conditions
1.94 to 282 in.—stationary conditions } one tooth at work

2.82 to (2.82 + 1.94) = 4.76 in.—changing conditions
4.76 to 5—stationary conditions } two teeth at work

A wider or narrower piece of work, a deeper or shallower cut, a different diameter of cutter and a greater or lesser angle of spiral would modify the figures given. To get the least possible variations in pressure the cutter should be large; the angle of spiral large, the cut deep, the work wide and the teeth close together. The only elements within our control are the diameter of the cutter, the angle of spiral and the spacing of the teeth. If nothing else but the fluctuation of pressure had to be considered, we would select a large cutter, a large spiral angle and fine spacing of the teeth. We will see later that other considerations compel us to make the spacing wide, in most cases; that we should select the smallest cutter possible under given conditions and that, though we should make the angle of spiral large, yet even there we are limited in our choice.

Causes of Chatter

In the discussion of lathe tools, mention was made of the tendency of a broad-nosed tool to cause chatter. The sections of metal would be split off at regular intervals, quite close together, and this would cause vibrations. If the natural period of vibration of one of the machine elements happened to coincide with the periodical splitting off of the chips, these vibrations would become of considerable magnitude. Making the tool round-nosed would destroy the regularity of the splitting off of sections of metal, at least to a certain extent, and chatter would not be so likely to occur.

Chatter is much more in evidence in a milling machine than in a lathe, and this is due to the peculiar way in which the cut is taken. In a lathe the tool remains imbedded between work and chip and the fluctuations in pressure are due to compression and splitting off of the individual sections of the chip. This same thing happens when a tooth of a milling cutter forms a chip. The fluctuations, however, are not uniform but change continually while the tooth is in the work. As soon as another tooth starts work, a similar cycle is begun and this is repeated for every tooth brought into action. If, for instance, the teeth of the cutter are spaced 1 in. apart and a cut is taken at a speed of 70 ft. per

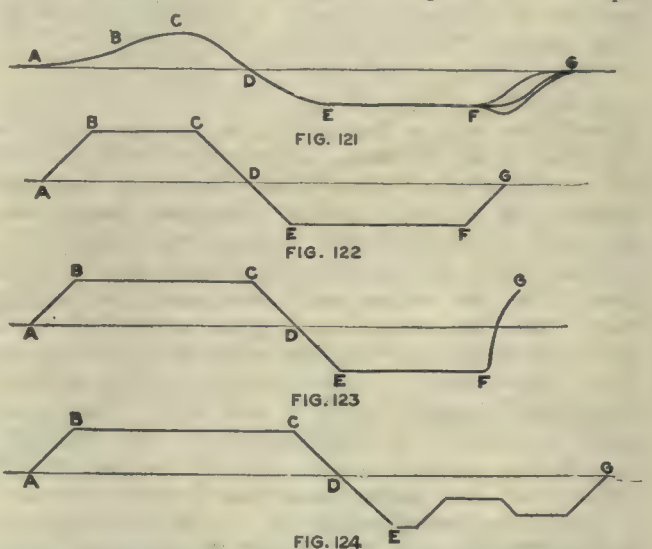


FIG. 121. PRESSURE DIAGRAM RESULTING FROM SPIRAL TOOTH ACTION. FIG. 122. MODIFICATION OF DIAGRAM WITH SECOND TOOTH ENTERING WORK AT *G*. FIG. 123. SECOND TOOTH ENTERING BETWEEN *F* AND *G*. FIG. 124. SECOND TOOTH BETWEEN *E* AND *F*

minute, then 840 cuts will be taken in one minute and the cycle of changing pressures recurs 840 times in that period of time. These cycles are perfectly marked.

When taking a roughing cut on a lathe there will be some variation in the thickness of metal to be removed, so that the formation of the chips is not always taking place in the same manner. The period of pressure fluctuations is, therefore, not always the same, and under such conditions there is little likelihood that vibrations will be built up. If they start one moment, the next will probably see vibrations of a different frequency started, and they will kill whatever vibrations have begun. We may often notice when there is more metal to be removed on one side of a piece of lathe work than on another, that chatter takes place during a part of the revolution only. Such unevenness of metal to be removed would not prevent the starting of vibrations when we take a milling cut. The milling cutter starts a new cycle at perfectly even intervals, that is, every time a new tooth strikes the work, and entirely regardless of the depth of cut. This is not saying that the unevenness of metal has no effect at all on the vibrations, but that it cannot kill them. A somewhat heavier or shallower cut would make the chip a little longer or shorter, but the beginning of a cycle is controlled only by the number of teeth of the cutter and the cutting speed.

There are other reasons why the milling machine is more liable to chatter than the lathe. Leaving out of consideration the piece of work itself, the lathe presents few elements which are apt to have individual vibration periods. Toolholder, toolslide, carriage, bed, tailstock, and headstock are heavy and irregularly shaped masses of cast iron which have a tendency to absorb vibrations. Even if they are not heavy enough to do this, they are built up out of many webs, ribs, bosses, etc., each of which has its own vibration period, so that it is not likely that a complete member, say a bed, has a vibration period. The vibrations of the long webs will probably be killed by those of the crossribs or ways or flanges. In the milling machine, on the other hand, conditions are much more favorable for the building up of vibrations. There are the arbor, spindle and overarm: simple cylindrical pieces which are easily set in vibration. Besides, these elements are of steel, which, being much more homogeneous than cast iron, is for that reason much more easily set in vibration. Note the ring when a piece of steel is struck by the hammer and the dull sound given out by cast iron. The braces in many existing milling machines are simple straight pieces of cast iron. Though supposed to assist in overcoming chatter, they themselves may be the cause of it. It may well happen that the removal of such braces stops the chatter. Braces of a more complicated pattern are not so apt to give this trouble, though even they, being of single-web design, may sometimes be set in vibration.

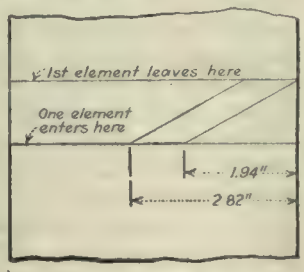


FIG. 125. ENTERING AND LEAVING POINTS OF FIRST AND SECOND TEETH OF EIGHT-TOOTH CUTTER

It is quite commonly thought that chatter in a milling machine is caused by inaccurate gearing, and many mechanics are, for this reason, in favor of cone-driven milling machines, the idea being that finishing cuts can be taken with open belt, thus avoiding chatter caused by the gears. Now, it is true that badly cut or adjusted gears may be noisy and also that they may assist in causing chatter, but they are, as a rule, not the cause of this annoying phenomenon.

The cause of chatter is often sought in looseness of the knee. It is supposed that the knee moves up and down under the alternating up and down pressures between cutter and work. A moment's consideration will show that this can hardly be the case. The idea that the heavy mass of knee, saddle, table and work should move up and down several hundred times, sometimes more than a thousand times a minute, does not seem reasonable. The following observation was made:

A face mill on a vertical milling machine caused chatter marks. The marks were radial, as might have been expected, and were ½ in. apart. The cutter had a speed of 70 ft. per minute, so that these marks were made at the rate of 70 × 12 × 8 per minute, or 6,720 per minute. Such a rapid movement of these heavy masses is unthinkable. It is not at all unthinkable, however, that the number of vibrations of the spindle (much like the vibrations of a bell) should have been that large. A loose knee may have some effect in so far that, there being no solid connection between knee and column, the mass of cast iron which might have absorbed the vibrations was not so great; to that extent a loose knee, or, for that matter, any other loose member of the machine may have helped to make conditions right for chatter, but it was not the source.

Chatter is one of the main troubles and very frequently encountered in milling practice and for that reason is being considered here at some length. In practically all cases the source of chatter must be sought in the conditions under which the milling is being done: in the cutter, feed, speed, arbor, etc. Machine and fixture may be contributing factors but they are not prime causes. If it is found that one machine chatters with a given job while another does not, it is often taken for granted that the second machine must be the better of the two. This may or may not be so. The first machine may show up better with some other job. However, this should not be understood to mean that the construction or design of a machine is of no importance so far as chatter is concerned. It must be heavy and rigid enough for the work, its metal must be properly distributed, its joints must have a minimum amount of looseness—just as is required of any other machine tool; but when all these requirements are met, a milling machine may still chatter.

Remedies for Chatter

If machine and fixture are in good condition, chatter may often be obviated by changing feed or speed or the relation between the two. Reducing the speed, but leaving the feed per revolution the same, changes the period of vibration and may bring it out of consonance with the machine. If, for instance, there is a part of the machine which would naturally vibrate at 840 r.p.m., this member is apt to cause chatter when an eight-tooth cutter revolves 100 r.p.m., but not with a seven-tooth cutter or not at 80 r.p.m. The feed per revolution might be increased, so as not to reduce the output.

Changing the feed, alone, may do away with chatter. Though the frequency is the same the nature of the chip is different. The tooth slides for a longer or shorter time over the work, and the entire sequence of conditions during the separation of one chip has been changed. This may have a tendency to modify the vibrations in such a manner as not to induce sympathetic vibrations in the machine. A little experiment which anyone can carry out may make the foregoing clearer.

Take a hollow object of somewhat irregular form: not a smooth tube, but, for instance, a paper bag slightly crumpled. Place it to the mouth and pronounce a vowel, changing the pitch gradually until a point is reached

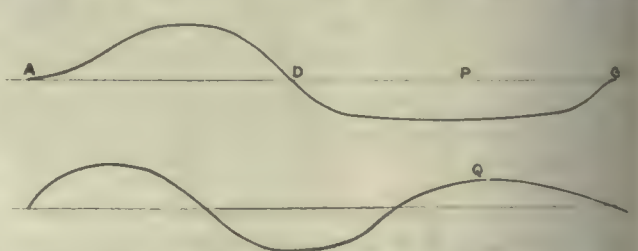


FIG. 126. TOOTH AND MACHINE PART VIBRATION DIAGRAMS

where the sound is full and clear. At that moment the condition prevails where the natural vibrations of the air column, contained in the bag, are in consonance with the tone produced. Now, suppose the vowel *ai* were produced, and that the experimenter should change

over to *O*. He will find that the tone is no longer so clear and full as before. In other words, the column of air is in most perfect consonance when pitch (number of vibrations) and timbre (nature or quality of tone) are both favorable. The cutting speed and number of teeth provide the pitch, and the form, length (along the arc) and thickness of the chip provide the quality, or form of vibration. By changing this quality the consonance may often be broken up. It is quite interesting to see how a chattering milling machine may often be silenced by changing feed, or speed, or both. As a rule it is better to *increase*, rather than to *decrease* the feed, as this will diminish the length of time the cutter tooth must slide over the work.

The reason why this discussion of chatter was linked to the results of winding the cutting teeth spirally around the body of the cutter is, that chatter is very largely obviated by just this method. We have seen how spiral teeth cause the fluctuations in pressure to be ironed out. This alone would reduce the tendency to set up violent vibrations, but there is more. During the time that one spiral tooth goes through the cut a cycle of changes occurs, and this same cycle will occur again when the next tooth acts, etc. Now this cycle is dependent on various items mentioned before, but there was one item which was left out of the discussion: the width of the work.

In Fig. 126, Diagram *P* is a duplicate of Fig. 121, and Diagram *Q* is an imaginary diagram of consonant vibrations of some part of the machine. The upper diagram starts with the entering and ends with the leaving of one tooth. If another tooth enters immediately afterward, the same diagram may be repeated. But the width of the work may be such as to make the second tooth enter a little later or earlier and so there will be two different cycles started: One dependent on the distance between the teeth and the other on the width of the work; and these two cycles must bear a certain relation to each other in order not to kill each other's effect on the natural vibrations of the machine element. The practical application of this fact lies in the possibility of stopping chatter by increasing or decreasing the width of the work. It is true that this is not possible once the work is given in our hands, but it is always possible to place it on the milling-machine table in such a way as to present a width of cut greater than the width of the work, by laying it down at an angle with the direction of feed. This is always possible with a job of slabbing.

Spiral teeth have still another desirable quality. They produce what is called a shear cut. As shear tools will be discussed in another chapter, this point will be passed over for the present.

It would be strange indeed if spiral teeth should have nothing but good qualities. As the chip bears hard against the tooth, and as this is at an angle with the centerline of the spindle, there must be end thrust; and it is sometimes thought that this is of enough importance to keep the spiral angle as low as possible. Tests have shown that the amount of end thrust is so small and its effect so negligible that any angle given to the spiral is safe. To minimize the effect of the end thrust it is well to have the thrust *toward* the column as the thrust bearings of milling-machine spindles are best adapted for that condition. When possible, right- and left-hand cutters should be used in gangs, thus partially or entirely neutralizing end thrust.

Now Is the Time to Replace, Repair and Improve Equipment

Some very sound advice is given in a circular issued by the American Tool Works Co., Cincinnati, Ohio, with the title "An Important Message of Value to You," from which the following paragraphs are taken.

The three dominant factors of production are: (1) Equipment; (2) organization; (3) human element.

It has occurred to us, now the breathing spell following several strenuous years of intensive effort is here, that this is an opportune time to consider preparation for future activities. We have all been so busy during the few years just passed that we have had neither the opportunity nor the time to give the attention to our equipment that it deserves, but, since the pressure of production is relieved, perhaps this is the proper time to consider three important things:

(1) Replacement of old equipment with new and better tools; (2) application of labor-saving and cost-reducing equipment to machine tools now in operation to make them more productive and profitable; (3) repairing of present equipment to make it more serviceable and productive.

We all realize that equipment represents the very heart of our business, and as such we depend upon it to a very great extent for the proper functioning of our plants. Many improvements in machine tools have been made in the past few years, more, in fact, than during any other similar space of time, because the normal development which has been constantly taking place was greatly augmented by the war's insistent demand for more productive and more efficient machine tools.

As a consequence, many machine tools which were looked upon as the last word in development five years ago have been supplanted by new and better designs that produce much more economically and are, therefore, necessary to the shop which would uphold its standards of efficiency and economy.

Let us make the most of the present lull to put our shops in condition to take immediate advantage of the first breezes of better times. We are getting ready now. Are you?

Probably one of the simplest and least expensive ways to reduce the time of machining operations is to supply machine tools with the proper toolholding equipment for the work they are doing, so as to eliminate all unnecessary changing of tools. Every time you make a tool change you lose time—and time is money in a manufacturing plant.

It is estimated that this country between the years of 1915 and 1920 produced the equivalent of 11 normal years' production. Imagine what a tremendous strain was placed upon the equipment of our manufacturing plants! Is it any wonder that a great deal of it shows visible effects of that wear and tear, especially as we were all compelled by necessity to depend largely upon unskilled labor to handle it.

We did not have the time during those five years to make the few repairs here and there necessary to keep our equipment in the best condition; we did only that which was necessary to keep it running day and night. If it deteriorated faster than it should, we did not care so long as it produced. If it looked bad and detracted from the appearance of our shops we did not worry if it would only stick to the job and keep running. Now, however, things are different. Every conscientious shop executive wants to have his equipment in good repair. Not only does he feel a natural pride in the appearance of his shop, but he knows that the cost of his production depends largely upon the condition of his equipment, and, further, he realizes that if he is to develop and maintain a high morale in his shop he must have his equipment in perfect condition and must insist upon his operators keeping it so.

On Feb. 1, 1921, the money in circulation in the United States totaled $6,141,265,012, as against $6,340,436,718 on Jan. 1, and $5,864,171,213 one year ago. Based upon a population of 108,000,000 the amount in circulation per capita on Feb. 1, 1921, was about $56.85 and on Jan. 1, 1921, it was about $58.70.—*From the Journal of the American Bankers Association.*

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Finding Dimensions on Profiles

By W. G. Holmes

In the making of gages, as explained in my article, "Finding Dimensions of Profile Gages," *American Machinist*, page 567, dimensions locating different points are required in order that accuracy may be assured. Below are given formulas which can be given to determine any dimension which may be required in the two types of gages considered. It is hoped that the formulas will be of material assistance to those who have problems of profile gages, forming tool outlines and similar contours.

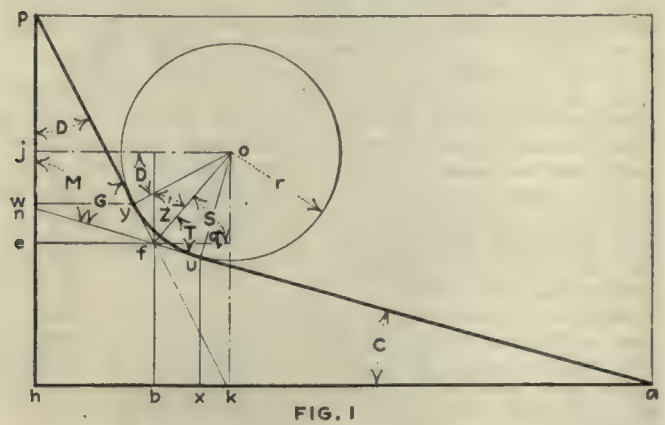


FIG. 1

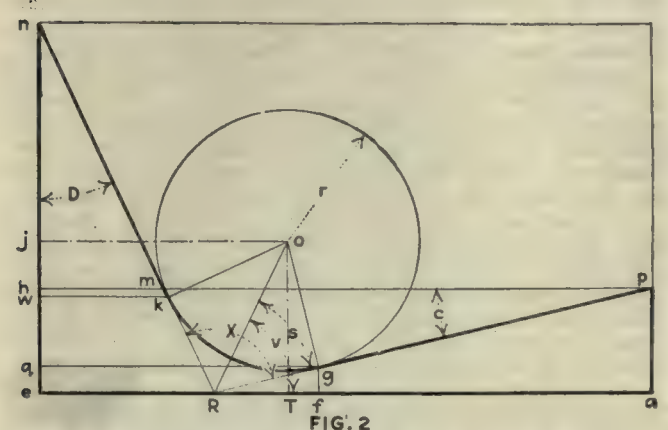


FIG. 2

FIG. 1. GAGE OUTLINE EQUAL TO 90 DEG. + C + D
FIG. 2. GAGE OUTLINE EQUAL TO 90 DEG. + D—C

Given a profile gage with the outline having the form of two lines joined by a circular arc, as in Fig. 1, the two lines forming an angle of 90 deg. $+ C + D$. The values known are ha, hp, C, D, and r; in order to make and check the gage it is necessary to know the location of the center of the circle, or the dimensions pj and jo; the location of the point of tangency u or the dimensions hx and xu; the location of the point of tangency y, or the dimensions pw and wy; and the location of the point of intersection f, or the dimensions pe and ef.

The formulas expressing the values of these eight dimensions in terms of the known dimensions are as follows:

$$M = 90^\circ + C$$

$$G = 180^\circ - (D + M)$$

$$T = \frac{90^\circ + C + D}{2}$$

$$S = T - C$$

$$Z = \frac{90^\circ + C + D}{2} - D = T - D$$

$$pj = hp - jh \quad (1)$$

$$= hp - he - je \quad (2)$$

$$= hp - (he - pn - ne) - fo \cos Z \quad (3)$$

$$= pn + ne - fo - \cos Z \quad (4)$$

$$= hp - hn + fn \sin C - r \operatorname{cosec} T \cos Z \quad (5)$$

$$= hp - A \tan C + \frac{np \sin D \sin C}{\sin G} - r \operatorname{cosec} T \cos Z \quad (6)$$

$$= hp - A \tan C + \frac{(hp - ha \tan C) \sin D \sin C}{\sin G} - r \operatorname{cosec} T \cos Z \quad (7)$$

$$jo = hb + bk \quad (8)$$

$$= fn \cos C + fo \cos S \quad (9)$$

$$= \frac{np \sin D \cos C}{\sin G} + r \operatorname{cosec} T \cos S \quad (10)$$

$$= \frac{(hp - ha \tan C) \sin D \cos C}{\sin G} + r \operatorname{cosec} T \cos S \quad (11)$$

$$hx = hb + bx \quad (12)$$

$$= fn \cos C + fu \cos C \quad (13)$$

$$= \frac{np \sin D \cos C}{\sin G} + fo \cos T \cos C \quad (14)$$

$$= \frac{(hp - ha \tan C) \sin D \cos C}{\sin G} + r \operatorname{cosec} T \cos T \cos C \quad (15)$$

$$xu = he - uq \quad (16)$$

$$= hp - pn - ne - bx \tan C \quad (17)$$

$$= hp - (hp - ha \tan C) - fn \sin C - fu \cos C \tan C \quad (18)$$

$$= ha \tan C - \frac{np \sin D \sin C}{\sin G} - fo \cos T \cos C \tan C \quad (19)$$

$$= ha \tan C - \frac{(hp - ha \tan C) \sin D \sin C}{\sin G} - r \operatorname{cosec} T \cos T \cos C \tan C \quad (20)$$

$$pw = pj + jw \quad (21)$$

$$= pj + r \sin D \quad (22)$$

$$= hp - ha \tan C + \frac{(hp - ha \tan C) \sin D \sin C}{\sin G}$$

$$= -r \operatorname{cosec} T \cos Z + r \sin D \quad (23)$$

$$wy = jo - r \cos D \quad (24)$$

$$= \frac{(hp - ha \tan C) \sin D \cos C}{\sin G} + r \operatorname{cosec} T \cos S - r \cos D \quad (25)$$

$$pe = pn + ne \quad (26)$$

$$= hp - ha \tan C + fn \sin C \quad (27)$$

$$= hp - ha \tan C + \frac{np \sin D \sin C}{\sin G} \quad (28)$$

$$= hp - ha \tan C + \frac{(hp - ha \tan C) \sin D \sin C}{\sin G} \quad (29)$$

$$ef = fn \cos C \quad (30)$$

$$= \frac{np \cos C \sin D}{\sin G} \quad (31)$$

$$= \frac{(hp - ha \tan C) \cos C \sin D}{\sin G} \quad (32)$$

Given a profile gage with the outline having the form of two lines joined by a circular arc, as in Fig. 2, the two lines forming an angle of 90 deg. $+ D - C$. The values known are *ea, nh, C, D and r*. In order to make and check the gage it is necessary to know the location of the center of the circle, or the dimensions *nj* and *jo*; the location of the point of tangency *y*, or the dimensions *nq* and *qy*; the location of the point of tangency *k*, or the dimensions *nw* and *wk*; and the location of the point of intersection *g*, or the dimensions *ne* and *er*. The formulas expressing the values of these eight dimensions in terms of the known dimensions are as follows:

$$X = 90^\circ + D - C$$

$$S = \frac{X}{2}$$

$$V = S + C$$

$$nj = nh + eh - to \quad (33)$$

$$= nh + mg \cos D - go \sin V \quad (34)$$

$$= nh + \frac{mp \sin C \cos D}{\sin X} - r \operatorname{cosec} S \sin V \quad (35)$$

$$= nh + \frac{(ea - hm) \sin C \cos D}{\sin X} - r \operatorname{cosec} S \sin V \quad (36)$$

$$= nh + \frac{(ea - nh \tan D) \sin C \cos D}{\sin X} - r \operatorname{cosec} S \sin V \quad (37)$$

$$jo = eg + gt \quad (38)$$

$$= (eh + nh) \tan D + go \cos V \quad (39)$$

$$= nh \tan D + eh \tan D + go \cos V \quad (40)$$

$$= nh \tan D + mg \cos D \tan D + r \operatorname{cosec} S \cos V \quad (41)$$

$$= nh \tan D + \frac{mp \sin C \cos D \tan D}{\sin X} + r \operatorname{cosec} S \cos V \quad (42)$$

$$= nh \tan D + \frac{(ea - nh \tan D) \sin C \cos D \tan D}{\sin X} + r \operatorname{cosec} S \cos V \quad (43)$$

$$nq = nh + eh - fy \quad (44)$$

$$= nh + mg \cos D - gy \sin C \quad (45)$$

$$= nh + \frac{gp \sin C \cos D}{\sin X} - go \cos S \sin C \quad (46)$$

$$= nh + \frac{(ea - nh \tan D) \sin C \cos D}{\sin X} - r \operatorname{cosec} S \cos S \sin C \quad (47)$$

$$qy = eg + gf \quad (48)$$

$$= (eh + nh) \tan D + gy \cos C \quad (49)$$

$$= nh \tan D + eh \tan D + gy \cos C \quad (50)$$

$$= nh \tan D + \frac{mg \cos D \tan D}{\sin X} + go \cos S \cos C \quad (51)$$

$$= nh \tan D + \frac{(ea - nh \tan D) \sin C \cos D \tan D}{\sin X} + r \operatorname{cosec} S \cos S \cos C \quad (52)$$

$$nw = nh + eh - ew \quad (53)$$

$$= nh + mg \cos D - gk \cos D \quad (54)$$

$$= nh + \frac{mp \sin C \cos D}{\sin X} - go \cos S \cos D \quad (55)$$

$$= nh + \frac{(ea - nh \tan D) \sin C \cos D}{\sin X} - r \operatorname{cosec} S \cos S \cos D \quad (56)$$

$$wk = nw \tan D \quad (57)$$

$$= \left[nh + \frac{(ea - nh \tan D) \sin C \cos D}{\sin X} - r \operatorname{cosec} S \cos S \cos D\right] \tan D \quad (58)$$

$$ne = nh + eh \quad (59)$$

$$= nh + mg \cos D \quad (60)$$

$$= nh + \frac{mp \sin C \cos D}{\sin X} \quad (61)$$

$$= nh + \frac{(ea - nh \tan D) \sin C \cos D}{\sin X} \quad (62)$$

$$eq = ne \tan D \quad (63)$$

$$= \left[nh + \frac{(ea - nh \tan D) \sin C \cos D}{\sin X}\right] \tan D \quad (64)$$

Re-grinding Valves

By H. S. Trecartin

Notwithstanding the high degree of accuracy obtainable in a properly equipped machine shop, it is difficult to obtain, between two metallic surfaces, the intimate contact essential to a watertight or steamtight joint without recourse to grinding. Valves used for the control of liquids are dependent upon the accurate contact of their surfaces for their "tightness."

Valves can be reground by hand with little trouble if the work is rightly gone about, but the correct methods are little understood by most mechanics. The principle causes of failure in grinding valves are, (a) the use of too much grinding compound, (b) grinding too long without re-distributing the compound, and (c) failure to observe care in keeping out foreign substances during the grinding.

The grinding of a leaky stopcock will be described, taking up the important points as they occur.

Re-grinding a Stopcock Valve

The nut on the end of the plug is screwed off and the plug removed from the body. A very small amount of grinding compound is spread evenly with the finger over the surface of the plug. A grinding compound sold by automobile supply houses for grinding gas-engine valves may be used, but it is best to use a grinding mixture which is especially prepared for this purpose by a large manufacturer of valves, and procurable in plumbing supply stores.

The plug is inserted in the valve and the grinding commenced. A small wrench may be used to turn the plug. The manner of doing this grinding is important. If the plug is rotated steadily in place, it will be found almost invariably that grooves will be cut in the surfaces. This is caused by the abrasive tending to gather in spots and to "ball." To prevent this the plug should be rotated back and forth three or four times, then slightly withdrawn and pushed back in a different position. This will tend to redistribute the cutting compound and will replace it on the high spots, which are the places that must be cut down.

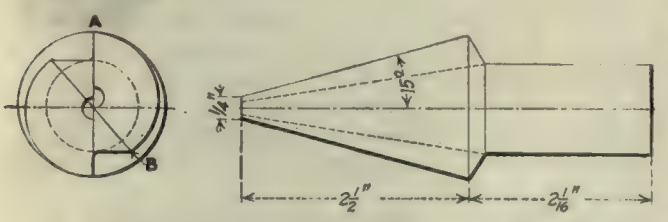
When the plug begins to stick or turn hard, it should be removed and wiped clean. The body should also be cleaned. An inspection of the surfaces should be carefully made. If it is seen by the bright marks that a sharp "high spot" is scratching one of the parts, the spot should be located and carefully removed. A fine file will do this if it is on the plug, or a smooth scraper will remove it from the inside of the body. If the surfaces appear to be touching fairly well all over, they may be finished to a closer contact by thinning the abrasive mixture with an equal amount of oil, and applying to the plug an exceedingly small amount. This should be ground in again, withdrawing the plug slightly every few turns. The surfaces should then be cleaned, using gasoline if available. Then a coating of clean soap should be applied and the grinding action gone through with again. After cleaning, a coating of oil should be put on, and the valve may be re-assembled.

Sometimes the plug will wear a slight depression in the body where it turns and the grinding will deepen this seat, leaving a ridge or shoulder on the body at the small end of the plug. The grinding will not cut this shoulder down much, and the end of the plug will abut against it and cannot sink into its seat as it should. When this condition occurs the shoulder should be removed from the inside of the body by carefully cutting it out with a scraper.

Backing Off a Cutter on the Milling Machine

By Joseph A. Olberding

Having some die sinking cutters to relieve and not having a backing-off lathe heavy enough to handle the job, we got very satisfactory results by relieving them



on a milling machine, using a circular table and vertical attachment. We used a long end mill ½ in. in diameter, and set our vertical head at the desired angle of 15 deg. We then put on the circular table and clamped the dividing head on it slightly off center (a few trials will give the desired amount of clearance).

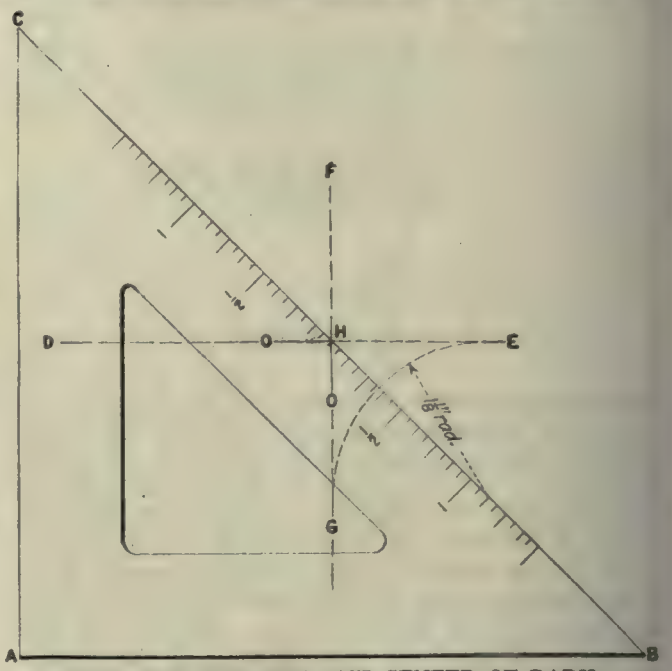
After relieving one side beginning at *A* and feeding the circular table toward *B* we backed up and indexed to the other flute and finished it in the same manner.

The result was a very good job which did not take much time.

Locating the Center of Radii—Discussion

By E. H. Weber

Referring to the article on locating the center of radii, by Chester E. Josselyn, page 1084, Vol. 53, of *American Machinist*, it seems to me that my method of



TOOL FOR LOCATING THE CENTER OF RADII

doing this has some advantages over the method given by Mr. Josselyn.

The sketch shows a 45-deg. triangle with graduations on the long side running both ways from a zero point at the center, these graduations being the secants of 45-deg. angles, or 1.4142 times the inch graduations obtained by projecting from the side *AB* to the side *CB* and then drawing the graduation marks at right angles to the side *CB* at the points of intersection of the projected scale with the side *CB*.

The triangle is used for locating radii where the tangents of the radii are at an angle of 90 deg. by positioning the zero lines to coincide with the tangent lines and then locating the center of radii by the graduation on the side *CB*, which bisects the angle included by the tangent lines.

The same method may be used on a 60-deg. triangle. I arranged one with two scales on its long edge, one at either end. One scale consists of the secants of 30-deg. angles, which are 1.1547 times the inch scale. The other scale consists of the secants of 60-deg. angles, which are twice the inch scale.

The former scale is used in locating radii between tangents that are at an angle of 120 deg., and the latter when the tangent lines are at an angle of 60 degrees.

Beyond the Toolpost

By J. C. Nicholson

The common toolpost on most lathes sometimes falls short when it is necessary to use a very long boring tool or to turn work which is almost as large as the lathe will swing. Of the various makeshifts used in such emergencies the one shown herewith has some good features.

Fig. 1 is a rear end view of the device mounted on the toolrest and Fig. 2 a top view. The construction is

simple for almost any ordinary shop. Two pieces of bar steel *A* about ½ x 1¾ in.—if the lathe is from 18- to 24-in. swing—are bent U-shape and then fastened together by a piece *B* of the same size with countersunk head screws *C*.

After these parts are assembled holes are drilled for the setscrews *D* and *E* and for the studs *F*, which are screwed into a plate *I* suitable to enter the toolrest slot. A round toolbar *G* or holder is clamped on a V-plate *H* as shown in Fig. 1, or if so desired a square or rectangular bar may be used instead without a V-plate. Vertical adjustment is by means of liners or shims placed under the toolbar or under the V-plate or between the toolrest and the entire device. Also some such adjustment may be had by turning the round bar in the V-plate.

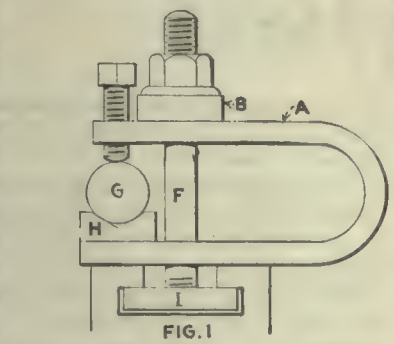


FIG. 1

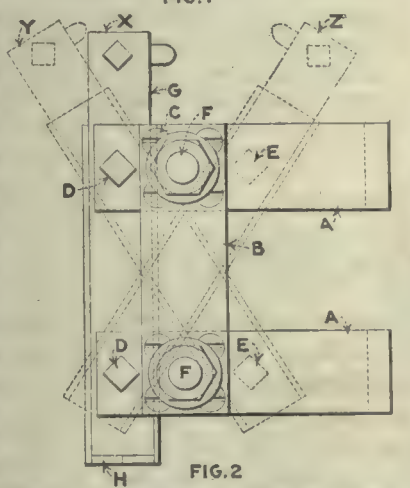


FIG. 2

FIG. 1. REAR-END VIEW OF TOOL CLAMPING RIG

FIG. 2. TOP VIEW OF TOOL CLAMPING RIG

The sketches show the toolbar in position *X* (Fig. 2) as it is used in turning work of large diameter, the bar being behind the toolrest slot in order to place it as far out as possible from the center line of the lathe. When used for boring the entire device is merely turned halfway around and the toolbar turned end for end in it, though it may be merely moved to the other side of the studs and setscrews *D* changed to positions *E*, or in most cases it may be left in the same position as for turning, and the cutter merely reversed. If for any reason it is necessary to machine a steep external or internal taper or any irregular concave or convex surface the bar may be shifted with some advantage to positions *Y* or *Z* as the case may demand.

The rig holds the bar very firmly, allows it to be overhung, little or much, as the case demands, and will hold as large a bar as one is ever likely to need.

Individual or Group Motor Driving

By Frank C. Hudson

One of the questions which arises in every shop is that of the relative value of individual or group driving for machine tools. Those who are taking advantage of the present lull to rearrange their shop layout, are doubtless giving it careful consideration at the moment.

The more conservative lean toward group driving and it seems to have much in its favor, especially in the matter of first cost. In shops which have both systems, however, there is a decided tendency to change to the individual motor drive even on small tools.

The cost of belting has increased considerably over pre-war days and there is the constant cost of maintenance which must be reckoned with. One superintendent of production states that he believes the cost of motors and wiring is not much more than belting, countershafts, etc., at the present time. The cost of motor repairs he considers lower than belting.

The absence of belting and countershafts, and the dirt which they deposit on the walls and ceilings, adds much to the appearance of a shop. The changing of speeds by push button or controller, insures their being changed more frequently, and there is an added element of safety which counts in its effect on the men.

There is always something attractive about a motor-driven shop with the absence of lineshafts, countershafts and belting. The tendency which is unquestionably in that direction, should be noted and studied by those who are making or contemplating changes.

This does not mean the elimination of belts. There are many places where the belt gives just the smooth, flexible transmission needed to secure the best results. Belting still has its place. But just as the milling machine has taken a portion of what was formerly planer work, so is the direct-motor drive taking over work where the belt was the only known method of securing results.

An Approximation Gage for Center Distances

By James McIntosh

There are many methods of measuring center distances, some of which are very efficient so far as results are concerned but are too slow and unwieldy for general use. The gage shown in Fig. 1 gave good results for the work for which it was designed. When the gage is in contact at point *A* the center distance *B* is

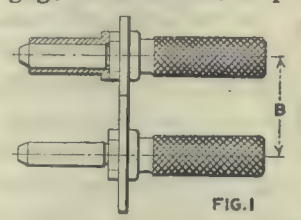


FIG. 1

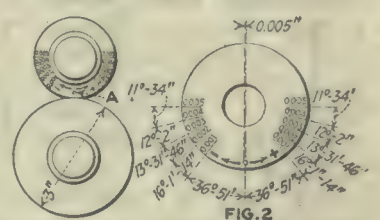


FIG. 2

FIG. 1. A GAGE WHICH CAN BE USED RAPIDLY AND EFFECTIVELY FOR GAGING CENTER DISTANCES

FIG. 2. LAYOUT FOR GRADUATING 2-IN. DIAMETER ECCENTRIC DISK

2.500 in. and has a range graduated to minus 0.005 in. or plus 0.005 in. Fig. 2 shows how the eccentric disk was graduated.

Milling Cams for Automatic Screw Machines

By Ernest C. Allen

In the shop where the writer is employed we have recently taken to milling the automatic screw machine cams instead of drilling and filing as has been the custom. The angles for setting up are computed as usual and are mathematically correct. It is seldom, however, that cams milled to the angles given attain the correct size, it generally being necessary to juggle back or forth a degree or so to get correct results. The trouble does not seem to be due to any deflection of the machinery as it would then be always in one direction, but occurs with total inconsistency. It is causing us considerable loss of time and I hope some of your readers may have found a solution for a similar difficulty.

IN THIS ISSUE

WE ADD to a record that we regard with some satisfaction by again opening the editorial section with the description of a machine just being introduced to machine tool users—this week the Rockford Milling Machine Co.'s No. 3 "High-Power" milling machine. This is the fifth of the last eight issues to carry as the leading article a description such as referred to—articles that are possessed of a high degree of news and information value.

How do you make your profits? W. R. Basset has written a splendid article with this question as title. He compares small profit on large turnover to large profit on small turnover, tells what the average return to a well-managed company should be, and makes some general statements about manufacture that will be recognized as true, although too frequently receiving less attention than they merit. Mr. Basset says: "I have more than once been surprised at the large number of these (manufacturing enterprises) which return to their owners an income much less than the savings bank interest on the money invested. . . . The unusually high earnings are achieved by those concerns which take a moderate profit on each sale, but turn their entire capital rapidly. . . . On the whole, machine shops require a heavier fixed investment than do most other industries. . . . In the machine shop industry most of the men I know feel that they should get from 20 to 25 per cent on the money they have invested. . . . In a competitive business the only possible way that I can see by which anything like so high a profit on sales could be realized would be if every manufacturer accurately knew his costs and was determined to get a price which would return that profit." "How Do You Make Your Profits?" begins on page 588.

A three-part combination article on bearing practice in railroad shops, by Hunter, begins on page 590. It is a comparison of the methods used in three middle western shops, the Wabash shops at Decatur, Ill., the Beach Grove shops of the Big Four at Indianapolis, Ind., and the Chicago & Alton shops at Bloomington, Ill. There are only seven pages devoted to the article and they are well laden with statements of facts and valuable illustrations.

Stanley has an article on press tools for a ball spacer for typewriters, page 597. He describes two-stage blanking tools, piercing tools for the central opening and rack surface and the first operation forming tools. He also furnishes a drawing of the layout for the piercing tools and a diagram of the piercing operations.

The article on press tools is followed by one on burnishing-broaches, written by Dixie, beginning on page 599. Dixie tells how to make and use burnishing broaches, about the kind of spoiled work that may be reclaimed by their use and about the turning of broached work with diamond tools. "It is surprising," he says, "how little knowledge there is among mechanics regarding burnishing-broaches. Not only are they easy to make and use, but a knowledge of their application often means the saving of a job which has been made too small or too large."

The Blanchard chuck is taken up by Sheldon this week in his fifth installment on magnetic chucks. The construction of the Blanchard chuck and the methods by which it is made seem to have afforded just the material needed to enable Sheldon to write another of his interesting compelling articles. Page 602. The story is too long for one issue—it will be concluded next week.

The third of Colvin's automobile transmission articles begins on page 606. It has to do entirely with gears. The subject is well handled and the article like the preceding ones, is thoroughly illustrated.

DeLeeuw's seventh article on metal cutting tools is concluded this week. You will remember that the article as a whole deals with milling cutters. The part published this week has to do chiefly with the causes of chatter and the remedies therefor. Page 610.

Beginning in page 624a we have articles on business conditions in England, the reconstruction of the Krupp Works at Essen and the condition of the railroads in Soviet Russia by our correspondents in London, Berlin and Riga. All are very interesting articles and they show that European conditions are indeed unsettled.

Coming Features

Next week we are to have the first of several articles on the Rolls-Royce Co. of America, at Springfield, Mass Colvin has called his first story "Transplanting Rolls-Royce Methods to the U. S." He says, of the first American chassis, that was completed in January, "It is so nearly a duplicate of its English mate that not even those who are thoroughly familiar with the car can tell them apart except for certain small earmarks which have nothing whatever to do with either the appearance or quality." That such results have been accomplished indicates that we are to have in this and the future articles on the Rolls-Royce some very absorbing stories.

A new contributor will be introduced next week. He is Joseph K. Wood, who has specialized on the design of helical springs, and who is now about to make public through the *American Machinist* his methods of design.

Among the other complete articles will be one on tools and operations in a railroad blacksmith shop by Stanley and some special correspondence on methods of motor assembly.

Of series articles there are to be the seventh part of "The Foreman and His Job" and the eighth of "Metal Cutting Tools."

EDITORIALS

We Should Make Haste Slowly with Immigrant Legislation

THE emergency immigration legislation rushed through at the last moment by Congress died by "pocket veto." While it may be advisable to put some new immigration legislation on the statute books we feel that it should be based on more deliberate consideration and on unquestionable facts.

The immigration question is one of the most complicated with which we as a nation are called upon to deal. It will not do to tackle it in our usual slap-dash, inaccurate way. We have been able to dispose of some of our domestic problems temporarily by such methods, but here we must fence with skilled antagonists—the emigration countries. Most of them have devoted much thought to emigration matters and have worked out clearly defined policies which may possibly be adverse to our best interests. The principal source of wealth in some of the emigrant nations lies in their productive labor. They cannot be blamed for protecting themselves from its permanent loss.

It will be as well, then, to make haste slowly in drawing and acting on bills regulating immigration. Legislators must not be swayed by partisan appeals or the demands of selfish class organizations. In this case at least the call of the country as a whole should receive the undivided attention of the representatives of the people. Any other course may lead to endless misunderstanding and friction with other nations, and we should be the last people on earth to do anything that would add to the ill-feeling which undoubtedly exists in certain quarters.

The foreign populations of some of our cities are nearly as large as those of the capital cities of the immigrants' home countries. Some of the suggested legislation will hit many of our most industrious citizens in a tender spot and will do little to increase the regard in which we are held abroad. The world has grown smaller since the war. We are more dependent on foreign markets to absorb our manufactures and consequently should not be hasty in passing laws that will endanger those markets.

Reducing Production Costs

Getting along with old machinery is one of the most expensive "economies" any machine shop can practice. Refusing to scrap machines which have outlived their usefulness is not practicing thrift and it's about as useful as hoarding old collar buttons.

How many shops do you know that scrap machinery when it has outlived its six to ten years' usefulness according to depreciation charges each year? The trouble is that shop managers think they are putting one over on the tax collector when in reality they are only cheating themselves.

There's only one way to get business when competition is keen—to be able to bid low and to make a profit on the job. This means that production costs must be low and this in turn means up-to-date machinery of every kind.

The shops which have put off getting proper machinery so as to have a small inventory may find it a case of paper prosperity. Shops which have replaced machine equipment as it wore out can do work much more efficiently.

Now is the time to remedy the mistakes of the past in this direction. New equipment may mean the difference between success and failure. The cost of production must be reduced and new machinery is the most efficient way of doing it.

Cut Production Costs—
With Modern Equipment

Increasing Capital Turnover To Get a Fair Return on the Investment

ON ANOTHER PAGE we have an article on the subject of what constitutes a fair return on the capital invested in a manufacturing enterprise. To the manufacturer of machinery and machine tools the problem of making a decent living from his business has always been a hard one and to some it has meant returns that were less than savings bank interest on the capital invested.

Working for the love of work is a praiseworthy action from a moral point of view, but carrying on a business that does not make a profit is sheer economic waste as it ties up valuable capital that might be utilized to better advantage elsewhere. It should be borne in mind that the companies analyzed in the article are engaged in all fields of industry. Not more than 15 per cent of them are in the metal trades and only one or two of these are machine-tool builders. As a consequence the rates of capital turnover attained in some instances are hardly applicable to machine-tool plants where one complete turnover annually is an exceptional achievement. In any event, however, the principle of striving to secure a maximum turnover of the working capital is sound and merits the careful consideration of the machine-tool builder.

As the author of the article points out, the amount of time lost between operations is often a serious factor and may be reduced appreciably by careful planning. Better tools may release more working capital than they tie up. More scientific purchasing will reduce the amount of capital frozen in inventories. Although the saving in each department may be small, taken together they are quite likely to turn the balance from loss to profit and pull the company through the difficult days which intervene between the present and the return of normal business. Machine tool builders are almost unanimous in their desire to maintain the wages of their skilled mechanics and rightly so for a contented man in the shop can do much to help the boss speed up material and capital turnover.

Shop Equipment News

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval. Brief descriptions appear later in Condensed Clipping Index in both American and European editions.

Whitcomb-Blaisdell 32 x 32-In. x 10-Ft. Planer

The Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass., has recently brought out an additional size and improved its second-belt-driven planer, which is shown in the illustration. Though the second belt is retained, there is an additional reduction obtained by gearing. The cushioning effect of the second belt is said to reduce the shock of reversal.

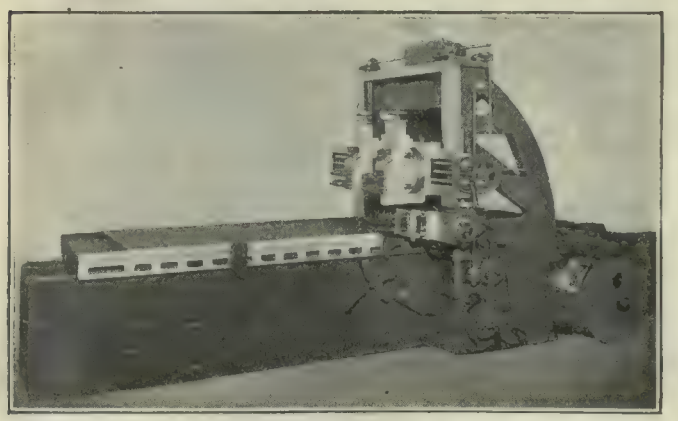
The bed is of the box type, closed at the top and open at the bottom except for a short space at the center of the bed where the bottom is closed to form an oil pocket, open at the top to accommodate the bull- and second-reduction gears. The second belt is outside the housings as in the standard machines.

The table is of box section, of extra width and depth, and is heavily ribbed to prevent springing. T-slots are planed from solid metal and the center slots extend over the full length of the bed. The housings are of box form and are tied together at the top by an unusually heavy tie bar, rendering the machine rigid under maximum cuts with the cross-rail at extreme height.

The Whitcomb patent lever binder is used to lock the cross-rail, and self-locking table dogs are provided so that a wrench is not needed to make adjustments.

The machine will plane work 32 in. wide, 32 in. high and 10 ft. long. It can be furnished with belt or motor drive. It has two heads on the cross-rail and may have independently operated side heads on one or both uprights. In the motor driven machine the motor is mounted on brackets at the top of the housings. Gear guards (not shown in the illustration) are provided to cover all exposed gearing in the feed train.

Driving pulleys accommodate a 3-in. belt. The countershaft runs at 500 r.p.m. and gives a cutting speed

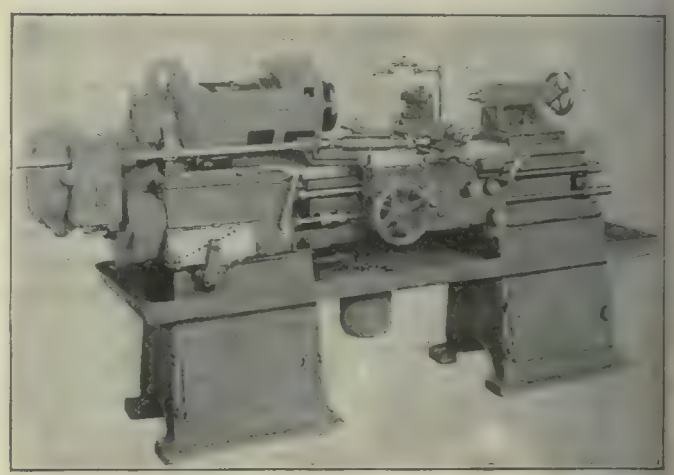


WHITCOMB-BLAISDELL PLANER

of 50 ft. per minute. The weight of the machine is 17,500 lb., and the bed occupies a floor space of about 7 x 16 ft. A 15-hp. motor is required to drive it.

Reed Prentice 14-In. Cone Head Toolroom Lathe

The Reed-Prentice Co., Worcester, Mass., has added to its line the 14-in. toolroom lathe shown in the accompanying illustration. It differs from the standard lathe



REED-PRENTICE-CONE HEAD TOOLROOM LATHE

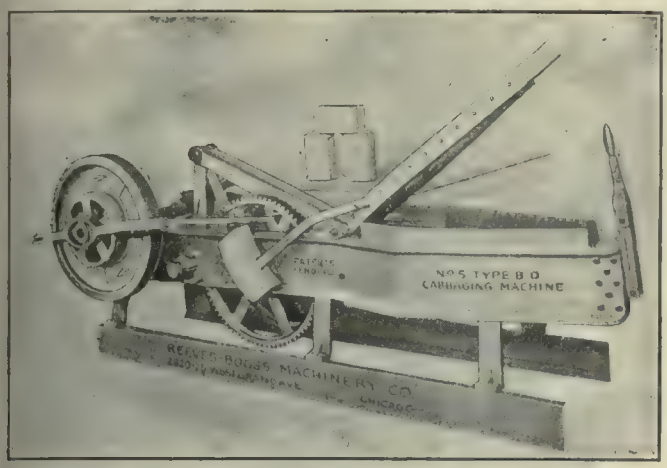
of that type and size only in having a head fitted with a four-step cone instead of having the regular geared head for constant speed drive. The largest diameter of the cone is 8⅛ in. and the smallest 4¼ in. The steps take a 2½-in. belt. The front bearing is 2⅛ x 4⅝ in., and there is a 1¼-in. hole clear through the spindle. Countershaft pulleys are 12 in. in diameter for a 3½-in. belt. Normal speed of countershaft 196 r.p.m. The weight of the machine with 6-ft. bed, compound rest, but without other attachments is 2,850 lb. All accessories including backing-off attachment are supplied.

Reeves-Boggs Scrap-Baling Press

The baling press or cabbaging machine shown in the illustration is made in four sizes by the Reeves-Boggs Machinery Co., 2926 Grand Ave., Chicago, Ill. The two smaller sizes make bales 5 x 5 x 10 and 5 x 5 x 12 in. in size, respectively, and are intended for baling skeleton punchings of sheet brass, copper, aluminum or other soft metals. The two larger presses make bales of 12 x 12 x 12 and 14 x 14 x 16 in., respectively, and will handle sheet-metal scrap of 14 gage and lighter. The machine is belt driven with the pulley face finished on the rim of the flywheel, which is connected with the driving shaft through a lever-controlled clutch.

The baling pressure is exerted by two side wings that are closed in by wedge-like slides carried by the ram, which is at the same time advancing and exerting pressure on the end of the bale. During the squeezing operation, the scrap is held down by a cover plate that is locked by the lever located on the right-hand end of

the machine. When the baling operation is finished and the ram has returned to its starting position the cover-locking lever is released and counterweights swing the cover plate up and out of the way for the removal of the

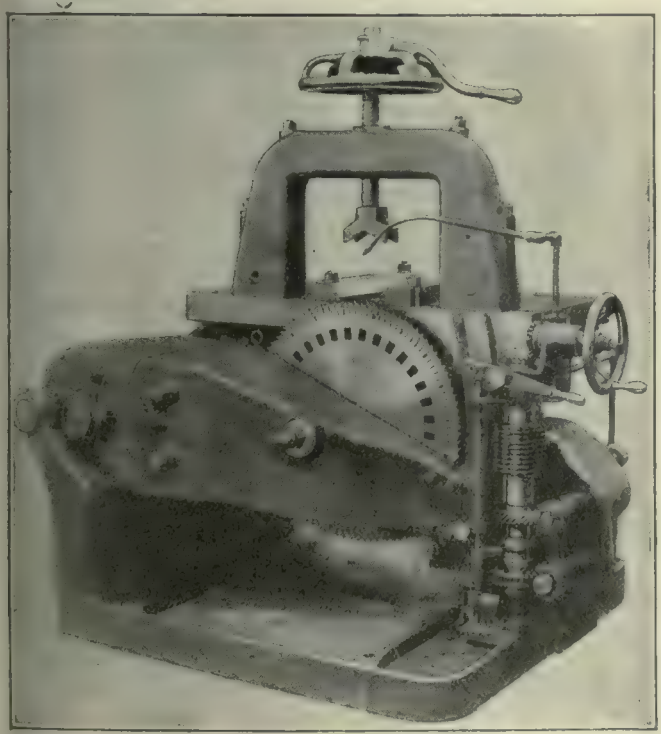


REEVES-BOGGS SCRAP-BALING PRESS

bale. A special attachment that operates by a foot lever can be applied, which is so arranged that it will lift the bale out of the machine that it may be more readily removed. All gears used on the machine are cut from the solid. The flywheel pulley is 30 in. in diameter with a 4½-in. face; and runs at 450 r.p.m. Five horsepower are required. The net weight for two smaller sizes is 3,500 lb., and for the larger sizes, 4,000 and 6,000 lb respectively.

Earle No. 26 "Lea-Simplex" Cold Saw

The Earle Gear and Machine Co., Stenton and Wyoming Aves., Philadelphia, Pa., has lately placed on the market the cold saw illustrated herewith.



EARLE NO. 26 "LEA-SIMPLEX" COLD SAW

Specifications: Saw, 26 in. in diameter. Work table: width, 22 in.; length, 44 in.; height, 35 in. Space under clamp yoke, 14½ x 18½ in. Floor space: belt driven, 60 x 72 in.; motor driven 48 x 72 in. Driving pulley: speed, 116 r.p.m.; diameter, 24 in.; face 6 in. Weight, 4,500 pounds.

The fixtures for clamping the work are conveniently arranged; the T-slots in the table permit holding the stock in any position and at any angle and the clamp screws can be tightened sufficiently to hold the work without the use of a bar or lever. The machine is provided with both a power and a hand traverse, a feed trip and a power return. By means of a quick-change device the feed can be varied from ½ to 1½ in. per minute and the changes can be made while the saw is cutting. All operating levers can be reached from one point and one attendent can operate several machines. The machine may be driven by either belt or motor.

Pawling & Harnischfeger Safety Crane Cab

The Pawling & Harnischfeger Co., Milwaukee, Wis., has developed a crane cab in which the entire controller equipment and current-carrying parts are enclosed, as shown in Fig. 1, the arrangement being intended to provide a maximum of safety for the operator. The

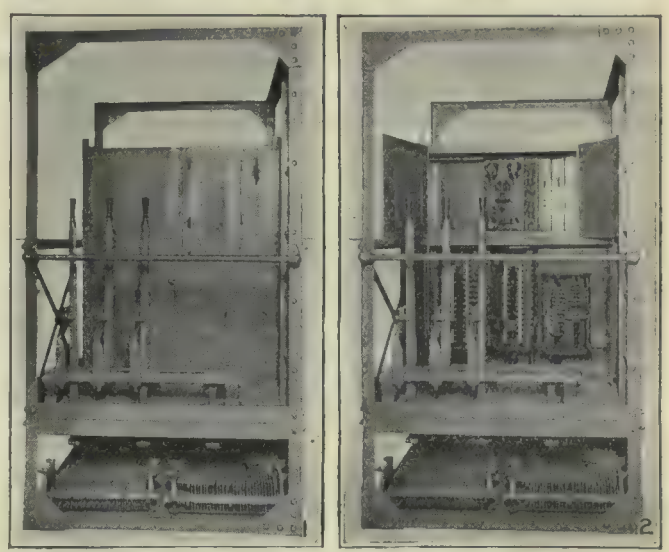


FIG. 1. ALL LIVE PARTS ENCLOSED IN CABINETS AT REAR.
FIG. 2. CABINETS OPEN, SHOWING ACCESSIBILITY

main switch, which is of the safety type, is operated by a lever extending through the switchboard cabinet.

The control levers are placed at the front of the cage and allow the operator an unobstructed view of the floor and the movements of the crane hook. All parts are accessible, the opening of the rear doors exposing the live parts for inspection and adjustment, as shown in Fig. 2. Access to the wiring, which is at the rear, can be had by removing a panel.

Hollingworth 28-In. Heavy-Duty Shaper

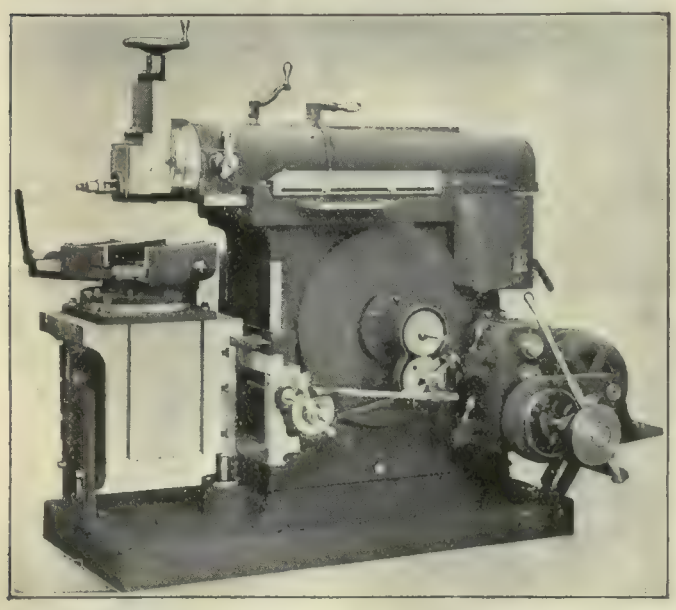
A 28-in. shaper intended for heavy-duty service is made by the Hollingworth Machine Tool Co., Covington, Ky., and is an addition to a line that already embraces 12, 14, 16, 18, 21 and 24-in. shapers. It is stated that changes have been incorporated in the design of the machine to insure rigidity and accuracy. The machine is furnished either cone-pulley or single-pulley driven, the latter type obtaining speed changes by the incorporation in the drive of a gear box with four speed changes. The single-pulley-driven type of machine may be fitted with direct motor drive, as shown in the illustration.

The shaper is of the crank type and fitted with back gears, so that with the four changes in the gear box or the four steps on the cone pulley there are a total of eight speeds available. The ram has a quick return stroke, and its rocker arm pivots on a shaft at the bottom of the column and supporting all of the weight of the arm. It is claimed that the double link connecting the rocker arm and the ram tends to neutralize the upward thrust of the tool. The rocker arm is of the open-pattern type, ribbed on each side, and has adjusting bolts for taking up wear. The ram is fitted in square ways with taper gibs that have but one screw each for adjustment. The toolhead is graduated and swivels to any angle up to 90 deg. The feed screw has a micrometer dial that is graduated to show thousandths of an inch.

The table is slotted on the top and both sides and can readily be removed when its use is not desired. It is bolted to a slotted saddle that can be used also for bolting up work. The vise is mounted on a swivel base graduated for the complete circle. Its upper jaw is scraped to a fit on the lower jaw and is held in place by steel gibs.

The cross-rail is elevated by means of a telescoping screw mounted on a ball-thrust bearing. The cross-feed on the rail can be changed while the machine is in motion, being controlled by lifting and turning a pawl. The crank arm for the feed crank is adjusted by a screw, so that the operator can set the pawl for any desired number of notches in either direction. The cross-feed screw has a micrometer dial graduated to 0.002 in. The length of the stroke can be accurately set by a graduated scale on the column, and the ram can be positioned by a screw driven through miter gears.

The shaft bearings are provided with bronze bushings which, it is stated, can be readily removed and replaced. The driving gears are semi-steel castings and the pinions are hammered steel, both being cut from the solid. No matter what type of drive is used, the machine is provided with a friction clutch that is controlled by a lever at the rear of the machine on the operating side.



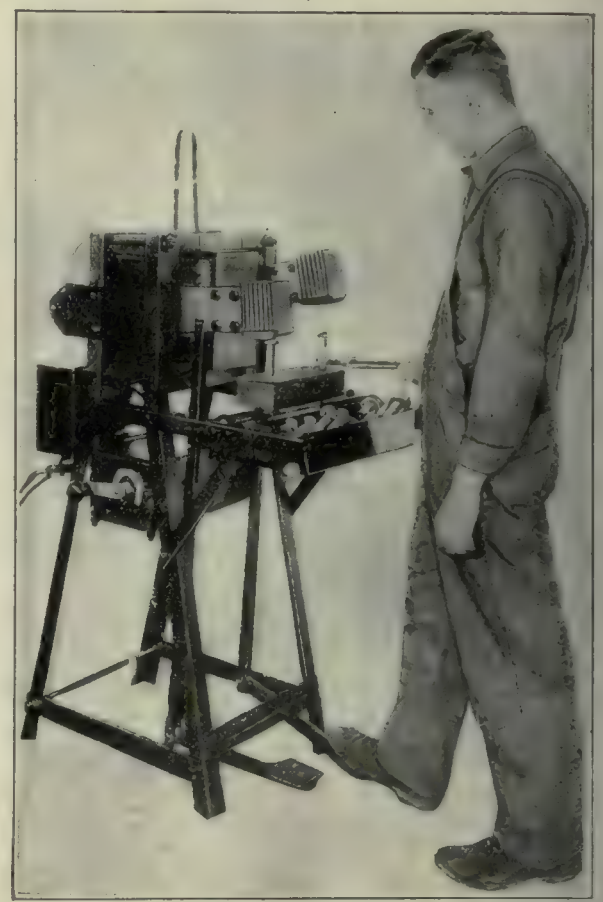
HOLLINGWORTH 28-IN. HEAVY-DUTY SHAPER

Specifications: Type of drive: cone pulley, single pulley with gear box, or direct motor. Eight changes of speed with either type of drive, using back gears. Countershaft: tight and loose pulley, 14 x 4½ in.; speed, 300 r.p.m. Floor space, 60 x 70 in. Weight: net, 5,500 lb.; domestic shipping, 5,700 lb.; foreign shipping, 6,100 lb.

G. E. Rivet-Heating Machine

The General Electric Co., Schenectady, N. Y., has recently brought out the electric rivet-heating machine illustrated herewith.

The heating unit consists of an air-cooled transformer with a single-turn short-circuited secondary, in which the rivets to be heated form a part of the secondary circuit. The primary winding is designed for 220,- 440- or 550-volt single phase circuits of 40, 50 or 60 cycles. The primary winding is connected to a drum controller, so that six different voltages can be obtained on the secondary. Adjustment of rates for heating the different sizes of rivets can be made by setting the handle on the controller.



GENERAL ELECTRIC RIVET-HEATING MACHINE

The secondary coil is divided into two upper electrodes, beneath which is an electrode of cold-rolled copper. The two rivets to be heated are placed on the lower electrode and the upper electrodes are then brought into contact with them by means of pedals. If rivets are not needed as fast as the machine will heat them, one rivet can be heated at a time and in this case a switch, connecting one side of the primary can be opened.

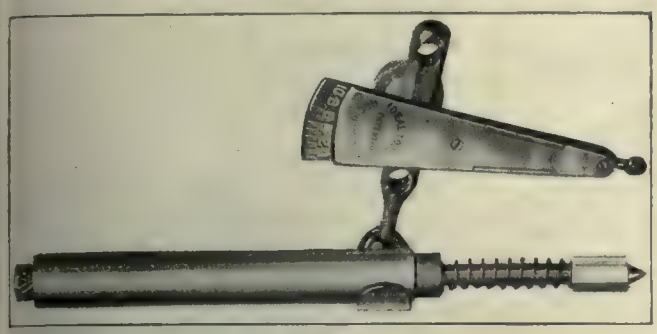
It is claimed that all adjustments can be made without danger to the operator as the control apparatus is wholly enclosed.

"Ideal" Center Tester

The illustration shows a center tester made by the Ideal Tool Co., Rochester, N. Y., and sold by Johnson & Miller, 42 Murray St., New York, N. Y. The device is used in connection with the test indicator made by the

same concern and described on page 171, Vol. 44, and on page 1144, Vol. 49, of the *American Machinist*. Its purpose is chiefly to aid in locating punch marks in line with the center of a machine spindle, either with the work stationary or revolving.

The tester consists of a holder through which passes



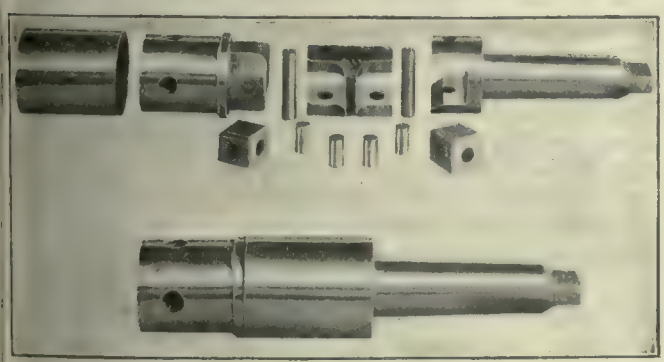
"IDEAL" CENTER TESTER

a rod carrying a center point and free to move through the holder. The holder is held in the machine spindle, and the center point is placed in the punch mark, being held there by the spring. Either the work or the spindle is then turned, the floating cone holding the center rod permitting the center point to move in case the punch mark be not directly in line with the spindle. The collar near the point thus presses on the contact point of the indicator, the deflection being shown in thousands of an inch on the scale.

The spindle and the punch mark are correctly aligned when the indicator shows the same reading entirely around the rod. The bar carrying the indicator is fastened to the holder by means of a ball joint. Thus, without using the center stem, the indicator can be swung so as to make contact with a turned surface, either internal or external, so that the device can be used for centering on drill presses, lathes and boring machines.

Cincinnati Engineering Tool Co.'s Universal Chuck

The Cincinnati Engineering Tool Co., 4659 Spring Grove Ave., Cincinnati, Ohio, makes the universal chuck that is shown in the illustration. The device can be supplied in three sizes and with any style of special shank or socket. It was developed for use with all types of boring and reaming fxtures, either of the



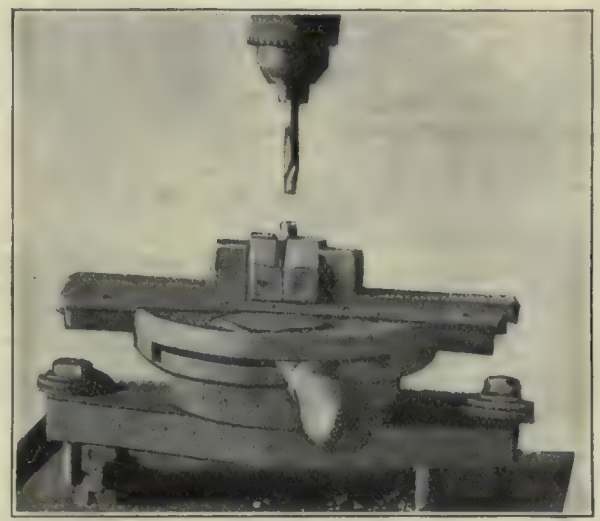
UNIVERSAL CHUCK OF THE CINCINNATI ENGINEERING TOOL CO.

vertical or horizontal type, that require a double support for the tool. It is said to overcome all errors due to the faulty alignment with the spindle of the machine base or table, or of the fixture.

The assembled chuck is shown in the lower portion of the illustration, and the parts of which it is composed are shown above. All parts are made of alloy steel hardened and ground to a finish. The universal joint is full-floating, and is stated to be very short, considering the movement that it allows, thereby saving considerable space and permitting its use on machines of moderate range. Tools are located in the chuck in the same manner as with a standard form of chuck. Attention is called to a safety feature of the chuck, obtained by the absence of projecting parts.

Quick Acting Fixture for Drilling and Tapping

A quick acting fixture for use primarily on drilling and tapping operations, but which can also be used on hand milling work, is illustrated herewith. The fixture



QUICK ACTING DRILLING FIXTURE

is shown mounted on a small drilling machine and the two jaws used in holding the work and the handle which operates them can be seen. The jaws are operated by a cam plate with the slot so arranged as to give a rapid motion until the jaws are almost in contact with the work, and then to increase the gripping power so as to hold the work firmly.

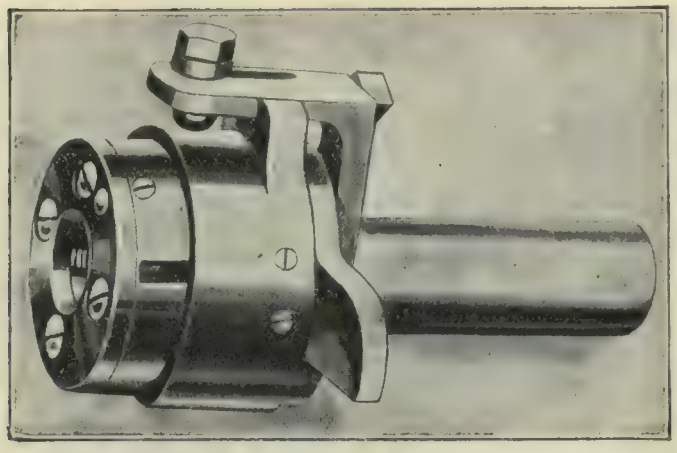
The fixture has a large hole through the center so that the work drops through as soon as the jaws are opened, and in this way saves considerable time in handling. The fixture is also provided with an arm for carrying drill bushings, that can be removed whenever found desirable. This device is manufactured by The Waldon Tool and Metal Manufacturing Co., 13 Ferry St., Norwich, Conn.

"H & G" Die Head for B & S Automatic Screw Machines

The Eastern Machine Screw Corporation, New Haven, Conn., has recently brought out the die head illustrated herewith and which is intended for use on Brown & Sharpe automatic screw machines.

The main feature of this die head is in the provision for holding it from revolving while cutting. Instead of the ordinary pins, an extension of the shell engages both sides of the overhanging arm attached to the body. The trip lever has been so designed as to make its operation sensitive enough for cutting very fine threads.

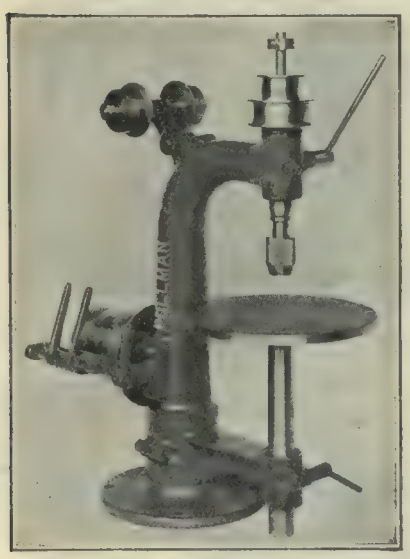
The adjustment for length of thread is made by a



"H & G" DIE HEAD FOR B & S AUTOMATIC SCREW MACHINES

screw which brings the tripping button to the proper point. It is claimed that the thread can be cut to a shoulder or a given point with great precision and that by a simple adjustment the depth of cut can be controlled to within one-half thousandth of an inch.

Pullman High-Speed Bench Drill



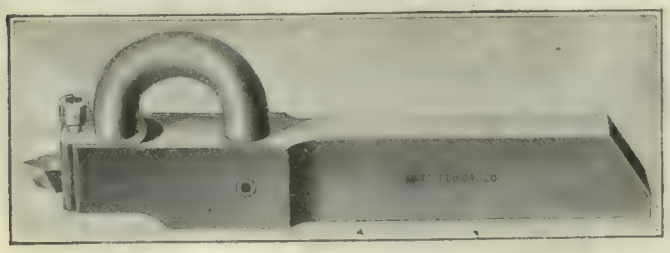
PULLMAN HIGH-SPEED BENCH DRILL

Specifications: Maximum distance from spindle to table, 9½ in. Maximum vertical movement of spindle, 3 in. Distance, center of spindle to frame, 6 in.; drill capacity, ⅝ in. Height, 28 in. Weight, 85 lb. Weight crated for shipment, 90 pounds.

The bench drill shown in the illustration has recently been placed on the market by the Pullman Ventilator and Manufacturing Co., York, Pa. It is rated as having a capacity of 12 in. and takes drills from No. 0 to ⅝ in. diameter, being intended for high-speed work on small parts. The machine can be furnished with a chuck, as shown in the illustration, or with the spindle-end bored for a No. 1 Morse taper. A two-step cone allows variation in the speed.

Miner Spring Toolholder

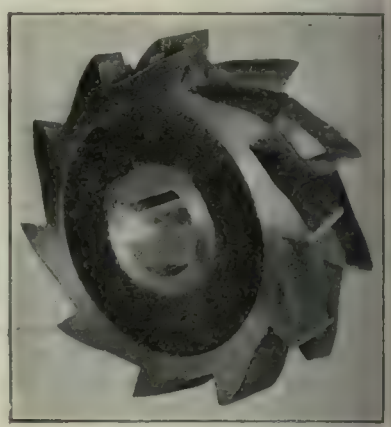
The Miner-Fuller Co., Plainfield, Conn., has placed on the market a spring toolholder, shown in the illustration. The toolholder is recessed in the front end for the section which carries the toolbit, this section being attached to a spring-neck as shown. This construction allows the tool to spring back and forth, but prevents any side motion. A full-length toolbit can be used, and the holder can be used as a solid holder if desired. The shank is heat-treated, and the spring-neck is of tempered toolsteel. The holder takes a ⅝-in. square toolbit. The shank is ⅞ x 1⅛ x 7 inches.



MINER SPRING TOOLHOLDER

Bridgeport "Herringbone" Milling Cutter

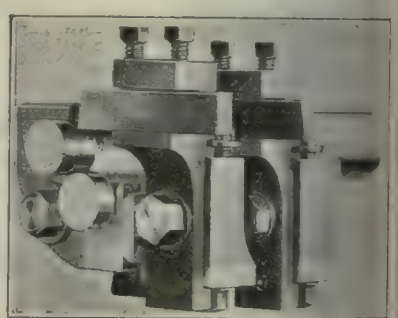
The Bridgeport Cutter Works, 50 Remer St., Bridgeport, Conn., has added the "herringbone" type, shown in the illustration, to its regular line of milling cutters. The cutter has, as its name would indicate, a double-opposed helical form of tooth, though the helices do not meet at the center as would a true herringbone. The cutters are made in two parts, permanently joined together. Cutters can be furnished in all diameters from 2¼ to 8 in., and in any width from ⅛ to 1½ in. The material used is a standard brand of high-speed tool steel.



BRIDGEPORT "HERRINGBONE" MILLING CUTTER

Biggs "Tangent Cut" Box Tools

The P. H. Biggs Machine Co., Cleveland, Ohio, has placed on the market two box tools, one of which (Model C) is shown in the accompanying illustration. These tools are intended to facilitate high-speed production of screw products or other parts which are machined in turret lathes. The tools are made entirely of steel, and are hardened throughout. Shanks, rollers, and studs are ground to size. The outstanding features of these tools are said to be the angular manner of setting the tools, and the fact that they are so designed that the cutting tools may be removed, sharpened, and replaced without disturbing the original adjustments. The tools are furnished in four sizes for turning from ⅛ to 1⅝ in. All tools of a given size are made with parts interchangeable.



BIGGS "TANGENT CUT" BOX TOOLS—MODEL C

The publication of "Quarterly Statement of Imported Merchandise Entered for Consumption" has been discontinued by the Bureau of Foreign and Domestic Commerce. It is not required by law, and its publication was discontinued with the issue covering the quarters ending with March 31 and June 30, 1920.

The yearly statistics will be published in Table No. 9 of the Annual Report on the Foreign Commerce and Navigation of the United States for 1920, and that table will be also issued as a separate report.

Business Conditions in England

British Domestic Markets Show Little Sign of Relief—Automotives and Machine Tools Quiet—Unemployment Decreases Slightly—Cost of Living Coming Down

BY OUR LONDON CORRESPONDENT

FLICKERS of light have once or twice tried to show themselves but gloom has prevailed, and the notification of pending removal of the excess profits duty has been quite ineffective on enterprise. Indeed, despite protests it has always been clear that this duty, while contributary, has never been a prime cause for the decline in trade and industry. The overseas markets may be described as non-existent, and until the central and other parts of Europe are on a firm basis no revival can be expected. Great Britain depends to a large extent for her food on her ability to export, and every effort will be made in that direction; but the government credit scheme has hung fire and a fresh start is being made. Some time ago announcement was made of the conditional contract obtained by the Armstrong-Whitworth organization to repair Russian railway plant. Now it is gathered that before long the Polish authorities will be on the market for a similar purpose, but no decision has yet been reached as to whether a British firm will be asked to undertake the repair of locomotives in their own shops in Poland, or to equip and possibly run Polish government shops for the same purpose. A charter, too, has been granted by the Chinese government by which power is given for the formation of a corporation having half Chinese and half British capital, removing the restrictions by which foreigners could not hold land or property outside the treaty ports. The corporation will provide technical and financial assistance by setting up factories, etc., of all kinds, and giving opportunities for British trading in China. The difficulties that confront traders have been shown up later by the marked objection in Italy to meet bills against goods purchased from Great Britain when exchange rates were more favorable—or should it be said unfavorable—to the continental buyer.

Another attempt has been made by means of exhibitions to liven-up business. In pursuance of a set plan, and as a rival to Leipsig, the Board of Trade, in conjunction with local chambers of commerce and so on, again organized a series of three industrial fairs, in no way clashing as to exhibits, and held one each for a fortnight in London, Birmingham and Glasgow. (Next year they may possibly all be centered in London.) Many foreign potential buyers were invited and a number came. In order that they might make their progress along the length of Great Britain without undue hurry, the Glasgow fair, closing in a few days, is a week behind the others. Any engineering shown was at Castle Bromwich, the center for Birmingham. But it was mainly of the hardware variety, with a few motors and ordinary cycles, a few machine tools, some woodworking machinery and a fair amount of small tools. Oringinally, these were banned by the Machine Tool Trades Association, but at the last moment the embargo was removed. Very little that is new was shown and, in regard to business done, as a corpse-reviver the exhibition failed.

The latest available returns show 1,223,000 workpeople registered as unemployed, together with 730,000 on short time, these numbers being of course apart from unregistered people out of work, etc. One of the few grains of comfort recently had been found in the fact that the rise in the figures of unemployment, which amounted at one time to more than 65,000 a week, dropped to less than 35,000; unfortunately, the figures have lately risen again so that nearly 40,000 are being added weekly to the unemployed. To meet the dangers of young girls and lads being out of work and consequently on the streets, juvenile employment committeees are organizing instructional and recreation centers and the Labor Ministry recently ordained that attendance at approved educational, etc., courses may be made a condition for receipt of unemployment pay in such cases. The government out-of-work insurance pay is to be increased to £1 a week for men, 16s. a week for women, and so on. Besides being of service in the manner intended, this allowance occasionally operates in rather odd ways, to say the least. For instance, it is possible to find engineering workpeople who, though they could perhaps be employed four days a week, prefer to be engaged three days. The explanation is that, being employed only half a week, they thus become qualified for half the government unemployment pay. In addition, they receive a donation for the same purpose from their trade union, and thus, from the income point of view, it may well be quite as profitable to work three days as to work four.

Machine Tools Not Selling

The machine tool industry is quite flat. While Pearn-Richards universal machines have actually been advertised for, among smaller and medium-size tools the only demand of late has been for certain classes of milling and grinding machines. This notwithstanding, one of the few firms specializing in grinding machines has practically closed down for the time being. Small tools have been in fair call. Few firms, in the Midlands at any rate, are working full time, and from 16 to say 25 hours a week is to be regarded as fairly normal now. India, Australia and Japan have been described as the relatively bright spots, but the home trade is in very poor condition. It is thought, too, that conditions are further depressed by the action of the government in auctioning-off many machine tools from munition factories. The prices obtained are not good and it has been suggested that if the remaining tools, etc., were held back an enhanced price may be obtained when trade shows signs of life, the difference more than paying for the loss of interest on present-day values. It is understood that the Machine Tool Association is urging this on the government. Despite conditions, most firms remain in existence, though one, the Storey Machine Tool Co., Ltd., New Cross, London, S. E., is being sold-up. This firm had been in existence 40 years or more but was not at all well-known in the engineering world until comparatively recently, having in the past acted rather as a factory for certain merchants. Some years ago these merchants erected and equipped

their own works elsewhere, and when openly entering the field the Storey firm, despite their manufacturing experience, were handicapped by the fact that they did not know the customers to whom the tools they made had been supplied.

Automotives Quiet

The motor industry may be described as working at half time. In the words of the official announcement of the Institution of Automobile Engineers "owing to the present state of trade it has been thought wise to cancel the proposed (summer) visit to Birmingham and as an alternative a three-days meeting will be held in London." A number of cuts in prices have been announced within the last two or three weeks. For instance, the Swift Co. has taken off various sums according to the type of car, averaging say about £40, and the 2-3 ton Daimler commercial chassis has been reduced by about £250. Then £100 was taken off the Citroën car. The new range of licensing fees has kept a number of cars off the road. The tax for the pleasure car is at £1 per hp. according to the accepted rating, and the minimum is £6, the license for a Ford car costing £23, while the Rolls-Royce car costs about £49. With a view to reduction of power. and therefore presumably of tax, a London firm has introduced bushes to suit Ford cylinders, thus diminishing the bore. The estimated saving of tax, if the authorities agree, is £7 7s. Motorcycles too, which in the past could be licensed for £1, now cost 30s. to £3, and if a side-car is added this means another £1. The license is usually for a year, but it is not necessarily taken out for a full year. This has worked out rather curiously. The motorcycle industry is of course no better off than others. But, although the overseas trade has dropped badly and the home demand is poor, firms are not altogether without hope, for they argue that the motorcyclist is postponing his orders until after the first quarter, in order to avoid something like a quarter's duty on the license. As to ordinary cycles, it has been said that improvement in demand has already shown itself, but it must be remembered that many machines were held in stock from last year. Many people are inclined to hold back in view of possible reduction in prices and for this reason agents have not been willing to take risks. In order to re-assure them Rudge-Whitworth, Ltd.,—"under no apprehension of a sweeping reduction in bicycles, motor bicycles or sidecar prices"—have promised to make good any reduction in price that may be announced between a month ago and May 31 next; that is to say, they will credit or refund the difference, if any, on all machines supplied during the period specified. The dealer. of course, undertakes to refund the reduction to his customer. A move in somewhat of the same direction has also been made by the Westinghouse Morse Chain Co., Ltd., Letchworth.

Financial Returns

Returning to automobiles, the report recently issued by Crossley Motors, Ltd., showed a decline, the profits for the year ending last October amounting to £35,642, or rather less than a quarter of the profits on the preceding year: the dividend for the second half of the year was therefore passed. With good will now entered at £1, the value of the stock in hand has nearly doubled in the year, being £986,424. Leyland Motors, too, paid no dividend on the ordinary shares, although the report, which is concerned with 9 months only, shows a profit exceeding £215,000. The stock held here has more than doubled in money value. Then again, the affairs of the Austin Motor Co. have been the subject of much conversation, some of it mere chatter. Particulars have been published of a scheme to enable the company to attend to its creditors, for it is proposed to issue a million pound 10 per cent first mortgage debentures, one half of which will be offered for public subscription, being required mostly to clear commitments by way of mortgage notes and debentures. The sum of £400,000 will therefore be paid to the trustee, to acquire these notes, etc., to be merged into the pending issue of debentures. These by arrangement with suppliers of material will act as security for paying-off systematically, over a period of 18 months, amounts due. All creditors who agree must pledge themselves to take no separate action to enforce payment of their debts without the concurrence of the majority. Affairs of at least two other motor car combinations are in the balance, and in the case of one well-known engine firm unless further capital can be raised by the company or other means are available to appease creditors the latter will probably enforce winding-up; then it is estimated that, if the negotiations are carried on with care, the creditors may receive an amount not to exceed 10s. in the pound. On the other hand the directors of the Wolseley motor concern (really a branch of Vickers, Ltd.) seem satisfied and, to turn to another section of engineering, Mather & Platt, Ltd., Manchester, had in 1920 the best year of their existence, with "distinctly good" present prospects. The net profits amounted to £285,211.

The Cancellation Evil

The cancellation trouble has lately reached sections of engineering which could heretofore be regarded as in a fairly satisfactory condition. Certain of the larger electrical firms now complain and woodworking machinery manufacturers have similarly been troubled. One firm has lost the work on an order amounting to £15,000 for Brazil, while another of its customers, a home firm, simply wrote "with reference to our order for machines kindly cancel." These machines were of a somewhat special character, valued at £1,000, and were due for delivery about three weeks after the receipt of the letter. Textile machinists can still claim to have enough in hand, but orders are evidently getting worked-up, as times of delivery quoted are steadily becoming shorter.

The shipbuilding industry has notoriously been suffering, and the estimate has been made that within the last 12 months the number of vessels stopped was 70 per cent more than the number of contracts obtained in the same time. British shipping is held-up to the extent of 10 per cent, according to one estimate, and the coal crises, which is thought to be inevitable as the result of the unexpected decision of the government to end financial control on March 31, will not help matters. The commercial connection, for Great Britain at any rate, between coal and ships is obvious. Apparently the fight will turn on the question of a national as against a district or pit wage.

The Stork Helps Business

One branch of industry, not hitherto regarded as of much importance from an engineering point of view, namely, baby carriage manufacture, is said to be prosperous; for during the war period no small section of the British public remembered the biblical injunction to

ncrease and multiply. As a consequence one firm of notorcycle and engine makers, commonly employing about 600 men and now having about 50 working at ittle more than half time, have just gone into business as producers of perambulator frames, etc.

Official reports state that the value of imports by air last year reached £677,047, with exports at £339,108. Such articles as clothes and furs seem to have predominated. Those among you who, like our friend E. A. Dixie, think that air services can be carried on profitably by "war- and poverty-stricken Europe" will be a little disconcerted to note that the Handley-Page daily service—the last from this country—to the continent, London to Paris, has beeen discontinued. This resulted from the subsidy of about £600,000 granted by the French government to the French air transport companies, thus wiping out English competition. The calculation has been made that with full load of 2,000 lb. at 100 miles per hour the cost of freight by air is 3d. per lb., including all charges, using the DH-18 machine. Some scheme to insure resumption of British flight between London and Paris seems probable.

H.C.L. Going Down

Turning to the brighter side, the cost of living as officially estimated has lately shown a marked decline and with a fall of 14 points was, at the beginning of February, 151 per cent above the cost in July, 1914. Though part of the decline is doubtless due to the need of shopkeepers, etc., to realize,—retail declines are well behind wholesale—it is for the most part a permanent drop and in many instances must lead to wage reductions, although there are a number of classes who have managed to force up wages and salaries on the basis of increased living cost without any automatic fall should such costs be reduced. During January it is known that nearly 700,000 workpeople received a net increase amounting to about £54,000 weekly in wages, while about 1,450,000 sustained a net decrease amounting to about £168,000 a week. Owing to the decline in trade causing lower consumption and to the greatly reduced orders from abroad, together with, as it has happened, a lower demand from home domestic customers due to the mild weather, the output of coal miners has decreased until the whole of the increased wages that accrued since the last dispute have been removed automatically. In fact, it may be said that the tendency all around is definitely toward reductions in wage rates for workpeople. This movement certainly applies to iron and steel in its semi-manufactured state, but it has not so far reached the finished manufactured stages, that is, it does not apply to those who are classed as engineering workpeople.

Fallacy of Wage Claims

The cost-of-living figures as officially estimated have been several times mentioned in these columns, and for the purpose of argument on wage matters are often regarded as absolute. They are based on the spendings of a workman, with wife and two children, having an income before the war of 28s. a week, and the family is supposed to buy the same commodities to the same extent both pre-war and at the date of calculation for percentage. Calculations relating to about 2,000 families were made in 1904, to set the original standard. This explanation is itself sufficient to expose the fallacy of many of the wage claims that have been made and, in fact, admitted. It is expected that the new figures which will be available in about a fortnight will show a further drop of at least 5 points.

Reconstruction of the Krupp Works at Essen

BY OUR BERLIN CORRESPONDENT

THE main strength of the now destroyed German war machinery rested on two groups of works solely devoted to the manufacture of war material, ne one, private-owned, of Krupp and the other consisting of the State Arms and Ammunition Works, now organized as a company, The Deutsche Werke, or erman Works, but still state property.

The state establishment, being by far the largest in ermany and having had no peace manufactures to fall ack upon, naturally constituted the most difficult of ne many problems presented by the readjustment of ne enormous German war industry. There was a ertain time after the armistice, when the existence of ne works stood entirely in question. Labor trouble of specially violent nature, and the process of the compulsory wholesale destruction of a large part of the achinery, made it appear very likely that the works ould not survive the crisis, and be prevented from aking a fresh start, an event which would have been ather welcome to the German industry as a whole.

It is now two years since the reconstruction in both orks was taken in hand. While, however, the state wned works, in spite of all the financial support and nfluence of the government, are still in the infant ages, the Krupp works at Essen are already on a air road to new prosperity.

This reconstruction work, performed in two years, is an achievement of no mean order, when considering the size of the plant, and the adverse circumstances existing. In comparison with the slow progress of the state works on a similar task it is held out as another instance of the advantages of private ownership, and the failure of the socialization theory.

Before the war Krupp employed 80,000 men altogether, of which 42,000 were in the service of the Essen works, 38,000 were distributed over the other works of the firm—the Gruson works, the shipyards at Kiel, and the steel works. During the war the floor space in Essen was increased from 280 to about 500 acres, and the number of workers to 115,000.

Whole Layout of Plant Changed

Of the work's original destination there is hardly any evidence left. The adaptation was carried out with much thoroughness, so that the workshops almost appear to have been designed for their present purposes. This was of course helped by the foresight of the management, in the general lay-out and equipment of the new buildings erected during the war. A peaceful vocation for the latter had been in view from the first, not because the disastrous end of the war was in any way anticipated, but because the firm could not think of

keeping all their largely extended plant employed with the manufacture of war material in peace time. The extensions therefore are not of the nature of improvisations, but have been built on a most solid scale. Few building alterations were made, the builder's share in the reconstruction having been more or less restricted to a thorough cleaning up. Nevertheless a visitor, familiar with the works during wartime, will receive from them an entirely new impression, which no doubt is caused by the radical changes in, and the re-arrangement of, equipment. Judging from appearances, this huge task was performed without stint. The firm's enormous capital reserves, accumulated during the war, were applied to the re-establishment of business on the most solid basis possible under the unstable conditions. A considerable part of the equipment consisted of machinery designed for armament purposes only. This plant has disappeared as if by magic. The firm had no option but to scrap this machinery, as under the conditions of the Peace Treaty it had to be made unsuitable for further use, which resulted in the destruction of all essential parts. The remnants were unsuitable for adaptation, and ended in smelting furnaces.

Preference for American Machinery

The present equipment consists in the main of a careful selection of the best machine tools of the former plant. This machinery has been thoroughly overhauled and appears to be in a good condition. Much of it had been sorted out, and new tools put in instead, wherever the present manufacture required them. Great care has evidently been taken to preserve machinery of American origin, of which the firm possesses quite a little. Nearly all leading American makes are still represented in the Krupp plant, foremost among them being automatics. Similar observations regarding the retaining of American machinery may be made in most German plants, an evidence of the esteem in which it is still held, in spite of the fact that no American tool in Germany has done less than seven years service. This also explains the fact that of the multitude of tools offered on the second-hand market, comparatively very few are of American make.

In pre-war times the manufacture for peace purpose in the Essen works was limited to parts of locomotive and rolling stock in general, motor parts, castings, high grade steel and various kinds of machinery, mostly buil by contract and not on a manufacturing basis. Th list of new manufactures adopted is extensive an shows considerable variety. Foremost is the manufac ture of locomotives on a large scale, after standardize design; motor vehicles, from motor cars down to moto rollers; tractors; harvesters and agricultural imple ments of all kinds; textile, oil and sugar machinery Another department is devoted to the manufacture o small tools and gages. How diversified Krupp' interests are is shown by the fact that they hav entered into a combine with the Ica Werke of Dresden, factory for photographic and cinematograph apparatu Not all the new manufacturing lines are already in state of perfection; the locomotive department farthest advanced, while others are still in the exp rimental stages. If the work in these departmen proves as successful as the locomotive enterpris Krupp's will soon be in the front rank of Germany machine building industry, and no doubt will become formidable rival to English and American firms.

Fight Against Socialism

The efficiency of the plant has greatly improve during the last year, but apart from the food conditio which is still far below the normal, it still bears witne to the fact that the Krupp works have been a hot-b of the most advanced socialistic theories. The unre following the revolution, made itself strongly felt the Krupp works. The situation improved after t discharge of the large army of temporary workers, w constituted the radical element chiefly. All skill workers were retained at full wages, during ma entirely unproductive months. This enormous sacrifi of Krupp's has really saved the situation, and was a large degree instrumental to the ultimate success the reconstruction work.

Condition of the Railroads in Soviet Russia

FROM A CORRESPONDENT IN RIGA

THE famine in Central Russia and the sufferings of the people are due, not so much to the experimental administrative methods of the Bolshevik government, as to the bad condition of the Russian railroads. According to government statements there are in Siberia 20,000,000 poods of grain which cannot be moved on account of the lack of locomotives and cars.

Telegrams were received here yesterday (February 27) telling of revolts in Petrograd and Moscow caused by the fact that the population had received no bread for three days. We know from the Bolshevik reports that of the 7,500 carloads of grain which should have been received at Petrograd during February only 3,000 were delivered by the railroads. Only 4,000 carloads will be delivered in March.

The Soviet government, of course, is using every possible means to speed up the railroads but it is a hopeless task because the tracks are out of repair, the locomotives and cars are worn out and the railroad workers are underfed and have no ambition to work. Even t best government—providing the Soviets should be ab ished—could not feed the population and establish re tively tolerable conditions in Russia unless the railro service could be greatly improved.

Russia herself is unable to build and repair lo motives and cars. She must have foreign help and lo motives at least must be purchased from foreign m kets. In 1913 there was a shortage of 2,000 freig locomotives and 80,000 cars, according to a care estimate made by the Ministry of Communications. to the number of new locomotives and cars added duri the last six years we have no statistical data but number is probably very small. Figures are availa however, to show the condition of the Russian locor tives in 1914. Of the 20,000 locomotives then in se ice on all railroads, more than 25 per cent were o twenty years old and practically worthless for effici service.

The war laid a heavy burden on the railroads. Car loadings were increased from 750 to 1,200 poods and as a result deterioration was rapid. Maintenance of way work was entirely insufficient because of the mobilization of skilled labor and the condition of the track fell away rapidly.

Before 1914 each engineer had his own locomotive and was responsible for its condition. In that year the system was changed and the changing crew plan was adopted. Inspection was careless and as there was no one responsible for the condition of the locomotives they soon got into very bad shape. The revolution only made things worse and today the Russian people are suffering the consequences.

The Bolshevik official organ *Novy Put*, for February 26, in discussing the railroad situation says, "There is no escape, the paralysis of the railroads must come in the near future and only a miracle can save us from the approaching catastrophe." That the miracle will appear is doubtful but the catastrophe seems to have begun. The revolts in Petrograd and Moscow are significant signs.

The worst problem that faces the railroad management is the lack of fuel. The same *Novy Put* reports that in January the railroads obtained only 77.7 per cent of the necessary firewood and 48.5 per cent of the necessary coal. We hear that the shortage for February is worse.

As to the fuel used in 1914, 70 per cent of the Russian locomotives used coal, 20 per cent liquid fuel and 10 per cent firewood. When the coal and oil districts of the South were lost by the Bolsheviks there was no recourse but to change over the locomotive fireboxes to burn wood. This was no easy task but in 1919 86 per cent of the locomotives in service were wood burners. Now the problem is to supply the necessary wood for the railroads that do not touch forested areas. Instead of usable freight the railroads of the North and East are mainly occupied in transporting fire wood for those of the South and West.

The solution of the railroad problem in Russia cannot be reached without foreign help and more particularly American help. The Bolshevik government has arrived at the same conclusion but is up against the difficulty of lack of means. The available gold which, according to reliable information, is only about 350,000,000 rubles, is not sufficient to pay for all that Russia needs. There are raw materials for export but the quantities are comparatively small and their transportation to the water front is almost impossible on account of the destruction of the railroads. It is estimated that Russia has printed paper money to the extent of 1 million million rubles. This means a gold reserve ratio of something like 0.05 per cent. The paper money is obviously practically valueless.

As to the future of raw materials which form the bulk of Russian exports, it is anything but bright. All the big farms which produce for export have been destroyed and many of the small farmers have no horses, no cows, no fertilizers and no desire to work and produce for the Soviet commissars. At the present time they are producing little more than enough to supply their own needs and the populations of the cities and towns are suffering accordingly.

The Bolshevik government understands the situation and plans to spend all the available funds for railroad locomotives and equipment and for machinery for factories and agriculture.

The Importance of Justice*

By A. L. DeLeeuw

There are two lines along which human tendencies present themselves; or rather, there are two sets of qualities with which we have to reckon: the individualistic, and the social tendency. Among the first, we find the desire of the man to protect himself and his family, the desire to lead as easy and comfortable a life as possible, the desire to safeguard himself and run as few risks as need be, the desire to answer the call of the wild, drop his work and go out and commune with nature or loaf or whatever term may best fit the occasion. Most of these desires are rather an annoyance to the employer, because to gratify them means high wages, fewer working hours, many devices to safeguard the workman, and much absence from work. On the other hand, there is the desire to store up nuts for a cold winter day; in other words, to obtain a competence; there is the desire to grow—physically, mentally, morally; there is what we generally call ambition, and which is really nothing more or less than this same desire to grow; the desire to produce something. And all of these desires help the employer.

The second line of human tendency is based on the instinctive desire of human beings to herd together. It leads to the protective instinct on the part of the strong, and the wish to be protected on the part of the weak. There is, perhaps, no better demonstration of this tendency than the existence of labor unions, which means a voluntary sacrifice on the part of some for the purpose of protecting others and which is intended to be a safeguard for those who cannot help themselves. Whether labor unions always work along these lines is another question.

Our whole social structure is based on these tendencies, and there is one peculiar tendency which is not at all primitive and which might be said to be the line along which human beings differentiate from animals, that is, the sense of justice.

There are many other peculiarities, tendencies, desires and principles which govern the conduct of men. It is impossible to go into them within the scope of this short paper. Moreover, most of them are merely manifestations, in one form or another, of the fundamental tendencies common to all humans.

They must be kept in mind constantly. There is no way of ignoring them successfully nor of getting around them. Above all, the employer should remember that, though for a time he may ignore any or most of the natural desires of his men without a hopeless breaking-down of the existing relations, ignoring or outraging the sense of justice will have its disastrous results immediately. Men do not want charity or protection; they will suffer want in silence, if they know that nobody profits by it; but one act of injustice, though it may cause them hardly any suffering, is resented to the end.

It is chiefly for this reason that the author believes in some form of definite contract between employer and employee, such as the task-and-bonus plan or any other plan by which both the amount of product and compensation are properly fixed and their relation maintained. He further believes that no form of welfare work alone, no paternalistic control, can be successful unless this craving for justice has first been fully satisfied.

*Address delivered at the joint meeting on Industrial Relations of the Metropolitan Section of the A. S. M. E. and the New York Section of the A. I. E. E., March 25.



NEWS SECTION

Havoc Wrought by Dust Explosions

The immense damage that may be caused by dust explosions needs no more striking example for its portrayal than the wrecking of a great Chicago grain elevator that occurred on the evening of March 19. This explosion was recorded in the newspapers throughout the country, but the illustrations shown here will no doubt convey added information about this great disaster. The grain elevator is one of the largest in the country and was built a few years ago at a cost of about $10,000,000 by the Chicago & Northwestern Ry., and leased to the Armour Grain Co. The explosion fortunately occurred when only watchmen were on the premises, thus reducing the probable death list to six. About 500,000 bushels of grain was destroyed, and the building was damaged to an extent that will exceed $5,000,000.

Special Elevator Construction

It will be noted that a large portion of the superstructure over the bins is still in place. The officials of the company ascribe the fact that there was not almost total destruction of this structure to the construction of the cupolas, drier house, conveyor galleries and marine tower. These were designed to provide relief for just such an explosion as has occurred; they had frames of heavy steel construction, but were enclosed by very light curtain walls that afforded little resistance to inside pressure, and so gave immediate relief when the explosion developed. These walls were wire mesh coated with a light covering of concrete, known as "gunite," and their value in this particular instance is shown by the completeness with which they have been blown off. Adjoining structures such as the drier house and the car shed were completely destroyed and their wreckage lies at the base of the bins.

A Secondary Explosion

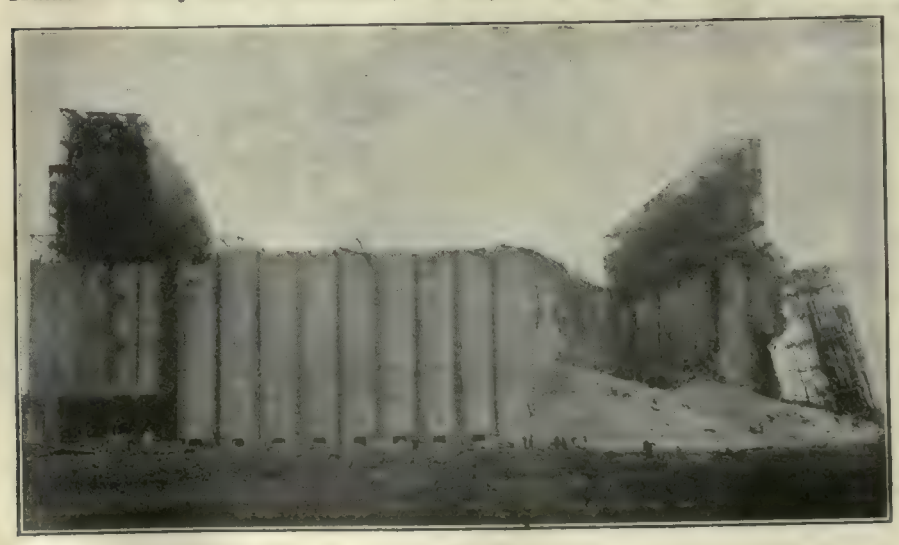
Reports indicate that there were two distinct explosions, the first of these occurring in the drier house. It is probable that the first explosion shook loose great clouds of dust throughout the structure and these burned, carrying the secondary explosion flame through all of the buildings. The danger of secondary explosions has been noted in many examinations of previous disasters, and has been proved by experimental tests that were made by the Bureau of Mines.

Danger Occurs in Many Factories

While most dust explosions have been noted in mills handling and storing grain and in coal mines, still the danger exists and damaging explosions have occurred in widely scattered plants. It has been demonstrated that this accident will happen in any industry where quantities of inflammable



dusts are produced. Wood-workin plants and factories engaged in grin ing or polishing operations on materia that produce a combustible dust, are subject to this hazard. When the du is distributed through the air in th right proportion, only a source of igni tion is required to fire what has prove to be an explosive mixture of terrifi power. Various causes can start th explosion, although the reasons mos commonly ascribed have been ope flames, static electric sparks and broke light bulbs, and even sparks produce in grinding operations.



Belgium Decorates Two American Engineers

Decorations have been conferred upo Daniel Letham and W. C. Bull by th Belgian government for their assistanc in connection with the handling of th machine tools which were purchased i this country. Mr. Letham was made Chevalier of the Order of the Crow for his assistance in the selection o the machine tools. Mr. Bull was mad an Officer of the Order of Leopold Sec ond for his service in handling trans portation matters connected with th shipment of the tools. Both these me are prominent in the machine industry

Business Conditions as the Big Banks of the Country See Them

High Wage Rates Are Illusory and Their Reduction Must Precede a Return to Normal Business, Says National Bank of Commerce

World-wide liquidation has reached a point where it cannot be halted for the benefit of any group or unit of production either in the United States or elsewhere. Employers and workers who are unwilling to face present conditions frankly and courageously are retarding resumption of normal business and working against their own interests. Prevailing wage scales, which under present conditions are of little real advantage to the workers, are an absolute deterrent to the lowered costs which must be established before the prices of coal and steel can be lowered and freight rates altered. High wage rates are purely illusory as long as widespread unemployment or part-time work reduces real income and impairs purchasing power.

The primary and wholesale markets, which for a time showed a spotty improvement, have in many lines again become dormant. Steel output has fallen to less than one-half of mill capacity. Railway traffic and earnings are decreasing week by week, production of coal has fallen to the lowest point in four years and building operations lag far behind the total of new construction known to be in immediate demand. Slow and moderate liquidation of borrowing from the Reserve banks is reflected in the slight but steady improvement in the reserve ratio of the Federal reserve system, although the fact should not be overlooked that a substantial part of this improvement is the result of gold importations, which have continued uninterruptedly for many months. There have been further marked declines in wholesale prices, but coal and steel, while lower, are still out of line with the general price level. Buyers remain unwilling to contract for other than immediate necessities, which are at a minimum.

Money Rates Rise

The reserve ratio of the Federal reserve banks has in the period under review risen from 49.6 per cent on Feb. 11 to 50.9 per cent on March 11, but the general situation has not materially changed.

There is little basis for any expectation that borrowers in general will secure their requirements at lower rates for some time to come. Nominal market quotations, however, may give an appearance of easier money conditions.

Production Picking Up

There is a growing recognition of the necessity for lowered freight rates on heavy tonnage items which can only be effected when there have been corresponding reductions in the wage scale both of railroad employees and of labor in the basic industries. The steel industry as a whole is reported to be operating at about 40 per cent of capacity. Price reductions on the part of the independent steel makers have not resulted in large orders.

A further decline in the price of cotton has somewhat affected demand for many classes of cotton textiles, but orders for immediate requirements continue to be placed. In certain staple lines there has been marked improvement.

Ginghams have moved well following drastic price cuts made several months ago by the large producers. Cotton consumption for February was 395,563 running bales, as compared with 366,270 running bales during January. Silk and wool manufactures, which were first to feel the effects of liquidation, have shown a measurable degree of improvement. There is a distinctly better movement in tires, and automobile inquiries and sales have increased encouragingly.

Building at Standstill

Although there have been reductions in the price of many building materials, high wage rates and working rules which make economical employment of labor impossible, together with high freight rates, have prevented material lowering of construction costs. As a result building has been restricted almost entirely to absolutely necessary work. The F. W. Dodge company's review of building and construction activity during February estimates new contracts awarded in the states north of the Ohio and east of the Missouri at $100,789,000 as compared with contracts for $216,663,000 awarded in February, 1920. A considerable volume of inquiries indicates that there is a potential demand which will make itself felt as soon as and not until costs of labor and material are lowered to what the public regards as reasonable. Meanwhile, the disinclination of labor not only to accept lower wage rates but to give adequate return for wages paid will continue to restrict new housing, thus directly preventing a reduction in rent which, next to food, is the largest single item of the workingmen's living expenses.

Railway Traffic Declining

Official statements indicate that both gross receipts and net earnings of the railroads fell off sharply during the month of January, in spite of the slight improvement which took place in many lines of business following the first of the year. Estimates of railroad earnings for February and the first two weeks of March indicate a further decline in traffic. Reduction in operating expenses commensurate with reduced receipts is impossible with the wages and working conditions established during government operation and still in effect. The working conditions in force on the railroads, like those in the building trades, are a burden on the entire community. Arbitrary regulations which make it necessary to employ several skilled men for work that one man could do are in conflict with common sense.

Guaranty Trust Co. of New York Warns Against Influx of Foreign Goods—Emergency Tariff Bill to Pass at Special Session of Congress

A statement by Secretary of Commerce Hoover that definitive figures on this country's foreign trade for February would show that imports of goods already in large supply here were increasing alarmingly has been followed by the announcement that the Republican members of the House Ways and Means Committee and the Senate Finance Committee, with the approval of President Harding, have agreed upon the passage of an emergency tariff bill as the first item on the legislative program of the special session of Congress called for next month. Mr. Hoover sees indications of a centering of world shipments upon American markets because of the high prices prevailing here and the desire to obtain dollar credits. He declared that notwithstanding the large surpluses of such domestic goods as cotton, wool, food products, and other primary commodities, foreign importations of these same commodities are being received steadily. In his opinion tariff legislation is apparently the only alternative now visible to stem this flood of foreign commodities coming to compete with domestic surpluses for sale in American markets. It has been decided, therefore, to repass, without change, the tariff bill vetoed by President Wilson, except that its period of operation will be reduced from a year to six months. The program as announced also contemplates the enactment of an anti-dumping law to pre-

vent dumping of foreign goods on American markets until the tariff schedules can be increased, an amendment of the Underwood Tariff law so as to place an American valuation on imports, and immediate preparation by the Ways and Means Committee of the permanent tariff bill to be introduced in the House about three weeks after Congress convenes on April 11.

Mr. Hoover's Policy

Mr. Hoover has publicly indicated the lines along which he will proceed in his proposed reorganization of the Department of Commerce. He makes it plain that notwithstanding his ambitious program for increasing the usefulness of his department he believes this can be, must be, done without materially increasing the cost of administration. Of his plans he says:

"In order to do service to the greatest advantage I wish to establish a wider and better organized co-operation with the trade and commercial associations, and will in a short time present some plans to this end. I want to see our efforts to push our foreign commerce more closely related to our industries. This sort of enlarged activity is within the original purpose of the department and requires neither legislation nor burden upon taxpayers. This is no time to ask for appropriations to undertake new work. It is the time to search for economy and reorganization, for effective expenditure on essentials, the reduction of less essentials, and elimination of duplication.

"Outside of voluntary measures, the only immediate extension of service lies in securing greater internal efficiency. The future of the department in its abilities to meet the needs of our industries and trade must await the thorough reorganization of the whole executive machinery now being vigorously undertaken by Congress.

"The great economic difficulties that we inherit from the war are obvious enough, and they emphasize the necessity of better governmental machinery to assist in their solution. Their final remedy must rest on the initiative of our own people—the rate of recovery can be expedited by greater co-operation in the community and with the community by the Government, and this department and the whole Government wishes to assist wherever it can to stimulate and assist this co-operation."

Employment Steadier

The United States Employment Service, obtaining its information from 1,433 firms in 65 principal industrial centers, reports that on Feb. 28 there were 1,626,958 workers employed, as against 1,643,253 on Jan. 31, a decrease of 16,295, or 1 per cent. The returns of this organization show that the greatest unemployment during February was in the iron and steel industry, a decrease of 7.3 per cent in labor employed being reported. Railroad repair shops showed a decrease of 6.6 per cent in the number of men employed.

According to reports made to the Department of Labor for February, ten industries showed increases in the number of persons employed, as compared with January, while in four industries there were decreases. The largest increase, 42 per cent, is shown in the woolen industry. Men's ready-made clothing shows an increase of 21.1 per cent and hosiery and underwear an increase of 20.8 per cent. The smallest increases, 0.8 per cent and 0.2 per cent appear in iron and steel and leather. Percentage decreases of 12.8 per cent and 3.3 per cent appear in car building and repairing and cigar making respectively.

When comparing February, 1921, with January, 1921, eight industries show an increase in the amount of money paid to employees and six show a decrease. The most important increases, 34.6 per cent and 31.4 per cent, occur in men's ready-made clothing and woolen respectively. Car building and repairing shows a decrease of 14.4 per cent while the decrease reported in the leather industry is 0.8 per cent.

Business Conditions Firm

Business conditions are about as they have been for several weeks, with the buyers of the country still holding to their belief that a lower level of commodity prices is about to be established. Purchases accordingly continue on the basis of ordering only to meet urgent needs. The farmers are busy with their planting and are not giving much attention to the marketing of their stored crops. Their buying, as shown by the reports of the mail-order houses, is marked by extreme conservatism. The steel industry continues to reduce its output, the average being about 35 per cent of capacity for the whole country. There are some indications of greater activity in building. Railroad traffic, reported slightly better than last month, is considerably less than it was a year ago. Altogether, the situation is indicative of the waiting attitude which seems to have taken possession of the people of the country. In the best informed quarters there is confidence that the underlying strength of industry and commerce and a belief that the settlement of the major problems here and abroad will stimulate business and help to solve the many minor ones which now vex the world.

The Money Market

The feature of the money market during the last fortnight was the fact that income tax and excess profits tax payments and the general overturn of funds on March 15 had apparently not the slightest effect upon the rates for demand funds. From the seventh to the sixteenth of the month no change in the posted rate for call money on the New York Stock Exchange occurred. On the latter date the rate went down from the prevailing rate of 7 per cent to 6 per cent. Call funds were obtainable for even less on private arrangement. The time money market has been quiet, rates being quoted at 7 and 7½ per cent, and only a moderate amount of business being done.

Improvement in the position of the Federal Reserve system continues. The ratio of total reserves to net profit and Federal Reserve Note liabilities was 51 per cent at the close of business on March 18, and the volume of Federal Reserve Note circulation fell below $3,000,000,000 for the first time since February, 1920. The reserve ratio is slightly lower than it would otherwise be by reason of a change in the method of computation. Under the new method, both the "deferred availability items" and the "uncollected items," the first of which was formerly added to and the latter deducted from the regular deposit fund in computing net deposits, are omitted.

Readjustment of Wages Must Accompany the Revival of Industry—National City Bank of New York Analyzes Present Situation—Foreign Trade Reassuring

The mild winter has been followed by an early spring and with the revival of outdoor operations there are symptoms of improvement in business, although they are not sufficiently pronounced to justify sanguine predictions. Retail trade continues surprisingly good in the cities, and wholesale distribution is very fair, considering the low prices of farm products and the amount of unemployment reported. Payments through banks reporting to the Federal Reserve Board and passing through the clearing houses are running 20 to 25 per cent lower than a year ago, which is not so great a decrease as might be expected in view of the decline of prices. The index number of commodity prices compiled by the Bureau of Labor for February last was 33 per cent below that of February, 1920. Current payments, of course, do not accurately represent current business, and considering the amount of unemployment at this time, it must be concluded that they are holding up better than production.

The movement of goods in retail trade makes a better showing than any other feature of the situation, indicating reserve buying power and that commodity stocks are being reduced. There is not the amount of distress that might have been expected from so much unemployment, nor the number of business failures that might be expected following so severe a depreciation of values. The most encouraging circumstance is the fact that the readjustment of wages and prices which is necessary to a general revival of industry is steadily progressing, and without a serious amount of friction.

One of the notable incidents of the month was the agreement between the meat-packers and their employees, by which the latter accepted a moderate reduction of wages. A compromise was brought about by negotiations in Washington in which the Secretaries of Agriculture, Commerce and Labor participated. The labor leaders yielded to representation by these officials to the effect that in view of the decline in cost of living and particularly the decline in prices of the live stock which these operatives were handling, packing house wages ought to come down.

Fair play requires that the compensation of workers in all industries shall rise or fall together. Moreover, when it does, employment is not disturbed; the workers are still able to buy each other's products; but when that balance is disturbed and any class of people suffers a severe loss of income business quickly becomes bad in the other industries and many workers are thrown out of employment.

A fair readjustment of wages in the packing industry means help toward the general readjustment which must be accomplished before there will be employment for everybody again.

Wage Reductions vs. Industrial Revival

It is a not uncommon remark that employers are taking advantage of the state of depression and unemployment to force wage reductions. It is an ill-advised comment, calculated to cause bad feeling and indicates a want of understanding of the actual requirements of the situation. The fact is that depression and unemployment exist because the industrial situation is out of balance, and there is no remedy except by such readjustment of wages and prices as will restore the balance and enable the various industries to exchange products on a fair basis. It is impossible when one-half the people of the country have lost approximately one-half their purchasing power for the other half of the people to go on without taking note of it. The depreciation of money which resulted from the war was not a natural or permanent development. Nothing of the kind has ever happened without a readjustment afterward, and it is always the case that the sooner that adjustment is accomplished, so that normal relations are restored between the industries, the better for everybody.

It is of no advantage to the workers in any industry to have costs maintained upon a level which prevents the sale of their products. Somebody must have the sagacity to attempt a restoration of the conditions under which an exchange of products is possible. The compensation of workers in the various branches of industry, which means their purchasing power, must be brought back into equilibrium. Whether it will take a long time or only a short time depends upon the rapidity with which the public comprehends the situation, and remarks of the kind referred to do not promote an understanding.

The iron and steel industry is operating at about 35 or 40 per cent of capacity. Prices continue to be shaded, pig iron of some grades selling under $25. The demand for structural steel is restricted by the high cost of everything, including steel, and especially the high wages in the building trades. Railroad consumption is restricted because practically the entire income of the roads is absorbed in paying the wages of their employees and for coal. Iron and steel are still high-priced, for one reason because wages in the industry are more than 100 per cent above pre-war rates, and for another reason because railroad charges are so high. The advent of spring has given a start to the automobile industry, which has increased the demand for steel in that quarter. The demand from agricultural implement makers is light, because the farmers are not in position to buy implements on the present level of costs, and the International Harvester Co. is both laying off employees and reducing wages.

This illustrates the hardships which the process of readjustment involves when it proceeds in this halting way, with many industries and many traders holding back. It is a hardship for workmen to have their wages cut and their time cut simultaneously, but a time cut alone accomplishes nothing in reducing costs. It is a hardship for workmen to be out of work entirely, and it entails loss to the whole community. It is a hardship for workmen who have taken wage reductions to have to pay full war-time charges for having their clothes or shoes made, or for railroad or street car service. It is a hardship to have goods at retail remain high when producers' and wholesalers' prices have fallen. Everybody who is insisting upon the old wages or prices for himself while accepting cheaper service from others is delaying the revival of prosperity.

Foreign Trade Situation

The foreign trade situation has not changed for the better in the past month. In one respect the European situation may be said to be reassuring. As time passes the menace of general revolution and social disorder is less threatening. Few people now think there is any probability of the Bolsheviki overrunning Europe or that anything more socialistic than a mild type of state-ownership is possible. Hundreds of representatives of labor organizations from all the countries of Europe have been in Russia to see the workings of the Soviet system, and their reports are not favorable. Europe is getting tired of disorder and short rations, and beginning to appreciate that production must go before distribution and consumption.

The unachieved settlement with Germany is the great obstacle to recovery in Europe, Allied troops have marched into Germany, but Lloyd George admits that this gets nowhere, and that it is impracticable to occupy the country. It has been proposed that British purchasers of German goods shall be required to pay one-half the value to the British government, receiving a receipt which may be transmitted to the German creditor together with a payment of an equal amount in cash, the German creditor to present the British government receipt to his own government for reimbursement. The German government has not assented to the plan, and unless it does the prospect is for a heavy falling off of trade between the two countries. The natural result would seem to be a shift of trade, so that each country will trade more with other countries.

F. A. E. S. Opens Offices in Washington

With the opening recently of its suite of offices in the National Savings and Trust Co. Building, in Washington, the Federated American Engineering Societies will direct its work in the future from the national capital. L. W. Wallace, the executive secretary of the organization, has been in Washington completing the arrangements for the opening of the national headquarters. He will not be able, however to take up his residence in Washington for another month. In the meantime, the offices will be in charge of A. C. Oliphant, the assistant secretary.

The principal effort being made at this time at the offices of the Federated Societies is in connection with the extension of the employment service of the organization. In addition to having one central controlling office the plan is to have branch offices in several of the larger cities. A full report on the employment service is to be made when the executive board meets in Philadelphia on April 16. Secretary Hoover, of the Department of Commerce, the president of the organization, expects to attend the executive board meeting. At this meeting a comprehensive report also is to be made on the activities looking to the establishment of a Department of Public Works.

Copies of a model bill on the matter of licensing engineers now are available at the office of the executive secretary. These bills are being sent out to those interested, not with the idea of offering a recommendation one way or the other in the matter, but in the hope that any state legislation which may be enacted will follow the general lines of the model bill which is the result of extended study.

New Steel Plant in Georgia

A site comprising more than eight acres and with a 1,000-ft. frontage opposite Fort McPherson, near Atlanta, has been purchased by Austin Brothers, manufacturers of steel bridges and structural steel, and announcement is made by officials of the company that construction work will begin within the next thirty days on a new plant. No announcement has been made as to the magnitude of the plant, but it will be one of the largest structural steel plants in the Southeast.

Tentative Program for Annual Meeting of U. S. Chamber of Commerce

The general theme of the ninth annual meeting of the Chamber of Commerce of the United States, to be held at Atlantic City, April 27 to 29, will be: "In the public interest more business methods in government; less government management of business." This announcement was made by the chamber today in making public a tentative program for the convention.

All of the questions to be brought before the meeting will be approached as they relate to the general subject. Speakers will include government officials and leading business men in many lines of finance, commerce and industry.

Much of the work of the convention will be done as heretofore in group sessions. Groups representing the major divisions of business will take up, first—problems peculiar to the industries or interests within the group, and second—major problems common to all business, which will include the question of the tariff and that of taxation.

The program for the meeting marks a new departure for the chamber in that groups will discuss questions of a more general nature than those affecting solely the industries within the group. The purpose of this is to get the fullest and freest discussion on broad general problems that touch various phases of business differently. In a membership as comprehensive as that of the chamber there is always a difference of viewpoint on important questions. The group arrangement as planned gives related industries the opportunity to express their views. Afterward the chamber if it is considered necessary can take a referendum vote of its membership on the questions considered and get after proper consideration the opinion of business as a whole.

On the day before the convention opens there will be a meeting of the National Council of the chamber, made up of one representative from each of the more than 1,400 organizations included within the chamber's membership.

In the first day of group meetings the group representing Domestic Distribution will discuss current price declines and their effects; constructive means for better marketing by produce exchanges and boards of trade, and methods of merchandising which will enable the distributor better to meet conditions of financial stringency.

Treatment of wages, contract cancellations, better accounting methods and the need of national statistics on production will be taken up by the group representing Fabricated Production. The Finance Group will have before it matters connected with the government's fiscal policy, taxation, including the proposed turnover tax, reorganization of government operations and the question of the government's future policy with respect to rediscount rates.

The group on Foreign Commerce will discuss foreign trade matters, including in its program such subjects as these—the work of national foreign trade conventions, foreign trade work of national trade bodies, foreign trade work of Chambers of Commerce, foreign trade work of banks, railroads and express companies, and the operations of foreign trade clubs. The aim here is to give an opportunity for an interchange of information as to the most approved methods of extending and prosecuting foreign trade effort. In connection with this group a meeting will be held for foreign trade organization secretaries.

The Insurance Group will discuss among other things: Private initiative as against state monopoly in insurance; insurance as a credit factor and the relations between government and insurance.

Recent agitation in Congress looking to the enactment of legislation which would provide for government management of basic industries will furnish the subject for discussion in the Natural Resources Production Group, where the main subject will be the government's relation to natural resources, including lumber, coal and oil. Another subject which will be taken up by this group is that of the proper activities of trade associations.

Transportation and communication will be considered under two groups; the first having to do with shipping, and the second railroad transportation. The subjects to be taken up by the Shipping Group are the sale of government-owned ships; the continuance of the Shipping Board and its functions as an operating organization and differentials in cost of operation under various flags. The Railroad Transportation Group will go into a report by the chamber's railroad committee, the present financial situation of the railroads in relation to plans for consolidation, and the shippers' part in rate making. The Civic Development Group will discuss "The Schools and Social interest."

When the groups meet to take up the subjects of taxation and the tariff each group will consider, with relation to taxation these questions: Should there be an increase in the income tax? Should there be a sales tax? Should there be a resort to loans? With regard to tariff policies these questions will be gone into:

(1) Should the tariff not be framed with due regard to export trade sales or the protection of manufacturing in the United States? (2) Should the fact that we are now a creditor nation alter our tariff policy with respect to protection? (3) Should the United States tariff offer trading or bargaining possibilities for international commercial treaties to encourage our export trade? (4) Should the United States tariff be liberal in its provisions in view of our desire for liberality of tariff on the part of other countries?

Taxation and tariff policies will be discussed also at one of the general sessions of the meeting. Other subjects which will be gone into at the general sessions include foreign financing, the International Chamber of Commerce, education, international relations and the relations of government and business.

Annual Election of the Machinery Club of Chicago

The annual election of the Machinery Club of Chicago will be held on Tuesday, April 19, 1921, from 11 a.m. to 5 p.m. It is stated that only resident members in good standing will be eligible to vote and that the presentation of the membership card is necessary to obtain a ballot. A nominating committee under the chairmanship of Clyde W. Blakeslee has prepared a list of nominees for the board of governors. The following candidates have been nominated for the term of one year: S. A. Ellicson, O. F. Weydell, A. W. Smith and Herman F. Kempe. For the term of three years there are the following nominees: H. E. Procunier, D. R. Hoffman, H. J. Reeve and Herbert S. White.

Hoover Offers Logical Course for Resumption of Trade with Russia

The following is from a recent editorial which appeared in the New York *Commercial:*

Perhaps the cleverest statement of the case that has yet been made regarding trade relations of this country with Soviet Russia is that of Secretary of Commerce Hoover. Hitherto discussion has been largely academic and has served little purpose other than to confuse the public mind. The chief difficulty has been that those who have discussed the matter have not had that intimate personal contact with actual conditions which alone makes possible a logical, concise statement of fact. They have gleaned their information and drawn their conclusions from written reports and interviews. This does not mean that such conclusions are without value, but it does withhold from them that clarity of analysis which stamps a judgment as authoritative and inspires confidence in the public.

There have been numerous general statements as to what this country should do in the matter of specific trade relations with Russia, but Mr. Hoover comes forward and argues with his customary definiteness and directness why we should not enter into such relations. The economic system put into practice by the Bolsheviki has practically resulted in a standstill of production in Russia. Therefore, her exportable commodities are almost negligible, and as a consequence her ability to import is extremely limited. Russia's only exportable commodities worth consideration are gold, platinum and jewelry, the value of which has been variously estimated at from $60,000,000 to $200,000,000. When this has been expended nothing remains as the basis for trade. Moreover, these com-

modities in themselves can scarcely form such basis since the title of Russian gold has been called in question by the French Government, which places obvious complications in the way. Restoration of the economic stability of Europe demands that Russia resume production, but the goods which Russia would obtain in return for the value of her present exportable commodities would in no way enable her to do this.

It is right here that Mr. Hoover cuts directly to the heart of the matter, when he declares that the root of the situation is not so much economic as political, for Russia's power to produce can never be restored under the system which the Bolsheviki are attempting to enforce. Hence, it is not only essential, but inevitable, that in time, and doubtless in a short time, that system be abandoned, or if not deliberately abandoned it will fall because it is a flimsy structure built on a foundation of false theories and treacherously unsound principles. The Bolsheviki are trying to save it by propping it up with brute force, but props are only very temporary affairs at best. For a long time it has been rocking dangerously in a violent wind of popular distrust and rebellion, and if not thus blown over will presently crash to ruin through the collapse of its foundations. Mr. Hoover's argument is that it would be an ill-advised waste of time, effort and money to attempt anything in the nature of definite trade connections with Russia at present. It is not common sense to try to do normal business with a nation suffering from the severest kind of hysteria. His contention is that the only sane and logical course is to wait until that nation shows signs of a return to reason.

In view of Mr. Hoover's extensive experiences in Russia and other European countries, his advice in this matter should prompt considerable thought.

New Foundry Grows in Ashes of Old One

Just two months to a day from the time fire destroyed its plant at 15 Albany St. the R. P. Power Foundry Co. at Worcester, Mass., has reopened a bigger and better plant. Last Saturday the heat was turned on under the furnaces and operations were resumed. The work of reconstruction was done by the company itself thereby giving employment to its own men. The plant was badly damaged by one of the many fires that raged in Worcester on Jan. 19.

The plant as rebuilt is 150 x 75 ft. in dimensions and is better equipped than was the old plant to do the general foundry jobbing business which the company has done for years under the direction of Mr. Power. The plant normally employs 75 men and Mr. Power declares that when present orders are out of the way there will be new ones enough to keep the furnaces going.

Hammacher-Schlemmer Co. Not To Dissolve

In view of the many conflicting rumors going about the business world recently, concerning the supposed dissolution of Hammacher-Schlemmer & Co., that company has issued a general denial of such action.

The fact is that the company was incorporated in New Jersey in 1893, but now finds it more advantageous to change its title to the State of Delaware. Consequently the New Jersey Corporation was dissolved and immediately reorganized under the Delaware law.

There has been absolutely no change in the personnel or policy of the corporation, except the addition of several directors.

The officers of the corporation are: William F. Schlemmer, president and treasurer; August Pahl, 1st vice-president; Herman Acher, 2nd vice-president; W. H. Siebert, secretary.

The directors are William F. Schlemmer, August Pahl, Herman Acher, William H. Siebert, Walter McKibbin, Louis Schmidt and August F. Brocke.

International Acceptance Bank, Inc., Will Open Early in April

Announcement is made of the opening, early in April, of the International Acceptance Bank, Inc., at 31 Pine St., New York City. The bank will conduct financial transactions of an international nature, including the opening of dollar acceptance credits and of foreign credits on all parts of the world, negotiation and collecting of bills of exchange, and a regular business in foreign exchange, drafts and telegraphic transfers.

The officers are as follows: Paul M. Warburg, chairman of the board; Daniel C. Wing, vice-chairman; F. Abbott Goodhue, president; P. J. Vogel and E. W. Davenport, vice-presidents; Fletcher L. Gill, secretary and treasurer.

New Congress to Tackle Patent Office Bill

Probabilities favor the introduction of separate bills at the opening of the extra session of Congress to provide for Patent Office reorganization and proposing the administration of government employee patents by the Federal Trade Commission. The insistence of Senator Norris, chairman of the Committee on Patents of the Senate, on retaining the government employee patent plan as a part of the Patent Office bill resulted in the loss of both measures.

Senator Norris probably will be chosen to head the Committee on Agriculture during the next Congress. He states that he will continue to take an active interest in both these patent bills but the policy for handling them will be in the hands of the new chairman. There is a very general demand in both Houses that the government employee patent bill be considered separately and not as a rider on another bill.

Mexican Commission Touring the U. S.

A number of prominent business men and industrial leaders from Mexico, who have been touring the United States as a "Good Will" delegation for the promotion of more cordial business relations between the merchants and manufacturers of the two republics, arrived in New York Monday, March 28, where they were entertained by the Merchants' Association. A public meeting was held in the afternoon at the Hotel Astor, which was addressed by Bruno Newman, vice-president of the Confederated Chambers of Commerce of Mexico. After the address the delegates answered a large number of questions concerning financial and industrial conditions in Mexico, the conditions and efficiency of the Mexican railways, banking facilities, taxes and duties on imports, etc.

The impression gathered from the addresses and from the answers to the various questions is that Mexico is on its feet and is fast recovering from the conditions which have obtained there for several years past. The better class of Mexicans have arrived at a stage of co-operation which has put them in control of the situation, with good prospects of their remaining in control. The railways, which are under the control of the government, are making every effort to render satisfactory service, and as soon as the various States of this country have arrived at a uniform mileage rate, arrangements will be made whereby a ticket can be bought to Mexico City from any point in the United States. Car-load lots of merchandise can also be shipped through, without having to be removed from the car at the border.

Market for Electric Equipment

The statement was made that Mexico is an "electrical country," there being more electricity used in Mexico than in the United States, in proportion to the population. The country is largely mountains, with excellent facilities for water-power, and practically every town of any size is electrically lighted. All kinds of electric commodities are in demand, with the exception of the electric washing-machine. The Mexican woman, however, is an excellent laundress, and the old method of washing clothes and bleaching them in the sun is still favored.

Electric cranes are in use in a number of places such as the unloading dock at Vera Cruz and other similar places. The electric industrial truck which operates with storage batteries has not, however, made its appearance there as yet. The great extent of the mining and oil-well operations, together with the amount of electrical equipment in use, should present an opening to builders of American-made machine tools and accessory equipment. Mexican buyers, however, have to be given longer credits than is the rule in this country, the usual terms there running from six months to a year.

Importers Organize to Fight Passage of Tariff Laws

At a meeting on Thursday, March 31, at the Pennsylvania Hotel, New York, the National Council of American Importers was organized.

As this was an organization meeting no definite program of action was laid out, but it was intimated by many of the speakers that the council will "take steps to educate the Ways and Means Committee of the House of Representatives, as to the need for consideration of America's import trade." In other words a campaign will be launched to prevent, if possible, the enactment of such legislation as the Fordney Bill, which one speaker characterized as "iniquitous to the business of the United States."

Resolutions were introduced empowering the chairman to appoint an executive committee which in turn will draw up a set of by-laws and give the organization the proper means of guidance. David Walker, of Morimura Bros., New York, was chairman of the meeting.

One of the most interesting features of the meeting was the discussion as to whether foreign companies, doing business in the U. S., should be admitted to membership. The majority of those present were in favor of making this an "All-American" association, to the exclusion of foreigners. However, the matter was left to the discretion of the executive committee.

The council will meet again in April when the plans of action will probably be announced.

Obituary

John Rahn, Jr.

JOHN RAHN, JR., president and general manager of the Rahn-Larmon Co., 2941 Spring Grove Ave., Cincinnati, Ohio, died suddenly at his residence in Cincinnati on March 11. He was born in Cincinnati, Ohio, May 1, 1862, and was educated in the public schools in that city.

At an early age he placed himself under the apprenticeship of the Sebastian Lathe Co. of Cincinnati, of which Benjamin Sebastian was president. Later he became foreman and superintendent for the G. A. Gray Co. under the presidency of G. A. Gray.

In 1898 he engaged in the lathe manufacturing business for himself at 215 W. Pearl St., Cincinnati. In 1899 he was made vice-president and general manager of the company under the name of Rahn-Mayer-Carpenter Co., of which company he became president when it became the Rahn-Larmon Co., in March, 1910. He was president of this company up to the day of his death.

John Rahn was one of the few pioneers left of those connecting links of pioneer days in the machine-tool industry in Cincinnati, being a senior member of two other firms which were instrumental in putting Cincinnati where it is today in the machine-tool industry of the world.

FRANCIS U. BREWER, manager of the Machinery Club of Chicago, died at his home in Chicago on Sunday, March 20. He had been about his duties in the usual manner at the Machinery Club only the day before and his sudden death was due to an attack of acute gastritis. Mr. Brewer is given much of the credit for the increasing popularity of the club during the two years and a half that it has been under his charge. Previous to coming to this club he had been manager of the restaurant of the Fair for more than fifteen years. He had retired after this connection, but finding that he would be far happier with something to occupy his time he took up the work of the Machinery Club with marked success.

Business Items

Evidence that industry is rapidly returning to normal in the South seems indicated by the fact that the Knoxville Iron Co., of Knoxville, Tenn., one of the largest iron rolling mills in the section outside the Birmingham district, has resumed operations on a twenty-four-hour-per-day schedule, with 700 employees. Edward D. Attix, an official of the company, states that business has picked up sufficiently to insure continued operation on this schedule for an indefinite period.

At a recent meeting of the stockholders of the Atlas Wheel Co., Cleveland, O., H. P. Arnt was elected president; M. MacEverhard, vice-president, and David D. Walker, treasurer. These officers together with H. A. Duetemeyer, E. S. Reed, E. E. Ledger and E. A. Fischer, comprise the directorate. It was announced that erection of a new plant having a capacity of 3,000 wheels will be undertaken soon.

At the annual meeting of the Seamless Tube Co., of Shelby, O., the following directors were elected: A. C. Morris, R. C. Skiles, C. A. Morris, F. Wiggins, E. Mansfield, Hugh Hilderbrand of Shelby and H. H. Stoner of Cleveland.

The New Haven Millwrighting Co. of New Haven, Conn., has recently been incorporated to engage in the handling and installation of machinery, etc. The capital stock is $10,000.

The Harry E. Gilbert & Son, Inc., of Bridgeport, Conn., has recently been organized and incorporated with a capital of $100,000 to engage in machinery manufacture and general mechanical business. The incorporators of the company are: Harry E. Gilbert, Maty Gilbert and H. Lees, all of Bridgeport.

The resumption of operations at the plate mill of the Bessemer Rolling Mill, Bessemer, Ala., the latter part of February, is taken as an encouraging sign by men connected with the iron and steel industries of the Birmingham district, and the hope is expressed that the near future will witness the resumption of operations at many of the other plants in the district. The Bessemer mill had been shut down for a period of several weeks.

The directors of J. H. Williams & Co., manufacturer of drop-forgings and drop-forged tools, with works at Brooklyn, Buffalo and Chicago, and St. Catharines, Ont., Canada, have elected the following officers to serve during the coming year: President, J. Harvey Williams; vice-president and general manager, A. D. Armitage; second vice-president, Frank W. Trabold; secretary and treasurer, W. A. Watson; controller and assistant treasurer, R. S. Baldwin; assistant secretary, C. B. Harris. Mr. Armitage is also president of the Whitman & Barnes Manufacturing Co., Akron, Ohio, but will be active in the management of the business of J. H. Williams & Co.

Forthcoming Meetings

The National Metal Trades Association will hold its annual convention at the Hotel Astor, New York, on April 18, 19, 20, 21. Homer D. Sayre, Peoples Gas Building, Chicago, Ill., is secretary.

The fifth annual convention of the American Gear Manufacturers Association will be held in Cincinnati, Ohio, April 27, 28, 29 and 30.

The ninth annual meeting of the Chamber of Commerce of the United States will be held at Atlantic City, April 27 to 29, with headquarters at the Traymore Hotel.

The annual meeting of the American Welding Society will be held in the Engineering Societies Building, 29 West 39th St., New York, on April 28.

The Society of Industrial Engineers will hold its national convention in Milwaukee, Wis., on April 27, 28 and 29. Geo. C. Dent, 327 So. La Salle St., is business manager.

The National Foreign Trade Council will hold its eighth annual convention in Cleveland, Ohio, on May 4, 5, 6 and 7. J. G. Hammond, care of the Council, 409 Park Bldg., Cleveland, is secretary.

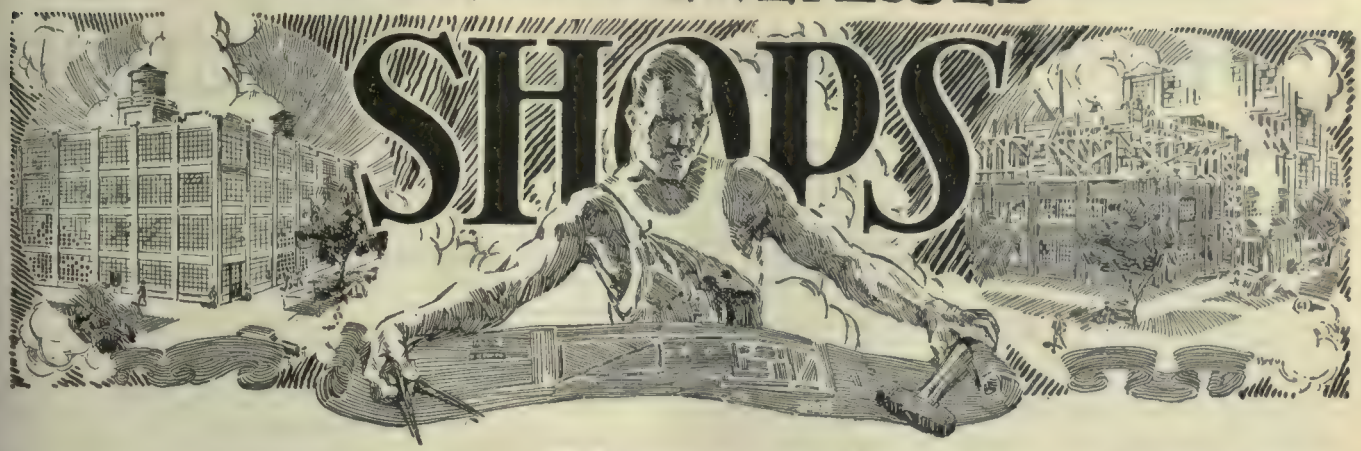
A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

Announcement is made that the regular spring meeting of the National Machine Tool Builders Association will be held in Atlantic City, N. J., on May 19 and 20. Headquarers will be at the Traymore Hotel. Ernest F. Du Brul, 817 Provident Bank Bldg., Cincinnati, Ohio, is general manager.

The spring meeting of the American Society of Mechanical Engineers will be held at the Congress Hotel, Chicago, May 23-26. Calvin W. Rice, Engineering Societies Bldg., 29 West 39th St., New York, is secretary.

The Society of Automotive Engineers, 29 West 39th St., New York announces that its summer meeting will be held at West Baden, Ind., on May 24 to 28 inclusive.

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Mass., East Boston—(Boston P. O.)—E. F. Tanner, 63 West Eagle St.—an 18 in. Barnes lathe with all attachments for experimental work.

N. Y., Auburn—The Simplex Mfg. Co., 38-40 Market St.—one No. 18 or No. 19 Bliss flywheel press.

N. Y., Buffalo—The Contractors Ornamental Steel Co., Inc., 115 Myrtle Ave., H. W. Meyer, Purch. Agt.—threading and tapping machine for ¼ in. to 1¼ in. pipe (used).

N. Y., Lincoln Park—The Kneeland Machine Co., T. W. Kneeland, Purch. Agt.—medium size welding machine.

N. Y., Rochester—The Alent Machine Tool Co., 479 St. Paul St., N. Alent, Purch. Agt.—medium size screw machine.

N. Y., Rochester—F. S. Coolbaugh, 191 Federal St. (machinist)—hollow spindle lathe, 6 ft. bed 12 in. swing.

N. Y., Rochester—B. Goetz, 101 Central Bldg. (jeweler)—metal rolling machine.

N. Y., Rochester—C. W. Holbow, 133 Ave. C (machinist)—drill press.

N. Y., Rochester—L. Soeffling, 14 Hawkins St. (machinist)—gear cutter.

N. Y., Schenectady—The General Electric Co., River Rd.—
One cam drawing press, equivalent to Bliss No. 1-B.
One knuckle joint embossing press, equivalent to Bliss No. 22.
One punch press, 2½ in. stroke, equivalent to Stiles No. 5.
Two inclinable punch presses, 2 in. stroke, equivalent to Bliss No. 19.
Four inclinable punch presses, two of 2 in. stroke and two of 2½ in. stroke, eqivalent to Bliss No. 21.
Two 24 in. upright drills, with lever feed.
One single spindle sensitive drill, round column type, equivalent to Avey.
One speed lathe 12 in., equivalent to Blount.
One turret lathe, equivalent to Pratt & Whitney 1½ in.
One turret lathe, equivalent to Pratt & Whitney ⅝ in.
One screw machine, equivalent to Brown & Sharpe ⅝ in.
One flat turret lathe, equivalent to Jones & Lamson 2 in.
One bench lathe, 7 x 32 in.
One milling machine, equivalent to Van Norman No. 2.
One vertical surface grinder, equivalent to Blanchard No. 16.
Two universal shears for profiles and bars, equivalent to Niagara.
One power hack saw.
Three shapers, one 30 in. and two 20 in.
Two wet tool grinders, 18 in. wheels.
Two tilting tumbling barrels, equivalent to 28 in. Henderson.
One four spindle sensitive drill, 15 in. overhang.

N. Y., Summitville—S. Brier (machinist) brazing machine.

N. C., Ashville—J. A. Campbell—two precision machine drills.

N. C., Burlington—The Midway Fdry. & Machine Shop, J. G. King, Mgr.—garage and machine shop equipment, including tools, etc.

N. C., Pineville—C. S. Oakley—sander, moulder, fast feed planer, rip saw, cut-off saw, band saw, shaper, tenner, mortiser and other wood-working machinery.

Va., Danville—Johnson Mfg. Co., J. A. Johnson, Purch. Agt.—small tapping machines.

Va., Doswell—Priddy & White, V. Priddy, Purch. Agt., tools for auto repair shop.

Va., Wytheville—R. P. Johnson, manufacturer of machinery, O. M. Johnson, Purch. Agt.—4 side planer and matcher.

Mich., Detroit—F. Montefore, 3513 3d St.—equipment for sales and service station.

Mich., Detroit—L. E. Murphy, Statler Hotel—millers, shapers, boring mills and complete metal working equipment for machine shops.

Mich., Lansing—The Michigan Screw Co., 506 South Hosmer St.—miscellaneous machine equipment, etc.

Mich., Ypsilanti—The U. S. Steel Co.—electric butt welder (used in good condition preferred).

O., Columbus—E. H. Huffman & Sons, 114 East Town St.—1 lathe, 2 drill presses, 1 grinder and other machine shop equipment.

O., Columbus—The Johnson Garage & Machine Co., Wall and Hickory Sts., E. C. Johnson, Purch. Agt.—complete automobile repair machinery, including lathe, drill press, and grinders.

Wis., Milwaukee—The Amer. Bander Co., c/o T. M. Lederer, 396 Lafayette Pl.—special machinery for manufacturing machines for banding cigars.

Wis., Milwaukee—G. T. Moore, 26 34th St. (machinist)—one 4 ft. lathe with approximately 6 in. swing.

Wis., Milwaukee—The Nordstrom Vulcanizer Co., 2706 St. Paul Ave., C. Nordstrom, Purch. Agt.—grinders and drill presses.

Wis., Oconomowoc—The Jenkins Barnhart Motor Co.—drill press and lathe for repair work.

Wis., Okauchee—W. Schradenbach, Main St.—power machinery and machine tools for garage.

Wis., Wauwatosa — The Hardt Garage Co., 47th and State Sts., A. Hardt, Purch. Agt.—drill press and lathe of sizes adaptable for garage repair shop.

Kan., Mulberry — The Midwest Fdry., Machinery & Boiler Co., A. W. Cunningham, Purch. Agt.—complete equipment for machine shop and foundry.

Mo., Carthage—F. W. Steadley, 930 Oak St.—machine shop equipment.

Mo., Joplin—The Union Iron Wks., 623 Kentucky Ave., W. Buttrum, Mgr.—2,000 or 2,500 lb. hammer.

Mo., St. Louis—Curtis & Co. Mfg. Co., Hamburger and Kienlen Sts., manufacturers of machinery and steel castings—Universal type piston machines.

Mo., St. Louis—The McQuay Norris Mfg. Co., Cooper and Elizabeth Sts., manufacturer of packing rings—piston machines, universal type.

Tex., Harrisburg—B. H. Elliott, Inc. (marine repair shop), W. P. Bulkley, Purch. Agt.—
One 12 in. lathe, 6 ft. bed.
One 36 in. lathe, 30 ft. bed.
One power hack saw.
One combination punch and shear.
One shaper.
One radial drill.

Ont., Galt—The Hi-Speed Tools, Ltd., H. Champ, Genl. Mgr.—equipment, iron working machinery and complete new machinery for the manufacture of screw cutting tools, gages, dies, etc.

Machinery Wanted

Conn., Stamford—Cohn & Abrams, 545 Main St.—candy manufacturing equipment.

Me., Portland—J. H. Feeney, 30 State St.—laundry equipment, 4 pocket washing machines, extractors 26 to 30 in., etc.

Mass., Medford—The Toppan Boat Co., A. Piggott, Purch. Agt.—small single surface panel planer with countershaft.

Mass., Quincy Adams—(Boston P. O.)—L. Grossman & Sons, J. B. Grossman, Purch. Agt.—two electric driven coal loaders, also other equipment for handling coal.

Vt., Burlington—The Bd. of Trustees of the University of Vermont—equipment for proposed dairy.

N. Y., Buffalo—The Hutchins Marine Laundry, 93 Elk St., H. J. Hutchins, Purch. Agt.—$10,000 worth of laundry machinery.

N. Y., Lewiston—The Riverside Pulp & Paper Co., W. Burke, Purch. Agt.—paper mill machinery.

N. Y., Rochester—C. C. Peck, 721 E & B Bldg. (mechanical engr.)—magnetic clutch.

Ala., Rockford—E. E. Brown—air drills, air pumps and gas engine for mica mining.

Fla., Palmetto—The Palmetto Crate Co., C. E. Gibbens, Secy.—complete woodworking machinery for the manufacture of orange crates and vegetable containers.

Ga., Macon—The Macon Box Co., B. B. Taylor, Mgr.—single head corrugated fastener driving machine.

S. C., Florence—Giles Bay Lumber Co., W. Barth, Purch. Agt.—locomotive crane, 10-ton capacity or larger, for standard gage track.

Va., Staunton—The Farmers Marl Lime Co., W. J. Chapman, Secy. and Treas.—complete equipment for grinding and drying marl, to have 200-ton daily capacity.

Ill., Chicago—The Mickelberry Food Products Co., 641 West 47th St.—meat packing and canning machinery.

O., Canton—The Continental Clay Co., Zinninger Bldg.—complete machinery for sewer pipe plant.

O., Cincinnati—The Pub. Wks. Constr. Co., 57 Wiggins Blk., N. Brehm, Purch. Agt.—revolving crane for unloading cars, ⅝ cu.yd. bucket (Byers or Pawling & Harnischfeger or equal).

THE WEEKLY PRICE GUIDE

THIS WEEK'S MARKET

The only change in the iron and steel market is in New York, where bars, structurals, plates, hoop steel and sheets have been reduced in price, owing to the dull market. Structural shapes and steel bars are down 25c. per 100 lb. In Cleveland, steel prices are unchanged, but business is only fair. Sheets and plates find a ready market with the smaller sheet metal workers, but carload orders are scarce.

It is felt in New York that the metal market is at the long-awaited turn for the better. Shutting down the mines has toned up copper, although 13c. is still the figure for lots up to a carload. Lead, also, is stronger. The trust has raised its price twice in four days: On March 28, from 4c. to 4.1c., and on March 31, from 4.1c. to 4.25c. There is a strong plumbers' demand for lead. Manufactured brass and copper products are unchanged in the warehouses of New York, Cleveland and Chicago. Cleveland reports babbitt metal firmer following the slight improvement in the automobile industry. The old metals market is dead.

Coke reflects the stagnation of the pig iron market, and prices have fallen off 25 to 50c. per ton. Linseed oil is down 1c. in Chicago, to 80c. per gal. in 5-bbl. lots.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$30 50
Northern Basic	27.52
Southern Ohio No. 2	30 50
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	36.51
BIRMINGHAM	
No. 2 Foundry	26 50
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75 sil	27 00
Virginia No. 2	*28 00
Basic	†26 25
Grey Forge	*27 00
CHICAGO	
No. 2 Foundry local	26 00
No. 2 Foundry, Southern, sil 2.25@2.75	33 00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26 96
Basic	26 86
Bessemer	27.00

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago
Structural shapes	$3.23	$3.33	$3.58	$3.58
Soft steel bars	3.13	3.23	3.34	3.48
Soft steel bar shapes	3.13	3.23	3.48	3.48
Soft steel bands	4.18	4.28	6.25	
Tank plates	3.23	3.33	3.78	3.78

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.25@$2.35
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	4.12

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.20@3.55	4.23	4.00	4.68
No. 12	3.25@3.60	4.28	4.05	4.73
No. 14	3.30@3.65	4.33	4.10	4.78
No. 16	3.40@3.75	4.43	4.20	4.88
Black				
Nos. 17 and 21	3.75@4.15	4.80	4.70	5.55
Nos. 22 and 24	3.85@4.20	4.85	4.85	5.60
No. 25 and 26	3.90@4.25	4.90	4.90	5.65
No. 28	4.00@4.35	5.00	5.00	5.75
Galvanized				
No. 10 and 11	4.25@4.70	4.43	5.00	6.10
No. 12 to 14	4.35@4.80	4.53	5.10	6.20
Nos. 17 and 21	4.65@5.15	4.83	5.40	6.50
Nos. 22 and 24	4.80@5.25	4.98	5.55	6.65
No. 26	4.95@5.40	5.13	5.70	6.80
No. 28	5.25@5.70	5.38	6.00	7.10

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$5.50	$5.25	$4.84
Flats, squares and hexagons, per 100 lb	6.00	5.75	5.34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	50%
Cleveland	50%
Chicago	50%

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	42
Hot rolled copper nickel rods (base)	52
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: $\frac{5}{32}$, 8½c. per lb.; ¼, 8c.; $\frac{5}{32}$ to ¼, 7¾c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	6.00	8.00	9.00
Spring steel (light)	8.00	7.00	12.00
Coppered Bessemer rods	8.50	8.00	7.00
Hoop steel	4.43	4.04	4.18
Cold rolled strip steel	9.00	8.25	9.25
Floor plates	5.75	4.00	6.03

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Galvanized	Inches	Iron Black	Galvanized
¼ to 3	57½%	44%	⅛	15½–16½%	+10½–11½%
			¼	19½–20½%	1½– 2½%
			⅜ to 1½	24½–25½%	8½– 9½%

LAP WELD

2	50½%	38%	2	20½–21%	6½– 7%
2½ to 6	53½%	41%	2½ to 6	22½–23%	9½–10%
7 to 12	50½%	37%	7 to 12	19½–20%	5½– 7%
13 to 14	41%				
15	38½%				

BUTT WELD, EXTRA STRONG PLAIN END.

¼ to 1¼	55½%	43%	⅜ to 1½	24½–25½%	9½–10½%
2 to 3	56½%	44%			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	48½%	37%	2	21½–22½%	8½– 9%
2½ to 4	51½%	40%	2½ to 4	23½–24%	11½–12%
4½ to 6	50½%	39%	4½ to 6	22½–23%	10½–11%
7 to 8	46½%	33%	7 to 8	14½–15%	2½– 3%
9 to 12	41½%	28%	9 to 12	9½–10%	+2 –2½%

Warehouse discounts as follows:

	—New York— Black	Galv.	—Cleveland— Black	Galv.	—Chicago— Black	Galv.
⅛ to 3 in. steel butt welded	44%	28%	42½%	33½%	57½%	44%
2½ to 6 in. steel lap welded	39%	24%	44½%	29½%	53½%	41%

Malleable fittings. Classes B and C, Banded, from New York stock sell at plus 6%. Cast iron, standard sizes, 15% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13 00
Tin in 5-ton lots	29 00
Lead	4 50
Zinc	5.30
ST. LOUIS	
Lead	4 10
Zinc	5 30

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.25	21.50	23 50
Copper wire (carload lots)	15.00	17.50	20 00
Brass sheets	17.25	24.00	24 50
Brass pipe	21.00	22.00	20 75
Solder (half and half) (case lots)	19.00	20.50	17 50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	15 25
Cleveland	19 00
Chicago	18 75

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill + less 8% for carload lots 11.50

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	13.70	14.30
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.25
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	10.00
Copper, heavy, and wire	9.00	9.50	9.00
Copper, light, and bottoms	8.00	9.00	8.00
Lead, heavy	3.25	4.00	3.50
Lead, tea	2.00	3.00	3.00
Brass, heavy	6.00	7.00	9.00
Brass, light	4.50	5.00	5.00
No. 1 yellow brass turnings	5.00	5.50	5.50
Zinc	3.00	3.00	3.10

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.1@28.2	24.50	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.00
Chicago	20.50
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	46.00	35.00
Commercial	30.00	16.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$1.00	+1.15
Hot pressed hexagon	List	1.00	+1.15
Cold punches hexagon	List	1.00	+1.15
Cold punched square	List	1.00	+1.15

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	70%
Cleveland	70%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	45%	60%	50%
1 and 1¼ in. by 3 in. up to 12 in	25%	50%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $3.50 Chicago..... $2.50
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows.
New York..... $4.50 Cleveland..... $4.00 Chicago..... $4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
6 by 6 in. and smaller	40%	50%	40%
Larger and longer up to 1 in. by 30 in.	40%	40%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	45%	50%	45%
Tinned	45%	50%	30%

Structural, ¼, ⅜, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$5.08 Cleveland...$5.00 Chicago....$5.08 Pittsburgh..$3.90

Boiler, same sizes:
New York...$5.30 Cleveland...$5.10 Chicago....$5.18 Pittsburgh..$4.00

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	25.50
Brass	21.00	24.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ⅛-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$8.50 per 100 lb.; New York price is 8c.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	10.00@13.00	13.00	14.25
Colored mixed	7.00@11.50	10.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	1½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$4.00@$4.50
Prompt foundry	5.25@6.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$0.80
Cleveland	100-lb. bag	1.05

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.73	$0.90	$0.80
5-gal. cans	76*	1.15	1.05

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

Wis., Milwaukee—The Petersen Flusher Co., 276 1st Ave., G. Petersen, Purch. Agt.—special machinery to manufacture sink drains, toilet drains, etc.

Wis., Sheboygan Falls—The Falls Roller Mills Co., c/o E. Gonzenbach, Pres.—grinding machinery.

Wis., Wauwatosa—A. Knauber, 63d St. and Johnson Ave.—one 22 in. to 26 in. band saw for woodworking plant.

Wyo., Shoshone—The United States Reclamation Service, Denver, Col., will receive bids until April 27 for furnishing one 30 ton traveling crane for the power house here.

Ont., Ottawa—The Slinn Bread Co.—special baking machinery and equipment.

Que., St. Victor—E. Villanuve—saw mill machinery.

Metal Working

NEW ENGLAND STATES

Conn., Hartford—M. L. Schoolnick, 93 Atwood St., will build a 1 story, 50 x 136 ft. garage on Flower St. Estimated cost, $28,000.

Conn., Norwalk—J. Donaldson, c/o H. W. Mather, Archt., Haviland Bldg., has had plans prepared for the construction of a 1 story, 50 x 135 ft. service station on West Ave. Estimated cost, $25,000.

Mass., Allston (Boston P. O.)— The Arcand Spring Co., 20 Cambria St., Boston, will soon award the contract for the construction of a 1 story blacksmith shop on Mechanic St. Estimated cost, $25,000.

Mass., Indian Orchard—The Chapman Valve Mfg. Co., Pine St., will soon award the contract for the construction of a 1 story, 50 x 275 ft. foundry with two 20 x 80 ft. ells. Associated Architectural and Eng. Co., 145 State St., Springfield, Archts. and Engrs.

Mass., Medford—L. B. Jeffreys, 15 Alfred Terrace, will build a 1 story, 60 x 115 ft. garage on Parkdale St. Estimated cost, $25,000.

Mass., Pittsfield—McCormick & Joyce, 444 North St., have awarded the contract for the construction of a 1 story, 45 x 80 ft. sales and service station on Maplewood Ave.

Mass., Roxbury (Boston P. O.)—T. H. Connolly, 110 Bower St., will build a 1 story, 120 x 145 ft. garage on Washington St. Estimated cost, $75,000. Noted Feb. 24.

Mass., Taunton—The Presbrey Stove Lining Co., 212 Somerset Ave., plans to rebuild its plant which was recently destroyed by fire. Estimated cost, $75,000.

R. I., Providence—W. A. Mulry Co., 97 Empire St., is having plans prepared for the construction of a 1 story, 120 x 135 ft. garage, sales and service station, on Elmwood Ave. and Russell St. Estimated cost, $75,000. B. S. D. Martin, 86 Weybosset St., Archt.

MIDDLE ATLANTIC STATES

N. J., Trenton—The Amer. Steel & Wire Co., Hamilton Ave., will build a 1 story, 60 x 313 ft. wire plant on South Broad St. Estimated cost, $20,000.

N. Y., New York (Borough of Bronx)—The Calabro Bldg. Co., Inc., 825 Burke Ave., will build a 1 story, 90 x 120 ft. garage on Hoffman St. near 184 St. Estimated cost, $45,000.

N. Y., New York (Borough of Bronx)—J. T. Tully, c/o C. Kreymberg, Archt. and Engr., 2534 Marion Ave., will build a 1 story, 65 x 100 ft. garage on 145th St. near Willis Ave. Estimated cost, $45,000.

N. Y., New York (Borough of Manhattan)—The Horizon Corp., 19 West 134th St., is having plans prepared for the construction of a 4 story, 75 x 100 ft. garage at 50-54 West 144th St. Estimated cost, $70,000. A Brociner, 110 West 40th St., Archt. and Engr.

N. Y., New York—(Borough of Manhattan) H. I. Stitler, Inc., 529 Washington St., is having plans prepared for the construction of a 2 story, 82 x 100 ft. garage, on Washington and Bethume Sts. Estimated cost, $50,000. Rouse & Goldstone, 512 5th Ave., archts. and engrs.

Pa., Pittsburgh—J. and J. B. Milholland Co., Tumell and Watson Sts., will soon award the contract for the construction of a 1 story, 56 x 123 ft. addition to its machine shop. Estimated cost, $50,000. Private plans.

Pa., Pittsburgh—M. Walker, c/o W. A. Thomas, Archt., Magee Bldg., will soon receive bids for the construction of a 2 story, 40 x 100 ft. garage on Kilpatrick and Ridgeway Aves. Estimated cost, $35,000.

SOUTHERN STATES

N. C., Raleigh — The State Highway Comn. has awarded the contract for the construction of 50 x 450 ft., 50 x 350 ft., 50 x 200 ft., and 50 x 150 ft. truck sheds and machine shops Estimated cost, $60,000. Noted Nov. 25.

MIDDLE WEST STATES

Ill., Chicago—The Chicago Blow Pipe Co., 216 North Sacramento Ave., has awarded the contract for the construction of a 1 story, 74 x 75 ft. factory, on West Lake and Clarkson Sts. Estimated cost, $30,000.

Ill., Chicago—The Runzel Lenz Electric Mfg. Co., 1751 North Western Ave., has awarded the contract for the construction of a 2 story, 50 x 60 ft. addition to its factory at 1755 North Western Ave. Estimated cost, $20,000.

Ill., East St. Louis—The Dependable Truck and Tractor Co., 231 Collinsville Ave., has had preliminary plans prepared for the construction of a 1 story, 100 x 250 ft. truck plant and power house in Washington Park. Estimated cost, $250,000. Reister & Rubach, Murphy Bldg., Archts. Noted Jan. 27.

Ind., Evansville—The Hercules Gas Engine Co. plans to build a 1 story, 250 x 250 ft. engine works. Estimated cost, $50,000. Private plans.

Ind., Indianapolis—C. and A. Potts Co., 816 West Washington Ave., will soon award the contract for the construction of a 1 story, 60 x 132 ft. foundry. Estimated cost, $45,000. Noted Feb. 10.

Ind., Muncie—The Muncie Gear Co. plans to build a 1 story, 100 x 200 ft. gear factory on North Vine St. Estimated cost, $50,000. Private plans.

Mich., Detroit—F. Montefore, 3513 3d St., has awarded the contract for the construction of a 2 story, 50 x 160 ft. sales and service station on High St.

O., Cleveland—The Jeavens Spring Co., 1603 Prospect Ave., is having plans prepared for the construction of a 5 story, 55 x 300 ft. factory and office building. Haven & Crosby, 40 Court St., Boston, Mass., Archts. and Engrs.

O., Columbus—The S. B. Hartman Estate will soon receive bids for the construction of a 2 story, 115 x 140 ft. garage, sales room and repair shop, on South 3d St. Estimated cost, $125,000.

Wis., Fairchild—The Fairchild Motor Co. has purchased a site on Main St. and plans to build a 2 story, 60 x 110 ft. garage. Estimated cost, $75,000. A. B. Ross, Mgr.

Wis., Manitowoc—N. C. Dicke Motor Co. Franklin and 11th Sts., will soon award the contract for the construction of a 2 story, 60 x 120 ft. garage, machine and show room building. Estimated cost, $75,000. Juul & Smith, Imig Bldg., Sheboygan, archts.

Wis., Okauchee — W. Schradenbach has had plans prepared for the construction of a 2 story, 50 x 80 ft. garage, etc., on Main St. Estimated cost, $75,000. A. Kuenzi, Watertown, archt.

STATES WEST OF THE MISSISSIPPI

Mo., Carthage—F. W. Steadley, 930 Oak St., has awarded the contract for the construction of a 1 story, 40 x 45 ft. addition to his chain and battery factory on Grant and 5th Sts., and for a 1 story, 50 x 100 ft. machine shop on Grant and 6th Sts. Estimated cost $5,000 and $10,000 respectively.

Mo., St. Louis—A. T. Morey, 5565 Bartmer Ave., has awarded the contract for the construction of a 1 story, 100 x 140 ft. garage with a 50 x 80 ft. wing, on Delmar and Lake Aves. Estimated cost, $75,000.

WESTERN STATES

Cal., San Diego—The Bureau of Yards & Docks, Navy Dept., Wash., D. C., has awarded the contract for the construction of a lean-to addition to structural shop, here.

CANADA

Ont., Galt—The Hi Speed Tools Ltd. has acquired an old factory and plans to remodel same and install machinery. Estimated cost $100,000. H. Champ, Genl. Mgr.

Ont., Toronto — The British Canadian Machine and Tool Co., 183 St. George St. is receiving bids for the construction of a 2 story, 40 x 100 ft. tool factory on King St. Estimated cost, $50,000.

General Manufacturing

NEW ENGLAND STATES

Conn., New Britain—The Niedzwieck Bakery, 215 Farmington Ave., will soon receive bids for the construction of a story, 45 x 65 ft. bakery. H. A. Ludorf Mutual Bldg., Archt. Noted March 24.

Conn., Stamford—Cohn & Abrams, 54 Main St., will soon award the contract for the construction of a 3 story, 40 x 85 f candy manufacturing plant, on Beckl Ave. W. R. Steinmetz, 442 Atlantic S Archt.

Mass., Newburyport—The Hannah Sh Co. will alter its shoe factory on Pleasa St. Estimated cost, $100,000.

MIDDLE ATLANTIC STATES

N. Y., Mt. Vernon—The General Optic Co. will soon receive bids for the construction of a 1 story, 30 x 200 ft. addition factory at 256 Washington St. Estimate cost, $75,000. Woodwell & Resler. 501 5t Ave., New York City, Archts. and Engrs.

Pa., Great Bend—The N. H. Pa Leather Co. will soon award the contra for the construction of a 3 story, 75 x 2 ft. tannery. Estimated cost, $150,00 Lockwood Green, 101 Park Ave., New Yo City, Archts. and Engrs. Noted Nov. 18

Pa., Pittsburgh—The Crane Co., Sou Michigan Ave., Chicago., Ill., will receiv bids April 10 for the construction of a story, 75 x 192 ft. and three 1 story, x 288 ft. buildings on 24th St., here. Co to exceed $1,000,000. Hunting Davis C Century Bldg., Archts. Noted Feb. 17.

MIDDLE WEST STATES

Ill., East St. Louis—Morris & Co., 12 West Adams St., Chicago., plans to bui a 2 story slaughter house. Estimated cos $150,000. E. Schaefer, mgr. B. Steven c/o owner, archt.

Ind., Muncie—The Ball Bros. Glass Mf Co., East 9th St., plans to build a gla factory on 9th St. Estimated cost, $50,0 Private plans.

O., Dayton — The Rinderknecht Lumb Co., Huffman Ave., has awarded the co tract for the construction of a 2 story, x 200 ft. warehouse and mill. Estimat cost, $45,000.

Wis., Beaver Dam—The Bell Mfg. C c/o C. S. Knapp, 200 Burnett St., is havi plans prepared for the construction of a story, 45 x 90 ft. factory for the manufa ture of novelties, etc. Estimated co $35,000.

Wis., Sheboygan—The Press Publishi Co., c/o C. Broughtoman, 795 Center Av will build a 2 story, 60 x 125 ft. publishi plant. Estimated cost, $75,000.

STATES WEST OF THE MISSISSIPP

Mo., Medill—The Producers Cold Stora Co. is having plans prepared for the co struction of a 3 story, 63 x 108 ft. packi plant. Estimated cost, $50,000.

Tex., San Antonio — The Gebhardt Ch Powder Co. has awarded the contract f the construction of a 2 story, 42 x 137 canning plant, to include a refrigerator sy tem. Estimated cost, $39,770.

CANADA

Que., St. Anne de Belleville—The Industr and Educational Publishing Co. will so award the contract for the construction u paper mill, to include a 70 x 250 ft. m chine room, 4 story, 12 x 60 ft. finishi department and 2 other buildings. Es mated cost, $150,000.

American Machinist

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Transplanting Rolls-Royce Methods to the U. S.

The Problem of Duplicating Accurate Work in Another Country—Care in Selecting Materials and in Workmanship—Operation Drawings That Eliminate Mistakes

By Fred H. Colvin
Editor, *American Machinist*

TRANSPLANTING a business from one side of the Atlantic to the other is not an easy task at best. But establishing a branch factory may be even more difficult when all phases are considered. In the first instance, you can take the personnel, the tools, fixtures and gages, and manufacture as before with only the handicap of new environments. In the second place, you can only transplant part of the personnel from the home plant and practically no tools, fixtures or gages.

You must establish a new plant, secure equipment which will give duplicate product, and train men to secure commercial interchangeability with the product of the parent plant. And when the product is designed with the idea that nothing is ever quite good enough, the securing of tools, fixtures and gages, and the training of men is doubly difficult.



FIG. 1. STOCK BINS AND VERTICAL TURRET LATHES

Such, in brief, was the problem which confronted the management of the Rolls-Royce Co. of America, in establishing its plant at Springfield, Mass. Handicapped still further by beginning work when all of our shops were still crowded with the aftermath of war work, when accurate tools, fixtures and gages were more difficult to secure than they should have been, the organization is to be congratulated on its progress. For, beginning with nothing but its personnel, drawings from the home plant, and models of the various parts, cars with completed chassis are now coming through the erecting shop in a satisfactory manner.

The First American Chassis

The first American chassis was completed in January and has been thoroughly road-tested in every way. It is so nearly a duplicate of its English mate that not even those who are thoroughly familiar with the car can tell them apart except for certain small earmarks which have nothing whatever to do with either the appearance or quality. And every essential part is interchangeable on these two cars.

To satisfactorily prove to themselves that the American and English products are interchangeable, a test was made in which an English chassis and an American chassis were assembled and the units and parts interchanged to the absolute satisfaction of the inspection department.

It should be stated that the parent firm, recognizing the importance of immediately attaining and maintaining the existing standards, selected for every department a staff of supervisors possessing expert knowledge of the Rolls-Royce manufacture and standards. The machine equipment is American throughout with the exception of the cam grinding machine which was built in Derby, England, because at the time everyone in this country was too busy to build a single special machine for them. This machine is of special design to grind the peculiar reverse curve cam used on the Rolls-Royce motor. The equipment of the Derby plant is also largely American, however, so that this is no departure and the shop executives know exactly what results can be expected from the different machines. Beginning with only blueprints and models of the main parts of the car, tools, fixtures and gages have been secured, a supply of material has been made available and work is actually under way in a satisfactory manner.

A Word About the Personnel

The works manager, George Bagnal and his assistant, J. E. Poole, are broadminded men and thoroughly practical mechanics. Both credit the foundation of their work and their desire to better mechanical methods, to the *American Machinist*, which years ago, became the inspiration to forward looking mechanics of Great Britain and other lands. They realize, perhaps more



FIG. 2. GENERAL VIEW OF MACHINE SHOP

thoroughly than some of us on this side of the water, that mechanics know no nationality, and no creed save excellent workmansihp.

It is particularly gratifying to note the harmony which prevails in the personnel, the eagerness of all to excel, if possible, the product of the parent plant, and the willingness to credit the working staff with their full share in the results.

Showing Why Accuracy Is Necessary

Some of the shop methods are of particular interest, and in order to appreciate just what these methods mean in the way of expense as well as results, we must bear in mind the small output of approximately one car per day or eight per week as a maximum. Production is never forgotten, however, and a bonus is paid for a good output. Prominent notices inform the men that a bonus is never cut without an entire change of method. But quantity is not the prime object. Shop mottos or slogans, prominently posted, urge the men to think about their work, others urge them not only to equal the Derby quality, but to beat it.

Every effort is made to let each man know just why certain things are done and why such great care is necessary. Men are shown what part their work plays in the construction as a whole. In addition, special classes are held at which engineers, tool designers, and others tell the men the whys and wherefores of the various requirements. Another innovation taken from the shop in Derby is the introduction of a half hour smoking period in both forenoon and afternoon. This does not mean a cessation of work, but that smoking is permitted at the machines during this period.

The problems involved in producing these cars are unusual in a number of ways. The construction of the original car must be followed in every detail. This involves special material and special methods. It involves the use of forgings where our practice is to use pressed steel fittings or malleable castings as being entirely satisfactory. It necessitated the making of thousands of special tools, fixtures and gages, which must turn out a product that will interchange with the car made in Derby. For in spite of a limited production, this is a machined and not a hand-made product as is usually supposed.

Not Hard Work But Good Machining

No scraping is done on the bearings but the machining probably takes fully as much time because of the painstaking care to secure the best possible results. And no matter what some may think as to the wisdom of the selection of some of the material used, there can be no question as to its quality, its dependability or the service it renders. Nor must we forget that the makers guarantee extends over a period of three years instead of three months.

The experience of the engineers of the Rolls-Royce Co. in securing absolutely dependable steels and the justification of their faith that they could secure in this country, the high-grade demanded, is very gratifying. It also proves them to be engineers of vision, shows further that they were not handicapped by national prejudices. Their problems and the solutions are of value to all users of high-grade steel.

Among the personnel is a steel expert who is versed not only in the theory but in the actual production of steel. He has been through the steel mills as a worker and knows the various steps in the process. This man watches the steel as it is being made and rolled. He watches it as it is forged into crankshafts, connecting rods, and other parts, and no steel is shipped from the

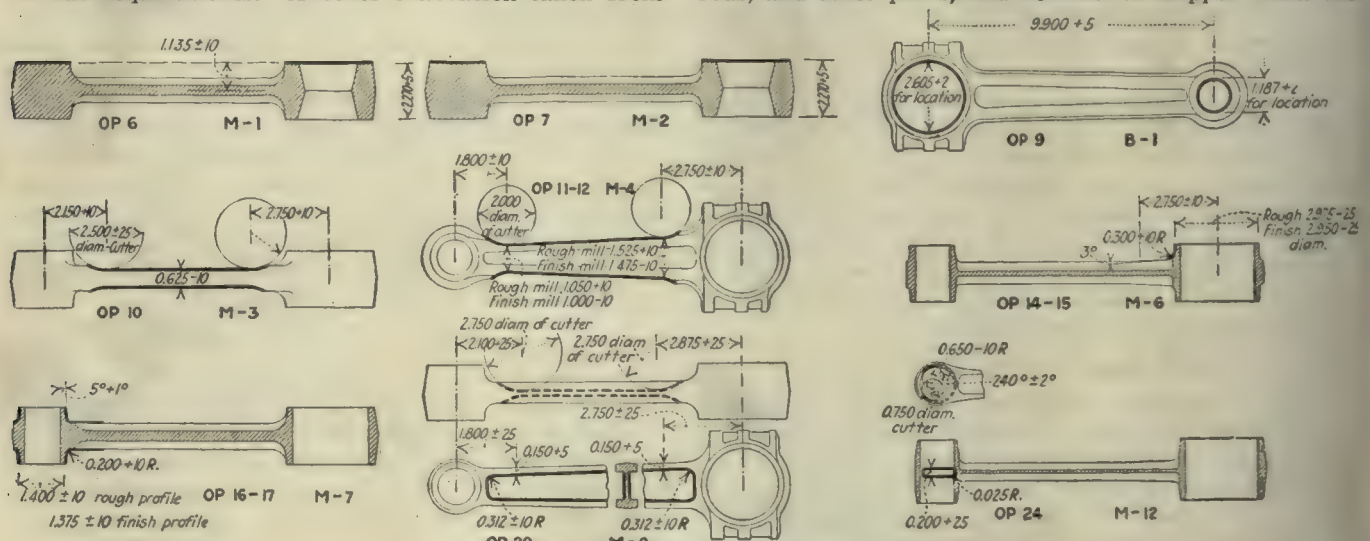


FIG. 3. SAMPLES OF OPERATION SHEETS

mill or forge into the plant without his mark of approval. This saves much in the way of freight on rejected parts and the time lost by partially machining defective material.

One of the difficulties was the presence of hair lines on the finished surface of forged parts. So numerous tests were made to see how deep these lines or cracks were. After many experiments, it was found that the lines usually disappeared within an eighth of an inch of the surface. Individual lines are usually only a few thousandths deep and these all seem to be confined to the outer eighth of an inch of a good forging. So crankshafts and other parts are made large enough to allow for the removal of considerable material and with it, any hair lines which may exist in the original forging. For while it may not be known positively that these hair lines cause a break, they are possible beginnings of fracture and are not tolerated.

The large amount of metal removed will be noted in the machining operation, particularly in the case of crankshaft and connecting rod. The crankpins of the former for example, are reduced from 2¾ to 2½ in. by grinding, in several stages, and hair line difficulties have been eliminated in this way.

Inspection and Test of Forgings

In the case of forgings which are not machined all over, as with the steering knuckle, these are first sand-blasted so as to remove the scale, and are then filed up by hand in order that any small surface crack can be more readily detected. Hand filing has been found more effective than grinding or buffing, on account of being less liable to close an existing hair line. All forgings have a coupon attached for testing purposes and forgings are given 100 per cent inspection in this way. All members of the steering gear on every car, from the steering knuckle to the connecting bolts or pins, are tested for hardness, soundness and strength. In the case of steering pin or bolt connections, the coupon is left on each end when the part is being machined. One of these coupons is used for testing the tensile strength and the other the case-hardening and heat-treating. In the making of parts which are to be case-hardened locally, they have found that the older method of case-hardening the whole piece and then turning off the portions which are to be soft, has proved the most satisfactory. Copper plating and similar methods have given way to the older practice.

Blueprints and Models

The method of handling work in the shop involves the use of both blueprints and models. The blueprints are arranged by operation and in such a way as to avoid confusing the operator on his particular work. This method is illustrated in Fig. 3, where nine operations on the connecting rod have been selected to illustrate the plan used.

The symbol in the corner indicates the particular kind of operation, those with an *M* representing milling and the *B*, boring. The first operation shown is the rough milling of one side of the rod. Both ends are made of the same length for convenience in machining. This avoids making steps on any of the fixtures and the large end is afterward faced down to its proper thickness. As will be noted, there is only one dimension on *M1*, showing the distance from the center line of the rod to one face, with a tolerance of plus or minus ten thousandths of an inch. In operation *M2*, the other side is milled, locating from the first side and the tolerance is plus five thousandths.

All tolerances are given in thousandths so it is unnecessary to use the decimal point in any of these cases. Here again, only the dimensions which interest the operator on the particular job are given. Operation *B1* bores both ends of the rod with a plus tolerance of five thousandths. Here again, the only dimensions shown are the two diameters and the center distance. Going to the next milling operation we find all the necessary dimensions for roughing the sides of the rod, the dimensions showing the limit of travel on the milling cutter in each direction.

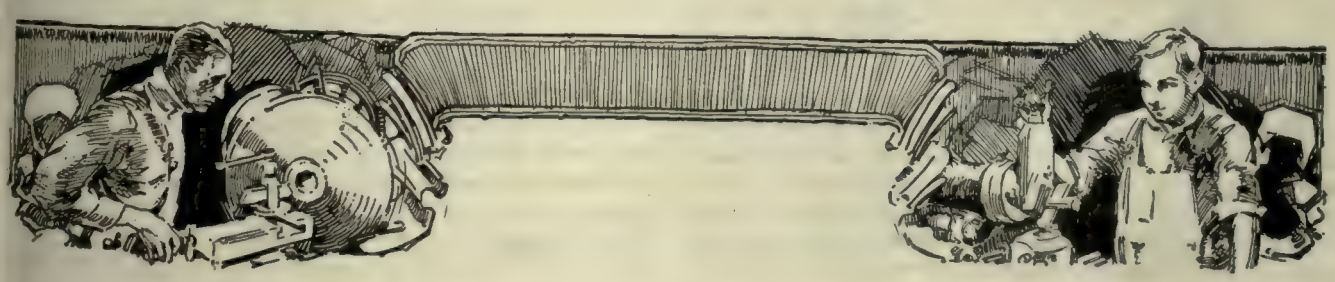
Eliminating Chances of Error

Other milling operations are shown in the remaining diagrams, in each instance, only the essential dimensions being given. This keeps the operator's mind entirely on his particular operation and gives no excuse for reading a dimension which belongs to some other operation. In the last operation shown, the small milling cutter cuts an oil groove about three-fourths of the way around the small end of the rod. This distributes the oil around the outside of the piston-pin bushing. This bushing has oil holes drilled through it and as the bushing floats between the pin and the rod, this insures lubrication on both sides. Although not shown in any of the operations in Fig. 3, oil is conducted from the main bearing to the small end of the rod by a small copper pipe which lies in the channel on one side.

Blueprints Augmented by Models

In addition to the operation blueprints, the toolroom is supplied with models of the main parts of the car in their various stages of completion. When the operator gets his blueprint he also draws the corresponding model from the toolcrib and keeps that beside his machine so as to give him a visual evidence of the operation he is to perform.

While these models are perhaps not entirely necessary they are often a great help when men are not thoroughly familiar with blueprints, and are particularly helpful in machining the parts for an entirely new product. The system has much to commend it on some classes of work, even though it is a return to a method very generally used in the days before blueprints became common in the shop.



Design of Helical Springs

A New Point in the Design of Helical Springs — Method Developed Particularly for Small Springs—Chart for Quick Determination of Values

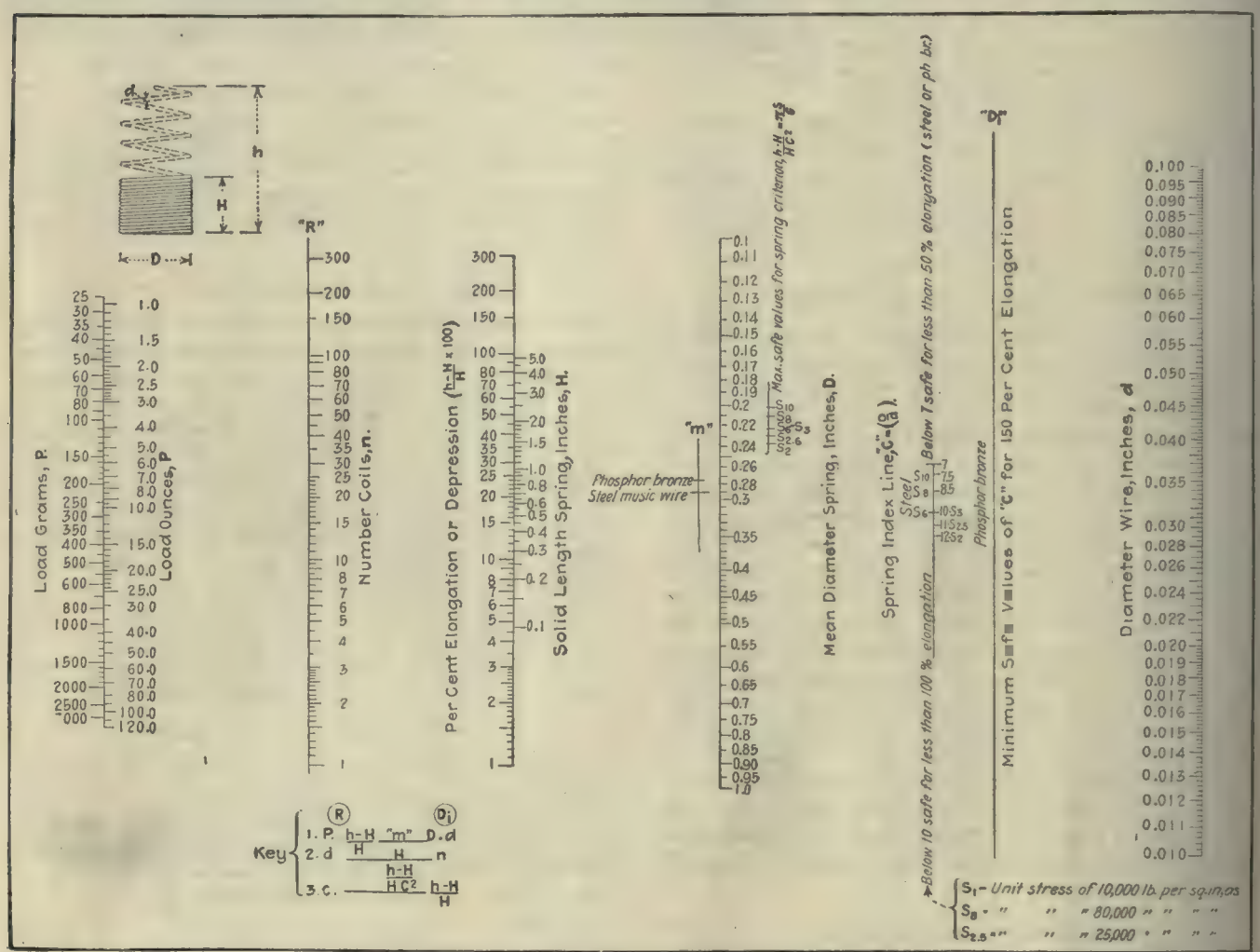
By JOSEPH KAYE WOOD
Engineer, Western Electric Co.

HELICAL spring design from the theoretical standpoint appears to many designers to be a very complex matter, in fact, quite a few will frankly admit that they design springs not by careful calculation, but instead by an approximate estimation of the various dimensions involved On the other hand, some designers attempt to design springs by careful computation, but complain of the laborious work involved.

I have had occasion to design and investigate many small helical springs, which led me to realize the urgent need of some systematic arrangement of the many factors that enter into the design of these springs. Consequently, I have written the following article, bringing out an apparently new fact and several corollaries to it, which simplify the design of helical springs both small and large. In this connection, I found it convenient to create two new terms: "spring criterion" and "material index." The fact spoken of is as follows: "That the spring criterion must not exceed the material index in order that the helical spring in question will be able to safely carry the maximum load as computed from the ordinary deflection formula." In symbols it is as follows:

$$\text{(Spring Criterion)}\ \frac{h-H}{HC^2} < \frac{\pi S}{G}\ \text{(Material Index)}$$

This condition was obtained by equating the maximum allowable work applied to the spring to its resilience, the resilience of a spring being the maximum amount of useful work that can be recovered from it after the removal of the load. The mathematical derivation may be seen at the end of this article. Thus, this



Instructions for Operation: Pass a line through the load "P" and the corresponding "Elongation or Depression," from the intersection on the line "R" pass a line through the proper point on line "m," and the prolongation of this line gives an intersection on the line "Di" (Key 1). A line through this point gives the value of "d" for a certain "D." In a similar way "n" is found, according to Key 2. By an inspection of the intersection of the "D"-"d" line on the "Spring Index" line, we note if the spring is safe. This can be verified by Key 3.

FIG. 1. ALIGNMENT CHART FOR DETERMINING SPRING SIZE

fact furnished a basis upon which to formulate a simplified method of procedure in helical-spring design, in which procedure a convenient parallel-scale chart is used. It also includes three important corollaries to the above condition (designated by Roman numerals) which if more generally known would be very useful in themselves. Although I have had small helical springs in mind when writing this article, upon examination I find that with the exception of the paragraph on material it applies to springs of all sizes.

Items To Be Considered

In designing a helical spring, we may classify the important considerations into three parts:

1.—Requirements of the spring:
- 1.1 Load (P)
- 1.2 Percentage elongation or depression $\frac{h-H}{H} \times 100$

2.—Dimensions of the spring:
- 2.1 Spring diameter (D)
- 2.2 Wire diameter (d)

3.—Material of the spring:
- 3.1 Modulus of elasticity for torsion (G)
- 3.2 Maximum safe fiber stress (S)

1. The requirements of a spring must necessarily be known from the requirements of the mechanical device to which the spring is to be applied.

2. The ratio of the spring diameter to the wire diameter, called the "spring index" (C), is very important, and it is found to be good practice not to have this value less than 7. Consensus of opinion as to what the minimum value should be varies between 5 and 7.

3. The material selected for a spring is the most important and fundamental consideration, as a material having as high an elastic limit as possible, and preferably a low value for the torsional modulus of elasticity, gives the most serviceable helical spring. Medium carbon steel of high strength with a low phosphorus and sulphur content should invariably be used in making up springs, but if the surrounding conditions are severely corrosive, phosphor bronze containing a small amount of tin and phosphorus should be used. However, under less severe corrosive conditions, steel springs may be copper plated to avoid using phosphor bronze. The process of drawing wire gives additional strength to the material used on account of the hard surface skin formed, the strength being exceptionally great for small wire, because of the greater ratio of the surface of a cylindrical solid to its cross section as the diameter decreases. Due to this surface structure, the fundamental formulas as regards torsional deflection and maximum safe working load may not hold exactly; nevertheless, as we lack sufficient data on spring material to supply constants for an empirical formula, we must use these formulas.

The capacity formula can be taken care of by assigning a large factor of safety, varying according to the severity of service to which the spring will be subjected. It has been found in small helical spring design, that for high-grade steel music wire of 0.050 in. diameter or less, a value of 100,000 lb. per square inch for the maximum safe fiber stress (S) allows a sufficient factor of safety for ordinary service conditions. For severe service conditions, the engineer's judgment will have to supply the value of (S) or it is recommended that the values in the following table be used for this purpose. By conditions of service is meant the frequency of operation of the spring and severity of sudden shocks or vibrations which may occur, and does not take into account atmospheric conditions. As far as known, there is no information which shows the definite relation between the frequency of operation and the degree of fatigue. The value of "G," the torsional modulus of elasticity, is universally accepted as 12,000,000 lb. per square inch for steel, and for phosphor-bronze wire 6,000,000 lb. per square inch, as shown in the accompanying table.

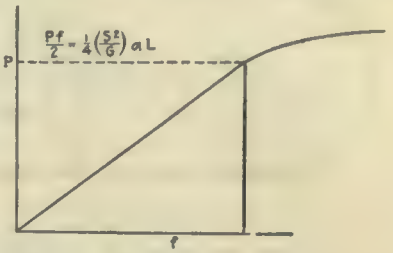


FIG. 2. STRESS-STRAIN DIAGRAM FOR SPRING

Formulas Used

The two following formulas are the principal ones used for the design of helical springs. The first one, known as the "Deflection Formula," depends upon the elastic property of the material, and the second, the "Capacity Formula," depends upon the strength and elastic limit of the material. The fundamental expressions of these formulas are derived in any book on mechanics, particularly Merriman's "Mechanics of Material," and also at the end of this treatise.

$$\frac{h-H}{H} = \frac{P}{2G} \times \left(\frac{D}{d}\right)^2 \times \frac{D}{d^3} \qquad \text{(Deflection formula)} \qquad (1)$$

$$P_c = \pi \times 2S \times \frac{d^3}{D} \qquad \text{(Capacity formula)} \qquad (2)$$

In addition, $N = H \div d$ (Number of spring coils)

The symbols in these and in the formulas given later have the following meanings:

P = Maximum operative load in ounces
P_1 = Initial load in ounces
P_c = Maximum safe working load in ounces
h = Maximum length in inches
h_1 = Initial length in inches
H = Solid length of spring in inches
D = Mean diameter of spring in inches
d = Diameter of the wire in inches
N = Number of coils in the spring
G = Torsional modulus of elasticity in pounds per square inch
S = Maximum safe fiber stress in pounds per square inch

$\frac{\pi S}{G}$ = Material Index

C = Spring Index = $\frac{D}{d}$

$\frac{h-H}{H} \times 100$ = Percentage Elongation or Depression

$\frac{h-H}{H} \times \frac{1}{C^2}$ = Spring Criterion < Material Index

Formula (1) should be used to find the diameter "d" of the wire for the spring which will satisfy the requirements of pressures and corresponding elongations or depressions. In lieu of the capacity formula (2), the following facts will be found more useful.

1. In order that a spring, as designed by the deflection formula (1), shall be safe for the maximum load, the Spring Criteron should not exceed the Material Index. In other words, no more work should be applied

to a volume of wire by a load P than what the material is able to give out again as useful work, this internal energy being known as the resilience of that particular

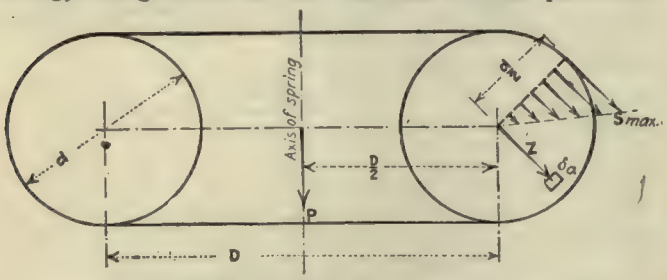


FIG. 3. SECTION OF SPRING FOR DETERMINING CAPACITY FORMULA

volume of material. See mathematical derivation at the end of this article.

2. For steel music wire (S = 100,000 lb. per square inch) under ordinary conditions of service, the value of the Material Index is equal to 0.026, and for phosphor bronze (S = 30,000 lb. per square inch) the Material Index is equal to 0.016, which permits us to make the following statements provided the grade of material is as herein specified.

I. A steel spring whose Spring Index is greater than 7.5 will be safe for the maximum designed load under ordinary service conditions, provided that it is not elongated or depressed more than 150 per cent.

II. A phosphor-bronze spring whose spring index is greater than 7.5 will be safe for the maximum designed load under ordinary service conditions, provided that it is not elongated or depressed more than 100 per cent.

III. Any steel or phosphor-bronze spring, with a spring index greater than 7, under any condition of

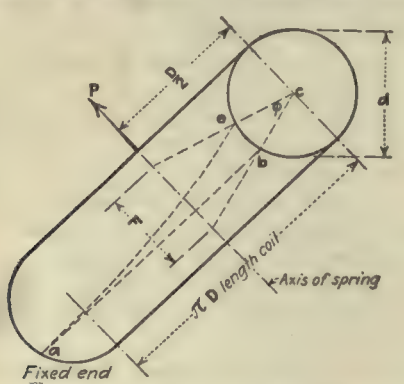


FIG. 4. CONSTRUCTION FOR DETERMINING DEFLECTION FORMULA

service, but not elongated nor depressed more than 50 per cent, is safe for the maximum load designed.

Similar limits for other conditions of service are given in the accompanying table.

Solution by Means of Chart

As the computation work involved for the foregoing formulas is rather great, a parallel scale chart has been prepared to facilitate the selection of a spring. To use the chart, shown in Fig. 1, pass a line through the load, and corresponding elongation or depression required, which gives an intersection point on the requirement line "R", which point should be connected by a straight line to a point on the material line "m," depending upon the material used. The prolongation of this line will give an intersection on the dimensional line "D," and passing another line through this point, will give intersections enabling a selection of spring and wire diameters. An inspection of the point where the latter line cuts the "Spring Index" line will give the spring index, and if this is above the limit for the percentage elongation or depression specified on the chart or in the table, the spring will not be safe for the maximum load selected, and if below, it will be safe. To verify this, pass a line through the "Spring Index" and the "Percentage Elongation or Depression." The intersection of this line on the "Spring Criterion" line must, in order to give a safe condition, fall below the limit point designated for different conditions of service. Finally, to determine the number of coils for the spring, pass a line through the point on the scale corresponding to the diameter of the wire and through the percentage elongation or depression point, and the prolongation of this line will give the number of turns on the "R" line.

When the initial length "h_1" for a compression spring is required, this value should be substituted for "H" in the numerator only, which gives

$$\frac{h - h_1}{H} \times 100,$$

as the value to be set on the "Percentage Elongation or Depression $\left(\frac{h - H}{H} \times 100\right)$" line of the chart. However, it will not be necessary to do this if the following simple law is used to determine the value of the initial length "h_1" corresponding to the required intermediate pressure, namely, "that the depressions or elongations of a helical spring are directly proportional to the loads applied."

Sample Problem—Steel Compression Spring:

Given

P_1 = 20 ounces
P = 30 ounces
H = 1 inch
h = 3 inches
D = ½ inch

To Find

h_1 = x inches
d = y inches
N = z

By above law $\frac{h - h_1}{h - H} = \frac{P_1}{P}$

Substituting $\frac{3 - x}{3 - 1} = \frac{20}{30}$

Or $x = h_1 = 1\frac{2}{3}$ inches

Now, $\frac{h - H}{H} \times 100 = \frac{3-1}{1} \times 100 = 200$ = "Percentage Depression."

LIMITS FOR DIFFERENT CONDITIONS OF SERVICE

Material	Nature of Service	Value of "S" in Lb. per Sq.In.	Value of "G" in Lb. per Sq.In.	Value of $\frac{*S}{G}$ = Maximum Limit of $\frac{h-H}{HC^2}$	Minimum Limit for Spring Index When Per Cent Elongation Is Less than 150%
Steel music wire	Shock	60,000	12,000,000	0.016	10.0
	Frequency above 30 operations per min	80,000	12,000,000	0.021	8.5
	Frequency below 30 per min	100,000	12,000,000	0.026	7.5
Phosphor bronze	Shock	20,000	6,000,000	0.010	12.0
	Frequency above 30 per min	25,000	6,000,000	0.013	11.0
	Frequency below 30 per min	30,000	6,000,000	0.016	10.0

By using the chart we obtain the value of "*d*" equal to 0.037 in., and by inspection of the point of intersection on the spring index line we find that the spring index is considerably below the position of any "*S*," for steel which shows that the spring will safely carry the maximum load. This is confirmed by finding the value of the "Spring Criterion" on the chart, which in this case is considerably below the position of any "*S*" for steel, thus showing that the "Spring Criterion" is less than the "Material Index" for even severe service conditions. The number of turns "*N*" is found from the chart to be 26.

The case where the spring index can be taken equal to 10 before using the deflection formula, makes the latter reduce to a simpler form.

$$d = \sqrt{\frac{1000\,P}{2G} \times \frac{H}{h-H}} = \frac{1}{155}\sqrt{P \times \frac{H}{h-H}}$$

$$= 0.007\sqrt{P \times \frac{H}{h-H}} \qquad \text{For Steel}$$

It should be noted that if an initial load held in equilibrium by close winding be required for a tension spring, then the initial length h_1 becomes the solid length H, the latter existing only in an imaginary sense. In connection with this it is well to bear in mind the following law:

$$\frac{h_1-H}{h-H} = \frac{P_1}{P}$$

The end loops for a tension spring are provided for by giving an approximate value to the length of the loops along the spring axis before using the deflection formula

$2L = 0.8D$ (where L = Length of one loop)

Finally, great care should be used in making or coiling a spring, particularly not to nick the wire with tools, and also not to allow the wire, if it be steel, to be exposed to corrosive influences from the moment the wire is drawn to the time for making it into the form of a spring. These points and others will be considered in greater detail in an article appearing at a later date.

Derivation of Formulas

Spring criterion must be larger than material index.

$$\frac{h-H}{H\,C^2} < \frac{\pi S}{G}$$

Work applied to spring $= \frac{1}{2}Pf$ (Maximum allowed)

Internal energy resulting or resilience $= \frac{1}{4}(S^2/G)aL$ (Total available useful work)

Where a = cross section $= \frac{\pi d^2}{4}$ and L = length of wire.

From the law of conservation of energy, ignoring friction losses, etc., and provided that the elastic limit is not exceeded; referring to Fig. 2:

$$\tfrac{1}{2}Pf = \tfrac{1}{4}(S^2/G)aL$$

Or,
$$P = \frac{\pi}{8} \times \frac{S^2 d^2\, Lf}{G}$$

$$L = N\pi D, \text{ approximately}$$

$$\therefore\ P = \frac{\pi^2\, S^2\, d^2\, D\, N\, f}{8\,G}$$

Now,
$$N = H \div d \text{ and } f = h - H$$

Hence,
$$P = \frac{\pi^2\, S^2\, d\, D\, H\, (h-H)}{8\,G}$$

But,
$$P = \frac{\pi}{8} \times S \times \frac{d^3}{D}$$

From Capacity Formula (2)

Therefore,
$$\frac{\pi}{8} \times \frac{S\,d^3}{D} = \pi^2\, S^2\, d\, D\, H(h-H)$$

Which gives,
$$\frac{h-H}{H} = \frac{\pi S}{G} \times \frac{D^2}{d^2}$$

Let, "*C*" equal the Spring Index $\frac{D}{d}$

And, "*M*" equal the Material Index $\frac{\pi S}{G}$

Then,
$$\frac{h-H}{H} = "M"C^2$$

or,
$$\frac{h-H}{H\,C^2} = "M" = \frac{\pi S}{G}$$

Which, for steel where $S = 100{,}000$ lb. per sq.in. and $G = 12{,}000{,}000$ lb. per sq.in., is, $\frac{h-H}{H\,C^2} = 0.026$

Hence $\frac{h-H}{H\,C^2}$, which should always be less than $\frac{\pi S}{G}$, may be called the spring criterion, and its maximum value depends entirely on the material used for making the spring.

Derivation of Capacity Formula

Capacity formula (2):

$$P_c = W = 2\pi\,\frac{Sd^3}{D}$$

Referring to Fig 3,

Resisting moment = Twisting moment

Twisting moment $= P \times \frac{D}{2}$

Resisting moment:

$\frac{S}{d/2}$ = Unit stress at unit distance from axis

$S\,\frac{Z}{d/2}$ = Unit stress at a distance Z from axis

$\delta_a\, S\,\frac{Z}{d/2}$ = Total stress on an elementary area δ_a

$\delta_a\, S\,\frac{Z^2}{d/2}$ = Moment of this stress with respect to center

$\Sigma\,\delta_a S\,\frac{Z^2}{d/2}$ = Internal resisting moment.

Since S and $d/2$ are constants, this resisting moment may be written $\left(\frac{S}{d/2}\right)\Sigma\delta_a Z^2$. But the quantity $\Sigma\delta_a Z^2$, being the sum of the products obtained by multiplying each element of area by the square of its distance from the axis, is the polar moment of inertia "*J*" of the cross section.

Hence, resisting moment $= \frac{S\,J}{d/2}$

"*J*" for circular section $= \frac{\pi\,d^4}{32}$

Substituting "*J*", resisting moment $= \frac{\pi\,Sd^3}{16}$

Hence, $P \times \frac{D}{2} = \frac{\pi\,Sd^3}{16}$

or, $P = \frac{\pi}{8}\,\frac{S\,d^3}{D}$, where P is in pounds

$P = 2\pi\,\frac{S\,d^3}{D}$ where P is in ounces (2)

Derivation of Deflection Formula

Deflection formula (1):

$$\frac{h-H}{H} = \frac{P}{2G} \times \frac{D^3}{d^5}$$

For meaning of symbols, refer to Fig. 4.

ϕ = Angle of twist in radians = ecb
ϵ = Deformation per unit length
E = Total deformation
F = Deflection per coil
f = Total deflection
S = Unit stress below elastic limit of shear
G = Shearing (or torsional) modulus of elasticity
J = Polar moment of inertia with respect to center
N = Number coils
P = Load in ounces

$$\text{By definition: } G = \frac{S}{\epsilon}$$

$$\epsilon = \frac{\phi\, d}{2} \times \frac{1}{\pi D} = \frac{\phi\, d}{2\pi D}$$

$$\text{And, } S = \frac{P D d}{4 J} \quad \text{From capacity formula} \quad (2)$$

$$\therefore G = \frac{P D d\, 2\pi D}{4 J \phi d} = \frac{\pi P D^2}{2 J \phi}$$

$$\text{or, } \phi = \frac{\pi P d^2}{2 J G}$$

Now: $\phi = \sin \phi$, approximately.

$$\text{And } \sin \phi = \frac{F}{D/2} = \frac{2F}{D}$$

$$\therefore \phi \quad \frac{2F}{D} = \frac{\pi P D^2}{2JG}$$

Since, $J = \frac{\pi d^4}{32}$,

$$\therefore F = \frac{\pi P D^3}{4JG} = \frac{32\pi P D^3}{4\pi G d^4} = \frac{8}{G} \times \frac{P D^3}{d^4}, \text{ for one coil.}$$

"F," "D," and "d" are in inches,
"P" in lb. and "G" in lb. per square inch,

The total deflection is equal to "f" $= \frac{8}{G} \times \frac{P D^3 N}{d^4}$

But, $f = h - H$, and $N = \frac{H}{d}$

$$\therefore h - H = \frac{8}{G} \times \frac{P D^3}{d^4} \times \frac{H}{d}$$

Or, $\frac{h-H}{H} = \frac{8}{G} \times \frac{P D^3}{d^5}$.

Where "P" is in cunces,

$$\frac{h-H}{H} = \frac{P}{2G} \times \frac{D^3}{d^5} = \frac{P}{2G} \times \left(\frac{D}{d^2}\right)^3 \times \frac{D}{d^3}. \quad (1)$$

Dr. Hollis Calls Attention to Present Industrial Dangers

In an address at the joint meeting of the Metropolitan Section of the A. S. M. E. and the New York Section of the A. I. E. E. in New York City, March 25, Dr. Ira N. Hollis, president of Worcester Polytechnic Institute, emphasized the danger of undue exercise of power by a minority as a danger against which the Republic will have to guard.

"Unchecked power of minorities is a danger to any form of government," said Dr. Hollis. "We saw what it did to Germany when the junker rushed a whole people into this horrible war from which we are hoping some day to recover, and we saw what threatened last winter when the mining men went out. The actual interference of minorities over legislation and over elections is one of the very striking things in America. Those who hold the balance of power are virtually rulers of America. How far can this be permitted to continue without a breakdown? The only safety we have at the present time is in playing off one minority against another. Can that type of legislation be tolerated which exempts organized labor from the statutes while placing capital and all associations under injunction and legal prosecution? Positively not. It is not equality before the law, and it exerts the same destructive influence that has been found in the old countries where there is class privilege. Many of the claims by capital and many of the claims by the unions are of doubtful value, even to the men whom they both desire to benefit. If carried to their logical ends with labor agents in Washington they would reduce labor to the same dead level that we find in China; and given the capitalist the power we should ultimately find the same kind of slavery that prevailed under the czars.

There are few people in our country who desire anything but good to the workmen. There are few employers who would not want to pay adequately for their services, and most of our trouble springs from the power of minorities to dictate and to divert the attention of the people as a whole from the true definition of words and the ultimate evil resulting from the organization of one class against the other. One of the features of modern life is the power of a strike. Labor has gained through the unions in some respects, but it will require a generation to discover whether that gain has been really of benefit or not, whether it has been at all proportionate to the losses and poverty and misery introduced by throwing men out of work for some ultimate benefit. There is no doubt whatever that the industrial worker has a right to organize and that he has a right through representatives elected to represent him to better his condition in any way that is within the law; but the penalty for the wrong kind of organization is the dominance of men who really are more interested in obtaining power and in playing the game than they are in benefiting the man who is earning his living at the work bench.

There have been fluctuations in unemployment which have had a corresponding bearing on the wealth of the industrial workers. Today, for instance, there are four million men seeking employment; four million units charged, we might say, with electricity of a negative kind, ready to fly towards any center of attraction. They will form, unless conditions change, the nucleus of a Bolshevik government, because it is they who are dissatisfied and it is they who have made the first step towards complete loss of confidence in any kind of government. This is no gain in wealth; it is a loss. The curse of our modern controversy on the subject of capitalism or the capitalistic government springs out of a total misunderstanding of what opportunity means. When the present governing classes in Russia speak of the bourgeois with a certain amount of contempt they refer to the people whose families made Russia. Are we here drifting backwards toward that form of government or are we going ahead in developing opportunities and openings for men to rise out of the ranks? No statistics can answer that. It is impossible to answer the question satisfactorily, but we do know that when the time comes that a man's right to make a living shall be judged solely by his membership in an association, in a church, in a political party or otherwise, then our government is in danger."

Defiance Inverted-Spindle Drilling Machine

Spindle Housing Stationary—Work Carried on a Sliding Head—Workhead Provided with Screw Feed—Forced and Flow Feed Oiling in Inclosed Housings

By J. V. HUNTER
Western Editor, *American Machinist*

THE employment of the inverted-spindle drilling machine has become more common during late years as new uses have been found for which its special merits render it adaptable. A common use is for deep-hole drilling, because of the chip clearance obtained when the drill is in an inverted position. Another is for that class of work that can be more conveniently held when standing upon the face that is to be drilled. A third class uses this type of drilling machine to avoid handling operations on the work. Thus, work that is being transferred from station to station while standing in an upright position, can be drilled on its lower face without having the workman expend effort in rolling it over and then again setting it upright.

It is said that experience gained in highly productive shops shows that it is cheaper to operate the drilling, tapping or boring spindle from the vertical position for the top surface of the work, drill the sides and ends with spindles in the horizontal position, and finally use inverted spindles for the bottom surface.

Construction of the Machine

The Defiance Machine Works, Defiance, Ohio, is building a line of inverted multiple-spindle drilling machines for the applications that have been mentioned. A belt-driven machine of this type is shown in Fig. 1. It has eleven spindles and was built for a special automotive job. The clearly apparent tendency of the designer was to keep as much of the mechanism as possible inclosed in adequate housings, which both protect the working parts from dirt and chips, and provide inclosures for the oil used in the lubricating system. Nearly all parts of the mechanism are oiled either by forced-feed, gravity-flow or by splash and spray. It is intended to have all internal working parts constantly running in a mist or spray of oil.

The base and column are a single casting of box construction, with broad finished bearing surfaces to which the unit parts of the mechanism are attached. The drive mechanisms for the speeds and feeds have been designed on the unit principle, and they are usually inclosed in compartments that have been cast integral with and on the outside of the main body casting. The column has finished square ways planed and scraped on its front face, upon which the work-holding fixture slides.

Method of Driving

A short drive has been planned from the pulley shaft to the spindle gear, in order to eliminate unnecessary lengths of shafts and bearings. Ball or roller bearings are used wherever the bearings are subjected to heavy service, in order to cut down the power losses. Although the feed drive can be controlled separately, the spindles can be stopped only by shifting the belt to the loose pulley.

When motor drive is used, the motor is mounted on a pedestal bolted to the rear of the column and base, Fig. 2. It drives through a silent chain inclosed in a grease case, and its starting mechanism is a push-button control switch located conveniently for the operator.

Spindle Drive Mechanism

The drill spindles, together with their driving mechanism, are housed in a separate casting bolted both to the base and to flanges on the front of the column. A single shaft carries the drive from the mechanism in the column to the speed-gear trains of the spindles. Since the machines are intended for single-purpose work, it has been possible to design the drive for each spindle so that its speed will be best suited to the diameter of the drill that it carries. The speed may vary considerably with the spindles of a single machine. Machines range from those with a large number of small spindles, such as shown in Fig. 1, to others with a few

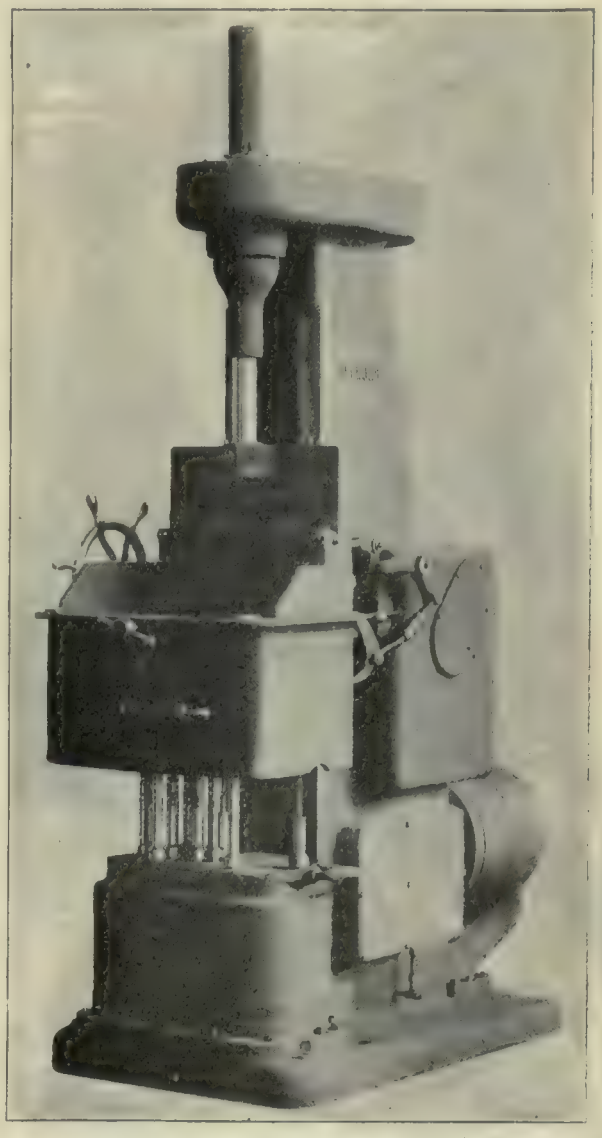


FIG. 1. DEFIANCE BELT-DRIVEN DRILLING MACHINE WITH 11 INVERTED SPINDLES

heavy spindles, as represented by the four-spindle machine shown in Fig. 2. The spindle drive gears are cut from steel and heat-treated.

Spindle Protection

The exclusion of dust and chips from the spindle bearings and drive mechanism is an important consideration in the design of inverted-spindle drilling machines. The plan adopted by this builder uses a sleeve with a conical base over each spindle, the base slipping over another sleeve that fits in the spindle opening in the top chip-plate. Felt washers are placed to exclude any

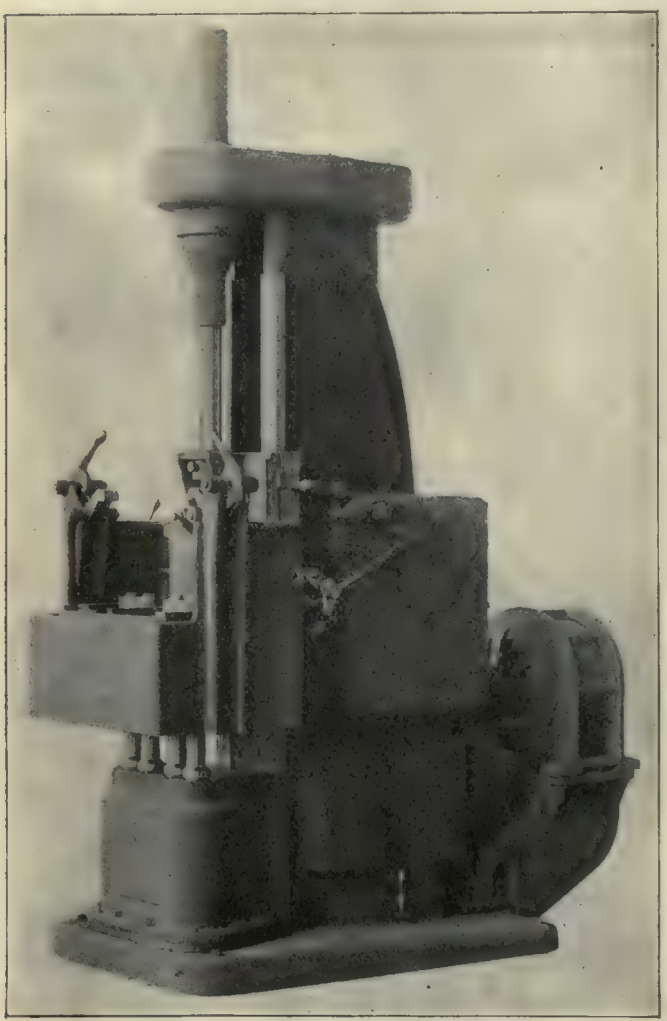


FIG. 2. MOTOR-DRIVEN MACHINE WITH FOUR SPINDLES FOR HEAVY DUTY

dust that might work up between the two sleeves. The chip-plate covers the top of the spindle housing and is but a mere shell that leaves a thin compartment surrounding the spindles and over the tops of their bearings. This compartment has an opening at each end, one of which is free and the other is connected by a pipe, shown in Fig. 1, with a vacuum exhaust line that can periodically be used to draw away any accumulations of dust in the compartment.

Workslide and Fixtures

In contra-distinction to the upright type of drilling machine made by the concern, the design of the inverted type provides for a stationary spindle housing, and the work is carried on a movable workhead that lowers it onto the drills. The workhead is mounted on a long saddle having square and flat-faced ways on the face of the column with adjustable gibs for taking up the wear. The outer face of the saddle is finished with a sliding bearing to permit adjustment of the work fixture when it is necessary to raise or lower it to suit different lengths of drills or depths of holes. A rack and pinion drive is provided for changing the position of the workhead on the saddle, and a screw clamp is used to fix it in place. The drill spindles are also equipped with collets that provide for individual adjustment, to care for the uneven grinding of the drills in a set.

Feed Drive Mechanism

The screw-feed rod reaches vertically from its housing in the top of the column to a bracket that extends forward from the casting of the workslide saddle. The feed screw is placed so that it will be located as nearly over the center of the area covered by the drill spindles as the nature of the work permits. It is claimed that this design occasions less side-thrust and twist on the saddle, and so makes possible greater accuracy in drilling. The feed-screw drive gears are located in a housing on the top of the column and are driven by a vertical shaft, inclosed in the column, from the main jackshaft in the base. The weight of the workhead and saddle is balanced by a counterweight that slides inside the column.

The range of feed may be set for automatic operation by means of the dogs that are adjustable on a slide on the side of the saddle (see Fig. 2). At the end of the down feed the upper dog engages a lever that throws off the feed and at the same time throws the feed-screw into reverse. This operates as a rapid return that quickly lifts the workhead until it has cleared the drills, and then another dog operates the lower lever on the side of the column and throws the feed-gear train into neutral. After the work has been replaced in the fixture, a single movement of the lever again throws the feed-gear train into operation and the cycle is repeated.

The Work Fixtures

These machines have been designed as units of production lines or systems, and between the different machines the work is carried on roller conveyors that bring the pieces up even with the locating face of the fixture, onto which it may be easily slid. The work is usually locked in place by a few quick-acting levers, such as shown. The clamping of the piece is thus a matter of only a few seconds, as is fitting for a machine producing standard parts in large quantities.

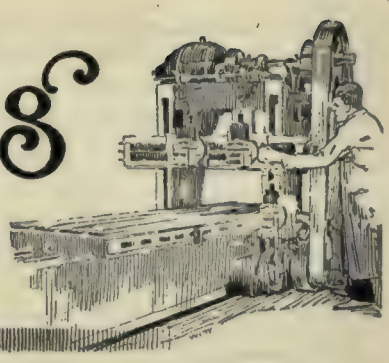
Machines of this type have also been made for reaming, for boring and for tapping in multiple. When the machine is intended for use on a multiple tapping operation it is necessary to arrange the feed of the screw to be equal to the lead of the taps. For occasions when taps with different pitches are run in the same job, it is necessary to arrange their spindle speeds so that they all run with the same lead.

Both the lubricating oil and the coolant solution are carried in reservoirs that are cast integral with the base of the machine. Gear-driven wing pumps are used for circulating these fluids. The oil level in its reservoir is constantly shown by a glass indicator on the side of the base. The operator is thus able to see the oil being fed to the bearings, so that he may be certain that the machine is being properly and continuously lubricated, an important point on a machine operating continuously.



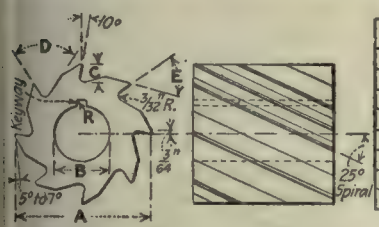
Metal Cutting Tools.

By A.L.DeLeeuw



VIII. Consideration of Milling Cutters Continued—Chip Breakers—Spiral Teeth—Action of Face and End Mills

THE previous chapters should not be considered a *theory* of milling cutters but merely a working hypothesis, just as the first chapter merely gave the writer's way of visualizing for himself what happens when a planer or a lathe cut is taken. The hypothesis



SIZE No.	A	B	C	D	E	R	No. OF TEETH	KEY-WAY
2½	1"	3/8"	65°	50°	1/32"	8	5/32"×5/64"	
3	1"	11/16"	65°	50°	1/32"	8	5/32"×5/64"	
3	1¼"	11/16"	65°	50°	3/64"	8	5/16"×3/32"	
3½	1¼"	15/32"	60°	50°	3/64"	10	5/16"×3/32"	
3½	1½"	9/32"	60°	50°	3/64"	10	1/4"×1/16"	
3¾	1¾"	15/32"	60°	50°	3/64"	10	1/4"×1/16"	
4	1½"	1/2"	60°	50°	3/64"	10	1/4"×1/16"	
4½	2	5/8"	60°	50°	1/16"	10	5/16"×3/32"	

FIG. 127. DIMENSIONS OF SLABBING CUTTERS

s of value to the writer because he has used it to explain o himself the action of milling cutters as he observed t, and, what is more, it has enabled him to predict what vould happen under a given set of conditions, thus naking it possible to steer clear of troubles and annoy- ng limitations. In that sense the hypothesis as presented nay be of value to others. Unfortunately, no funda- nental observations have been made in regard to chip ormation with the exception of the previously men- ioned experiments by Professor Nicolson. A certain mount of special apparatus and a great deal of time nd skill would be required to carry out experiments nd collect data. Until such has been done we will have o satisfy ourselves with a hypothesis which has at east the merit of not disagreeing with known facts nd phenomena.

We will now apply the ideas brought out in the last hapter to the construction of milling cutters of that lass where the teeth are formed on the outside of a ylinder, or, to be more correct, on the outside of a ody of revolution. (Let us say, for the reader not amiliar with geometrical terms, that a body of revolu- ion is a body which might be formed in a lathe.)

When the body on which the teeth are formed is a ylinder the cutter is called a plain or spiral cutter, ccording to whether the teeth are parallel with the xis or are wrapped spirally around the body. When he body is a cone or part of a cone, the cutter is called n angular cutter, and when the body is of some other hape, it is called a formed cutter.

Plain mills are used only for narrow work or where ome peculiar condition does not permit the use of spiral eeth; in all other cases, spiral mills are used. Orig- nally, plain as well as spiral mills were made with very fine teeth; they were, in fact, rotary files. Later on the teeth of cutters were spaced further apart and one can find in handbooks, treatises on milling, and various magazine articles a variety of rules and formulas to determine the proper number of teeth for a given mill- ing cutter. The writer does not know on what these rules were based, nor is it of any importance, for a series of experiments and tests conducted by him in 1908, and after, showed conclusively that the tooth spac- ing then in use or recommended, was far from econ- omical. This spacing was about ⅜ in., so that, for in- stance, a 3½-in. cutter would have from 28 to 32 teeth.

At the present time teeth of milling cutters are spaced according to requirements. The spacing of a cutter used for slabbing heavy steel work is entirely different from that of the little cutters used for the grooving of sewing machine needles. For the present we will con- fine ourselves to those cutters which are used in general machine-shop practice. Such cutters are now made almost exclusively with spiral teeth. It has been found that, all things considered, an angle of spiral with the axis at 25 deg. is most advantageous. Until a very few years ago an angle of 10 deg. was most commonly used.

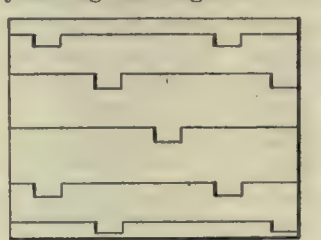


FIG. 128

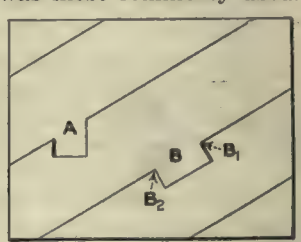


FIG. 129

FIG. 128. CHIP BREAKERS ON PLAIN MILLING CUTTER.
FIG. 129. CHIP BREAKERS ON SPIRAL CUTTER

It was found that a rake angle of 15 deg. was very suitable for milling steel, whereas an angle of about 8 deg. was more suitable for cast iron. It was also found that a clearance angle of 5 deg. would give the best results for slabbing steel, whereas an angle of 10 deg. was better adapted to cast iron. For general purposes a compromise has been made, so that such a cutter used for general purposes will have a spiral angle of 25 deg., a rake angle of 10 deg., and a clearance angle of 7 or 8 deg. The spacing recommended is about 1½ to 1⅝ in. from tooth to tooth, but this distance must necessarily vary with the size of the cutter. Fig. 127 gives the dimensions for slabbing cutters from 2½ to 4½ in. in di- ameter.

Cutters of this style are often called high-power, or wide space, cutters. The name high-power cutters

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is rather misleading as it gives the impression that such cutters are not adapted to the lighter work. As a matter of fact they are adapted to light as well as heavy work under almost all conditions. They consume much less power for a given cut than the old style cutters with many teeth, no rake, and a small spiral angle. Tests made by the Cincinnati Milling Machine Co. and described in the "Treatise on Milling and Milling Machines," show that the mere reduction of the number of teeth in a cutter had the effect of increasing the amount of metal removed per net horsepower from 0.442 to 0.731 in. A comparison between a cutter with 25-deg. spiral, 10 teeth, and with 10-deg. rake, and another cutter with the same angle or spiral, the same number of teeth, but no rake, shows that the first cutter will remove 1.074 cu.in. per net horsepower, whereas the second cutter—the one without rake—removes only 0.724 in. Comparing the old style cutter with many teeth and no rake with the new style cutter with few teeth and the 10-deg. rake, we find that the modern cutter will remove 1.074 cu.in. against the old style cutter's 0.442 cu.in. of metal per net horsepower, or almost two and a half times as much.

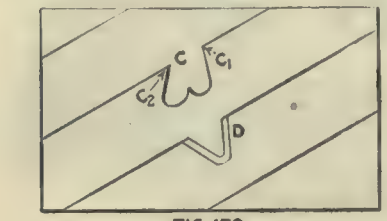


FIG. 130

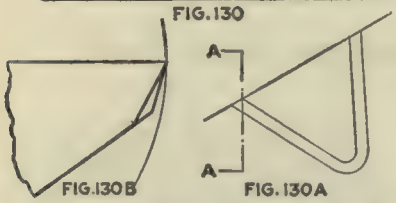


FIG. 130. OTHER FORMS OF CHIP BREAKERS

Putting this in another way, we notice that much less power is required for a given cut when we use the new style cutters, so that a weaker machine can be used for doing the same work; or, if the same machine is used, it will be strained to a less extent, less heat will be developed, and if the piece of work is of delicate section, the work will spring less. If, then, conditions will allow it, a wide spaced cutter should be used when a milling machine is hardly sufficiently powerful to do a given piece of work, and particularly when pressure and heat developed in the cut would have a tendency to distort the work. In other words the wide spaced cutter shows its usefulness in a more decided fashion when we use it for light work than for heavy.

In the previous articles we have discussed the reasons why rake and a small number of teeth should cause freer cutting action. We have also seen that in order to avoid shock it would be well to have a great many teeth and a large spiral angle. As a rule, the tendency to chatter is not very great with a 25-deg. angle and especially not if the teeth are cut with rake. There are a few cases, however, where the sections of the work to be cut are so thin that it would spring under the cut if an attempt were made to remove a large amount of metal per tooth; and so it will be found that there are individual cases where better results are obtained with the narrow-spaced than with the wide-spaced cutter. However, in all cases where the nature of the metal and the method of holding the work will permit, rake should still be used as well as a large spiral angle.

There are cases where rake is not desirable. If, for instance, we should have to cut lead, we would be compelled either to use a cutter without rake, or else with such a large amount of rake as to make the shape of the teeth resemble a sharp knife. The reason for this is that, after the cutter tooth has penetrated into the metal, there is a tendency to pull the cutter downward; in other words, it will gouge itself into the work if there is rake. This same would be true if the tooth were very sharp, like a knife, but in that case the power required to separate a chip from the body of metal would be so little that the pressure would not be sufficient to make the tooth penetrate further. For all practical purposes, it is well to use cutters without rake where we have to cut metal of the nature of lead. On the other hand where we have metal of the nature of cast iron, an impure heterogeneous mass composed of hard crystals and impurities and, consequently, with the tendency to act as an abrasive on the cutting edge, we must do all that is possible to strengthen the body of the tooth, so that a large amount of rake is not permissible, not because the large amount of rake would not make the cutting action easier, but because the sharp edge would soon be dulled by the action of the grit in the material.

It was customary to notch the teeth of slabbing cutters for the purpose of breaking up the chip. This was particularly useful with plain milling cutters, and almost to the same extent with milling cutters with a small spiral angle. Breaking up the chip would leave a little bit of metal uncut so that the next tooth would have to take an irregular amount of metal along its cutting edge, that is, it would have to remove a little bit more where the previous tooth had a chip breaker. The introduction of this little irregularity would quite effectively prevent chatter in many cases. However, it was found that the corners of the notches were the weak places in the milling cutter. They were the first points to dull and, of course, if a single point of the milling cutter has become dull, the rest must soon follow.

In Fig. 128 is shown a plain milling cutter with chi

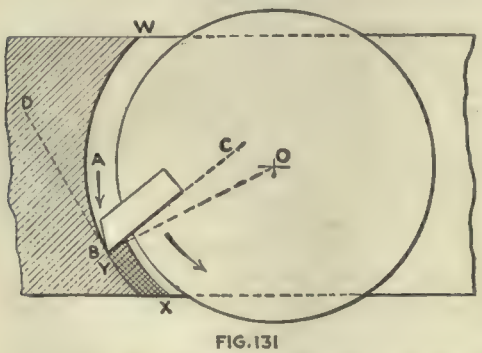


FIG. 131

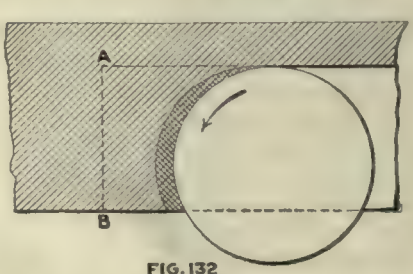


FIG. 132

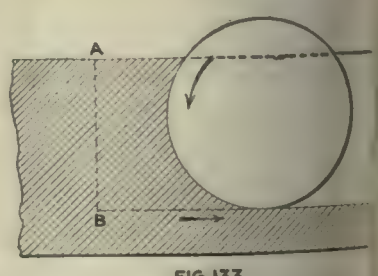


FIG. 133

FIG. 131. PLANER ACTION OF FACE MILL. FIG. 132. FACE MILL WIDER THAN CUT. FIG. 133. SAME AS FIG. 132 BUT WITH OPPOSITE FEED DIRECTION

reakers as they used to be made. It will readily be een that the edges of the notch have no clearance, so hat the corners must soon dull. Fig. 129 shows the ame kind of chip breaker in a spiral cutter. In *A* they re shown cut in such a way as to make the axis of the hip breaker coincide with the direction of movement f the cutter. Again, there is no clearance at the two dges. At *B* a chip breaker is shown cut at right-angles o the edge of the tooth, showing that there is clearance t the point *B*, but negative clearance at the point *B*. n Fig. 130 a different kind of chip breaker is shown. he one shown at *C* consists of two notches intersecting

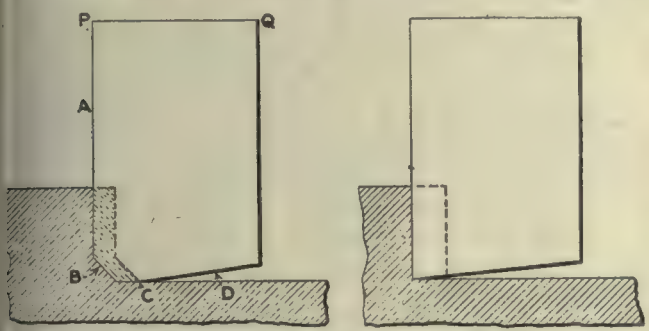


FIG.134 FIG.135

IG. 134. CORRECT FORM OF FACE MILL TOOTH. FIG. 135. AN UNSATISFACTORY METHOD OF GRINDING TOOTH FORM

ach other so as to provide clearance at both points C_1 nd C_2. The chip breaker seen in Fig. 130A is of a ifferent nature. This chip breaker is drawn to an nlarged scale in Fig. 130B, and shows that, due to its eculiar shape, all points in the arrow (which is the irection in which the cutting takes place) are in a ower plane; that is, closer to the center than the cut- ing point *A*. In other words, all points of this chip reaker have clearance. Not only was it found that the orners of chip breakers, when not properly constructed, ould give out before the rest of the cutter, but it was

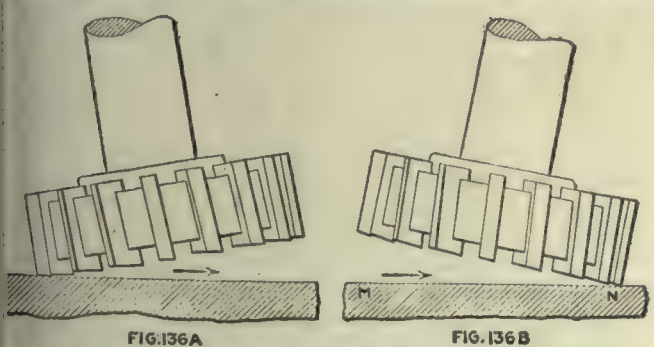


FIG.136A FIG.136B

FIG. 136A. MILLING MACHINE SPINDLE LEANS LEFT. FIG. 136B. SPINDLE LEANS TO RIGHT

lso found that the chip breaker, however well con- tructed, would reduce the life of the cutter. Wherever here is a chip breaker in tooth No. 1, there will be a ittle bit of metal left which was not removed by that ooth and which must be removed by the next tooth, so hat a part of tooth No. 2 will have to take a cut twice s large as would otherwise be required. In practice t will be found that a portion of a tooth lying directly ehind the chip breaker of the previous tooth will dull nd break down before any other part of that tooth. Fortunately, it was also found that chip breakers are ot at all required when the angle of 25 deg. is used. Though wide spaced cutters with a 25-deg. angle spiral re still made with chip breakers, this may be con- sidered merely another case of human inertia. No perceptible difference can be found in the action of a properly constructed spiral cutter with or without chip breakers.

With the cutters so far considered, the finished surface of the work was produced by the cylindrical surface of the cutter sweeping over it. When the finished surface is produced by the sweeping over it of the end surface of the cutter, then the cutter capable of doing this work is called a face mill. In almost all cases the action of the face mill is entirely different from that of the spiral mill. Two cases must be considered here: (A) when the diameter of the cutter is greater than the width of the work to be milled, and therefore when the full width of the work is swept by the cutter; (B) when less than the full width of the work is swept by the cutter.

Fig. 131 illustrates the first case. The cutter is here again represented as having only one tooth. It has advanced a distance equal to the thickness of the shaded portion in the sketch, and now removes this section just as a planer tool would, except that this latter tool would move in a straight line instead of in a curve. Two sides of the blade are at work. A part of the bottom of the blade removes the thickness of the chip from the metal to be finished, and the vertical edge going through *B* separates the chip from that portion of the metal which will be removed later on.

In a roughing cut the depth of cut is probably several times the feed per tooth, so that such a milling cut corresponds to a planer cut with a relatively fine feed. In other words, the side of the tool does practically all of the work. Let us take, for instance, an 8-in. mill having 10 teeth, taking a cut $\frac{1}{4}$ in. deep and with a feed of 8 in. per minute. Let us suppose that the cutting speed is 60 ft. per minute, which corresponds to a spindle speed of about 30 r.p.m. This means that $30 \times 10 = 300$ teeth pass a given point per minute. In that time the cutter has advanced 8 in. so that the feed per tooth was 8/300 in. per tooth, or approximately 25/1000 in. Such a cut, then, would correspond to a planer cut of a depth of $\frac{1}{4}$ in. and a feed of less than $\frac{1}{32}$ in. This shows that less than $\frac{1}{32}$ in. of the bottom of the tooth comes into action, whereas $\frac{1}{4}$ in. of the side of the tooth is at work. It is often erroneously thought that the bottom of a face mill is doing the work, and for that reason many people grind the bottom of the teeth of their face mills to a perfect plain surface at right angles to the axis. As a result, they get the same effect as if they were taking a planer cut of only $\frac{1}{32}$ in. feed with a tool 1 in. in width, allowing the entire inch of width to drag over the work. We would never think of doing such things while planing, yet it is the most common way of taking cuts with a face mill. The shape of the tooth should correspond to the shape of a planer tool used under such conditions, and this is the round-nosed tool. However, to grind a large number of round-nosed tools all held in one body to exactly the same shape, and have them all stand out to the same diameter and to the same depth would be exceedingly difficult.

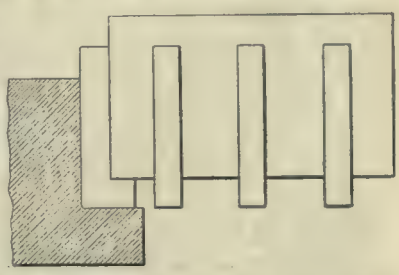


FIG. 137. TYPICAL END MILL CUT

For this reason, we give the face mill tooth a somewhat different form: we compromise, and give it the form as shown in Fig. 134. The side *A* is the cutting side. The corner *B* is beveled at an angle of 45 deg.,

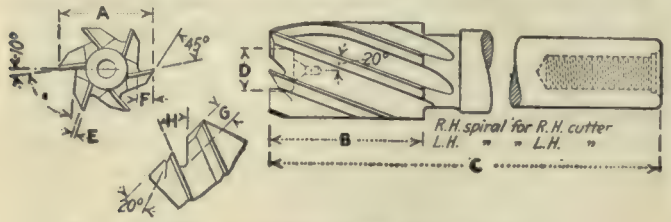


FIG. 138. COMMON TYPE OF END MILL

to give the tooth a shape somewhat approaching that of a round-nosed tool. The land *C*, which is in the plane of the finished work, is kept short and should not exceed $\frac{3}{16}$ in. The portion *D* is ground away at a slight angle, generally 3 to 5 deg. The width of the cutter *PQ* must be kept fairly large to give it sufficient strength and sufficient bearing in the body if it is an inserted blade, or to give it enough chip clearance if it is a solid face mill. But for cutting purposes the portion *D* does not come into play.

Realizing that trouble is experienced if the full width of the tooth rests on the work, many shops grind the teeth of their face mills as shown in Fig. 135. In this case, the bottom of the tooth is not ground to a right angle with the axis, but is relieved at a slight angle, often not more than one degree. This manner of grinding is not satisfactory. In the first place, there is a sharp corner which reduces the life of the cutter, as has been mentioned before. In the second place, each succeeding tooth striking over the work leaves a little groove of triangular section, and produces an unsightly, scratched appearance, as there is no flat—or land—to remove this scratched-up surface.

It was said that part *D* of the cutter blade is not in action. This would be true if the spindle of the milling machine were at perfect right-angles to the work. However, such is never the case. Take for example a vertical milling machine, and it will be found that the spindle leans either one way or the other. In Fig. 136A, the milling machine spindle leans to the left, and the work feeds to the right, as shown by the arrow. In this case, the portion *D* of the blade does not act. If, however, the spindle were leaning to the right and the work were feeding to the right, then a portion of the work *M* which has passed the leading tooth, would gradually come to the position *N* where it would meet a tooth standing at a somewhat lower level, and the portion *D* of the blade would remove a slight amount of metal. If the entire bottom of the blade were straight, then this tooth would have to take a slight finishing cut the entire width of the blade which would probably cause chatter. The bevel given to this portion *D* prevents this condition and will finish up the work smoothly and without causing chatter.

In Fig. 132 a condition is shown where the cutter does not sweep over the entire width of the work. In this case, we have a condition approaching the action of a plain milling cutter, because the initial depth of the cut is zero. There would be the same tendency for the cutter to crowd away from the work as in a plain milling cutter, only in this case the conditions are very much more favorable to the cutter. With a plain milling cutter—or a spiral cutter for that matter, we might want to take a cut 4 in. wide, of a depth of $\frac{1}{8}$ in., and the cutter would have to penetrate the work for this entire width of 4 in.; whereas the tendency to hold the cutter down is caused only by the fact that after the cutter has once penetrated there is a layer of metal above the blade which requires, to a certain extent, vertical pressure to shear it off. This layer, however, is thin, so that the resistance against penetration is very great and the tendency to hold the cutter down is relatively small. When we have a condition as represented in Fig. 132, where we will suppose that we are also removing $\frac{1}{8}$ in. of metal, we have the condition of a plain milling cutter taking a cut $\frac{1}{8}$ in. wide, and of a depth equal to the distance *AB*, which may be 4 in. or even more. Recapitulating, in one case, we had a cut 4 in. wide and $\frac{1}{8}$ in. deep; in the other case a cut 4 in.

A	B	C	D	E	F	G	H	J	No. OF TEETH	No. OF TAPER
$\frac{1}{4}$"	$\frac{11}{16}$"	$2\frac{5}{32}$"	$\frac{3}{32}$"	$\frac{1}{64}$"	$\frac{3}{64}$"	$\frac{3}{64}$"	20°	90°	4	4
$\frac{3}{8}$"	$\frac{3}{4}$"	$2\frac{7}{32}$"	$\frac{1}{8}$"	$\frac{1}{64}$"	$\frac{1}{16}$"	$\frac{1}{16}$"	20°	90°	4	4
$\frac{1}{2}$"	1"	$3\frac{7}{32}$"	$\frac{3}{16}$"	$\frac{1}{32}$"	$\frac{3}{32}$"	$\frac{3}{32}$"	20°	90°	4	5
$\frac{3}{4}$"	$1\frac{5}{8}$"	$5\frac{3}{32}$"	$\frac{5}{16}$"	$\frac{1}{32}$"	$\frac{5}{32}$"	$\frac{1}{8}$"	30°	90°	4	7
1"	$1\frac{7}{8}$"	$5\frac{15}{32}$"	$\frac{7}{16}$"	$\frac{1}{32}$"	$\frac{5}{16}$"	$\frac{3}{16}$"	30°	90°	4	7
$1\frac{1}{2}$"	$2\frac{1}{4}$"	$7\frac{1}{8}$"	$\frac{5}{8}$"	$\frac{1}{32}$"	$\frac{1}{4}$"	$\frac{1}{4}$"	25°	75°	6	9
2"	$2\frac{3}{4}$"	$9\frac{3}{32}$"	$\frac{15}{16}$"	$\frac{1}{32}$"	$\frac{9}{32}$"	$\frac{1}{4}$"	30°	70°	8	10

FIG. 139. DIMENSIONS OF END MILLS

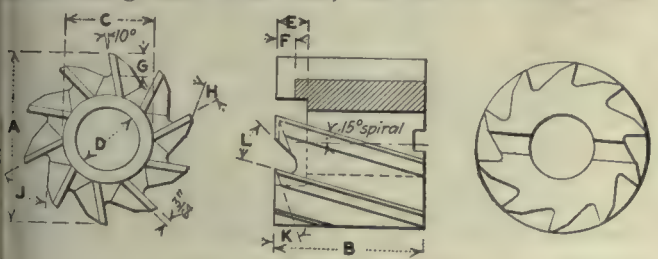
deep and $\frac{1}{8}$ in. wide so that the effects of the comma-shaped chip are almost negligible in the face mill. However, there are cases where the depth of cut is quite great, and the width much less than in the case represented in Fig. 132. If, for instance, we should have to take a cut as shown in Fig. 137, we should not overlook the fact that we will have conditions resembling the plain milling cutter much more than the face mill.

Finally, there is the case shown in Fig. 133. As a rule, such conditions can be avoided, but often it may be found desirable to take a cut such as illustrated. In Fig. 132 the cutter entered the side of the work which was left standing, whereas in Fig. 133 it enters the side of the work which has to be removed. If the distance *AB* were very small, the cutter would have a tendency to drag the work in the direction of the arrow; we would take up the lost motion in lead screws, etc., the cutter would dig in, and might cause a wreck. Where the depth of the cut is considerable—such, for instance, as shown in Fig. 133—there is still the same tendency, but the resistance offered by the metal from *A* to *B* is so great that such a cut can be taken without any danger of pulling the work into the cutter. The writer remembers a case where an extremely heavy cut had to be taken, the section of metal to be removed being about 4 in. wide, about $3\frac{1}{2}$ in. high, and, being of irregular shape, of a cross-section about 10 in. square. The instructions were to do this with one cut, but the shop men, fearing that the cutter might break under this extremely heavy duty, tried to do it in two cuts. As a result several cutters were broken and always on the second cut. When the cut was taken in one single operation no cutters were broken. The reason was that the distance *AB* had become small on the second operation so that the cutter would pull the work in with resulting disaster. When the entire amount of metal was removed in one cut there was enough distance *AB* to prevent the cutter from pulling the work in.

Face mills, even more than plain mills or spiral mills, are made in innumerable sizes, from $\frac{1}{8}$ in. up to 10 ft.

The smaller sizes are commonly called end mills. There is no distinct line of demarcation where the end mill stops and the face mill begins. Speaking broadly, end mills are used more for cuts such as represented in Fig. 137; face mills for ones like those in Fig. 131. When a mill of the face mill type is made in one with the shank, it is always called an end mill. When it is keyed or screwed or bolted to the nose of the spindle, it is always called a face mill. When the mill itself is made separate from the shank, and either keyed or screwed or shrunk onto it, it is sometimes called the one and sometimes the other. Fig. 138 is a typical end mill. As the action of an end mill in a large number of cases is the same as that of a spiral mill, the teeth are generally mounted spirally around the body. Sometimes they are parallel to the axis. Again, they are sometimes made with, and sometimes without, rake. They may be made right and left hand, that is, so that they will cut when the spindle is turning in a right-hand or in a left-hand direction, and furthermore the spiral may have a right-hand or left-hand slope, and that regardless of whether the mill is for right-or left-hand rotation. Whether a right- or left-hand cutter should be used depends entirely on the direction of the spindle. In a duplex machine both right- and left-hand cutters would be used.

Whether the cutter should be made with or without rake depends largely on the nature of the cut to be taken. As the difficulty of sharpening the cutter is somewhat greater with rake, and end mill without rake



A	B	C	D	E	F	G	H	J	K	L	No. OF TEETH
1¼"	1¼"	27/32"	1/2"	5/16"	7/32"	7/32"	45°	70°	20°	30°	8
2"	1⅝"	1 1/16"	¾"	⅜"	7/32"	¼"	45°	60°	20°	30°	10
2½"	2¼"	1⅜"	1"	½"	9/32"	5/16"	50°	60°	20°	35°	10
3"	2⅜"	1½"	1"	⅜"	11/32"	⅜"	50°	60°	15°	35°	10
4"	2¼"	2¼"	1"	¾"	7/16"	½"	50°	60°	15°	35°	10
5"	2⅝"	3"	1"	⅞"	½"	9/16"	50°	60°	15°	35°	12
6"	2⅝"	3¼"	1"	⅞"	9/16"	⅝"	50°	60°	15°	35°	12

FIG. 140. DIMENSIONS OF SHELL END MILLS

nay be preferable, provided the cuts are light and especially when materials other than steel are to be worked. t is actually better to use end mills without rake for rass, hard aluminum alloys, etc.

These mills are shown with tapped hole for draw-in olt, though quite often cutters of this description are nade with a tang. The writer would like to discourage he use of a tang for end mills. The drive of the end nill should be accomplished by the intimate contact beween the shank of the mill and the taper of the spindle. When this intimate contact is destroyed, the mill can o longer produce good work, regardless of whether it s driven or not. The tang would keep on driving the nill, and the operator would not notice that the fit etween mill and spindle had been destroyed. With a raw-in bolt intimate contact is assured and if this ontact is not sufficient to drive the mill against a certain cut, the only thing to do is to use a mill with heavier shank or drive in some other way.

When the end mill is used over a very small portion of its length only, spiral teeth are of no benefit. But where it is used as an ordinary spiral mill, the spiral is of as much importance for smooth action as it is for spiral mills mounted on an arbor. On mills of this latter class a spiral angle of 25 deg. was recommended. If this angle were used on end mills a very sharp and rather weak point would be formed where the spiral teeth join the end teeth, so that an angle of not more than 20 deg. is recommended for end mills. Fig. 139 shows a tabulation of the main dimensions of some sizes of end mills.

There has been quite some controversy as to whether a right-hand or left-hand spiral should be used on a right-hand end mill. Experience has taught the writer the following: where a considerable portion of the length of the end mill is used for a cut, and where the material is steel or any other material forming strong chips, the spiral should be the same hand as the cutting direction of the mill; that is, a right-hand end mill should have a right-hand spiral, whereas a left-hand end mill should have a left-hand spiral. The right-hand spiral on a right-hand end mill has the tendency to pull the chips away from the work. If the spiral were the other hand, the chips would be crowded toward the work and would have to be chewed up by the mill in order to get out of the way. The only reason given for making a right-hand mill with a left-hand spiral is that the same cause which would pull the chips away from the work would also be the cause of pulling the mill out of the spindle. This argument is of very little strength. The pull is not sufficient to cause any trouble when the shank of the mill has a fair fit in the spindle. Besides, if the mill is of any considerable size it should be held in the spindle by a pull rod or draw-in bolt.

When end mills are used for profiling on a hand-operated profiling machine, it is generally desirable to use them either without spiral or with the spiral in the opposite direction from that recommended for ordinary practice. The spiral would act against a tendency of the cutter to cut too deep or below size.

The end teeth of an end mill should be treated just like the ends of the blades of a large face mill; that is, the corners should preferably be beveled, a very small land at right angles to the axis should be provided and the rest of the teeth should be relieved. It used to be customary to extend the teeth of an end mill to a point

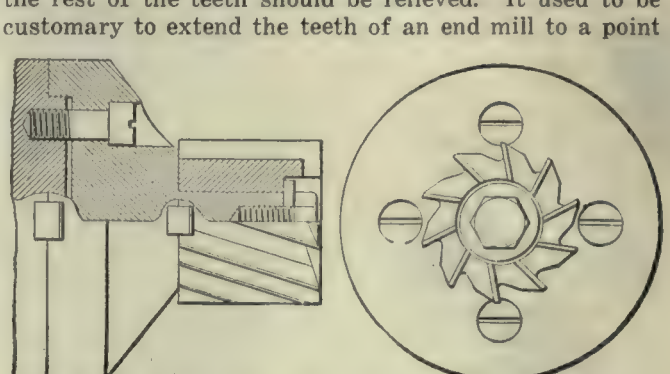


FIG. 141. ADAPTER FOR DRIVING LARGE SHELL END MILL

as close to the center as it was possible to bring them, apparently with the idea that these long teeth would add to the cutting quality or the life of the cutter. As a matter of fact, all they did was simply make the grind-

ing so much more difficult. The present end mills are counterbored, and the counterbore is made as large and as deep as one dares to go without danger of weakening the remainder of the teeth too much. A deep counterbore makes it possible to grind the cutter many more times. It may be said that the length of life of an end mill is proportional to the depth of the counterbore. To a certain extent the counterbore also assists in keeping the cutter cool, for with a sufficient supply of coolant the counterbore will be filled and the body of the cutter will be cooled from the inside as well as the outside.

When end mills get to be beyond a certain diameter, it is no longer profitable to make them solid, though lately this matter has not been of as much importance as it used to be. Until a few years ago all end mills were made out of a single piece of steel, which was of the diameter of the largest part of the end mill. The mill part itself might be only 2 in. long, but the shank might be 7 or 8 in. For an end mill of 4 in. diameter, a piece of high-speed steel 4 in. or more in diameter and 9 or 10 in. long would be required, whereas this high-grade metal was only required for 2 in. of its length. Nowadays, the shanks are often made of carbon steel and welded to the high-speed cutter. There is, of course, always the possibility that the weld is not perfect, so that, to a certain extent, welded cutters are viewed with suspicion. The writer's experience has been that welded mills can be made quite successfully and without any more danger or breakage than solid cutters. In fact, it is possible to select for the shank a material which has greater strength than the high-speed steel itself. It is, however, necessary to do the welding in the proper way, and to allow enough extra metal on both shank and cutter for a flash. The amount of extra material to be allowed for a weld should be equal to one-fourth of the diameter at the weld for each of the two pieces. If, for instance, the diameter of the cutter at the weld is to be 1½ in., then an extra length of ⅜ in. should be allowed for the cutter and also for the shank. Another point of importance in making welded cutters is to make the weld at a point where both pieces are of the same diameter. Of equal importance is the necessity of employing a butt-welding machine of sufficient capacity.

Fig. 140 shows a tabulation of the dimensions of some sizes of shell end mills. A shell end mill is in some way assembled with its shank. The methods of assembling vary considerably. For ordinary work, and even quite heavy work, the shrinking method can be very successfully used. By this method the stub end of the shank which is to enter the shell is made from one-half to three-fourths of a thousandth larger than the bore of the shell. The shell is provided with a keyway and a key is laid in the stub end of the shank. Placing the shell in hot water expands the bore sufficiently to allow the shank to be driven in with light taps. To remove the shell it is again placed in hot water, which will expand the bore sufficiently for the shank to be driven out without much trouble. Care should be taken not to make the amount of shrink too great for a shrink naturally sets up heavy strains in the shell and might cause it to break, particularly across the corner of the keyway. This danger does not need to be taken too seriously if the proper dimensions for shank and bore are selected.

Though the shrink drive gives quite good results for light and medium cuts, it is not quite sufficiently positive for heavier cuts. When the shrink is no longer sufficient to do all of the driving, the key which was laid in the stub end of the shank must do part and may be all of the driving and has a tendency to split th cutter. Breakage of shell end mills by splitting at th keyway is quite a common occurrence when this styl of drive is used. For this reason it is preferable to d the driving by means of a cross-key at the rear surfac of the mill. This method is shown in Fig. 140.

Though this cross-key assures a good drive betwee the shank and the end mill, yet it does not solve th problem of driving the shank positively. It may b quite easy to give a powerful drive to a 2-in. end mil by means of a No. 12 B. & S. taper, but such a driv would not be sufficient for a 6 in. shell end mill whe it is used to its full cutting capacity. Fig. 141 show how this difficulty may be overcome by making a adapter which is driven from the spindle by means of cross-key, which in its turn drives the mill by mean of a cross-key, and which is centered on the spindle nos

Ordering Materials by the Month

By Peter F. O'Shea

The cost of keeping an inventory of materials on han is so great, especially of late, that if even a small pa of this material is stocked longer than is absolutel necessary, waste is involved that should be eliminate The favorite method of maintaining stock is by max mum and minimum method, so that when the stoc sinks to a certain dangerously low point it is at onc renewed; but the supply is never raised above a ce tain maximum. Between these two limits, howeve there is considerable margin, which varies from mont to month, so that at certain periods of the year c during a dull season the stock will last a long time.

The Ritter Dental Manufacturing Co. finds that saves a great deal of this time and speeds up its tur over of raw materials by keeping stock on the basis c one-month's parts. Each month the manufacturing re quirements for the next month are determined, and sheet is issued to each department showing the co responding quantity of each part that is to be made. similar sheet goes to the raw-material stores' clerk He looks up his inventory cards and sees whether o not the required quantity is on hand. This quantit in a given month may be less than the former minimum If a barely sufficient supply is on hand no new orde is placed.

This method came in especially handy when the re cent slump struck the market and caused a decrease i output. It is a more flexible method than the estab lishment of a standard maximum and minimum. O course, the stores' clerk or the purchasing departmen should adjust its maximum and minimum to suit trad conditions, but this frequently is a very complicate matter requiring skill and judgment, and, therefore, i likely to be overlooked in the stress of routine work Moreover, a card upon which several changes of maxi mum and minimum have been made does not remai very neat.

A Man's Greatest Mistake

By F. C. Bryant

The sketch appearing on page 272 of the *America Machinist* has, I believe, a wrong caption.

The caption should read: "The Man Who Is Makin His Greatest Mistake." For it is the writer's firm belief that the man who ventures nothing is making greater mistake than he who tries much and fails.

Methods of Motor Assembly

Assembling the Essex Pistons and Connecting Rods—Testing Squareness of Pistons—The Testing Room and Motor Stands

SPECIAL CORRESPONDENCE

THE proper assembling of motors has more to do with their satisfactory performance than many seem to realize. In some cases good workmanship on the motor parts is neutralized by lack of care in assembling and the completed motor may be no more satisfactory than one which is carefully assembled from parts not so accurate.

Without going into extreme details, the following illustrations show the high spots in the assembly of the Essex motor. As the way in which a motor is assembled has much to do with its running qualities it is interesting to note the care taken in the various operations shown.



FIG 1. ASSEMBLING PISTONS AND CONNECTING RODS

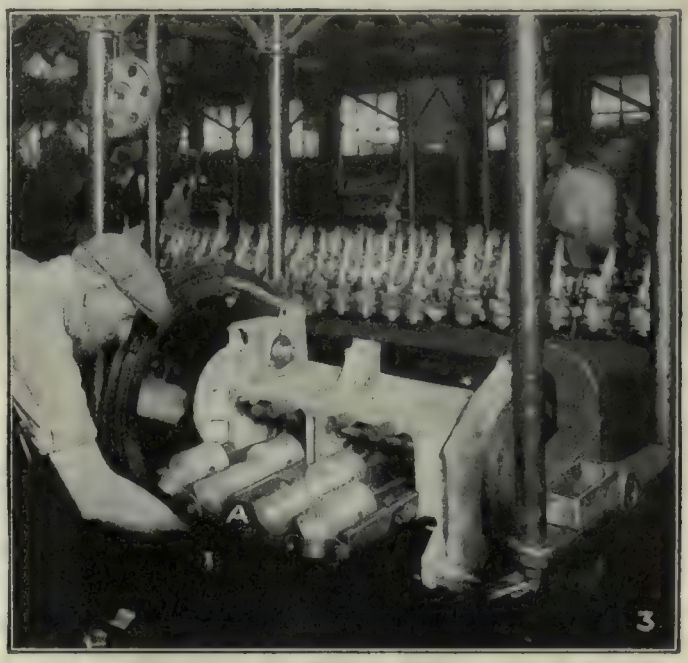


FIG. 3. TESTING SQUARENESS OF PISTONS

Fig. 1 shows the piston-pin bushings being pressed into the connecting rods and the rods being assembled to the pistons by means of the floating piston pins shown. Three assembled pistons and rods are shown against the back of the bench in the foreground, the piston pins being tried in the rod bushings before being assembled, as can be seen.

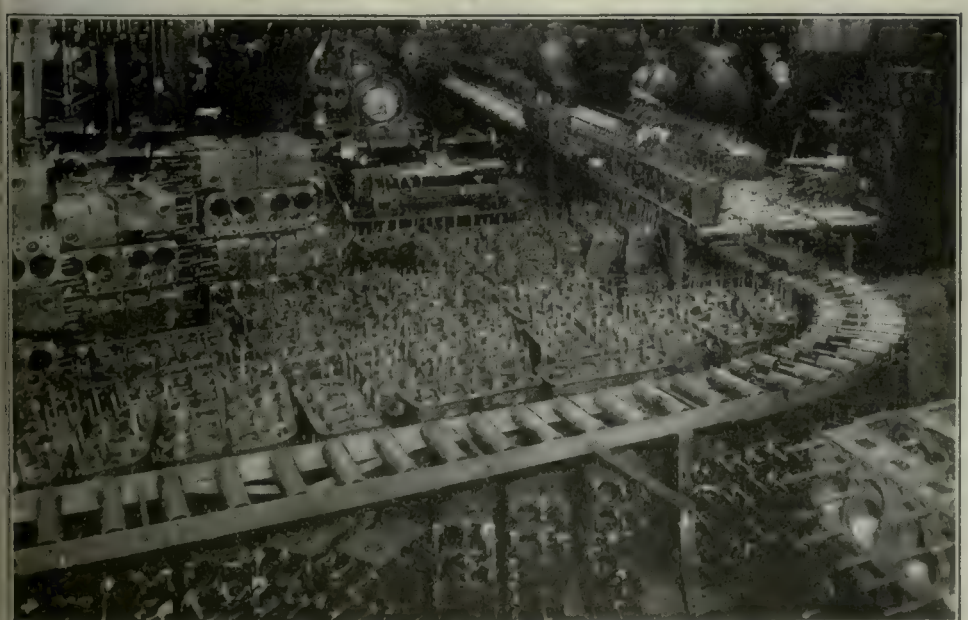


FIG. 2. STUDDING CYLINDERS FOR ASSEMBLY

The cylinders are studded before going to the assembling department, a lot being shown in Fig. 2. They are moved to the assembly department on the roller conveyors shown.

Before fastening the cylinder block to the engine base or crankcase the crankshaft and camshaft are assembled in the revolving frame shown in Fig. 3. Here a testing block *A*, which is in the form of half a cylinder block, is bolted into place, and the connecting rods and pistons tested for squareness at different points of the stroke before the cylinder block is put into place. It will be noted that the cylinder



FIG. 4. TRAVELING ASSEMBLING STANDS USED

block studs are protected by short lengths of rubber hose which keep the threads from injury and also safeguard the knuckles and elbows of the operators. The timing gear *B* is hung where it can be conveniently reached when the assembler is ready for it.

After being assured that the piston movements with relation to the crankshaft are correct the cylinder blocks are put in place, the line proceeding as in Fig. 4, by means of the carriers which are supported in the overhead track at *A*, with side thrust rollers as at *B*. Moving along this track, the department shown in Fig. 5 is reached. Here the oil pans or lower halves of crankcases are put on, the timing gear covers put in place and the motors are then ready for the block test.

The motors are handled by the overhead crane shown in both Figs. 5 and 6, the latter showing the kind of hook or tongs used in lifting the motors. The motors can be quickly handled and placed in the proper stands without delay by this device.

Fig. 6 gives an idea of the size of the testing room and also shows the convenient arrangement of the testing stands. The motor is clamped at four points, as when in the car. The inlet and exhaust connections are readily made by means of the quick acting handles *A* and *B*. The thermometers *C* and *D* show the temperature of the cooling water as it goes into and leaves the motor. Drop pans are provided and the funnel *E* carries off any surplus oil and makes it easily possible to keep the floor of the testing room clean and free from oil and grease.

There are electrical connections on every stand, both for testing the starter and supplying current for ignition. A little examination of the floor construction will show that the stands are located over a sort of subway which carries all piping and wiring and which is readily accessible by lifting one of the floor plates as *F*.



FIG. 5. ASSEMBLING OIL PAN AND TIMING GEAR COVER

The Oakland Motor

One of the reasons that assembling methods differ widely in various motor shops is on account of the difference in production. As the production increases it becomes necessary to introduce new methods which allow a steady flow of material from one end of the department to the other, from the time the material enters the department until the completed motor is on the way to the test stand. The view in Fig. 7 shows the cylinder blocks starting on their way from the final machining operation to the assembling department. Plain slides are used in this case. One of the first assembling operations is to insert the studs which hold the main

bearing caps in place. A crankshaft balancing machine is shown at *A*. The connecting rods and pistons are fed into the lines as the motor blocks pass toward the further end of the room.

In Fig. 8 we have the beginning of the "burning in" of the crankshaft bearings. The cylinder block is clamped in position at *A*, the handwheel *B* making the operation very easy. The transmission at *C* is driven by an electric motor and allows various speeds to be easily obtained. It will be noted that the cylinder block has simply been switched off the main line for "burning in," and after this has been accomplished it swings back into the line and goes on toward final assemblage.



FIG. 6. THE MOTOR TESTING ROOM

Fig. 9 shows one of the motors with the crankshaft and flywheel in place and the six pistons with their connecting rods in the cylinders but not in place on the shaft.

After the connecting rods are put in position the cylinder block is again switched off the main line and goes to another motor as shown in Fig. 10 to have the connecting rod bearings "burned in," as with the main bearings. Fig. 10 also shows very clearly the method of clamping and the ease with which it can be done. The slide *A* is provided with the handle *B* so as to allow it to be easily moved into clamping position. The clamping screw *C* is provided with a good-sized handwheel and handle which allows rapid clamping.

After the final "burning in," the oil pan or lower crankcase is put in position, the motor turned over and mounted in the cradle shown at *A*, Fig. 11. This cradle has casters which run in the channel irons shown. Mounted on the cradle the motor is moved along for



FIG. 7. STUDDING FOR BEARING CAPS

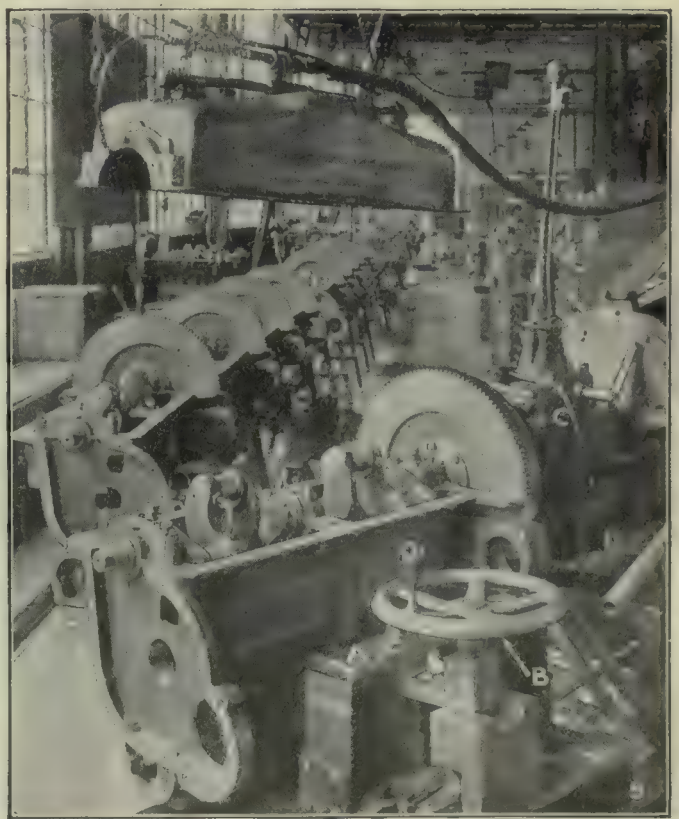


FIG. 8. "BURNING IN" MAIN BEARINGS



FIG. 9. PUTTING IN PISTONS AND RODS

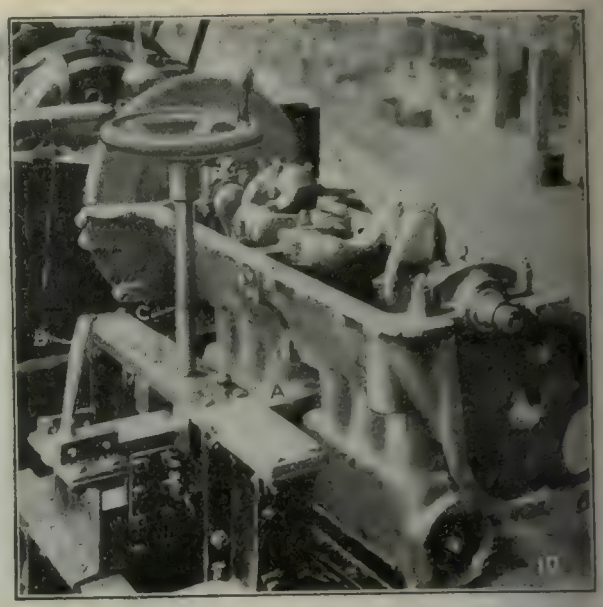


FIG. 10. "BURNING IN" ROD BEARINGS

further assembling, including the putting on of cylinder heads, valves, starter and generator. At the end of this runway is a small overhead crane which carries the motors to the testing stand.

Different devices are used for running in crankshafts and connecting rods. Fig. 12 shows the machine used in Plant No. 3 of the Studebaker factory in Detroit. The rods are mounted on the crankshaft, which is placed in the machine and held by the four bearing caps shown. The crankshaft is driven from a belted pulley at the right, the upper end of the connecting rods being guided by the plates *A* and *B*. The plate *B* swings down over the end of the rod, confining the ends of the piston pins in the ways shown and guiding the upper end of the rods during the running-in operation. The cover *C* is let down over the rods to keep the oil from being thrown over the shop.

Part of the Ford Assembly

A busy portion of the Ford motor assembly department is shown in Fig. 13. This view also gives something of an idea as to the method of using conveyors of various kinds and the way in which the motors are handled generally. The motors are brought in from the left along the cross runways shown, being mounted on small special trucks, as can be seen on close examination. The overhead conveyors at each side of the picture, *A* and *B*, keep the assemblers supplied with the different parts which are to go in place. The conveyor at *A* is handling transmission covers, while the conveyor on the right handles inlet and exhaust manifolds as at *C*.

Nuts and bolts are tightened by a modified electrically driven drill as at *D* and *E*. These portable machines are provided with counterweights which travel inside the pipes *F*, the pipes being hung from small trolleys so as to be readily moved along the high beams suspended from the roof. This arrangement enables the machines to be very easily handled and to be moved as far as necessary along the track. The machines contain a friction driving device which slips as soon as the bolt or nut has been tightened to a predetermined amount.

When for any special reason it is necessary to take a motor out of the line the device shown at *G* makes it easily possible to do so, rapidly and without undue effort on the part of the worker. This device consists simply of a long lever, suspended near one end by a chain from overhead and the short end provided with a pair of special tongs as shown. Dropping the hooks or tongs into position on a motor and bearing down on the outer end of the long lever makes it not only easy to

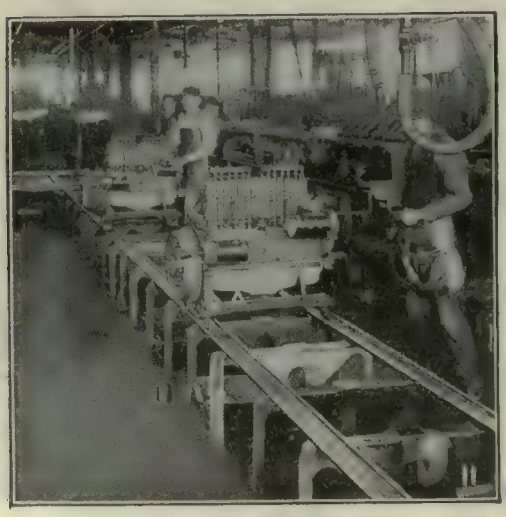


FIG. 11. FINAL ASSEMBLY STANDS

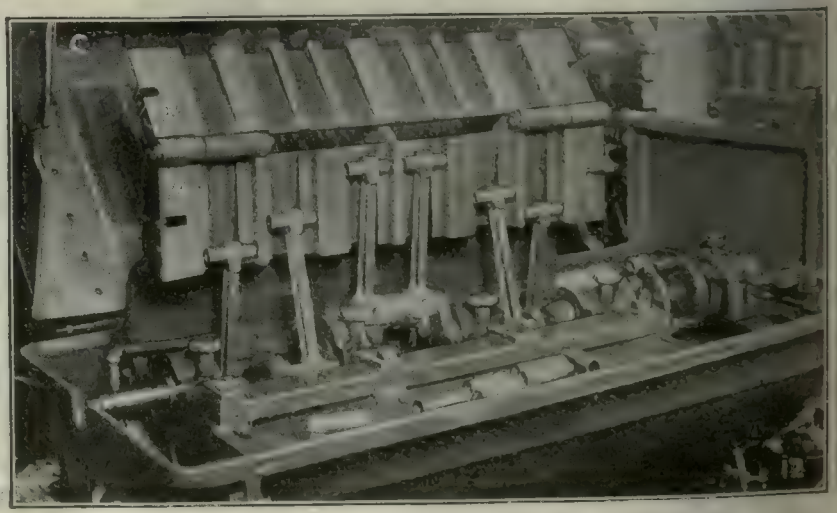


FIG. 12. RUNNING IN STUDEBAKER CONNECTING RODS

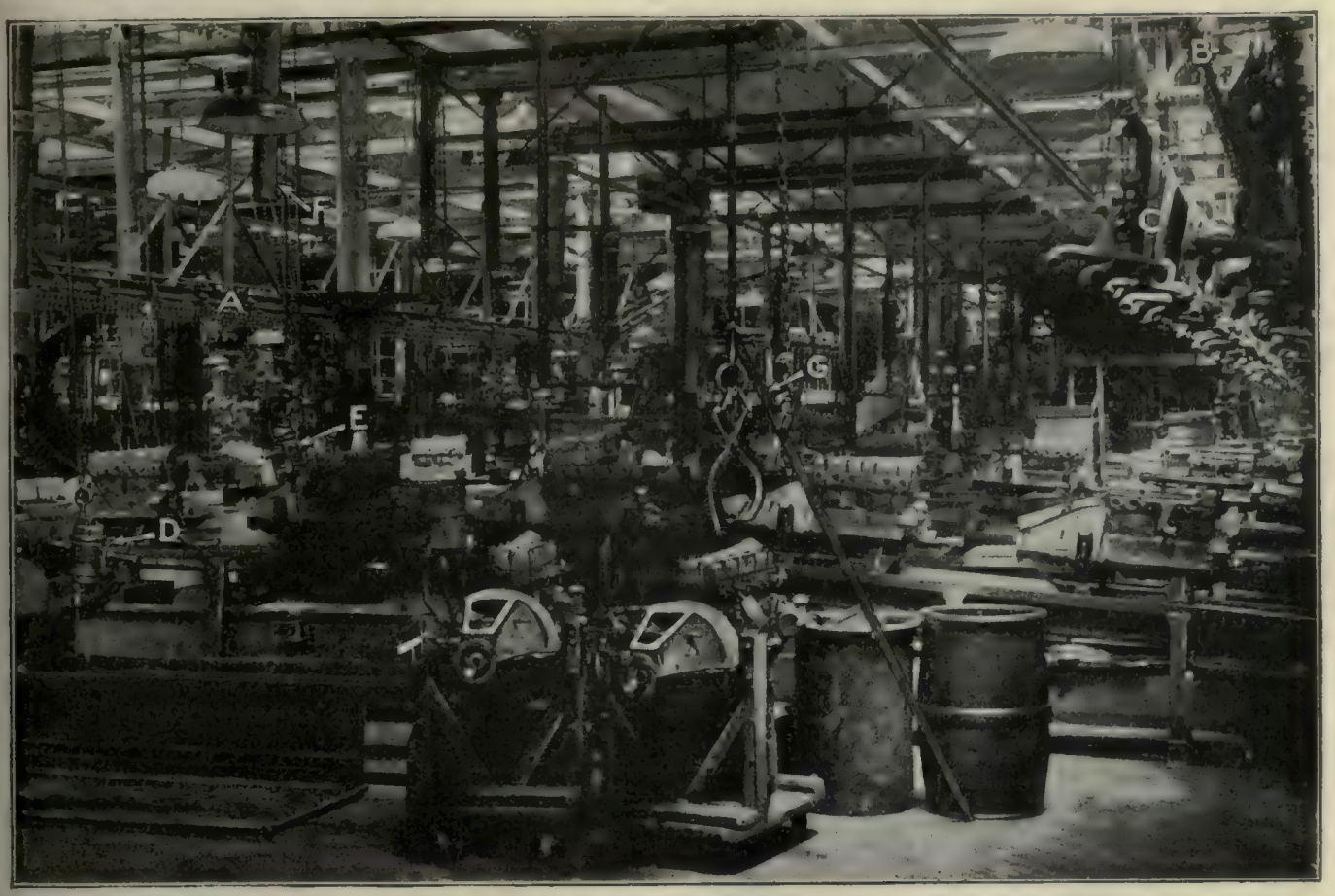


FIG. 13. A CORNER IN THE FINAL ASSEMBLY DEPARTMENT

lift the motor but to swing it out of place and on to the stand shown

After the motors pass down the tracks they come to the testing department as shown in Fig. 14. Here both manifolds may be seen in position and the motor is ready for the final running-in.

The motor is mounted on the stand shown, each stand being provided with an electric motor capable of driving it at the proper speed. Each motor is provided with a full equipment of electrical instruments and this test definitely measures the load or power required to run the motor, or in other words the friction load.

It has been found that as the motors are set up in assembly it requires about 90 amperes to start them. This must decrease to 25 amperes at the end of a ten-minute run or the motor goes back to find the cause of the extra friction. This method makes a very accurate way of measuring the internal friction of the motor, and shows the maximum friction load that will be required while the motor is new and the bearings tight.



FIG. 14. RUNNING TEST FOR FRICTION

More Advice on Packing

The *Journal* of the American Bankers Association has this to say to those who contemplate going into South American markets:

The transportation problems in Central and South America are scarcely known in this country. Few people realize the transfers necessary and the various kinds of transportation used to convey an article from the United States to Bogota, Colombia, a city of 150,000 inhabitants, 700 miles up the Magdalena River and more than a mile and a half up in the air. Few people realize that ocean steamers can ply the Amazon River and its tributaries into countries on the west coast. In other words, Ecuador and Peru on the west coast have navigation facilities from both the Atlantic and the Pacific oceans.

On the other hand, most of the commerce in Central and South America travels on mule back, llama back and wagons, on difficult paths or no paths at all, and the goods must be packed properly to stand the strain and to enable them to be carried by vehicle or animal.



The Foreman and His Job

Suggestions for live foremen who wish to go up the ladder; and for firms who want better shop executives

By Fred H. Colvin
Editor, American Machinist

THERE is a general complaint that the average worker lacks interest in his work—that quitting time and pay day are the two main factors in his mind. This is too true in many cases, but it is the penalty we have paid for over-specialization in industry; for developing machining methods at the expense of the individuality of the worker. We are learning, however, that interest can be stimulated and that it is much better for all concerned when this is done.

In the old days the apprentice often lived with the owner of the shop. He knew all about the work that came in, its difficulties and the way they were overcome. He heard the problems discussed, he saw just how the work was done and in many cases helped to do it. The machinist was of necessity an all around man who usually handled a job from start to finish and it was very natural that he should be keenly interested in it. But his interest would have been killed at once if he had only drilled one size holes in the same piece day after day, without even knowing what the piece was to be used for.

Humanizing Methods

The new methods of sub-division of work are here to stay, but they must be modified and humanized so as to consider the personality of the man who does the work. For without this you cannot secure interest, and without interest, production lags, the man becomes dull or sullen and there is no joy in the work.

Interesting men in their work may be easy or difficult, depending on both the work and the men. Exact directions or rules are out of the question, but suggestions can and will be given. These suggestions can be modified by the firm's attitude or policy, but a liberal attitude on its part will be of great help to the foreman. If the management insists on the old policy of keeping the men in ignorance of their work, the foreman who wants to climb into bigger and better work, had better hunt a new connection—he cannot grow much in such a place.

The direct question is how can a foreman help to interest his men in their work?

First of all by being sure that they understand what they are doing and why. If the department makes only a part of the complete product, let them know about this part, what it does, why it must be made well and what the output must be to keep the production of the whole plant up where it belongs. Keep the idea of quality always uppermost. Show them the advertisements and point out that it is the job of the shop to try to make every claim come true to the customer.

Be sure that each man knows just what his part plays in the complete unit. Show how slighted work will affect the whole product—how this hurts the reputation of the firm and means loss of orders, laying off of men and harms all concerned.

The Materials They Use

The more the men know about the material they work with, the better. It is another point which can be emphasized to increase interest. Where does the iron and copper and coal come from—how is it mined—how does it get here—what does it cost? How do we get brass and aluminum? What is the difference between brass and bronze?



THERE IS A GENERAL COMPLAINT THAT THE AVERAGE WORKER THINKS ONLY OF QUITTING TIME AND PAY DAY

Photographs of the product in use in various parts of the country—and of the world—together with maps with the distance marked from the factory to the different points, all help to arouse interest in the work.

If there are foreign workers, any photographs of their own country, particularly in connection with the product, can hardly fail to arouse and maintain interest.

Connecting the Worker and His Work

The main thing, however, is to connect the individual worker with his work; to make him see how his work connects with the next operation, or if he spoils this



IN THE OLD DAYS THE APPRENTICE OFTEN LIVED WITH THE OWNER OF THE SHOP

piece, that he has wasted the labor of all who have worked on it previously. The cost of the material and of the labor, the delay to the completion of the product by spoiled work, and all such problems, will help in promoting the family feeling which marked the small shop of the olden days.

Some of the more progressive shops are trying the experiment of training men to do two or more operations as a means of increasing their interest. If this means the finishing of the piece, so much the better, for the completed product means more to anyone than a small part of the work possibly can. This must be done cautiously, however, because temperaments vary widely and it may not always work. And whatever you try, do not count on perfect results every time—we are bound to be disappointed at times. A thing that will work perfectly with one man may fail with the next owing to a difference in the temperament or training of the individual.

There is another factor which must be reckoned with also. When some kinds of men have grown accustomed to repetition work they often lose the desire for a change, they become almost automatons and do not care to change. But we must not forget that men who grow to want their thinking done for them in the shop are also very apt to let others think for them outside of the shop, in civil or community life.

And we have no means of being sure that the *right* men will act as leaders. It is much safer to have men think for themselves both in the shop and out.

Mechanical Facts Usually Interest Men

The most common shop operations involve interesting mechanical facts and contain valuable lessons. They also afford many opportunities of rousing interest of various kinds and degrees, depending on the mentality of the men being dealt with. Much also depends on the personality of the foreman and the way in which he approaches the men.

When dealing with uneducated types, with men who have never had opportunities for learning, a sort of big brother attitude will usually secure confidence and interest. The main thing is to show that you are absolutely square in all your dealings, for nothing is more appreciated, even by the most ignorant.

The man who snags castings can be told about the wheel he uses, the millions of little pieces of diamond hardness that cut small pieces of metal as the wheel rubs against the iron, has its appeal to many minds, even of the helper type. The way the abrasive is made in electric furnaces with electricity which comes from the water power of Niagara or other great water falls, can be made interesting. The molding and baking of the wheel, the need of care in making the wheel so that it will not burst, and what happens when it does burst unless guards are provided, all affect the man who snags castings. The safeguards, the use of goggles, the necessity of keeping the work from jamming between the wheel and the rest, are all points which can be used in various ways.

The Cost of Things

The prices of grinding wheels and other things are always of interest, and it is a good thing to have men know what the tools they use cost. It all helps in counteracting the notion that everything beside the cost of labor and material is clear profit—and this is the cause of much discontent.

The user of drills, even on commonplace drilling operations, will be interested in knowing how drills are made and the ways in which they should be used. The motion-picture film issued by the Cleveland Twist Drill Co. on drills and drilling has proved a great help in many shops. Other films can also be obtained and the motion picture will be found a great help in many



MEN WHO GROW TO WANT THEIR THINKING DONE FOR THEM IN THE SHOP ARE ALSO APT TO LET QTHERS THINK FOR THEM OUTSIDE OF THE SHOP

ways in interesting men in the machines they use as well as in those they build.

The motion picture can show the men how coal, iron and copper are mined and made into the commercial metals which they use. In a similar way it can show

them the uses of their own product under difficult and trying circumstances. If for example, the shop product is a motor truck, motion pictures showing the trucks pulling out of bad holes, overcoming obstacles which could not be surmounted except for good materials and good workmanship, cannot fail to put a thrill into the blood of every man who helped to build them. This of course always assumes that the management is big enough to treat its men fairly and plays its end of the game fairly and squarely. Unless it does, all work of this kind is wasted. The foundation must be right and in this case *the foundation begins at the top.*

If the worker is shown how such apparently little things as the cleaning mixture for washing machine parts, the kind of slushing compound for preventing rust and similar problems, are given close and careful study by highly skilled engineers, their own jobs take on a different aspect. The importance of little things should be impressed on each man as they frequently overlook the effect of small things on the output or the reputation of the shop. In other words, the more the average worker knows about the product and the problems of manufacturing it, the better for him and for the work.

Tools and Operations in a Railroad Blacksmith Shop

Practical Value of Sample Boards, for Heavy Work—Device for Handling Forging at Furnace and Anvil—Bulldozer Dies and How They Are Used

BY FRANK A. STANLEY

THE accompanying illustrations show some of the equipment and methods used for forging and forming locomotive and car parts in a Western railroad shop.

We are accustomed to see in certain manufacturing plants, sample boards carrying parts which are made as a regular product of the factory. These samples aid in many cases in getting tools and gages made up properly, and lead to a complete understanding as to just what a particular piece is like. They may be used in conjunction with drawings, or by themselves as a check on the accuracy of duplicate parts produced in their likeness, as they can be considered models or master parts by which manufactured pieces may be checked. It is not often, however, that the sample board is used to any extent in connection with such heavy work as locomotive and car forgings. As a matter of fact, there is no place in which such sample boards are more useful than the railroad blacksmith shop.

In Fig. 1 are shown some large sample boards with forged parts made at the Southern Pacific shops in Sacramento, Cal. These boards have proved of great aid in the production of certain classes of parts. As a rule a drawing or sketch for a blacksmith in a railroad shop or elsewhere, does not carry any extra number of dimensions, and if the regular machine-shop blueprint is used there are apt to be so many figures of no importance to the blacksmith that they lead to more or less confusion. Consequently, a real sample of the forging is often an aid in keeping before the blacksmith just what the part is to be like when it leaves the anvil. He may measure or caliper any portion of the sample forging for duplication of a dimension and such samples also form a check on the accuracy of general forgings, as well as for numerous other parts.

The shops referred to above do a great deal of forging, forming and bending work and many bulldozers and other tools are used for forming engine and car parts. Some of this work is illustrated in the accompanying half-tones. In Fig. 2 is shown a frame forging under way with the work in the fire and the outer end clamped between angle sections *A* for holding in the chain sling. The forging is turned by a form of pilot wheel *B* which enables the work to be handled in the fire and under the hammer without difficulty.

Bulldozer dies are used for forming draft sill reinforcing plates, truck frame parts, car corner irons, drawbars, carry-irons, etc. The dies shown in Fig. 3 are for manufacturing push-pole corner irons for box cars. The corner iron as formed is shown resting on one of the dies at the right. Corner irons are made right- and left-hand, two of each for a car. The material is open hearth steel $\frac{3}{8}$ in. thick, sheared to $7\frac{1}{4}$ in. wide and measures, after being formed to a right-angle, $\frac{33}{32}$ in. on the one leg and $15\frac{1}{8}$ in. on the other. The plate of metal is heated and placed in the dies. One stroke of the bulldozer does the work of forming the pocket and at the same time the corner is bent to a right-angle as

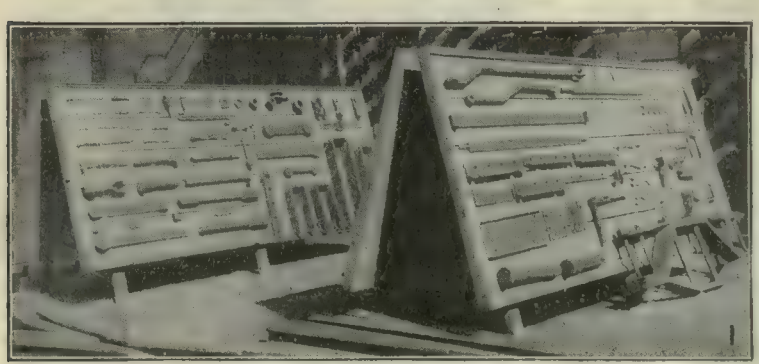


FIG. 1. THE SAMPLE BOARDS

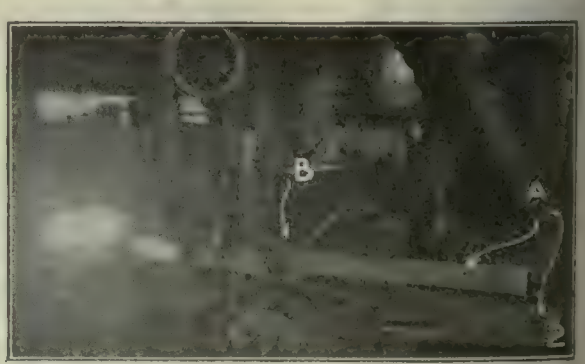
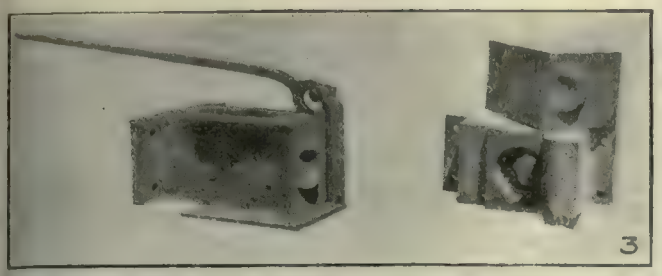


FIG. 2. A FRAME FORGING IN THE FURNACE



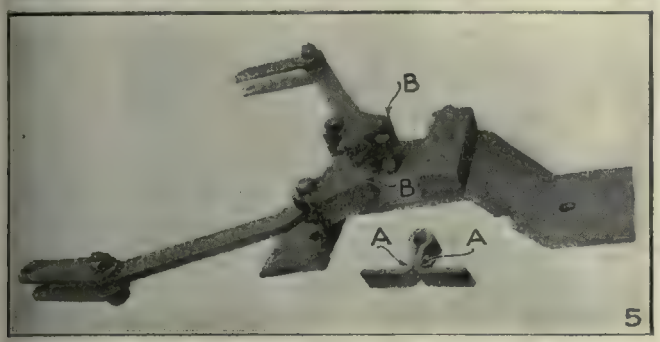


FIG. 3. DIES FOR CORNER IRONS
FIG. 5. BENDING DIES FOR FLOOR RACK HINGES



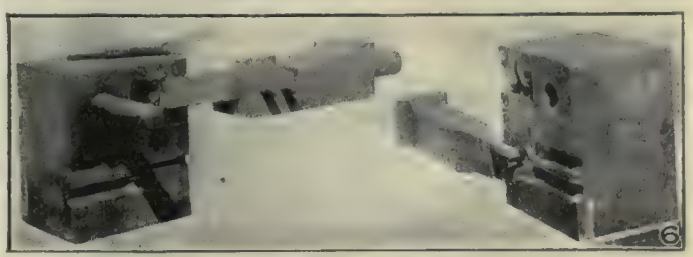


FIG. 4. DIES FOR DRAWBAR CARRY-IRONS
FIG. 6. DIES FOR BEADING TOOLS

shown. The dies are made of cast iron. The lever clamps the work for the forming operation. This lever is connected by a bolt to the upper end of the clamping strap and the lower horn on the fork bears against a lug on the die so that when the handle is pulled down a powerful clamping effect is exerted to hold the work against the die. The pocket in the work is 1½ in. deep from the highest point, while near the corner of the iron it runs out to nothing so that its circumference is approximately two thirds of a circle.

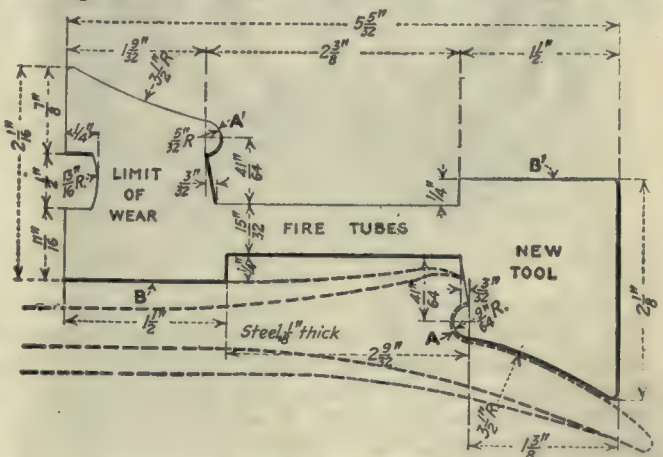
The dies in Fig. 4 are for making draw-bar carry-irons for flat cars, one of the formed irons being shown under the punch in the illustration at the right.

The operation in the bulldozer dies is forming the ends of the carry-iron at right-angles to the body, and the punching of four $\frac{15}{16}$ in. holes for bolts by which the part is afterward secured in place on the car. The material is 1 in. thick by 3 in. wide and the work is performed in the one heat.

Clamping the metal for the operation is accomplished by means of the hinged plate at the front of the die and the forked lever pivoted to the plate. The plate is provided with four clearance holes for the passage of the piercing punches and acts as a stripper for them upon their return stroke. The die block carries a steel face in which are inserted four steel dies, that are readily kept in good condition and easily replaced when worn to a point where no longer serviceable. Similarly, the four piercing punches are secured in the head by screws which allow the punches to be removed for sharpening or replaced when worn out.

The dies in Fig. 5 are bending and forming tools for hinges for floor racks used on refrigerator cars. This outfit is used in connection with a pneumatic machine having a horizontal piston connected to a toggle arrangement, for closing the jaws and bending the hot pieces of metal around the forming post at the center of the device. At the same time the jaws, in swinging around under the toggle action, form the right-angle bends in the metal at *A* and *A*; also around the corners of the jaws at *B* and *B*. A variety of work can be accomplished on this type of apparatus, different jaws of special character being used for the different classes of jobs.

Beading tools for boiler tubes are used extensively in the shops and are made in quantities for both fire and superheater tubes in the dies shown in Fig. 6. The



IG. 7. A GAGE FOR BEADING TOOLS

tools wear, particularly at the throat, where the impact is taken against the work and it is important that the degree of wear and consequent change of shape at this point be held within certain limits and so checked by suitable gages that the tools may be corrected or replaced when the wear has reached the limit established by the gages. One of the beading tools is shown lying on the top of a forging die. In making these tools in quantities of, say, several hundred at a time, the annealed octagon steel is cut to length and the $\frac{11}{16}$-in. diameter shank is turned to its length of $2\frac{3}{8}$ in. Then the blanks are heated and the operations of flattening, punching and forming the beading ends are performed by the dies. The fins are removed, the edges rounded and the tools are hardened and tempered. One of the gages referred to is shown in Fig. 7. The end at the right is for the contour of a new beading tool, the other end is for limit of wear as the tool is used. Thus at point *A* the gage has a radius of $\frac{3}{64}$ in. for the new tool while on the limit end the corresponding radius at *A'* is $\frac{5}{32}$ in. The shank of the tool rests along edge *B* for the gaging of the new tool, and along edge *B* for gaging for wear.

Magnetic Chucks—V

BY ELLSWORTH SHELDON
Associate Editor, *American Machinist*

(Continued from last week's issue)

COILS for the Blanchard chuck are wound from number 16 and 18 cotton-insulated copper wire. There are two coils in the 16-in.; four in the 26-in.; and five in the 30-in. chuck. A set of coils for the larger chuck is shown in Fig. 81 ready to be put in place. The coils shown on the truck in Fig. 82 have just come from the winding machine and are waiting to be taped.

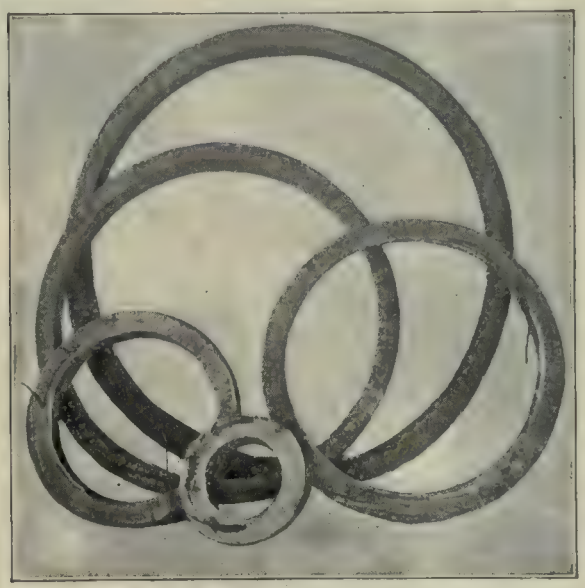


FIG. 81. A SET OF ENERGIZING COILS FOR A 30-IN. CHUCK

The coil winding and taping apparatus is shown in Figs. 83 and 84. The coils are wound upon separable wooden bobbins mounted upon the faceplate of the motor-driven winding device, which may be seen to better advantage in Fig. 83. The device is started and stopped and the speed is controlled by means of a treadle so that the operator has his hands free to guide the wire.

A skill acquired by long experience enables the operator to lay on the wire as smoothly as thread is laid on a spool by an automatic thread-winding machine. When the right number of turns is laid on (a counter on the winding device attends to the measuring) temporary binders of tape are tied about the coil and the bobbin is removed. After a sufficient number of coils are wound and tied they are wrapped with tape by the ingenious machine shown in Figs. 84 and 85.

Although this taping machine is a regularly marketed product its application is limited and it is therefore not well known. Because it is one of those devices the operation of which seems so obscure, yet when in operation is so extremely simple as to make the observer exasperated to think that he did not understand it at once, it will be described.

The C-shaped part of the frame *A*, Fig. 84, covers and forms a bearing for an interrupted ring of brass having gear teeth upon its periphery as shown in the perspective, Fig. 85. This ring is driven by two pinions spaced far enough apart so that despite the open part of the ring the gear will not run out of mesh with both pinions at the same time, and the pinions are both geared from one driving shaft so that the ring turns as readily and continuously as if it were a complete circle. The table clamps to the bench before the machine at the right height to bring the coil that is to be taped to the center of the winder. Radially disposed rollers in this table facilitate the handling of the heavy coil.

Placing a coil in position as shown in Fig. 84 the free end of the tape, drawn from a spool under the table, is wrapped by hand two or three times around the coil and drawn taut so that it will not pull away. The machine is then started and the revolving brass ring, carrying the tape with it, wraps tape around the coil as the latter is turned slowly on its axis by hand so that the tape is laid spirally. The reader will probably want to know at this juncture why the tape does not wind up on the outside of the brass ring; it does—that is why there are rollers in the channel of the ring; but the tape that is wrapping around the coil is being drawn from the *underside* of the rapidly increasing skein that is being wound onto the ring.

After the ring has made about twenty revolutions, wrapping during this time twenty turns of tape around the coil and also wrapping twenty turns about itself, it is stopped and the tape leading to the spool is cut. Upon starting again the ring continues to wrap tape about the coil, still drawing from the underside of the skein, until the wrapping is finished or the supply of tape exhausted. If the tape has been cut from the spool at the right time, these two conditions will be reached simultaneously. After the taping is finished the coils are ready for the insulating compound by which they are protected from moisture. The machinery for impregnating them consists of two tanks, one of which can be sealed against atmospheric pressure, a vacuum pump and an air pressure pump. Both tanks contain steam pipes for heating the impregnating compound. Coils to be impregnated are loosely overlaid (individually, and by hand) with a cheap porous tape and then stacked in the vacuum tank, which at this stage is empty. After the tank is filled with coils it is closed and sealed, the air exhausted, and the steam turned on. The coils are thus heated and dried in what is nearly a complete vacuum.



FIG. 82. COILS WOUND READY FOR TAPING

When a sufficient time has elapsed to insure that the coils are thoroughly dry, a valve in the pipe connecting the two tanks is opened and the liquid compound, having in the meantime been heated by the steam pipes in the



FIG. 83. WINDING A COIL

open tank, is drawn into the vacuum tank, covering the coils.

When the vacuum tank is full of compound the connecting valve is closed, air admitted to the tank, and finally air pressure is raised by the pressure pump, driving the impregnating fluid to every part of the coil.

Remaining under pressure for some moments in the hot liquid, the connecting valve is again opened, when the air pressure on the surface quickly drives the liquid back to the open tank. The excess of air pressure in the vacuum tank is now released, after which the tank can be opened and the coils taken out.

The object of the preliminary covering is now evident, as this outer layer is stripped off, taking any excess of compound with it and leaving each coil smooth. A coil thus treated is reasonably safe from the intrusion of moisture unless the latter is accompanied by some chemical that will attack and break down the compound.

Assembling the Chucks

The operation of assembling the chucks is shown in Fig. 86. Usually four chucks are carried along together, but in this case the operations are shown in progression.



FIG. 84. TAPING A COIL

Nearest the observer is a chuck body which has been cleaned and dried ready for the assembling. Next, strips of fiber are laid on the bottom of the groove (which becomes the top when the chucks are finished, for they are turned bottom side up for assembling) and other strips are stood up edgewise at either side of each groove; the object being to forestall any possible abrasion of the coils when the latter are set in place, for it is intended to have them fit rather snugly.

In the third chuck from the observer the coils have been set in, and in the chuck next the instrument board the final filling of insulating compound has been poured and the fiber cushions or bearers which eventually take the weight of the coils have been placed. Fig. 87 shows a clearer view of this last chuck; which is ready to close. In the regular assembling operation current is turned on as soon as the coils are in place and connected up, the meters showing instantly whether or not anything is wrong with the wiring. The "main poles," as the divisions between the coils are termed, are tested before the cover plate is put on,

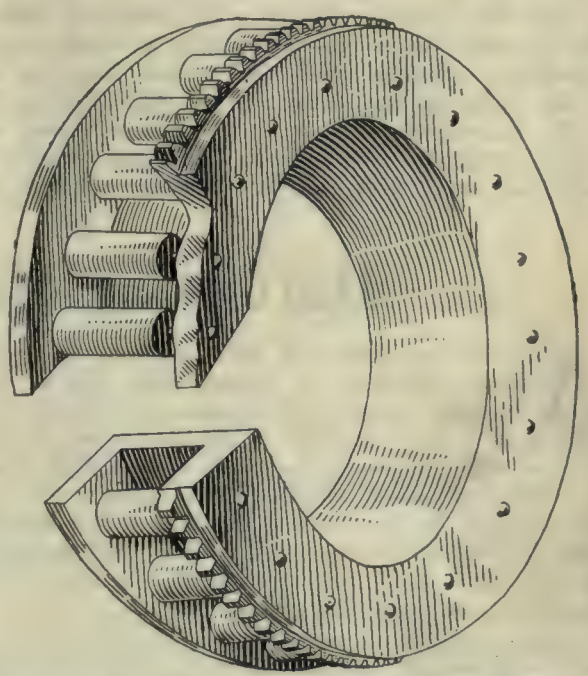


FIG. 85. PERSPECTIVE OF THE BRASS RING IN THE TAPING MACHINE

with a dipping needle which should show the poles to be alternately north and south as the center of the chuck is approached. If the needle turns over as it passes each pole it assures the assembler that the coils have been put in the right way; for it is essential to have the current flow in opposite directions in adjacent coils, else consequent poles instead of normal ones would be established and the magnetic effect would be neutralized.

The leading-in wires from the coils are not joined together from coil to coil but are all brought to the terminal block seen in Fig. 87, and here provision is

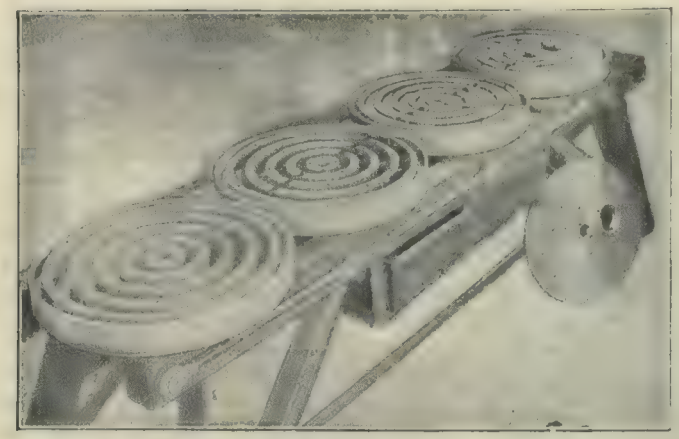


FIG. 86. CHUCKS IN PROCESS OF ASSEMBLING



FIG. 87. A 26-IN. CHUCK READY FOR THE BOTTOM PLATE

made to connect all four coils in series when the chuck is to be used on a 220-volt circuit, or to connect the inner and outer coil in series, the second and third coils in series, and the two pairs thus formed in parallel when 110-volt current is available. The current consumption in watts is the same in either case.

There is of course much more wire in the outer coil than in the others. In making up the two pairs in the above case, joining the large coil to the small one makes the combined amount of wire equal to that in the combined intermediate coils, therefore the two pairs are in electrical balance. Bringing the leading-in wires to the terminal block instead of joining them together provides a means of changing a chuck from 110 volts to 220 volts, and vice-versa, without disassembling it.

The Blanchard chuck is built for hard, heavy work and to withstand rough usage. Because much of the work that comes to it consists of rough castings, upon which the magnetic grip is far less powerful than upon smooth surfaces, it must possess more than ordinary holding power, and this desideratum is attained by the use of soft steel of high magnetic permeability for the entire magnetic circuit of the chuck; by the concentric disposition of the coils, which permits the fullest possible utilization of the space; and by the ample cross-section of the magnetic path, so that in holding work that covers large areas of the chuck surface the magnetic currents are not choked by reason of a restricted path in the chuck itself.

The Blanchard chuck shows a somewhat higher current consumption in relation to its superficial area than other chucks for the reason that the unbroken web of steel between the bottom of the brass filled grooves and the coil chambers must be saturated; but this disadvantage when compared with the amount of work turned out by the machine is so small as to be negligible.

Hardening Hammer Die Blocks

AT THE convention of the American Society for Steel Treating, in Philadelphia, Pa., a paper entitled "Hardening Hammer Die Blocks" was read by R. B. Kerr, foreman of the heat-treating department at the John Deere Harvester Works, East Moline, Ill. The methods he suggested have been in use under his direction for a number of years and are offered, as he said, "not with the idea that they are perfect, but with the hope that they may be helpful." The following is abstracted from Mr. Kerr's paper:

While die blocks can be heated successfully in either coke or oil furnaces or even in the smith's forge, a gas-heated furnace of the oven type is by far the most convenient and satisfactory for this work.

When heating dies the considerable air pressure required to burn fuel oil makes necessary the most extreme care to prevent scaling or surface decarburization in the parts to be treated. The furnace, therefore, should be of the muffle type, the heating chamber completely inclosed, or if this is not available, the die should for protection be packed face down in a gas-tight box of suitable size half-filled with charcoal, and the whole thing heated up. If the piece to be heated is of considerable size, the packing box should be made with hinged ends which fold down out of the way so that the die can be lifted out readily by grab hooks or a sling. This "safety first" method entails some extra work and inconvenience, but the results justify it. Personally, the writer can testify through considerable experience that it is better to go to some extra trouble to assure success, than to have an opportunity later on to frame up excuses that will pass when asked to explain "how it happened."

It might be said that this method of pack-hardening is excellent for heating dies and tools of nearly all descriptions. The parts come out of the packing box uniformly heated with a surface perfectly free from scale and in the best possible condition for hardening. The process is an old and successful way of heating steel. It deserves to be more widely known and practiced.

Whatever the type of furnace used or the means employed the all-important thing is to get a good heat on the die; a thorough, slow-soaking, uniform heat, for upon that depends to a great extent the success or failure of the operation. Particularly for the benefit of the younger steel treaters it may be said that thorough careful heating, more especially when handling comparatively large blocks of steel, is most essential. It is the author's opinion, based on a long and varied experience in hardening steel, that more dies and tools are ruined by careless heating than from all other causes combined.

For heating, a gas-fired oven furnace of ample capacity should be used as being most convenient and suitable for the job. If the oven is already hot, so much the better; if not, bring it up pretty well before putting in the work. Dies of any description should not be put into a cold furnace. Nothing is gained in time, and besides, some chance of surface decarburization are offered with a rapidly rising heat.

Place the die in the furnace face down, unless the nature of the impressions makes this impossible; in which event it is good practice to protect the surface from possible gases

y laying a closely fitting piece of asbestos or sheet steel n top while heating. As another precaution, if the die is f considerable size and the impressions are deep or irregu- ar, it is well to bring it up to a dull red heat, about 1,300 eg. F., and let it partly cool off in the furnace before tak- ng the hardening heat.

Heat slowly and regularly. The time required will, of ourse, vary in proportion to the heating area of the fur- ace and the size and shape of the piece to be treated. he average grade of hammer die steel will harden nicely at round 1,450 deg. F. and the heat always should be held tationary for at least 15 min. before removing the die rom the fire.

The quenching tank should be of ample size and the water upply arranged so that it can be forced upward against he face of the die with considerable force and volume, sing an overflow pipe of sufficient size to take it away. n most cases clean, fresh water is all that is necessary, ut if extreme hardness is required or if the water is soft r muddy, river water as an example, the addition of a ttle salt will sharpen it. If this is done, a loosely woven ack filled with salt and suspended in the tank will be ound most convenient. Place a resting rack across the op of the tank, arranged at sufficient depth so that the mpressions on the face of the die will be well covered with ater when the die is laid on it. On flat surfaced dies or n dies in which the impressions are shallow, a depth of rom 1 to 1½ inches is about right.

When all is ready get the piece out of the fire. If there re any dangerous looking corners or sharp projections that o not need to be hard, partly cool them off with a water et or piece of water-soaked waste to prevent chipping. lace the die on the testing rack face down and turn on he water. If the piece is wide or flat, prevent warping r crowning by keeping the back slightly cooled off; just nough water and no more. Run the hand over the face requently to find how it is cooling off.

Never let a die cool off entirely in the water. Whenever he face is cool enough to prevent the temper from draw- ng, get it out as quickly as possible and lower it into the il tank. Keep the die moving or agitate the oil.

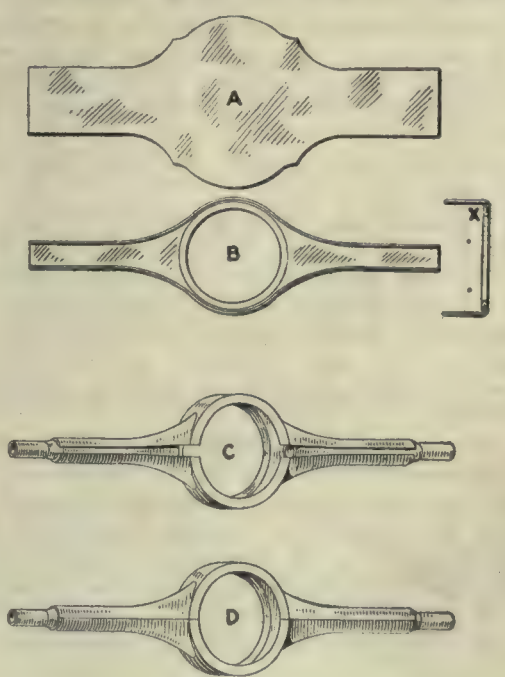
The temper should be drawn slightly on all hammer dies, oth to relieve strains and to give them resiliency or spring, s well as for better wearing qualities, and the drawing hould be begun immediately; even before the die is quite ooled off. If there is an oil tempering furnace large enough t hand, get the piece into it. Raise the temperature to round 400 deg. F. and hold it there for an hour or so. If or any reason this method cannot be used, swab the die ith light machine oil and place in a furnace partly cooled ff. Leave it there until the oil begins to flash, then remove nd allow it to cool off in the air.

As stated above, a die should never be allowed to cool ff entirely in the water. When a mass of steel at the hard- ning temperature is plunged into cold water, the grains in s outer surface immediately become set and rigid. A cer- ain amount of contraction and shrinkage also takes place, artly because of the change from high to a low tempera- ure and also because of the hardening of the metal. The mount of this shrinkage is in exact proportion to the sur- ace area of the mass being treated; the greater the area he more the shrinkage. If this change took place all the ay through there would be no trouble; but it does not. n the first place, the interior of the piece cools off much ore slowly than the outside and secondly, the setting of he grains due to hardening extends in a depth of from to ½ in. at the most. This suddenly chilled outer layer s consequently being forced against the softer mass inside ith an enormous pressure, causing distortion and strains hich become more marked as the piece cools off. When he temperature recedes to a certain stage, governed partly y the temperature of the quenching water and the air, a iolent action takes place. This is the danger point. The riction created by the molecules striving to adjust them- elves to the new conditions generates heat inside; heat eans expansion, and unless this condition is offset promptly y heat applied to the outside to relieve the strains, the ie, particularly if a large one, has about an even chance f bursting open. Whether it does or not, the strains are there and are just as liable to manifest themselves in service later on as they are to appear immediately after hardening.

Allowing the dies to remain in the water too long and failure to draw the temper promptly after hardening is responsible for considerable breakage. This is partly due to the lack of proper equipment, and also to the fact that the principles involved are not so generally understood as they might be even among steel hardeners. This heat generation by friction or, as some might call it, molecular reaction inside of a body of steel, is no pet theory, for the author has noted its effects during many years of close observation and practice in the heat-treating of steel. Furthermore, he believes it will be found in line with the natural laws governing cooling bodies. Be that as it may, the writer has found this method of hardening dies a success and can recommend it to steel treaters who are having trouble.

Erratum—The Columbia One-Piece Axle Housing

In describing the machining operations on the Columbia axle on page 27 of the issue of January 6, 1921, the statement was inadvertently made that the Columbia axle housing was made of two parts welded together.



THE FOUR STAGES OF AXLE HOUSING CONSTRUCTION

In reality the axle housing is constructed of a single piece of sheet metal so that only one weld is necessary.

The development of this axle housing from the flat sheet is shown in the accompanying illustration, in which *A* shows the blank before forming, and *B* after the first operation in which the center is drawn as shown in the sectional view at the right. It will also be noted that the center is considerably stiffened by turning in a thickness of metal as shown at *X*. This also affords sufficient thickness for tapping for the cover plate.

The operation shown at *C* folds the housing over the end tubes, while *D* shows the housing completely closed and in place ready to be welded along the single seam shown. This construction makes an exceptionally stiff axle housing and one which differs from the usual two-piece construction in the manner shown.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Air Blast by Induction

By Frank Richards

There are some facts that should be known about the economic use of compressed air, facts which we might know and remember, if there were a way of impressing them upon us.

In most industrial establishments of the present day there is a regular supply of air at 6 or 7 atmospheres, (75 to 90 lb. pressure), distributed throughout the works and constantly on tap whenever it may be required for operating pneumatic tools and other purposes, and it is a very common thing to use such air direct for blowing or for various purposes where air at very low pressure would do the work. The waste of air in this way is enormous and the only reason is in the failure to provide simple devices by which such wastes might be avoided.

As a practical object lesson I wish to call attention to the two halftones.

Take a piece of paper mailing tube, or roll up a sheet of paper about 1 or 1¼ in. in diameter and 6 or 7 in. long. Place one end close to your mouth as in Fig. 1, and blow hard holding your other hand 3 or 4 in. from the other end to feel the effect of the blast. Then hold the tube 3 or 4 in. away from your mouth as in Fig. 2 and blow through it, holding the hand up as before to feel the effect.

The actual result is astonishingly the reverse of what the common supposition is. In the case of Fig. 1, with the tube held close to your mouth, you do not feel a blast of air against your hand at all, while in Fig. 2 you feel it strong. Try blowing at a lighted candle. With the tube as in Fig. 1, the candle will not be blown out, while with the Fig. 2 position it is extinguished at once, even if held at some distance from the tube.

The explanation is: the centralized and concentrated jet of air, Fig. 2, draws into and carries with it a considerable quantity of air. In Fig. 3 we have the air flowing from one pipe *A* into another pipe *B* with an open space between them, and the arrows suggest the inrush of outside air to increase the volume. In many cases it might be practicable to have another open space

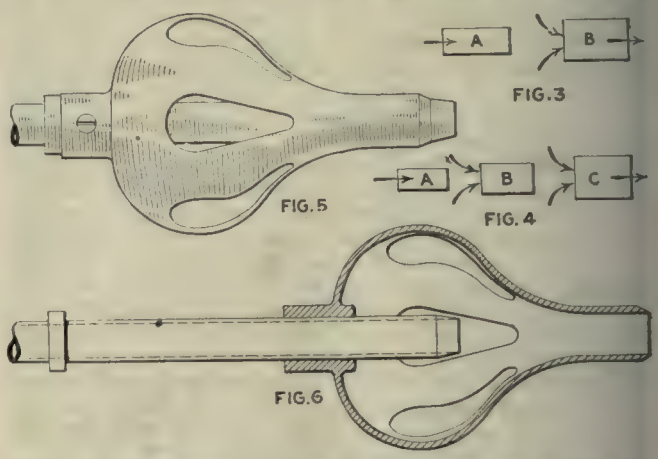


FIG. 3. AIR GATHERS VOLUME BEFORE ENTERING TUBE *B*. FIG. 4. SHOWING HOW VOLUME INCREASES. FIG. 5. AIR INDUCTION NOZZLE SET FOR FULL PRESSURE DIRECT BLAST. FIG. 6. AIR INDUCTION NOZZLE SET FOR MORE VOLUME WITH LESS PRESSURE

and another pipe *C* (see Fig. 4), the ultimate effect being thus still more increased.

Concerning the power consumed, as there is no getting something for nothing, pressure is simply exchanged for volume, this being carried so far in some cases as to increase the original volume under high pressure (see Hiscox) as much as 30 times, but only with final pres-

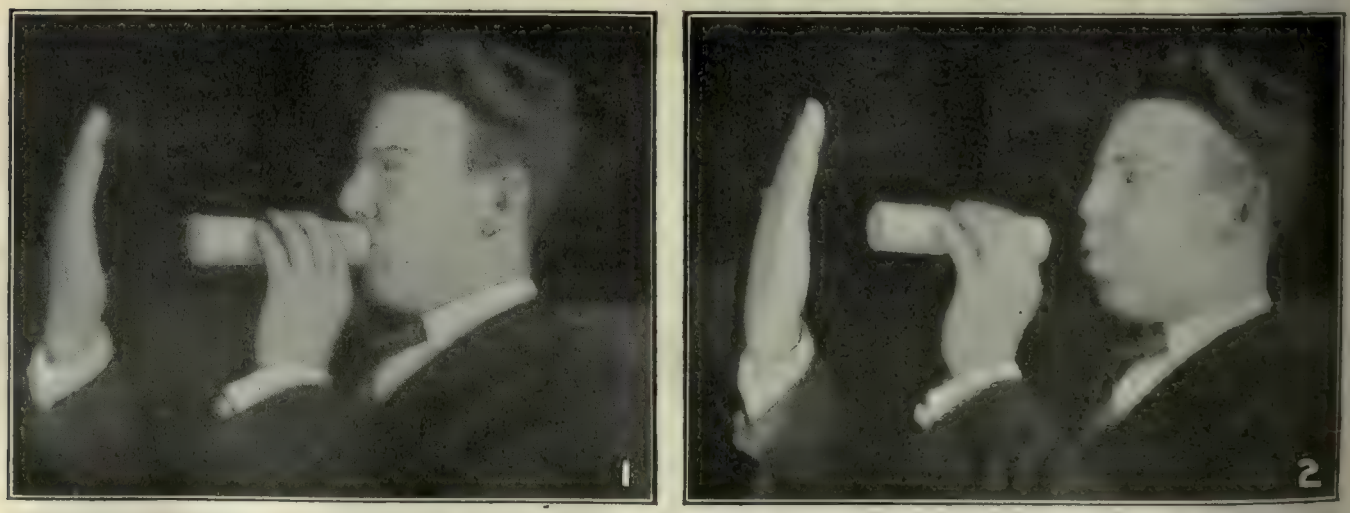


FIG. 1. NO BLAST IS FELT ON THE HAND. FIG. 2. BLAST IS VERY NOTICEABLE. LIGHTED CANDLE MAY BE BLOWN OUT EASILY

sures approaching atmospheric. Or there may be a considerable increase of volume with some of the original pressure retained, as for the blowing of metal furnaces or blacksmith fires.

In places where compressed air is supplied, it is common practice (the wastefulness of the direct air blast being more or less understood) to rig up an induction blast by means of an ordinary pipe and fitting using a tee or a cross with a small compressed air nozzle discharging a jet into the middle of the fitting and drawing in free air through the side openings to mingle with it. Such an arrangement will, with one quarter the amount of compressed air or less, do the work of blowing a fire or anything of that kind.

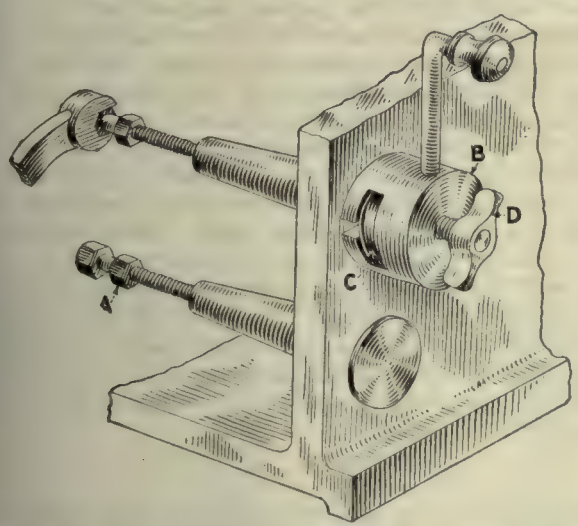
No one, surely, need be told that the air induction nozzle shown in Figs. 5 and 6 would be more economical of air and more satisfactory in every way than any cobbled-up arrangement of standard pipe fittings. Fig. 5 gives a direct blast of air at the full pressure. The air delivered by the internal jet in Fig. 6 is largely augmented by the free air drawn in through the side openings in the head. This head may be adjusted and fastened in any position that experiment may determine to be most effective.

An investigation of the possibilities and limitations of air induction would be very profitable for our experimental physical laboratories to engage in, and information and data of great value to users of compressed air might result.

Special Wrench for Assembling Gas Engine Valve Tappets

By J. H. Vincent

A well-known gas engine has valve tappets in which hexagon-head screws, as shown at *A* in the illustration, are driven for a considerable depth to be used later for



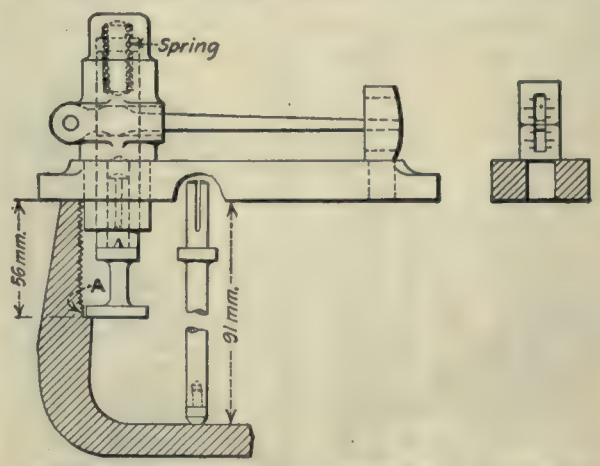
WRENCH FOR ASSEMBLING VALVE TAPPET PARTS

adjustment of the tappet rods. The assembler was supplied with the special wrench shown at *B* which greatly facilitated setting in the screws. The slot *C* in the body of the wrench is slipped over the head of the tappet which is then locked securely in place by a turn of the thumbscrew *D*. Taking the handle of the wrench in one hand the workman rapidly revolves the tappet while he holds the head of the screw with a S-wrench in the other hand. The operation is thus very quickly completed.

Aero-Engine Cylinder Depth Gage

By James McIntosh

The Aëronautical Inspection Department (British) had a very rigid inspection department to assure accuracy of "spares" in the field. Cylinders were held



AN INDICATOR TYPE DEPTH GAGE WITH A NUMBER OF DIFFERENT LENGTH ENDS FOR SEVERAL DEPTHS

to very close limits. After the liners were fitted they were gaged from a surface used as a base line. The seat *A* for the liner was 56 mm. from the base line. The end of the liner was beveled in order to make a tight fit, being screwed into the aluminum head after the head was heated. The depth of the head was 91 mm. These distances were held within limits by the indicator type gage shown in the illustration. Three depths were inspected by transferring different length rods, which were split to make a spring fit in the end of the gage spindle.

Chart for Determining the Pressure on a Cutting Tool

By J. B. Conway

It is often desirable when designing tools, and necessary when designing a machine for removing metal, such as a lathe or planer, to know the pressure exerted by the metal upon the tool removing it. Extensive experiments of Mr. Taylor and Dempster Smith, the latter of Manchester, were conducted for the purpose of arriving at some definite idea of this pressure, and the former has embraced the results of these experiments in the formulas which follow.

The pressure, naturally, is dependent upon the character of the material being cut and varies with the hardness, depth of cut, and the feed. In turning, there is also the side pressure created by the feeding of the tool parallel to the axis. The experiments cover cast iron and steel, the former being divided into two classes, namely, hard and soft cast iron. In order to solve the formulas, the three quantities mentioned must first be predetermined or known. In machine design, the maximum feed and depth of cut that would likely be required of the unit would be assumed, while in the design of a tool, fixture or auxiliary equipment for the fastening of a part to be machined the factors in the formulas would be governed by the current shop practice.

The total pressure in pounds on the tool when cutting is found as follows:

For steel, $P = C \times D^{0.933}$

For cast iron, $P = C \times D^{0.933} \times F^{0.75}$,

when P = pressure on tool; C = a constant; D = depth of cut; and F = feed in inches. C = 230,000 for steel, 69,000 for hard cast iron, and 45,000 for soft cast iron. If any considerable amount of calculating is required, the character of the formulas necessitates the use of

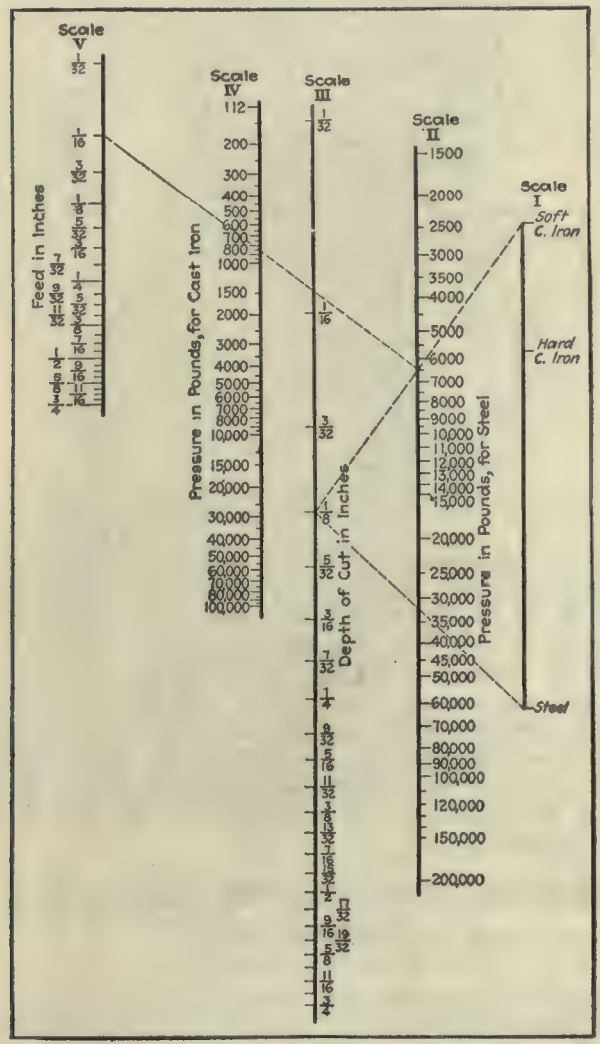


CHART FOR DETERMINING PRESSURE IN POUNDS AT CUTTING EDGE OF A TOOL WHEN FEED IN INCHES, DEPTH OF CUT AND NATURE OF MATERIAL ARE KNOWN

Based upon the following formulas, from Mark's Mechanical Engineers' Hand Book. For steel, $P = C \times D^{0.933}$. For cast iron, $P = C \times D^{0.933} \times F^{0.75}$; when F = feed in inches, D = depth of cut in inches, C = constant which is 230,000 for steel, 69,000 for hard cast iron and 45,000 for soft cast iron.

To read the chart proceed as follows:
For steel, connect point on scale I marked "Steel" with the depth of cut in inches on scale III, and on scale II read the pressure in pounds. For cast iron, connect point on scale I with depth of cut on scale III; thence from the intersecting point on scale II swing the straight-edge to the feed in inches on scale V, and on scale IV read pressure in pounds.

logarithms and, at best, is tedious. The accompanying chart has been designed for the purpose of rapidly solving the equations and gives, as well, a visual comparison when different values are assigned to one or more factors.

An example will perhaps serve best to make the use of the chart clear. Assume that it is required to find the pressure exerted at the point of a tool cutting steel, with a depth of cut of $\frac{1}{8}$ in. (0.125 in.). First, lay a straightedge on the chart connecting the point on Scale I with the "depth of cut" on Scale III; then on Scale II read the pressure in pounds.

For cast iron, first determine the degree of hardness of the material, whether "hard" or "soft"; then with a straightedge connect the corresponding point on Scale I with the depth of cut on Scale III; from Scale II, at the intersection of the straightedge with the scale, swing the former to the "feed in inches" on Scale V; then on Scale IV read the pressure in pounds.

In the examples shown on the chart, for the first we obtain 32,890 lb. when cutting steel, and 850 lb. for soft cast iron. Other examples could be given, but these two should enable one to readily use the chart. It may also be employed inversely, as to find the feed when the depth of cut and pressure are assumed, for cast iron; or the cut, when the other factors are known or assumed. It will be noted that in the formula for steel no mention is made of the "feed," and it is assumed that this formula is in such form that both factors are covered, which perhaps could not readily be accomplished in the case of cast iron. It would, however, be convenient if this factor were given separately.

In order to arrive at the result by solving the formula by ordinary methods the following procedure would be necessary. Using "logs," for the first step we have

$$\text{Log } 230{,}000 + (0.933 \times \text{Log } 0.125) = \text{Log } P.$$

And for the second example,

$$\text{Log } 45{,}000 + (0.933 \times \text{Log } 0.125) \times 0.75$$
$$\text{Log } 0.0625 = \text{Log } P.$$

The convenience of the chart will be appreciated by those who have occasion to employ logarithms and know the confusion at times resulting from the use of negative characteristics, which characteristics in the above formula are all negative, as the values for D and F are all less than one.

In the solution of problems such as enter into tool design, the chart will be found useful, as in the case of determining the proper sizes for "fastening" bolts, screws and clamps, particularly friction clamps or those dependent upon pressure from above to obtain holding power. For, in the second example, where the pressure was found to be 850 lb., this pressure multiplied by the radius would equal the turning moment, or the force which must be counteracted by proper fastenings to prevent the part being machined or turned from slipping. Also, it would be employed as a basis for determining the size of bolts or screws to be used.

From the initial pressure, the component and resultant forces acting upon the tool equipment can be arrived at and are determined by the several angles on the tool which are in contact with the work. Thus, the downward and lateral pressures can be found for enabling one to proceed further with the design. It is, of course, common knowledge that these pressures and forces exist, but before the formulas were made public very little was understood concerning their actual values, and the design of equipment was largely a matter of experience and good judgment.

Novel Use for a Valve Grinding Attachment

By E. A. Dixie

I was recently in a shop where one of the drilling machines is permanently fitted with a valve grinding attachment. You know the thing I mean; mechanism whereby the spindle of the machine is caused to make say three quarters of a turn forward and then a fraction of this backward, so as to simulate the hand operation of valve grinding.

In this shop the device is, as a general thing, used for the purpose for which it was built but the other

day I saw it at a new job and it was doing it just as satisfactorily as it does the old one.

One of the cub apprentices had drilled a lot of castings ready for tapping. The tapping was to have been done on a vertical tapping machine but the cub had make a mistake and the holes were so small that the machine driven tap would not stand up to the job and broke off.

All the other drilling machines with the exception of the one with the valve grinding attachment were tied up on long runs at the time. However so many fixings had been put on it to make the valve grinding attachment a permanent affair, it would have been a big job to make the spindle run continuously in the one direction, so that the holes in the castings could be re-drilled to correct tapping size.

The superintendent is a resourceful man; he sent to the tool crib for a ⅜-in. hand tap and tap wrench and tapped one of the holes by hand, turning the tap right handed till it stuck and then backing it out a little to break and clear the chips. Having proved to his own satisfaction that the holes were large enough to tap in this manner the tap was mounted in the chuck in the spindle of the valve grinding machine and the same cub set at the job of tapping.

The valve grinding machine gave just the required motion, the tap being driven right-hand for three quarters of a turn then backed out for a little over a quarter of a turn, breaking and clearing the chip. While not as fast as it could have been done on the tapping machine, had the holes been drilled the correct size, the job was done in about the same time that it would have taken to re-drill and tap them.

Inaccessibility of Auto Parts

By I. B. Rich

Some weeks ago a letter in the *American Machinist* by George Little called attention to a very pertinent question in automobile design, the inaccessibility of parts which require adjustment and repair. Getting at the average motor from either above or below, is usually an all-day job. Crankcases must be tight, and the use of aluminum or sheet steel makes it necessary to find some way to overcome the spring of the metal in making the joint. Hence the multitude of bolts, lockwashers and nuts.

As a suggestion along this line I submit the plan

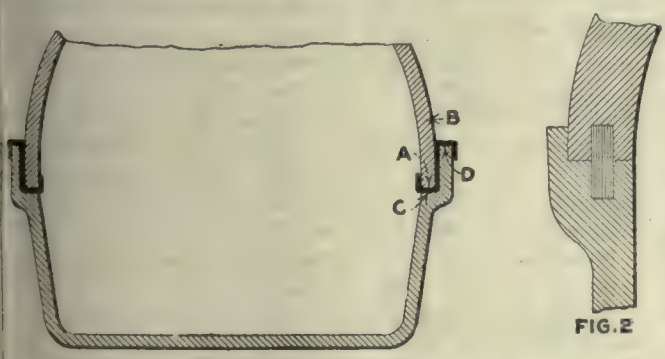


FIG. 1

FIG. 2

FIG. 1. THE JOINT BETWEEN PAN AND BASE
FIG. 2. ANOTHER TYPE OF JOINT

shown in Fig. 1, no bolts being used in this construction. The lower half or pan, of either sheet steel or aluminum, is designed to come up around the engine base. Between them, to form the joint, is a sort of Z-shape gasket, preferably of copper and perhaps with lengthwise corrugations, if found necessary.

The engine base *B* is finished on its lower edge *A* and the pan on its upper edge *D*. While finishing at *C* would perhaps be an improvement—it is not necessary. With a sheet-steel pan the shoulder would be automatically finished in the dies.

The clamping of the pan up against the engine base would pull the Z-gasket into contact at *A* and *D*—the

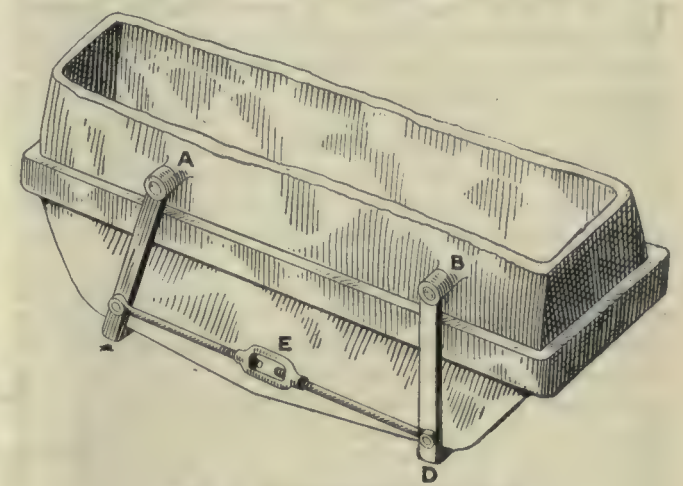


FIG. 3. SUPPORTING THE PAN

shoulder merely supporting the gasket against *A* but the real oil seal being at *D*. Another form of seal is shown in Fig. 2. Here a channel is cast in the base and pan—or formed in the latter, if of steel, and a felt washer inserted as shown. The first method is probably more satisfactory.

The pan is then held in place by clamps shown in Fig. 3. These can be of many varieties. As shown they are stirrups or U-straps hung from *A* and *B*. They can be made to swing clear of the ends or to unhook from the top when released. As shown they are drawn together by a turnbuckle at each side of the case. This is preferable to having a single fastening at the bottom on account of the possibility of its being knocked off or distorted by a rock or high spots in rutty roads. This is only one of many ways of accomplishing the desired object of eliminating the multitude of bolts on the crankcase. With this device a pan should be taken down in ten minutes and replaced in the same time.

Know Why You Do Things

By H. G. W. Reichenbach

On page 367 of the *American Machinist*, A. W. Forbes writes about setting tools on a lathe. He mentions that it lies with the machinist to use his own judgment whether tools should be set on the level with, under, or above the center. I thoroughly agree with Mr. Forbes.

I know from experience that in cutting off stock of large diameters, I have found it satisfactory to set my cut-off tool slightly above center and as the tool got nearer to the cut-off point or to the center, I would have to set it lower—that is, level with the center.

I have also found out from experience that the best and quickest way to cut off a piece of stock (regardless of diameter), is to turn the tool upside down, set the cut-off tool at dead center and run the lathe backward. Care must be taken to set the cut-off tool exactly square with the stock to be cut off. In this manner I have cut off 6-in. cold-rolled steel inside of five minutes.

IN THIS ISSUE

WE HAVE read with a great deal of interest Colvin's first article on the American Rolls-Royce, which opens this issue. After studying the methods employed to obtain accurate parts and the care taken to maintain a very high standard in quality of material we can easily understand that the makers are justly proud of their product. The current article is the forerunner of a series on the Rolls-Royce, the individual articles of which will be announced from time to time in "Coming Features."

The second article this week, beginning on page 628, introduces a new contributor and an unusual subject. They are Joseph Kaye Wood, an engineer of the Western Electric Co., and helical spring design. Wood bases his calculations upon two original terms which he introduces in this way: "I have had occasion to design and investigate many small helical springs, which led me to realize the urgent need of some systematic arrangement of the many factors that enter into the design of these springs. Consequently I have written the following article, bringing out an apparently new fact and several corollaries to it, which simplify the design of helical springs both small and large. In this connection I found it convenient to create two new terms: 'spring criterion' and 'material index.' The fact spoken of is as follows: That the spring criterion must not exceed the material index in order that the helical spring in question will be able to safely carry the maximum load as computed from the ordinary deflection formula." If we were designing many helical springs we should certainly give this article careful study to see for ourselves if someone hadn't been kind enough to make our task easy.

Western Editor Hunter has supplied a description of the Defiance inverted spindle drilling machine that has only recently been placed on the market. Hunter's description goes far enough into detail that when you have read it you will feel that you are well acquainted with the machine. Page 633.

In the eighth installment of "Metal Cutting Tools" DeLeeuw continues his consideration of milling cutters. Chip breakers, spiral teeth, face mills and end mills are the subjects treated.

The Essex, Oakland and Ford methods are described under "Methods of Motor Assembly," page 641. The article tells of the assembling of the Essex pistons and connecting rods, testing the squareness of the pistons, and of the testing room and motor stands; of the application of connecting rods and pistons to the cylinder block of the Oakland and of the "burning-in" of the crankshaft bearings; and finally of the use of conveyors is assembling Ford motors, the application of transmission covers and manifolds and of measuring the friction of the motor.

"The main thing is to connect the individual worker with his work; to make him see how his work connects with the next operation, or if he spoils this piece, that he has wasted the labor of all who have worked on it previously. The cost of the material and of the labor, the delay to the completion of the product by spoiled work, and all such problems, will help in promoting the family feeling which marked the small shop of the olden days." You will, of course, recognize the foregoing as coming from Colvin's "The Foreman and His Job." It begins on page 646.

Stanley, it seems, has an inexhaustible supply of good things to tell us about railroad shop methods and devices. His article this week is short but at the same time it tells a whole lot about blacksmith tools and operations. Bulldozer dies and sample boards receive particular attention. Page 648.

Part five of "Magnetic Chucks" is concluded in this issue beginning on page 650. It deals with the Blanchard chuck, dealing with winding, taping and assembling.

Many have grown rather pessimistic, at times, because business is slow. By comparison with conditions in some other countries, we are well off. The reports from our London and Berlin correspondents, pages 664a and 664b, show that conditions in England and Austria are poor indeed. "Assertion is made that British industry is fighting for its life," is the report from England; and the Austrian letter says that "politically the critical stage may be said to be past but economically the country is still in a very precarious position." There is, however, here and there, improvement indicating a brighter future.

Coming Features

The next issue is to be devoted entirely to complete articles, which means that those of our readers who are following the series articles will have to forego that pleasure for a week. The articles selected for the coming issue are somewhat unusual and we believe that you are going to start in with the first and read straight through. They deal with such subjects as machine shop operations on textile machines, construction and repair of sugar machines and methods in a shipbuilding plant.

Looking a little farther ahead, we find that we are ready to announce a new series, "Tool Engineering," by Albert A. Dowd and Frank W. Curtis of the Albert A. Dowd Engineering Co. of New York City. The series is devoted to jig and fixture design and related subjects and is planned to cover a very wide range. The first article will be published two weeks hence.

EDITORIALS

Working Two Shifts!

FROM New England comes word of a machinery building plant which is running two shifts. It is not a large plant as manufacturing plants go, but neither is it a small one.

What is more, the men are working on a fifty-hour-week basis. It sounds almost like good times, for one little group of men at least.

A good augury for the future is the fact that this particular company is eight months behind on one of its models. In this connection it might be well to add that the management is not at all apprehensive of cancellation troubles.

As we have intimated before it takes more than one swallow to make a summer and by the same token one busy shop does not mean the revival of all industry to normal activity. On the other hand, each busy plant brings business to other manufacturers who lie between it and the source of raw material. The forward movement of the endless chain of production is stimulated and we are all a little nearer to the "normalcy" of our hopes.

Is There a Good Landing Field in Your Town?

ALL who have followed the trend of the times are convinced that commercial aviation is on the way, and that it must be reckoned with in the next few years. As rapid transportation cannot fail to stimulate business activities in many lines, we should all encourage its development.

The first requisite for commercial flying, either spasmodic or regular, is a series of landing fields, covering all probable air routes. The Army and flying clubs all over the country are doing what they can toward this end. If we had the modern automobile with no place to run it except around the back yard the situation would be much like that of aerial transportation of today. Good roads made the automobile possible. Landing fields will do the same for the airplane.

Governor Hartness of Vermont, himself a licensed pilot, is urging his state to become a pioneer along this line. Each of us can do a little by arousing interest in the necessity for landing fields as an aid to the advance of aviation. No town or city without one or more landing fields will be on the map when air travel develops as it is bound to do.

Cut Production Costs With Modern Equipment

THERE is a hoary old story of the shiftless farmer whose house had a very leaky roof. When it was fair it didn't need fixing—and when it rained of course he couldn't fix it until it cleared up.

It's the same way with too many machine shops throughout the country. Their leaky roofs are in the shape of poor machine equipment. When demand is good buyers will pay a high price for their product, and they feel they do not need to put in new machinery.

But when business is slack and they feel they cannot buy—that is the time when their poor equipment counts most against them. They cannot meet competition and the business goes to those who have proper machinery for producing work at low cost.

These lame ducks always think that the successful bidder must be losing money at the prices he bids for work. They are very apt to call it cut-throat competition, when in reality it is simply foresight and good management in having up-to-date shop equipment.

In one recent case of this kind a contract was taken at what seemed a very low figure and the high bidder protested that it could not be made for the price asked. So the successful bidder showed his shop time on the job to be 48 hours, as against the other bidder's estimate of 155 hours. A comparison showed modern equipment in one plant—out-of-date machinery in the other.

Now is the time to look over your equipment with the same critical eye as though you were appraising a competitor; to ask yourself whether you can afford to let business go to the other shop because of its better equipment. Production costs must be brought down by the use of the best machinery possible.

The Only Way to Stimulate Business—Buy Now

MACHINE tools are indirectly behind all kinds of manufacture. It is because of this indirect connection that the machine-tool industry fluctuates with general business, but often at different periods.

As the demand for manufactured articles must precede the demand for more machine tools, the real problem is what will stimulate buying of machine products? There is only one answer—for each to buy what he needs and to buy it now!

We are talking of thrift campaigns—but few seem to realize that hoarding is not thrift. The kind of thrift that makes for better business is the kind that makes a man buy what he needs at a fair price, instead of waiting for bargains at panic prices.

Buying staple manufactured articles at a fair price, hastens the day when new machines will be needed for their production. Machine-tool orders will not and can not come first. Wearing shoes and clothes beyond your usual limit, making the old business or passenger car do another season, putting off that washing machine another year, all delay the return of demand for machine tools.

Unless some one buys, there can be no sales, no demand for more product, no reason for manufacturers buying new machinery. "George" will not do it all—we must do some of the buying ourselves.

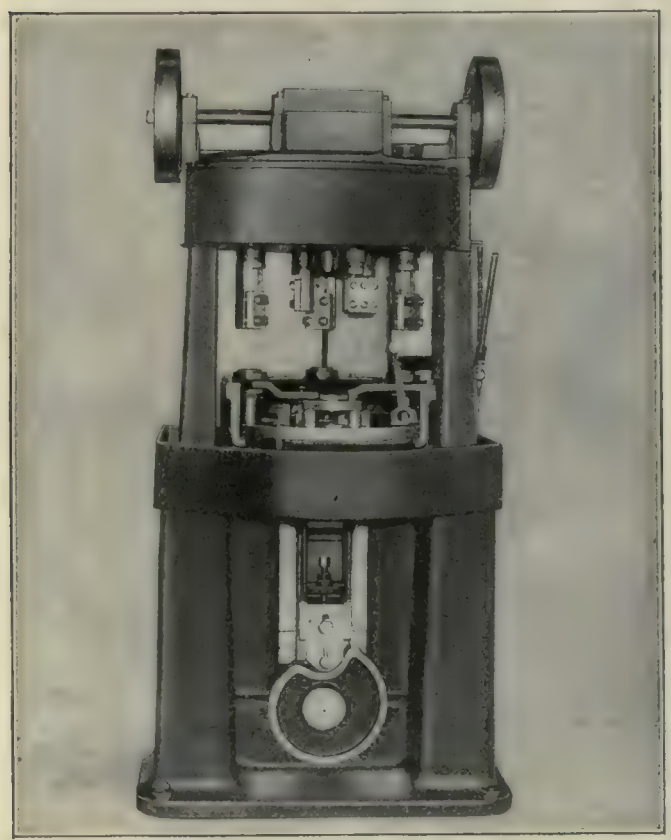
Let everyone who can, buy what is needed *now*—and business will pick up all along the line.

Shop Equipment News

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval. Brief descriptions appear later in Condensed Clipping Index in both American and European editions.

Manufacturers' Consulting Engineers Multiple-Spindle Vertical Boring Machine

The illustration shows a vertical-spindle boring machine recently developed by the Manufacturers' Consulting Engineers, McCarthy Bldg., Syracuse, N. Y. The machine is intended for production work, being



MULTIPLE-SPINDLE BORING MACHINE MADE BY THE MANUFACTURERS' CONSULTING ENGINEERS

adapted to the handling of a single part, such as a cylinder of an automobile engine or a connecting rod, the latter case being illustrated. If it is desired to machine different parts on the same machine, it is necessary to change the head of the machine, the rotary fixture and the cam.

The spindles rotate only and are fixed in a vertical position. The rotary fixture and the work are fed upward to the cutting tools. The cam feed makes it possible to obtain a very quick return and variable feed, so that when desired it is possible to finish the bottom of a hole. One idle position of the rotary fixture is allowed, so that the loading and unloading are done while the machine is working.

The machining time for producing an automotive connecting rod on the machine, rough boring, semi-finish boring and reaming both the large and small holes, is said to be 65 seconds. The large hole in this case is 1⅞ in. in diameter and 1¾ in. long. A larger machine of this type will complete more than one rod per cycle, if desired. The machine equipped for boring cylinders is stated to rough bore, semi-finish bore and ream a 3¼-in. cylinder 9 in. deep in 1½ minutes. If it is desired to finish the bottom of this bored hole, one cylinder is completed in 1 minute and 42 seconds.

Becker Planer-Type Milling Machine

The Becker Milling Machine Co., Hyde Park, Mass., has placed on the market a planer-type milling machine having a crossrail adjustable for height. The machine shown in the accompanying illustration has a horizontal spindle, although vertical-spindle machines can be furnished, two heads being placed on the rail if desired. The machine is built in sizes from 24 to 48 in. in width and in standard lengths up to 20 ft., the specifications given being for the machine illustrated.

The housings are of heavy box section, bolted and dowelled to the bed of the machine and tied together above with an arch of deep box section. The length of the bed is 1¾ times the working surface of the table, so that under the most severe conditions the table is well supported. The table feed is thrown out either by dogs clamped to the side of the table or by hand. The table is of box section said to be heavy enough to meet all strains due to clamping and milling.

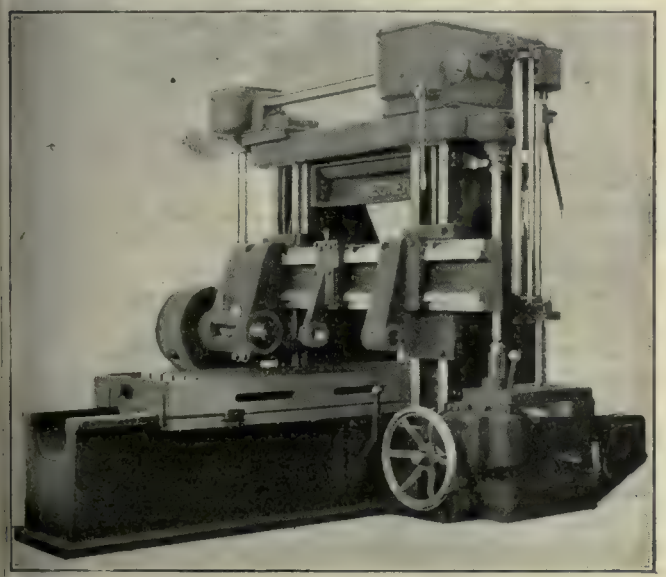
The machine is driven by a 20-hp. motor running at 1,200 r.p.m. and mounted, together with the speed box, on the upper beam above the arch. In the speed box are sliding gears giving eight changes of speed in geometrical progression. The gears are of forged steel and the necessary changes are controlled from below by means of hand levers. The gear box can be driven by means of a single 14 x 6-in. pulley. A clutch is furnished on the pulley for stopping and starting the machine, the lever for operating the clutch being located on the front of the machine. On direct motor drive, this eliminates the stopping and starting of the motor in order to stop the machine.

The longitudinal feed of the table is through a cast-iron rack and steel worm, which runs in an oil bath. The wormshaft is connected to the feed box, which is fastened to the lower side of the right-hand housing. In the feed box are the feed-change gears, the reverse gears and rail-elevating mechanism. It is stated that the sliding feed gears are so arranged that changes of feed can be made very readily while the machine is running, without injury to the gear teeth. In addition to the above feeds, the table is equipped with a power-driven rapid traverse.

The rail is of box section, is counterweighted, and can be securely clamped at any desired position on the

housings. It is elevated by power but has a hand adjustment through the feed box. A friction clutch is provided for the rail-elevating shaft to eliminate the danger of stripping the teeth of the gear trains, in case the operator fails to loosen the rail before attempting to lower or elevate the rail by power.

The heads, either horizontal or vertical, are mounted on the rail and are provided with power and hand traverse, the power traverse coming through a box on the end of the rail. Provision is also made for clamping the heads to the rail. The spindles are of crucible steel and run in phosphor-bronze boxes provided with means of compensating for wear. They are driven through a worm and worm gear running in oil. All gears are of steel and the bearings of bronze, all bearings being provided with sight-feed oil cups. The



BECKER PLANER-TYPE MILLING MACHINE WITH HORIZONTAL SPINDLE

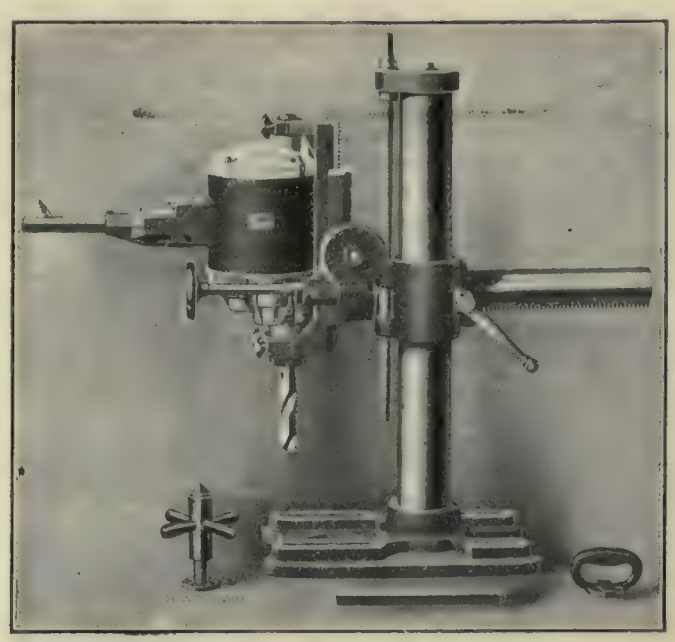
Specifications: Width between housings, 36 in. Bed 1⅔ times the working length of table. Table feed; changes, 16; range, ½ to 14 in. per minute. Quick traverse, 75 in. per minute. Maximum distance between top of table and under side of rail, 24 in. Spindle speeds; changes, 8; range, 12 to 78 r.p.m. Hole in spindle; taper, No. 13 B & S; through, 1⅛ in. Spindle largest diameter, 4⅛ in. Spindle, hand adjustment, 6 in. Belt, width, 3 in. Driving pulley; diameter, 14 in.; speed, 550 r.p.m.

operating levers are on the operator's side of the machine, making control of the heads as centralized as possible.

Hisey-Wolf No. 3 Radial Drill Stand

The illustration shows a radial drill stand made by the Hisey-Wolf Machine Co., Cincinnati, Ohio, and intended for the holding of the portable electric drills made by the concern. The stand is known as the No. 3 and is made in two styles, the NN and the NNA. It holds a portable drill of either the single- or two-speed type and having a capacity of 1¼ in. Since the stand enables the use of the electric drill for precision work, it greatly increases the scope of usefulness of the tool.

The column is made of steel tubing. A horizontal adjustment of the head of about 12 in. is made by means of a rack and pinion, an operating radius of 20 in. in any direction being obtained. The vertical adjustment is made by means of a screw, about 20 in. of travel being provided. The feed motion of about ? in. is controlled by means of a handwheel, while



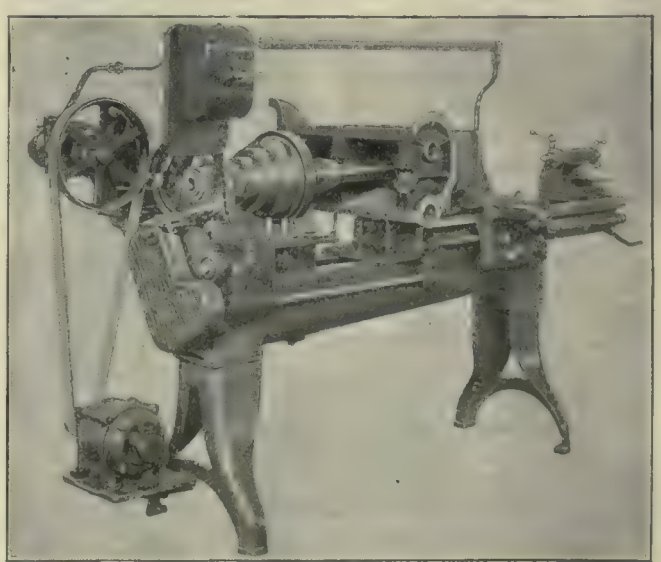
HISEY-WOLF NO. 3 RADIAL DRILL STAND

the quick return is effected by means of a crank. The handwheel and the worm may be operated in either the horizontal or vertical position, making the drill adaptable to use in places where the space is limited. The head, in which the drill is shown mounted, can be swung at any angle, a graduated dial being provided to enable quick setting.

The machine can be furnished to operate on either 110 or 220 volt current, either direct or alternating. Fitted with a portable drill carrying a motor, the dimensions boxed are 18 x 28 x 42 in., the net weight is 225 lb. and the shipping weight 300 lb.

Barnes Cylinder Reboring Attachment

The Barnes Drill Co., 814-830 Chestnut St., Rockford, Ill., has placed on the market a cylinder reboring attachment for use in connection with its sliding-extension gap lathe, as shown in the illustration. It is intended to accommodate any size or type of cylinder.

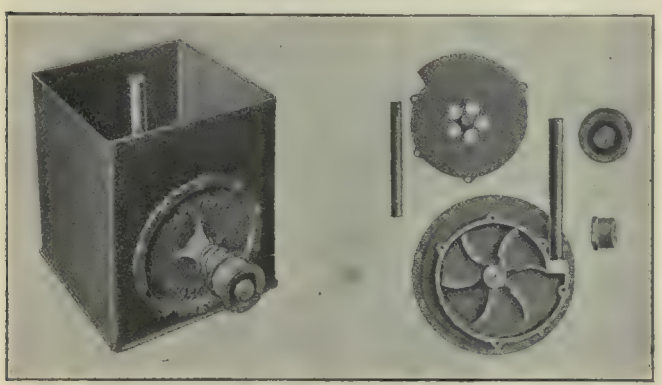


BARNES MOTOR-DRIVEN EXTENSION GAP LATHE WITH CYLINDER REBORING ATTACHMENT, SHOWING SET UP FOR FORDSON TRACTOR BLOCK

The attachment consists of an angle bracket to be clamped on the carriage of the lathe, a 2½-in. diameter boring bar with Morse taper shank to fit the spindle of the lathe, a high-speed steel cutter, and a draw-bolt to go through the spindle to assure positive drive. The bracket carries a hardened bushing to guide and support the boring-bar. A taper bushing which slides into the old hole to assist in centering the cylinder and supporting bolts for steadying the outer end of the cylinder, are also included. These bolts screw into an angle-shaped shoe which slides along the gap on the ways of the lathe bed. It is said that after setting up the job, less than five minutes is required to take a cut through a 4-in. cylinder.

Lafayette Soluble-Oil Pump and Agitator

The illustration shows the Lafayette soluble-oil pump and agitator recently placed on the market by the Fruchey Machine Co., 454 East Lafayette Ave., Detroit, Mich. The pump proper consists of a rotor on a ⅝-in.



LAFAYETTE SOLUBLE-OIL PUMP AND AGITATOR

Specifications: Floor space, 12 x 16 in. Capacity of tank, 10 gal. Capacity of pump per minute at 1,000 r.p.m. at 6 ft. rise, 6 gal. Horsepower required, ¼. Size of outlet pipe, ½ in. Width of belt, 1¼ in. Shipping weight, 32 pounds.

shaft, running between two plates. The shaft is hardened and the inner end abuts a hardened steel button which acts as a thrust washer, the suction of the pump in operation tending to draw the rotor shaft against the button. The inlet is through five holes in the cover plate, and the outlet is through a vertical pipe. The pump is always charged with the oil or cutting fluid, which is said to eliminate loss of prime. The agitation is effected by the break in the veins next to the hub. The pump is self-lubricating, since all parts run in the oil. The tank, which can be furnished in any size desired, is made of 16-gage galvanized iron.

Reliance Self-Lubricating Bearing

A self-lubricating bearing has been placed on the market by the Reliance Machine and Specialty Co., 101 Green St., Jamaica Plain, Boston, Mass. The bearing is made both in a wide range of sizes, from those used on phonograph motors to those required for machine tools and in many different types, both radial and thrust. The illustration shows one of the standard types of radial bearing or bushing.

The bearing consists of two parts, the outside bushing usually being made of steel tubing. In case the bearing is apt to be subjected to severely corrosive conditions, the outer casing may be made of bronze, or it may be made of steel and tinned. The inner bushing is made of bronze, and is drilled with a number of ¼-in. holes, the holes being slightly larger on the outside than on the inside of the bushing, so that the lubricating mixture with which the holes are filled will be retained in them. In assembling the bearing, the outer casing is expanded by heating and then shrunk on the inner casing, after which the two are pinned together. Neither of the bushings is split. It is stated that the bearing is manufactured with fewer operations than ordinarily required on bearings for similar purposes. The holes in the inner casing are filled with a lubricant composed of pulverized lead and graphite, as well as other ingredients. It is stated that this lubricant is forced into the holes from the outside, under pressure, and cannot be jarred loose when the bearings are in transit. The lubricant is automatically supplied to the shaft, so that the friction is very greatly reduced, without the necessity of providing any lubricant from the outside. In order to replace the lubricant after it has been exhausted, the two bushings are separated.

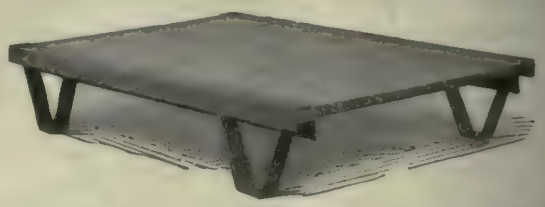


RELIANCE SEF-LUBRICATING BEARING

The bearings can be furnished in any length or diameter required. The shaft holes are ordinarily made larger than the standard size of the shaft to which the bearing is fitted, so as to provide a running tolerance. The outside diameter of the bushing is ordinarily made slightly above the standard, so as to allow for a driving fit. The inner casing is made with a thickness of $\frac{3}{32}$ in. The outer casing can be made with any desired thickness, to suit the requirements. It is stated that the bearing has a very wide range of adaptability and that its life is very long.

Stuebing Steel-Bound Lift Truck Platform

The Stuebing Truck Co., 141 Fourth St., East, Cincinnati, Ohio, has recently developed the portable truck platform shown in the illustration. The platform is made of oak bound with angle steel, and supported by steel legs which are made with broad bearing surfaces,



STUEBING STEEL-BOUND LIFT-TRUCK PLATFORM

so as to eliminate the possibility of injuring floors. The bolts and nuts with which the platform is assembled bear on steel plates so as to save wear on the wood. This platform is made in sizes to suit the purchaser and can be furnished in box type, sectional bin type, stake type, table type, or other designs. The platform is said to possess strength and convenience of operation and to be adaptable to all types of lift-truck work.

The Machine Tool Shop in Time of Depression

Careful Survey of the Product, Its Market and Financial Resources Back of It Advisable—Value of a Good Budget—Better Times Ahead

By E. J. KEARNEY
President, Kearney & Trecker

IT IS OFTEN said that depressions have their advantages, for the reason that they eliminate competition by the application of the law of the survival of the fittest. A little careful thinking along this line will certainly lead us to a different conclusion, for in periods of inflation and overbuying a great many are tempted to enter the industry because of the easy money in sight at the time. It is doubtful if there is any advantage to the older and stronger concerns in a condition of business likely to cause this elimination. Is it not better for the industry as a whole for concerns that are in the business to remain in it, studying the conditions that are necessary for success, learning of its hardships and severe reactions, and preparing to take care of the legitimate demand when it comes, rather than have a new crop with each period of inflation? A study of the history and statistics of our industry will show that it is subject to very violent fluctuations. The product is purchased only as an addition to capital assets, and at the first sign of a general falling off of business, orders cease and unhappily cancellations of machines already ordered, take place, resulting in closing or partial closing of shops, followed by a considerable amount of unemployment.

If a young man starts out to select a trade to which he desires to be apprenticed, with the expectation of finishing at, say twenty, he would, if he were wise and had proper vocational guidance, make a survey of the industries before making his selection of the one he would adopt for a life work. In making this survey, he would take into account the prospect for continuous employment throughout the years of his working life, which might reasonably be expected to extend from, say, twenty to sixty, or forty years, as a journeyman, during which time he might reasonably hope to be continuously employed. In some industries like the building trades in our northern climate, he might not expect to be employed for more than two-thirds of the time, depending upon the climatic conditions in the city where he lived and the branch of the building trade to which he belonged and whether it involved inside or outside work, the wages on the whole adjusting themselves to the conditions of enforced idleness incident to the trade.

In the machine-tool industry, during his forty years of activity, he might reasonably look forward to several years of idle time—possibly as much as one-third. At present, those older employees in our factories, who form the main support of our organization—the men with whom we are loath to part are not working, on the average, more than two-thirds as many hours per week as they were a year ago; and even if their wages have not been reduced, their earnings are on a much lower basis.

The industry might be stabilized, if it were possible to run continuously over a long period of years on the basis of the average production, building up a sufficient amount of stock to take care of any boom, running the factory forty-eight hours a week, year in and year out, just as the pumping station might run continuously, filling the reservoir that would take care of the fluctuating demand for water. Such a program would require financing far beyond anything possible in connection with the machine-tool industry. It would require a very much larger margin of profit than is ordinarily enjoyed if machines were to be built and carried through several years, with the possibility of antiquation before sale, to say nothing of interest, taxes, storage, and care during that period. The margin of profit required for such a system is best illustrated by referring to the practice of certain dealers in buying second-hand machines at scrap prices in times of financial distress and carrying them over into a period of prosperity, when the demand for immediate delivery is such that unusual prices can be obtained.

Three Classes of Business

If we were to make a survey of the industry, we would find that the financial and general strength varies greatly, one concern with another. They might roughly be divided into three classes, understanding, of course, that no exact classification is possible as the entire scale would be covered. We have on one hand concerns with abundant liquid assets that are so well financed that they can hold their organizations together and continue to operate on a reduced basis through a protracted period of depression. Then, there is a second class, perfectly solvent, that are able to weather quite a long storm but which will run into difficulties if the period be greatly protracted. There is a third class at the lower end of the scale that with any prolongation of the period, unless its affairs are very carefully steered, must face insolvency. It is necessary, in times like the present, for every one to make a careful survey of his own business.

First, as to the nature of product. Is it of a more or less special character so that the marketing of it, if it were carried into stock, would be a question? Or, is it a more or less standardized product which has gone through a long period of development and is not likely to be faced with strong competition in the near future, in the way of improved design of such a character as to either greatly reduce the cost of the machines or enhance their productive capacity?

Second, there should be a survey of the stock on hand, the stock in the hands of dealers, and the condition of the shop inventory as regards the amount and kind of material on hand.

Third, the survey should take into account the kind of a sales program that is practiced. What arrangements have been made in the past for the continuity of sales? Some of the smaller and younger concerns, when they enter the market during periods of great activity, find that they can dispose of their entire product through one dealer willing to give them large orders—perhaps taking their entire outputs for re-sale in a comparatively restricted district. Naturally, their sales outlet will be much less over a protracted period of depression than it would be if they had a number of agents scattered over a wide territory, who were here and there picking up an order for them.

Fourth, and the most important, is a careful inventory of financial resources, which, after all, is the foundation of the whole structure. After having made a survey of one's business, such as I have just stated in brief outline, I believe it to be of first importance to lay down a definite program-chart, a course as it were, for the immediate future. The survey has taken into account the kinds and quantities of material on hand, the work in process, and the minimum purchases of material necessary to complete the machines under way, where such machines can be carried over into stock, sales being lacking. Where a shop builds various kinds and sizes of machines, a selection should be made of those machines that will give the most employment to labor with the least expenditure for material. While laying emphasis on a program that will involve the minimum expenditure for material, I am mindful of the fact that a great many companies purchase their castings from foundries that depend upon them for their existence and any complete cessation of the purchase of castings might possibly put the foundry out of business, which is a question that must be taken into account and given its proper value as to whether it is not advisable to give some support to the foundry on which you depend for your castings in times of prosperity.

Forecast the Future

In making up a program, it would seem to me to be the wise thing to look ahead to see what the probable market might be for a few months. No one, of course, knows how long this depression is going to last. We have different ideas as to the extent and nature of it and as to what constitutes "normal." If we were to use as a base line the growth of the machine-tool industry prior to 1915 and extend that line, it would come out this year—1921—at a point far below the boom period of the last six years.

Forecasting the future in this respect should be done conservatively, depending upon the financial strength of the one making up this program. Without expressing my own opinion, but merely restating what I have heard from many business men in this and other lines of industry, some of which are now recovering, there might be expected a slight improvement in the machine-tool market during the spring over the months of January, February, and March. Nothing very great, however; and for the succeeding months, until October, little better than the present. I am not putting this forth as a prophecy. I am merely repeating remarks that I have heard on the street and elsewhere.

Value of the Budget

I am a firm believer in the preparation of a budget as a proper course to be pursued in both domestic affairs and in the expenditure of the Government, and it is just as important for a business concern, especially at this time, when the outgo exceeds the income. Any banker will tell you that a great many business men do not make a proper survey of their business to ascertain what their probable financial needs will be. They live too much from day to day. Finding that bills are pressing, they require another ten thousand dollars. They go to the bank and get the ten, without sufficient knowledge as to what their next month's requirements are going to be —or the month after.

Every one of us must depend upon banks, and our chance of receiving the required accommodation is greatly enhanced when we can show that we have a definite program and know exactly when and how much money will be required during the few months just ahead. Take your banker fully into your confidence, and do not wait until you are pressed before doing so. He requires time for investigation and analysis of your affairs before coming to a decision.

I have prepared a simple budget, a hypothetical one, showing how this can be done in a simple way. This is prepared covering a six months' period, which may be too long or too short, depending upon the condition of your business and the character of the product.

BUDGET FOR SIX MONTHS ENDING SEPTEMBER 1, 1921

Cash on hand, March 1			$5,000.00
Liberty bonds to be sold (at market)			2,500.00
Add:			
Customers' accounts outstanding March 1		$25,000.00	
Estimated sales for March	12,000.00		
Estimated sales for April	20,000.00		
Estimated sales for May	20,000.00		
Estimated sales for June	15,000.00		
Estimated sales for July	10,000.00		
Estimated sales for August	10,000.00		
	$112,000.00		
Less: Customers' Accounts Outstanding September 1	20,000.00	92,000.00	
			$99,500.00
Deduct:			
Probable Disbursements:			
Accounts Payable March 1	$22,000.00		
Purchases for the period	46,000.00		
	$68,000.00		
Less: Accounts Payable September 1	20,000.00		
	$48,000.00		
Shop wages	$46,000.00		
Salaries	5,000.00		
Federal taxes	6,000.00		
Miscellaneous	8,000.00	65,000.00	113,000.00
Cash in bank, September 1			5,000.00
			$118,000.00
Deficit to be met with bank loan			$18,500.00

This budget anticipates the carrying of a $5,000 balance in the bank at all times. On this point I wish to lay special emphasis, as some of our newer members may not know that their standing with the bank depends very largely on the maintenance of an adequate balance. Many banks are loaning money at the present time at the same rate of interest as that charged by the Federal Reserve Bank on re-discounts, so that no money whatever is made out of the loans except on the free balances that are left with them, which may be less reserves, loaned to someone else. If you want your bank to prize your account, make it worth while to them by carrying a balance equal to 10 or 20 per cent of your loan.

So much for the budget, in which I have great faith. The unknown factor is how much can be sold during the period and how soon we may expect something in the way of recovery. These are things which each and everyone must settle for himself. We certainly hope that it comes soon enough so that the weakest among us can stick it through.

We are citizens of a country, the richest in the world, with resources of all kinds at our command. We are slack not because we do not have the means to buy, but because we, as buyers, are frightened and all other buyers are of the same mind with us. It is possible in our desire to cut to the minimum, that we may be "penny wise and pound foolish." It is well to be conservative—but not too conservative, as after all, resumption depends upon confidence among ourselves as well as among those to whom we expect to sell our product.

Let us look at the future courageously, with faith in this great basic industry. Let it be a time for study of improved production methods, costs and other things necessary to give us a share in returning prosperity.

Business Conditions in England

Coal Situation Serious Due to Decrease in Exports—Further Cuts Noted in Automobile Prices—Some Small Tool Makers Busy

BY OUR LONDON CORRESPONDENT

HAVING by continued hammering helped to make an impression on the stiff defense offered by the Chancellor of the Exchequer against assaults on the excess profits duty, the Federation of British Industries, through the president, has recently addressed the British Prime Minister himself on the industrial condition of Great Britain, the purpose being to draw his attention "to the great dangers which confront British industry at the present moment." In fact assertion is made that "British industry is fighting for its life and the next twelve months may be the most critical in the economic history of this country." Coal being almost the basis of metal and other industries, to say nothing of exports, reference is naturally made to the coal situation, as to which daily conferences are being held for the purpose of arriving at a solution of the wage difficulty.

As to transport, the federation regards the burden as crushing. Nor are conditions improving here, for, despite the largely increased rates and fares, the railways are steadily losing money, though the loss will soon be mitigated by the fact that, owing to the decreasing cost of living as officially determined—the fall announced for last month was 10 points—wages of railway men will automatically come down by 4s. a week, this implying a saving to the companies of about seven and one-fifth million pounds a year.

The exchange position is one which the government cannot easily affect, except by providing as far as possible for the free interchange of goods between nations, and the new arrangement with Russia, whether it involves recognition of the present government or not, will be welcome—provided the passage of goods is not one-sided. The federation will therefore press for a reduction in the income tax as a means of lightening the present load, high taxation necessarily reducing savings and consequently the flow of capital to industry.

England Depends on Exports

Great Britain depends for her continued existence as an industrial country on her ability to export in exchange for food, the home food production being sufficient, it was recently stated, to keep the nation over the week-ends. Yet, eliminating for the moment our "invisible exports" by way of shipping services, etc., the value of exports during the working week has been steadily diminishing. The calculation has been made that, while in July of last year our imports amounted to about 6.1 million pounds worth per working day and our exports to 5.1 million pounds worth, by last month our imports had fallen to about 4 million pounds worth and our exports to 2.8 million pounds worth per working day, not merely because of the fall in prices, but also, in fact chiefly, on quantities. In quantities imported raw materials are at present not much more than half those of the pre-war period; indeed taking all imports, the weight seems to be about five-eighths.

A change appears to have come over the position regarding wages. Until recently the employing element has endeavored to obtain increased output with a view to the maintenance of present wage rates. Now a distinct move for wage reductions seems quite clear. Of course, with decrease in the officially estimated cost of living, numbers of workers automatically suffer reductions. As officially recorded, the decrease during February was £450,000 a week, applying to some 1½ million work-people. But with the decline in living costs the actual net value of the wage, even when the sum is reduced, should be kept about constant, while persons who have not suffered reduction have actually by the process of events received an increase in real wages. In engineering wages are stabilized—to use the latest "blessed word"—for a few weeks longer, that is for men. Lower rates for women and for boys have been agreed upon. Reductions are demanded in iron founding and similar claims are being put before the Industrial Council for a number of other industries.

Meanwhile, unemployment continues to increase. Leaving out of account youths of both sexes, according to the latest announcement 872,000 men and 335,000 women are registered as unemployed, with 708,000 men and women on short time. At the beginning of the current month considerably more than £1,000,000 a week was being paid out as unemployment benefit from the state insurance scheme, which covers 12,000,000 workers, men getting £1 a week and women 16s. The Minister of Labor has claimed that "provision on that scale has never been made in this or any other country before." The sums thus paid are of course outside trade union benefits. Unregistered unemployed are estimated by the hundred thousand. Nor is that all. Many firms are retaining their men to build up stocks which must almost inevitably be sold at a loss—when they are sold.

The decline in the engineering industry has not been stayed and short-time working extends in some instances to makers of textile machinery, while sugar machinery manufacturers, who also were well placed, are now finding new orders difficult to obtain. Reduced naval estimates carry with them further discharges of men from the dockyards.

The spring has been expected to bring with it some measure of return of prosperity to the motor trades and the hesitating purchaser has been helped by further declines in prices which have been announced almost daily—even by a firm who not long ago publicly announced doubt as to the need for this action. American imported cars are among those reduced; for instance, the price of the Maxwell four-passenger has just been dropped by about £100, and of the Chalmers Six by about £150. The well-known Vauxhall cars have been further reduced by £300 or so, this being the second cut of about the same amount in the present season. But so far the long-predicted crashes have been staved off.

On the machine-tool side the market for standard tools barely exists. Makers of some small tools are relatively well off; the call for gages and twist drills has not become any more insistent but the shops

engaged on milling cutters are at least moderately employed and some firms could even run overtime on orders for screwing tackle. The only machine tools that really occupy the energies of firms just now are the heavier and rather special orders.

The prospect of the Sheffield steel firms have naturally been the subject of rather anxious discussion and public statement has been made of the relief felt when the directors of Vickers, Ltd., gave notice declaring payment of the full dividends on both classes of preference shares and stock. Announcement has yet to be made regarding ordinary shares. As to Cammell, Laird & Co., both old and new ordinary shares will receive 7½ per cent, with £102,970 to go forward. Hadfields, Ltd., has been compelled to reduce the dividend, the profit last year amounting to £107,856, against £203,254 the year before. Here the total dividend is 5 per cent free of income tax, with £135,727 carried forward. Adjustments may yet be necessary in regard to taxes. The molders' strike is put forward as the reason for the decline in profits. The directors announce that, with a view to the development in the use of the Hadfield system of manufacture and the sale of its special products in the United States, the Hadfield-Penfield Steel Co., has been formed, in which the Sheffield firm halds a substantial interest. The British Aluminum Co., after making provision for excess profits duty and corporation tax, shows profits amounting to £428,157 against £348,108 the previous year. Although last year was so successful, a decline was seen in the autumn and since then output has been seriously curtailed.

The last report from the London Iron and Steel Exchange records mostly unrelieved depression. Several more furnaces have been blown out and the pig-iron section is described as in a rather worse position. Reductions in the prices of steel billets have been mentioned, but throughout forward buying is rare. Discouragement has resulted from the news that "a Glasgow concern had placed an order in Belgium for 10,000 tons of steel rails at a price £7 below that quoted by English and Scotch makers." Apparently during last week 20,000 tons of pig iron and between 10,000 and 15,000 tons of manufactured material was delivered into Scotland from the European continent.

Readers of these columns will be interested to learn that the European edition of the *American Machinist* is just completing twenty-one years of existence.

The Present Position of Austrian Industry

Financial Condition Almost Hopeless—Machinery Building Plants Doing Better But Still Below Normal—Commercial Penetration by the German Combines Increasing

BY OUR BERLIN CORRESPONDENT

AFTER the Austrian Empire fell to pieces the political leaders of German Austria got up and proclaimed that the country could not live as an independent state. This verdict was possibly the worst advice that those men could have rendered their country. The atmosphere of hopelessness it created brought the economic machinery to an almost complete standstill and developed a particularly bitter labor movement. For more than a year Austria has been on the brink of Bolshevism, and would no doubt have submitted to it, if the population were not so averse by nature to all extremes and violence. Politically the critical stage may be said to be past, but economically the country is still in a very precarious position. The war, and the upheaval following it, left stronger marks on Austria than on Germany, and her labor situation is far less settled.

Much time, and a considerable portion of the national wealth left to Austria, have been wasted in the post-war years while waiting for political developments. If they had been applied to reconstruction the country would now find herself in a better position.

Whether Austria really cannot live independently will be seen in the future. Hers will be a hard task, too hard perhaps for her strength, but that it is not quite hopeless is demonstrated by the improvements, which set in toward the middle of last year, and which are now becoming more and more marked. Almost all branches of industry share in this improvement, foremost among them the mining, iron and steel, electrical and machine-building industries.

The highly developed iron and steel industry of Austria, formerly in such a prosperous state, but during the months following the end of the war almost at a complete standstill, is now slowly recovering. The production of pig iron almost doubled last year, as compared with 1919, but has only reached 15 per cent of the production of 1916. The output of steel increased slightly in 1920, compared with the preceding year, and amounted to one-fourth of the output of 1916. The output of rolled products was 16 per cent higher than in 1919, and 27½ per cent of the production of 1916.

The Alpine Montangesellschaft, the largest iron and steel producer of Austria, had lately to blow out two of its six openhearth furnaces, on account of the lack of scrap iron. The employment of the iron works is also greatly hampered by the limited supplies of coal. Apart from that a considerable portion of the Austrian pig-iron production has to be sent to Czecho-Slovakia in exchange for coal. The high-grade steel works, like Böhler, Phönix and Ternitz, are in a more favorable position, as they receive a better supply from the increasing output of the local collieries. Those works have, since the beginning of last year, enjoyed a brisk demand for high-grade steel. The price of this steel has now nearly reached the world market parity. Most of the openhearth works and foundries are shut down on account of lack of raw material and coal. Of the seven blast-furnaces in Styria only two are working at fullest capacity, in spite of the extensive use of charcoal.

The keen competition of the German iron and steel industry, which is making itself felt, has brought into relief the absence of an organization of the Austrian iron and steel industry. The Austrian Eisenkartell, the Syndicate of the iron masters of the Austrian Empire, came to an end with the latter. It is no mere coincidence that not only in Austria but also in the other

tates formed upon the territory of the erstwhile Austrian Empire, the old Eisenkartell is evoking desires or its resurrection in some shape.

Negotiations have been commenced between the iron nd steel works of Austria, Czecho-Slovakia, Hungary nd Roumania, with the object of coming to an agreeent on all interests in common. It is quite possible hat these negotiations will ultimately result in the ormation of a trust, combining the iron and steel interests of the countries mentioned.

If this project is realized, Austria's industry will reatly benefit by it, as it is one of the chief objects f the intended combine to raise the Austrian iron and teel production, which used to be the chief source of upply for the former Empire, to its full capacity.

The situation of the factories representing the higher tages of production, mainly machine-building facories, is much better than it was a year ago when the eneral opinion of the future of this industry was very loomy. Austria has now no less than 478 machineuilding and kindred factories, not counting the small hops with less than fifty workmen, the number of vhich is far higher. These factories represent, in the ggregate, the machine-building and metal-working ndustry of the old empire, with the exception of Bohemia, whose production is, however, more of the eavy type, and the much smaller industry situated in Budapest.

The home market of the Austrian industry used to e a state of 50 million inhabitants, which has dwindled down to a country of 6 million inhabitants. The facories are, as a rule, very well equipped with highrade German and American machine tools. The equipnent is, indeed, frequently far superior to that of German factories of the same size and character. Notvithstanding this fact, the Austrian machine building ndustry was never able to compete with that of Gernany in the export business. This may be ascribed to ack of enterprise more than to any other reason.

The collapse of the old empire and the formation of new states on its territory, which shut themselves off rom the present Austria, deprived the latter's industry f its best markets. In the course of time, old conections have, however, been resumed, especially as the new states found it impossible to make themselves indeendent of their former sources of supply. This resumption of trade is becoming more and more marked, nd is at present keeping the Austrian industry fairly usy. The position of the industry in those markets s now, however, quite changed. They have become export markets, and the Austrian industry can sustain ts position in them only so long as it is able to comete with foreign rivals. The badly deteriorated exchange has so far permitted the industry to do this, ut wages are moving up continuously and it is feared hat the Austrian industry will be superseded by that f other countries, mainly Germany.

A number of the foremost firms, realizing this danger, are directing all efforts toward building up a real export business, on the strength of economical quantity production. The Austrian Arms Manufacturing Co. (Oesterreichische Waffenfabrik), for instance, has taken up the manufacture of motor cars on a large scale, and is now producing a car of excellent quality and at a moderate price. The country contains no less than five large motor car companies, which are equipped exceedingly well, and are doing their utmost to get abreast of their German competitors.

Factories making mining machinery are well employed on conveying and hoisting plant, for home and foreign orders, as the increase of the coal production requires new installations. There is, however, little demand for iron and steel works equipment. The Austrian locomotive works, completed, in 1920, 211 locomotives and 173 tenders, as against 144 and 97 respectively in the preceding year. Railroad car factories are mostly employed with repair work.

The present employment of the Austrian machine building industry, although quite satisfactory, judged by the very gloomy expectations of a short time back, does not nearly come up to its full capacity. As in any country that has been at war, it increased considerably during the war, and even under normal conditions there would have been difficulty in providing work for the extensions that have come into being.

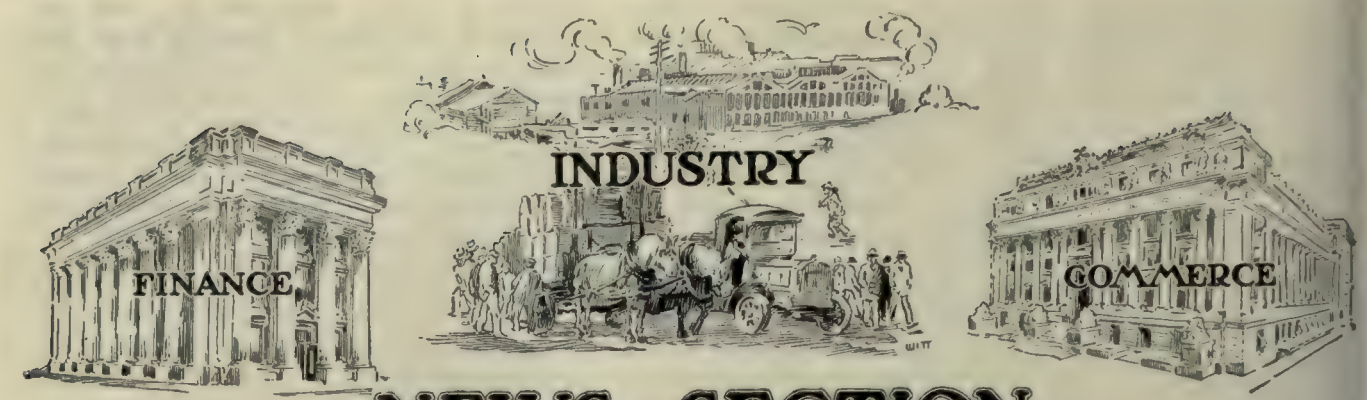
The difficulties have been particularly great in the case of the state works, engaged in the manufacture of arms and ammunition, which in the course of the war grew quite out of proportion to the reduced size of the country. There are five such plants, two of which are very much larger than any private manufacturing plant in the country. The larger of these, Wöllersdorf, has a floor space of 300,000 sq.yd., and the other, the Arsenal at Vienna, is not much less. These plants have been kept going only on account of the workmen, and by their influence. Even their greatly reduced operations require a state subsidy, which for the present year is estimated at 80 million crowns, but is expected to be considerably larger. These works are excellently equipped with modern machinery, and they have a very large stock of raw material at their disposal.

Like the German state works, they are drifting along without any commercial aim or business-like management, apparently for the reason only that they exist and have to provide work. The Austrian government is fully cognizant that the works are a dead load on the country's strained finances, and that no improvement can be expected as long as they are run as state works. It is intended to organize them as companies, in which the state will be a shareholder, or to turn them entirely into private enterprises.

The hopeful outlook which the increased activity of the industry affords, is counteracted by the country's desperate state of finances. The fact that a country of six million inhabitants has a deficit of 42,000 million crowns in one year needs no comment.

German business men have made the country's natural resources an object of closest study, and in their opinion they would, if properly developed, become a valuable addition to Germany's productive powers. Hence the interest exhibited not only for the state works, but in a much larger degree for the country's mineral and water power resources. The Stinnes combine has already acquired the chief interest in the high-grade steel works of Böhler & Co., is now negotiating for a controlling interest in the largest Austrian mining and steel producing company, the Alpine Montangesellschaft, and in fact is trying to buy up every promising property that can be bought.

Other industrials of smaller size have followed the lead of the Stinnes combine. So far, the Austrian federal governments, which are decisive factors in the sale of natural resources, and private owners are resisting such offers. Nevertheless, the penetration of Austria by German industrial interests, in anticipation of political changes, is on the way.



NEWS SECTION

American Textile Machinery Co. To Enter European Markets

The Crompton & Knowles Loom Works of Worcester, the Whitin Machine Works of Whitinsville and the Draper Co. of Hopedale, the three great textile machinery builders of Worcester county, Mass., own three-fifths of the stock of the American Textile Machinery Co., which has been established to market in European countries the machinery built by the stockholders. The other stockholders are the Saco-Lowell Co., textile machinery, and Lockwood, Greene & Co. of Boston, mill engineers.

The American Textile Machinery Co. has established headquarters in Paris, and branch offices in Italy, Spain, Portugal, Norway and Sweden. Already some machinery has been sold, but in common with everyone else handling American goods in Europe the serious handicap exists of credits and the rate of exchange. However, the company's officials believe that the matter of European exchange and credits is being arranged satisfactorily, and that the sale of American textile machinery through the agency of the company will soon be placed on a very substantial basis.

Personnel of the Combine

The president of the company is Chester S. Allen, a former Worcester man. The first vice-president is W. L. Nicoll of Paris, the second vice-president is Frank J. Hales of Boston and the treasurer Charles L. Talbot of Boston. The directors include Irving H. Verry, vice-president of the Crompton & Knowles Loom Works; E. Kent Swift and Lawrence M. Keeler of the Whitin Machine Works, Whitinsville, and Bristow H. B. Draper of Hopedale.

Belgian Export Trade Gain

During 1919 the monthly export trade of Belgium rose from only 1,000,000 francs in January to 353,711,000 in October.

During 1920 the lowest monthly figure was 147,542,000 francs in January, from which the monthly shipments rose to 842,665,000 in June, falling off slightly during the subsequent months.

Middle-West Factories Resume Operations

The Minneapolis Steel and Machinery Co., manufacturer of Twin City tractors and structural iron, reopened its foundry last week and will inaugurate an intensive three-months tractor manufacturing program.

George M. Gillette, president, said business is much improved. The company has an order for every tractor to be made. The demand for tractors in the Central and South Central States is good, he said. The company recently shipped tractors to Venezuela and Czecho-Slovakia.

The Shaw Enocks Co. has such a demand for tractors for road maintenance work that the plant is operating night and day.

The Minneapolis Traffic Association reports marked improvement in the business situation, as evidenced by increased railroad tonnage here and at other points nearby.

The Minneapolis assembling plant of Ford Motor Co., employing 700 persons, recently resumed. C. C. Hildebrand, manager, said that there has been quite an improvement in the situation in the country.

N. M. T. A. May Re-elect Newton

Albert E. Newton of the Hobbs Manufacturing Co. has been named for re-election as president by the nominating committee of the National Metal Trades Association. The election of officers will be held at the annual meeting at Hotel Astor, New York, April 20 and 21.

Other officers nominated are: First vice-president, George O. Rockwood, Rockwood Manufacturing Co., Indianapolis; second vice-president, W. W. Coleman, Bucyrus Co., South Milwaukee, Wis.; treasurer, F. C. Caldwell, H. W. Caldwell & Son, Chicago; counsellors, for two years, L. J. Chandler, Chandler Co., Springfield, Mass.; A. C. Gilbert, A. C. Gilbert Co., New Haven, Conn.; G. W. Mixter, Pierce-Arrow Motor Car Co., Buffalo; Paul C. De Wolfe, Brown & Sharpe Manufacturing Co., Providence, R. I.; Paul T. Norton, Case Crane and Engineering Co., Columbus, Ohio.

Triple Convention of Machinery Associations at Atlantic City

The big combined convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers Association will be held at Atlantic City, N. J., on May 16 to 18 inclusive, with headquarters in the Marlborough-Blenheim Hotel. The business program for the entire convention has not yet been completed but several of the sessions have been arranged and speakers have been selected.

On the afternoon of the first day, the sixteenth, there will be a triple session. Three speakers will be heard as follows: "Motor Truck Transportation," by S. N. Thompson, of the White Co., Cleveland, Ohio; "Business Conditions," by M. W. Mix, of the Dodge Manufacturing Co., Mishawaka, Ind.; "General Southern Conditions," by W. P. Simpson, of C. T. Patterson Co., Ltd., New Orleans, La. On the other days of the convention each association will hold separate sessions, taking up its own particular problems.

A feature of the closing of the convention will be a combined "Au Revoir" meeting on Wednesday at which the newly elected officers will be presented.

The evenings of the convention days will be taken up with vaudeville shows, dancing and a grand ball at the Marlborough-Blenheim on Tuesday night.

W. C. Peterson to Supervise Atlas Metallurgy

The Atlas Crucible Steel Co., of Dunkirk, N. Y., announces that W. C. Peterson, who for the past twelve years was associated with the Packard Motor Car Co., has been placed in charge of the metallurgical department of the Atlas Crucible Steel Co.'s mill at Dunkirk. During Mr. Peterson's term of service with the Packard company he has been in charge of the metallurgical laboratories, heat-treating departments and research work and he has resigned this important position to take up similar work at the Atlas. Mr. Peterson's work will include standardization of chrome-molybdenum products.

Business Conditions as the Big Banks of the Country See Them

Peoples National Bank of Pittsburgh Sees No Revival of Trade—Railroad Situation Worse—Foreign Politics Unsettled

At the opening of the second quarter of 1921 predictions made three months ago remain to be filled. Trade revival has not occurred; on the contrary, the volume of business has steadily contracted. Here and there improvement is noted, but it has been in those lines which anticipated by three to five months the general reactionary movement—as in textiles, rubber, and motor car construction—which set in last year. The change in the money market has been less pronounced than expected. The percentage of bank reserves is higher due to gradual liquidation of long-standing credits, but more than usual conservation is being observed in extending fresh credits where borrowers have been slow in adjusting their affairs to existing conditions. Some industrial corporations have become ultra-conservative in setting up reserves against possible eventualities of the future, and the disposition is becoming a little more general to set ahead the date for a positive revival in trade as a whole.

The Steel Trade

Contraction in the steel trade is more pronounced, and the Pittsburgh district has gradually lost ground, although it is perhaps still more fortunate than some other industrial sections. Prices have further receded, but the movement is much slower now than earlier in the year. As this review is being written, the Steel Corporation continues to adhere to 1920 quotations on basic products, but its official tonnage figures tend to confirm unofficial reports that new business is rapidly shrinking. The latest available figures on unfilled orders show that the total on its books was about 6,933,000 tons on March 1. The report due on April 10 will probably show that this total is down to or below 6,500,000 tons which would compare with 8,148,000 tons at the beginning of the year and with 9,982,000 tons at the corresponding date in 1920. The showing, however, would still be better than in the second quarter in 1919 when the business booked fell to 4,282,000 tons on May 30. That was the period when the trade was halting to learn whether or not pre-war prices were to be immediately re-established.

The price policy of the chief producer at that time was fully endorsed by subsequent events, in view of which its reiterated policy of the past four months appears to be fully justified. Today's average price in the open market is roughly $4 a ton lower than it was two months ago, and fully $16 a ton lower than a year ago, while Steel Corporation prices are said to remain virtually the same as two years ago.

From all appearances price concessions have not attracted any appreciable increase in new business. On the contrary, pig iron output is at the lowest rate in several years, and steel ingot output is about 23 per cent below the monthly average for the full year of 1920. Toward the end of March, the price movement became nearly stationary.

The decline in foreign steel markets last month was really precipitous, and yet the latest figures on British exports show a decrease from the average of 1920, probably due to German and Belgian competition.

Railroad Situation Worse

The railroad situation went from bad to worse during the month just closed. It finally reached a stage where heroic methods were adopted to reduce operating expenses. The decrease in gross earnings was reflected in the large addition to the number of idle cars, due to the falling off in freights, particularly of fuel and of the raw materials which enter into steel making, but extending also to most other industries and to products of farm and forest. The effect upon operating income was even worse, because overhead charges remain virtually unchanged. The latest available figures show that after providing for operating expenses, fixed rentals and taxes, rail transportation was conducted at an actual loss on many of the largest systems. These conditions were not confined to any particular zone, but were quite general throughout the country.

Financial Retrenchment

The first recourse was to retrench in all improvements involving new capital; the second, to curtail purchases of supplies except for the most pressing needs; the third, to cut down operating forces; the fourth, to dispense with clerical help wherever possible; the fifth, to reduce forces in the engineering departments engaged in planning for the future, and the sixth, to reducing wages of labor not embraced in the "National Agreement" negotiated last year. In a few instances, announcement of proposed cuts in wages of organized labor was made, anticipating a favorable outcome to an appeal taken to the Railroad Labor Board to suspend or amend the award made last year. This appeal failing, the orders issued to reduce wages of labor under last year's agreement were rescinded.

Being blocked in an attempt to take a short cut in readjusting labor costs to post-war conditions, some of the roads have announced conferences to be held this month between employers and representatives of organized labor to obtain voluntary consent to a reduction in labor costs. In one instance where this method was adopted last month, the proposed reduction was rejected by the men and appeal was taken by the roads to the Railroad Labor Board. Of course, it is possible for scores of such appeals to be made, and if each were considered separately and in turn, months would elapse before a decision could be reached in the last appeal filed. The consequence would be a multiplicity of varying costs in the same general territory, which would make for confusion to shippers, for dissatisfaction on the part of labor, and possibly for irretrievable financial loss to the operating companies. The hope is to have the appeals consolidated into one in order to reach a decision as speedily as possible.

Foreign Political Situation

Some interesting developments appeared in the foreign situation in the month just closed. We have space to refer only to two of the most important. The first was the failure of the German Government to comply with the demands of the Reparations Commission for the deposit in bank of the equivalent of $250,000,000 gold to the credit of the Allies. Germany was given the option of making the deposit in London, Paris or New York. It made neither selection nor deposit. Its non-compliance was followed by disturbances in the chief industrial centers of Germany, but these did not reach the proportions of a revolutionary movement.

U. S. Declines Russian Trade

The second event of interest was the signing of an agreement restoring trade relations between Great Britain and Russia. The politico-economic effect of this action cannot be fully appraised at this time, but it may easily deflect some existing international trade currents. Within less than two weeks after the signing of this agreement the U. S. Government denied application by the Soviet Government for the opening of negotiations looking to the restoration of similar relations between the United States and Russia. Early in the war, when the Imperial Russian Government was in the market for external loans, the Russian Empire was described as an inexhaustible reservoir of undeveloped raw materials. Great Britain and Germany have much greater need for such materials than has the United States. What the effect of the resumption of trade relations will be upon the demand for American raw materials remains to be seen.

David Forgan, of National City Bank of Chicago, Offers Intelligent Analysis of Present Industrial Situation

The present industrial situation is the worst that this country has experienced in many years. The so-called panics of 1893 and 1907 were not so disastrous because the reversal was neither so severe nor so sudden. This time we fell from the heights of seeming prosperity to the depths of depression—almost over-night. The wave of great volume, high prices and unprecedented profits broke, and we were confronted with an industrial panic in which buying almost ceased, cancellations of former orders were numerous, prices melted, and profits gave place to losses. In the last few months of 1920 many business concerns not only lost the profits of many preceding months, but in some cases of many preceding years. This was due to the fact that while all expected a reversal some time, most men were too close to their own business, too pressed with unfilled orders, and too burdened with the difficulty of procuring their raw materials to be able to sense the hour of the approaching change. As a rule, therefore, they were caught with heavy inventories to be written down, and correspondingly heavy indebtedness to be arranged with their bankers. Followed the passing of dividends, the cutting of overhead expense, the cessation of unfinished new building, the discharging of employees—all of which were necessary to the life of the particular business, but harmful to the general situation by curtailing the general buying power.

In former periods of depression we could sell largely to Europe and lean on her for financial support, but now Europe hangs like a millstone about our necks—owing us billions on which she is as yet unable to pay the interest, and prevented from buying freely from us by her post-war political confusion, her financial inflation, and the consequent break-down of her exchanges.

Who Is to Blame?

In a discussion of this kind the facts must be faced. Naturally, the man on the street asks how such facts are possible in the richest country in the world, and who is to blame. If he reads a labor paper he will be told that the whole thing is a conspiracy on the part of capital—and particularly "Wall Street" to break the unions. If he reads the magazine articles of some professor of political economy, he will be told that the banks—and particularly the Federal Reserve Board—are to blame for allowing such expansion of credit and currency that p rices soared and the inevitable crash followed. If "Wall Street" is to blame it must have used its supposed power as Samson used his—not only to destroy his enemies but himself—for if anyone is walking the floor these nights it is "Wall Street" where all the business troubles of this country come to a head; and if the bankers are to blame, they now find themselves partners in numerous enterprises the condition of which gives them grave concern. The truth is that no one was to blame. Parallel conditions exist in all countries. We, and all the so-called civilized world have been and are in the grip of economic forces too strong for any class, any monetary power or any government to avoid. The expansion of credit, the high prices for labor and for goods, the fictitious prosperity and the resulting industrial crash were the inevitable and unavoidable aftermath of the costliest war in history. They are all explicable by and attributable to the working of the law of supply and demand.

What of the Future?

No conservative banker will commit himself to very definite prophecy at the present time. This, however, may be safely said, that the crisis has been passed, that the worst is over, and that recovery, although slow, has begun and will be sure. If the new Administration at Washington disposes of our chief problems wisely, I see no reason why the present year should not witness a return to fairly normal business. Revision of Federal Taxation, the Tariff, and Railroad Freights are fundamental. They are too complicated to discuss here, but they must be studied and settled scientifically—not politically.

In many lines, particularly those which were first hit, and hardest hit, orders for goods are now quite numerous. They are still small, and represent a hand-to-mouth policy on the part of the buyers, but urgency of shipment is a very noticeable and encouraging feature of these orders.

At such a time as this there are always pessimists who cannot see what is ever going to happen to cause a recovery, but in a long experience I have never found that the pessimists were right. I have great faith in the recuperative powers of the United States of America, and in the consumptive demands of one hundred and seven millions of Americans.

Determination is Lacking

Psychology plays an important part in all human affairs. If our people once make up their minds that recovery has set in, its progress may gather a momentum that now seems impossible.

Liquidation both in materials and wages must be well balanced. Some retailers are still trying to get war prices, and some laborers are still threatening strikes for the maintenance of war-time wages. These will have to yield. Generally speaking, however, business men have taken their medicine, and laboring men have shown a reasonable disposition. If all of this results in a reduction of the high cost of living, and a return to saner business ideas the present hard experiences will not have been an unmixed evil.

German and Italian Activities

Special Correspondence

A report from Madrid is to the effect that the Spanish Railway Admininstration has placed an order in Germany for 119 heavy locomotives. The German Locomotive Works promised to deliver the engines within a period of eight months, while the most favorable British offer was for delivery in ten months. In addition, the German Government has declared its willingness to pay an indemnity in case the German firm should not deliver the engines in the time agreed upon. Furthermore, the German house has agreed to accept payment in German marks or Spanish pesetas. The locomotives have to be paid for after they have been in service for a period of six months and after the Spanish Railway Administration has declared same to be absolutely satisfactory. Easy terms, indeed!

Italian Capital for Rumanian Industries

With the assistance of some of the leading Italian banking institutions a company styled "Sindacato Industriale Danubiano" has been formed at Milan for the purpose of developing the metal industries in Rumania. In connection herewith it may be stated that the Rumanian market should offer a good field for American machine tools of all kinds. The machines at present in use are mostly old and worn out.

The Italian Government is seriously considering the construction of a fourth Alpine tunnel. The most favored project is that of piercing the Splügen chain of mountains at a cost of about 700 million francs.

The Zeppelin Works of Today

The extensive establishments of the German Zeppelin Works at Friedichshafen on the lake of Constanz (Bodensee), not far from the Swiss frontier, where during the war tremendous airships were built, have now undergone, like the Krupp works, considerable changes and reconstructions. Instead of heavily armed airships the works are now turning out all kinds of peace material. A large number of skilled mechanics and workmen, especially trained in the construction of airship material, had to be discharged. Large quantities of special machines and apparatus especially designed and built to suit the former work, had to be disposed of at considerable loss to the company. It will be remembered that the construction of airships, on account of the Versailles treaty, remains forbidden for a long time, and in spite of successful negotiations which have been carried on with the Argentine Republic, Chile, Sweden and some other countries with a view of building airships for those States there is very little hope that the works will be allowed to build airships again in the near future. For this reason the administration had to reorganize the entire plants of the company.

Siam a Ready Market for American Machinery

According to a statement issued by vice-consul Carl C. Hanson there appears to be no machinery manufactured in Siam. The volume of such imports from abroad has hitherto been comparatively small, owing to the fact that the Kingdom's manufacturing interests remain as yet undeveloped. Considerable quantities of modern mining machinery has, however, been in use in Siamese Malaya, notably tin dredges, many of which have been supplied by well-known American firms. These firms have also furnished similar machinery for excavating canals for Siam's extensive irrigation scheme which is now under construction.

In view of the latter scheme, which is expected to bring extensive, more or less dry, areas under cultivation, and part of which may be completed during 1921, it is expected that a fairly large number of tractors and other agricultural machinery will be needed very soon. In fact, experimental work has already been successfully done in the use of several well-known American tractors. Demonstration by capable engineers is essential in the beginning, and there are now in Siam two experienced American engineers who may possibly undertake the work.

Of marine motors the small American outboard type has become very popular, and owing to the fact that some 400,000 small boats are registered as in use in Bangkok alone there is likely to be a demand for these.

Owing to the partial failure of Siam's rice crop for the 1918-19 season there has been but little activity in the imports of rice-milling machinery during the last two years, but prior to the war Germany did an extensive and sole business in this class of machinery. However, the prospects for a fair rice crop for the current 1920-21 season are good, and therefore a normal demand for this machinery seems possible.

The demand for textile machinery has hitherto been insignificant. Cotton goods or other textile fabrics and yarns are not manufactured in Siam, but some weaving is done on native and Chinese looms.

Hugo Stinnes To Build R.R. Equipment for Soviet

According to an article in the *Golos Rossij*, the official Russian organ published at Berlin, the well known German iron master Hugo Stinnes is negotiating with the Soviet government with a view to acquiring the large Briansk steel and machinery works. It is stated that Stinnes promised the Soviet government that as soon as he had taken possession of the Briansk works the works would turn out 70 locomotives during the first year, 200 in the second and 1,200 in the third year and that the production would finally reach 8,000 locomotives and 80,000 freight cars per year. One-third of the net earnings would be turned over to the Soviet government, the report adds.

The End of the German Steel Trust

The Stahlwerksverband, which is the official title of the German Steel Trust, one of the mightiest and most influential institutions of pre-war Germany, has just delivered its death-song in the shape of a business report covering the time between July, 1919, and June, 1920, at which date the business activity of the corporation came to an end.

The beginning of the dissolution of the trust dates back into the early stages of the war, when the powerful structure commenced tottering on account of the steadily growing tendency of its members to free themselves from all restrictions with regard to production and distribution. The enormous demand for steel products during the war caused the steel trust to be more and more considered as something entirely superfluous and a severe handicap to individual progress. It would have fallen to pieces before the War came to an end if the government had not brought influence to bear upon the steel works for the sake of the continuation of the trust. Conditions, however, became critical after the separation of the Luxembourg and Lorraine Works and great difficulty was found in patching up matters from April, 1919, to the end of September, 1919. When, however, at the end of July the Sarre works also left the trust, all hope for its continuation was abandoned. The government conceived the idea of a new body which was to take over the functions of the steel trust, under the control of the government, as far as distribution and the control of prices was concerned.

This body, the Eisenwirtschaftsbund, or Iron Economy Society, came into existence in April, 1920. Strong pressure was used by the government to keep the steel trust alive until operations of the new society came into swing. The corporation agreement was compulsorily renewed four times, until the third of June, 1920, when its activities were terminated definitely.

The last business report of the trust makes sad reading, and is conspicuous for the absence of optimism. It deals very severely with the official institutions for the control of the export, the export licenses, and the slow, red-tape, business procedure for obtaining them, which were patiently borne by the foreign buyers only so long as the foreign markets stood in great need of German steel products. Many substantial orders at good prices were lost while the export offices could not prevent large quantities of steel, especially rolled products, which were bought at inland prices obviously for inland consumption, from finding their way across the frontiers through the "Hole in the West," which is the common term used for the occupied territories, where control of exports is handled indifferently and very leniently. In this way, only 11 per cent of the total shipments of 1,278,310 tons could be sold abroad. Even the strong inland demand of that period is not looked upon as a hopeful sign, as it was discovered to be artificial and inflated by speculation.

After delivering a parting shot at the steel trust's successor, the Eisenwirtschaftsbund, which it is said, in the opinion of the steel industry is perfectly superfluous and out of place, the report gives vent to rather pessimistic views on the present situation and on the outlook, which is declared to be very gloomy. The main danger to the German industry is seen in the growing competition of foreign rivals, whose situation is steadily improving, while the German industry has not seen its worst time yet. The latter is existing solely on the grace of the low exchange, and is thus controlled by a factor which in itself is uncontrollable. A sudden rise of the exchange, like last year's, would land the German steel industry in a sorry predicament.

The shipment of semi-finished products was 314,762 tons, as against 439,309 tons in the previous year, or 124,547 tons less. Of these shipments, only 12,234 tons, or 3.89 per cent, were sold on foreign order. The shipment of railroad material was 586,814 tons, which is 229,097 tons less than in the preceding year; on foreign order were shipped 120,886 tons, or 20.46 per cent. Of rolled shapes, 384,743 tons, or 57,077 tons less than the previous year were shipped, of which only 12,183 tons, or 3.22 per cent, were sold on foreign order. The shipments of steel bars amounted to 279,456 tons; the exports of steel bars could have been much higher, says the report, if the steel works had been free from the fetters of government control, this being the more regrettable as it evidently caused the loss of several important markets to foreign competitors. The figures in the table represent the shipments in tons of the various products during the individual months of the business year.

MONTHLY SHIPMENTS OF GERMAN STEEL PRODUCTS

Month, In Tons	Semi-finished Material	Railroad Material	Rolled Products	Total	Increase or Decrease, 1918
July—1919	42,712	55,491	37,598	135,801	—63,181
August	34,762	62,008	40,542	137,312	—68,626
September	58,254	61,147	42,233	161,634	—21,960
October	26,412	59,632	36,233	122,277	—30,892
November	19,084	43,122	34,988	97,194	— 9,106
December	18,967	51,666	30,097	100,730	— 5,057
January—1920	12,543	33,412	27,164	73,119	—52,242
February	19,062	39,830	29,338	88,230	—42,990
March	22,516	36,563	27,687	86,766	—63,150
April	21,858	42,581	27,872	92,311	—30,088
May	17,200	45,164	26,060	88,484	—28,204
June	21,332	56,198	24,931	102,461	—13,274
Total tons	314,762	586,814	384,743	1,286,319	—410,721

Metal Trades in Southeast Show Appreciable Gain

Business conditions in the Southeast have taken an upward trend the past two or three weeks which appears to give every promise of a return to normal—or at least something like normal—within the next thirty or sixty days. There is a much better feeling in industrial circles as regards the outlook for the future than has existed in this section for many months.

Financially the South is in bettter shape than it has been for some time, with money more easy to obtain and rates of interest gradually descending. Reporting for the Sixth Federal Reserve District, which comprises the group of states in the Southeast, the Federal Reserve Bank of Atlanta estimates that at least 50 or 60 per cent of last year's cotton crop is still being held, and that approximately half of the amount held is pledged as collateral for loans. The volume of loans being made throughout the district, according to the report, is generally larger than for the same period in 1920, which would indicate that the money market in this section is rapidly assuming stability, for at this time a year ago loans were very easy to obtain.

The Birmingham Boom

Men of the iron, steel and metal trades industries in this section generally regard conditions in the Birmingham district as a barometer reflecting conditions thoughout the whole South, and therefore a great deal of optimism is prevalent because of the wide-spread resumption of activities during the past two weeks in many of the foundries, shops and plants in the Birmingham district. It is generally believed that the period of depression has become a thing of the past and that the iron, steel and kindred industries of the South will continue to experience steady improvement from now on until the full return to normal has been reached.

At Anniston, Ala., which is one of the largest soil pipe manufacturing centers in the country, it is estimated that at least 2,000 employees are now at work in the various foundries and shops, a number of which only resumed operations the latter part of March. Several other pipe plants in the district, principally at Bessemer and Birmingham, also resumed operations the latter part of March, and as these plants are the largest consumers of pig iron in the South the resumption of activity presages a revival in the demand for pig iron. While no immediate response is anticipated expert opinion is that the iron now on hand will soon be worked off if structural operations continue to gather pace as they have been doing.

Blast furnaces in the district, most of which closed down a few weeks ago, are expected to resume shortly. The largest stack of the Woodward Iron Co., near Bessemer, Ala., was touched off the latter part of March, and is the first of the larger furnaces to resume in response to the betterment in conditions affecting the iron making industry. The iron market remains sluggish, small lots for immediate shipment being the principal business obtained, but the resumption of activities at many of the foundries in the district means that they will shortly exhaust their present pig iron stocks and the market will undoubtedly become active again.

The Tennessee Coal, Iron and Railroad Co. has resumed operations at the blooming and plate mills in Fairfield, and every steel mill in the district is now running either on part or full time schedule.

Alabama a Big Reducer

According to an official report of the American Iron and Steel Institute, which has just been made public, Alabama produced during 1920 a total of 2,392,962 tons of pig iron. Figures previously announced in the *American Machinist*, but which were unofficial, gave the state 2,354,803 tons for 1920, only 38,159 tons under the official figures now available.

The total for the year was greater than the ouput for 1919, when the output of the furnaces amounted to 2,130,092 tons. Only the years of 1916, 1917 and 1918 exceed those of 1920 in the amount of pig iron produced, but it must be remembered that these were years during the greatest activity of the World War when metal of all kinds was in demand. During the first six months of 1920 Alabama produced a total of 1,225,236 tons of pig iron, the slump in the iron market causing the total figure for the year to fall considerably below estimates made while business conditions were flush and the demands were greater.

Sale of Motorized Equipment by War Department

The Director of Sales, War Department, announces sales of motorized vehicles, trailers and bicycles to be held through the agency of the Quartermaster Corps as follows: At Camp Normoyle, San Antonio, Tex., during the week beginning April 11; at El Paso, Tex., during the week beginning April 18; at Jeffersonville, Ind., during the week beginning April 25; at Schenectady, N. Y., during the week beginning May 1.

These dates are tentative and subject to revision. Sales will be conducted under the general policies and procedure in effect at the recent disposal of motorized equipment at Camp Holabird, Md.

The classification and final inventory of the various motor vehicles and equipment is now being made. Prior to the opening date of each sales and in ample time to permit buyers to make inspections a detailed list of all items to be offered will be available. This list and other definite information may be obtained upon request from the officer in charge of motor transport activities at the respective camps.

Federal Highway Council Urges Store-Door Delivery

Railway traffic executives in Eastern territory now have before their committee a proposition from the transportation committee of the Federal Highway Council to make a larger use of the highway and motor truck in the store-door collection and delivery of freight.

Numerous meetings of the council's committee have been held to determine the proper policy in approaching this important subject. The proposition now before railway executives is the concrete result of these meetings.

In determining the class of traffic which would economically come under the new plan of delivery, J. C. Lincoln, traffic manager of the Merchant's Association of New York, has had embodied in the plan of procedure the principle that store-door delivery should apply to all station or platform delivery. This would exclude carload lots delivered to sidings, but would include carload lots handled over freight platforms at terminals. In most smaller cities carload lots are seldom handled over platforms, while at New York City a large portion of the freight is so handled whether it is carload or less than carload lot.

A Concrete Proposition

A motion has also been adopted to the effect that "the committee deems it most advantageous to have store-door delivery a carrier service, but at additional rates not included in the through rates." It was brought out in the discussion that store-door delivery tariffs should be published separately, similar to the lighterage tariffs of New York.

Upon the suggestion of William J. Pitt, of Philadelphia, the committee has adopted a recommendation that "the carriers, to avoid congestion and delay, be urged to establish and operate in all large cities a store-door collection and delivery system to be performed by, or under the control of the carrier, the carrier to assume liability for the safe transfer by their representatives, a reasonable charge to be assessed for such service."

Government Needs Topographic Draftsmen

The United States Civil Service Commission states that there are openings in the government service for copyist topographic draftsmen at entrance salaries of $900 to $2,000 a year; hydrographic and topographic draftsmen at entrance salaries of $1,600 to $2,000 a year, and junior topographers (topographic aids) at entrance salaries of $720 to $1,500 a year.

In addition to the basic salaries appointees whose services are satisfactory will be allowed the increase of $20 a month granted by Congress.

Full information and application blanks may be obtained by communicating with the United States Civil Service Commission, Washington, D. C.

Robert A. Bole Dies at Pittsburgh

Robert Alexander Bole, age 62, vice-president, director and district sales manager of Manning, Maxwell & Moore, Inc., died on April 2 in the Schenley Hotel, Pittsburgh, Pa., where he made his home. Mr. Bole was well-known in the iron, steel and railroad circles where he gained a nation-wide prominence.



ROBERT A. BOLE

He was born in Old Allegheny City, a son of the late Robert and Euphemia Kirkpatrick Bole. He received his education in the Pittsburgh schools. In early life he became identified with the Westinghouse Machine Co. and rose from the ranks to secretary of that company. Following his long and faithful service with the Westinghouse interests, he became identified with the large manufacturing company of Niles-Bement-Pond Co. and, after serving with them, resigned his position to become associated with Manning, Maxwell & Moore, Inc. At the time of his death, he had been identified with the latter company for a period of 26 years.

Mr. Bole enjoyed a very wide circle of business and personal friends throughout the East, especially in Pittsburgh and New York City. His sterling qualities of integrity, justness and keen business judgment gained him great prominence in manufacturing and civic activities. At the time of his death, Mr. Bole was also a director of the Western National Bank of Pittsburgh and an active member of the Duquesne Club, Pittsburgh Athletic Association, Pittsburgh Country Club, Pennsylvania Society of New York and the Engineers Club of New York. In his early life he was a member of the United Presbyterian church and was later identified with the North Presbyterian church. Mr. Bole never married. A sister, Mrs. T. Charles Hare, survives.

The Edwin Poulton Foundry Co., New Orleans, La., plans to begin full operations in its new building about April 1. Castings and iron products will be made.

Business Items

Meldrum-Gabrielson Corporation, Syracuse, N. Y., has taken over the M. S. G. L. Co., Inc. It will, in addition to the manufacture of accurate limit gages and the building of special tools, etc., manufacture and sell execlusively the Gabrielson milling machine for the Gabrielson Manufacturing Corporation. Carl Gabrielson is consulting engineer; Alexander Meldrum, general manager, and A. J. Littlejohn, general sales manager.

The New Jersey Machinery Exchange of Newark, N. J., has purchased the plant and equipment of the Allaire Woodworkers Corporation at Farmingdale, N. J.

The Ideal Sheet Metal Works Co., Inc., has been organized at New Orleans, La. J. J. Kurz is the proprietor. The company will engage in a general line of sheet-metal manufacturing.

The C. G. Young Co., Inc., consulting engineers, has opened an office at 501 Fifth Avenue, New York City. The company will devote its attention to serving industrial corporations seeking more satisfactory and more profitable results by adoption of new or modified product or by changes in methods. By reason of its foreign work and connections this firm is in a position to be of special service in foreign investigations and undertakings.

Several thousand dollars worth of machinery, machine tools and equipment was destroyed by a fire which gutted the plant of the Valdosta Machinery Co., at Valdosta, Ga., March 4. The main building, 100 x 200 ft., was entirely destroyed, the total loss amounting to between $15,000 and $20,000.

The Landis Tool Co., of Waynesboro, Pa., has moved its New York office from 50 Church St., to 51 Chambers St. The change took place on April 9. M. G. Dunbar is in charge of the New York office.

Announcement is made by D. Stergias, president of the Stergias Repeating Arms Co., of Wilmington, Del., that the company has obtained an option on part of the Old Hickory munitions plant at Nashville, Tenn., where a factory will probably be established to manufacture the products of the Stergias company. Mr. Stergias was recently in the South to visit the Birmingham district where it is also planned to establish a drop-forge plant for the manufacture of gun material to be used at the factory in Nashville.

Township trustees would be given authority to buy all machinery necessary for the maintenance of township roads in a bill introduced in the Indiana General Assembly. Heretofore it has been necessary to advertise for bids on such machinery through the Board of County Commissioners, upon the recommendation of the township trustees. The bill if passed will permit the township trustees to deal direct with machinery dealers.

Increased production of 50 per cent with corresponding decrease in number of men required to accomplish it has been secured by ingenious installations of mold carrying, lifting and pouring devices in squeezers department of Modern Foundry Co., in Oakley Colony, Cincinnati, Ohio.

The Jacobs Manufacturing Co. of Hartford, Conn., manufacturer of drill chucks, has increased the capital stock of the company from $50,000 to $500,000.

W. N. Best, Inc., has sold its business to the W. N. Best Furnace & Burner Corporation, 11 Broadway, New York City, which has just been incorporated under the laws of the State of New York, with a capitalization of $1,000,000. The new company expects to conduct business in this country, and to organize companies in foreign countries where oil is procurable as fuel.

Dr. W. N. Best has given to each of the employees stock in the new company as a reward for their services, the amount of stock varying according to the length of time each employee has been with the company and the ability which each employee has developed. Dr. W. N. Best, F.R.S.A., the retiring president of W. N. Best, Inc., is the consulting engineer of the new company and has a large financial interest in it.

Announcement is made that the firm of Arison, Goodwin & Knapp, industrial engineers of Chicago, Ill., has dissolved on the retirement of L. G. Knapp. The business will be carried on with Colonel Edgar E. Arison and L. Reeves Goodwin as the senior members under the firm name of Arison, Goodwin & Associates.

The American Steel and Wire Co., Worcester, Mass., has taken bids for the construction of a one-story 40 x 110-ft. brick and steel assembly hall building at its plant in West Haven, Conn. It is hoped to award the contract soon so as to have it ready at an early date. The welfare department of the company plans the erection of assembly halls at all its plants which are not now equipped with one.

Two changes have been effected recently in the district office organization of the Cooper-Hewitt Electric Co., maker of Cooper-Hewitt lights. The Philadelphia office force has been increased by the addition of two salesmen, and the force has moved into larger quarters in the Drexel Building. The St. Louis district office has moved from the Central National Bank Building to the Title Guaranty Bank Building.

Evolution of an "American Machinist" Article — VI



At last we arrive at the Editor's desk, and the old joke about it being hard to interview the editor doesn't go in the office of the *American Machinist*. Anybody desiring to consult him can readily do so and will always find him congenial. He is here shown giving each article, in page form, his final O. K. This is the final editorial step and after a page is O. K.'d by the editor it is sent to the composing room and regarded as a closed incident. Like all editors, he is always as busy as the proverbial one-armed paper hanger. His duties are manifold and of such nature that they would make a very interesting story in themselves.

United States Council of National Defense Issues Final Report of War Industries Board

Encouragement of permanent intimate combinations or associations of industry under government supervision, involving a radical change in the present attitude of the government toward such groupings, is recommended in the final report of the United States War Industries Board just completed by Bernard M. Baruch, who was the board's chairman. This is one of the conclusions the board came to as the result of its successful direction of industry during the war in conjunction with the temporary associations of the various industries evoked by the war necessity. It is held that great public benefits in the way of prices and abundance of goods, resulting from economies in production and distribution, are capable of being effected through the mutual co-operation of members of industrial groups, and that the present governmental policy of enforced isolation and costly competition is not conducive to the general welfare.

But as the same power born of association that makes for potential benefits may also make for potential injustices, it is recommended that there be created some sort of government agency which shall supervise such associations, both for the purpose of promoting their beneficient possibilities and checking their opposite potentialities.

A concise recommendation is also made for the maintenance of a skeleton organization along the lines of the War Industries Board which by reason of its form and its peace-time contact with industry would be capable of immediate expansion and action in the emergency of another war. In this way the experience gained in the World War may be permanently capitalized. "One is led to the thought," Mr. Baruch says, "that in a similar emergency there ought not alone to be a mobilization of man power but of things and of dollars."

The report is issued in book form from the Government Printing Office, and is entitled "American Industry in the War." The preface quotes the brief report made by Mr. Baruch to President Wilson at the conclusion of the board's general work in December, 1919, in which a full and detailed history was promised. It describes the book—which contains about 150,000 words—as "an analysis and narrative of the War Industries Board, whose function it was to supervise the industries of America that the energies of each should, as far as practicable, supplement those of all others, and that all should contribute to the limit of their combined ability to one common purpose—the winning of the war."

"Communism Must Go—If Russia Is to Live"

"There is just one way for Russia to be reconstructed, and that is for Communism to fall. If Lenine wants to give in, as some people would have you believe he has apparently given in, he has just one step to take, the re-establishment of private property and the re-establishment of reward for individual effort." These are the words spoken by Captain Hugh S. Martin, of the Military Intelligence Division of the U. S. Army, at a meeting of the Merchants Association of New York, held at the Hotel Astor on April 6.

Captain Martin spent three years in Russia and is credited with the distinction of being the only loyal American admitted to the deliberations of the Bolshevik government. The Captain gave a graphic description of the rise of Bolshevism and its attending disorder and bloodshed.

"Bolshevism," he said, "is the spectacle of an insignificant minority attaining power by deception and holding by bullets that power against the will of an overwhelming majority."

"They tell you that Petrograd is dying because we blockaded Russia. A greater lie has never been spread upon a credulous people. Russia is dying today—the industry is gone—because Bolshevism has destroyed individual initiative and human ambition."

The Captain then went on to give his deepest impressions concerning Bolshevism. He declared that the four most important things he noticed about this new order were the ease with which the Bolshevist agitator manages to corrupt and poison the mind of the mass; the methods used by the agitator in organizing his adherents; the capacity of the Bolshevist for destruction, and the peculiar philosophy of the Bolshevist—or his method of converting or bewildering those who come into contact with him.

In closing Captain Martin said, "Bolshevism is not a Russian experiment, a Russian institution; it is essentially internationalism. It admits it cannot live in Russia alone, and unless it can spread its insidious doctrines throughout the world and set up a world soviet republic it has got to fall in Russia. They tell you that Bolshevism is changing. I tell you that Bolshevism will change only when Bolshevism falls."

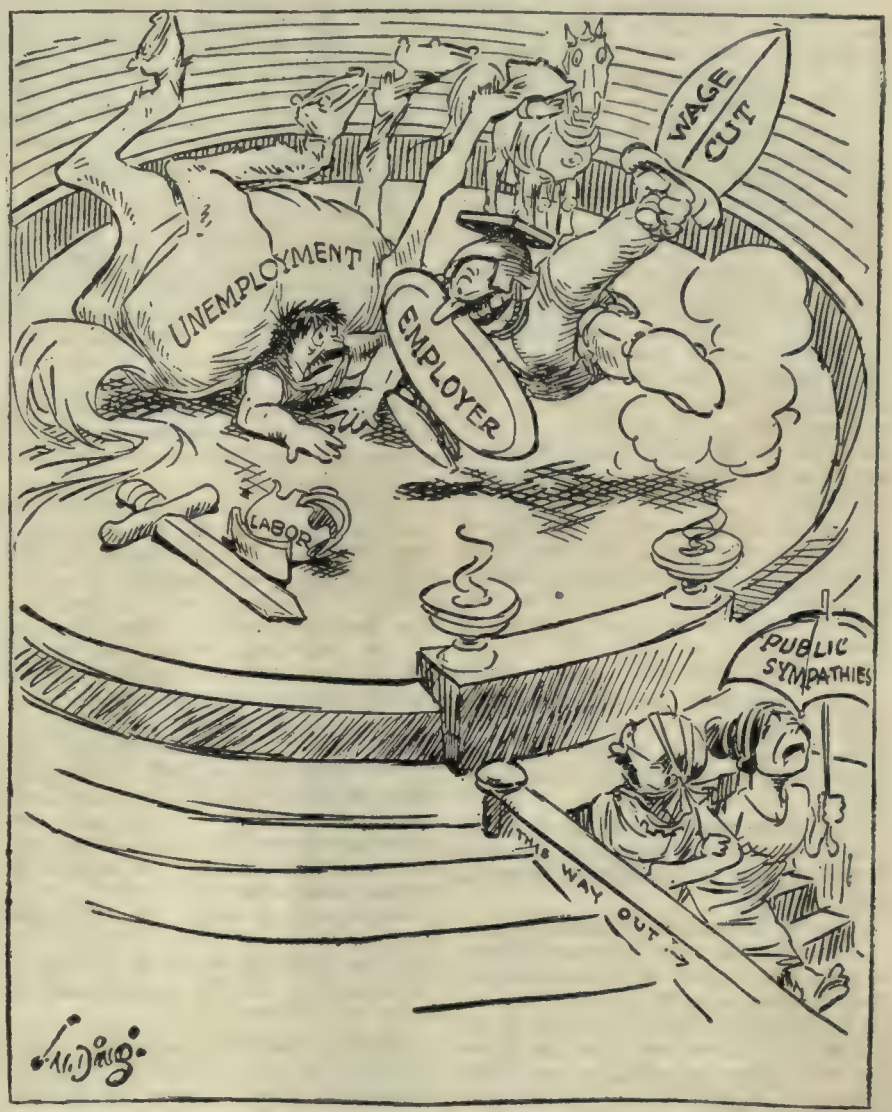
The other speaker of the day was Sir Paul Dukes, who fought in the Red Army during the revolution in Russia in 1917. Later, as a British Secret Service attaché, he spent some time investigating the theories and practices of the Soviet régime in Russia.

Sir Paul told of some of his experiences during the bloody days of the revolution. He narrated these incidents in an amusing way, but without losing sight of the lesson or the idea which he wished to bring out. On the future of Russia he had this to say: "The fate of Russia, you know, is intimately bound up with the fate of the rest of the world. Of course, no one can say when

we shall be once again in touch with that great country, a country which in a hundred years has raised itself to be on a par with the rest of the nations of the world.

"America is the greatest democracy in the world, and there is a great part for America as well as for my own country to play in the restoration of Russia, and in the teaching of Russia, how to use, how to employ this great gift of freedom which temporarily they have allowed to slip out of their hands. And if you do that, if you help us, if we work together in teaching the Russians how to do this thing, how to profit by liberty, and what duties it carries with it, I assure you, knowing the Russian people as I do, that they will not be lacking in their gratitude."

Look Out! Laurels Won in That Kind of Victory Will Only Lead to a New Challenge



J. N. Ding in New York Tribune

Personals

R. B. HUBBELL has resigned as sales manager for Churchill-Morgan-Crittsinger, Inc., to resume his former position with the Heald Machine Co., Worcester, Mass.

J. A. COWLES has severed his connection with the McVicker Engineering Co., Minneapolis, Minn.

A. D. ARMITAGE was re-elected president of the Whitman Barnes Co. of Akron, Ohio, at the annual meeting of the stockholders. Other officers elected include: C. E. Sheldon, chairman of the board of directors; A. B. Hall and R. S. Carter, vice-presidents; E. A. Fisher, secretary and treasurer; S. H. Cuttle, assistant secretary. Directors other than officers elected were: George Hill, C. B. Raymond, F. A. Siberling, A. H. Cummings and J. R. Nutt.

JAMES R. LOWE has been made general sales manager of the Harrisburg Foundry and Machine Works, Harrisburg, Pa., having previously been sales engineer with the Midwest Engine Co., Anderson, Ind.

E. L. JOHNSON was re-elected president and general manager of the Rubber City Tool and Templet Co., Akron, Ohio, at the annual meeting here last week; W. A. Skelton, of Cleveland was named vice-president. Other officers are: W. D. Ernsberger, treasurer; Mrs. J. H. McWade, secretary; J. H. McWade, director.

ALBERT J. ROMER, formerly mechanical engineer of the New Departure Manufacturing Co., Bristol, Conn., and more recently chief engineer and designer of the Northway passenger car of the Northway Motors Corporation, Natick and Boston, Mass., has formed the Romer Motors Corporation, Boston, Mass. A factory for the manufacture of passenger cars will be erected at Danvers, Mass.

CLARENCE M. DAVISON, until recently manager of the service station Aslop Motor Corporation, Richmond, Va., is now general superintendent of the Poole Engineering and Machine Co., Baltimore, Md.

GEORGE H. KENDALL is now with the Jefferies-Norton Corporation of Worcester, Mass. He was formerly in the standards department of Norton Co. of Worcester.

CARL W. BETTCHER has been appointed sales manager of the Eastern Machine Screw Corporation, New Haven, Conn. Mr. Bettcher will devote his attention especially to the expansion of sales of H. & G. die heads.

FRED W. CEDERLEAF has resigned as chief engineer of the Sparks-Witherington Co., of Jackson, Mich., and has joined the Zeigler Manufacturing Co. as works engineer.

C. L. SMITH has joined the staff of the Moore Iron Works, Inc., 1600 E. Missouri St., El Paso, Tex., in the capacity of sales manager. The company specializes in all sorts of structural steel and cast iron work.

G. S. MARTINDALE has severed his connections as resident engineer for the General Motors Corporation, St. Louis, Mo., to become works engineer for the Champion Coated Paper Co., Hamilton, Ohio.

E. T. SPIDY has resigned his position as production engineer of the Angus shops of the Canadian-Pacific Ry., to take a position as assistant superintendent of the Dominion Engineering Works, Montreal, Canada.

C. H. PETERSON, formerly with the Iron Mountain Co., Chicago, Ill., is now vice-president and general manager of the Viking Corporation, manufacturers of automatic fire protection apparatus, Hastings, Mich.

LOUIS T. KLAUDER has resigned his position as construction engineer for the Philadelphia Rapid Transit Co. and will enter the consulting engineering field, specializing in plant design and construction.

E. E. DAVIS, manufacturing superintendent of Gilbert & Barker Manufacturing Co., Springfield, Mass., recently resigned his position with the company.

S. A. HUGHES, assistant to the works manager at the plant of Gilbert & Barker Manufacturing Co., Springfield, Mass., recently resigned his position with the company.

J. F. CARATINI of the general sales department of the Gilbert & Barker Manufacturing Co. of Springfield, Mass., recently returned to this country after nearly a year spent in Porto Rico and the Dominican Republic in the interests of his company.

WILLIAM ROBERTS, formerly connected with the engineering department of the Rolls-Royce of America, has established offices at 457 Main St., Springfield, Mass., under the name of the Engineering School of Drawing. He will specialize on production and efficiency work and designing of tools and special machines.

GUSTAVE BATTIN, for a number of years Paris sales engineer for the Allied Machinery Co. of Paris, has been elected a director of the C. E. Carpenter Co., Société Anonyme of Paris, dealers in American machine tools. Mr. Battin will look after sales in the Paris district.

J. W. STANNARD, secretary-treasurer of the American Auto Parts Co. of Detroit, Mich., has been elected first vice-president of the Industrial Cost Association.

H. S. PECK, controller of the S. K. F. Industries, Inc., has been made national director of the Industrial Cost Association.

JOHN R. COMSTOCK, assistant superintendent of the blast furnaces of the Steelton, Pa., plant of the Bethlehem Steel Co., has resigned to become assistant to the general manager of the M. A. Hanna Co. of Cleveland, Ohio, the latter firm marketing ore and pig iron. Mr. Comstock is a former resident of Mechanicsburg and entered the Steelton plant nine years ago after graduating from Stevens Institute.

Obituary

WILLIAM HENRY RUNGE died at his home in Seneca Falls, N. Y., March 10, after an illness of three months. His death was not wholly unexpected by his friends who knew of the unsuccessful attempt last Spring to relieve him by a surgical operation. Mr. Runge was born in Syracuse, N. Y., March 13, 1867, but had been a resident of Seneca Falls, N. Y., the greater part of his life.

Born into what would today be considered a large family and having the advantage of but a common school education, he was obliged early in life to take up the battle for a livelihood. Denied the advantages of a university training and education, which with his natural endowments, would doubtless have aided in placing him among the foremost mechanical engineers of this age, by his untiring industry and devotion to his chosen vocation and liberal application of common sense with which he was richly endowed, he overcame many of the handicaps with which he started in life. The Golden Rule was his code, perhaps without being conscious of it. He very naturally won for himself a large circle of friends whose loyalty could never be questioned.

For practically thirty years he was an important member of the organization of the Seneca Falls Manufacturing Co., Seneca Falls, N. Y., and during the past fifteen years served as mechanical engineer. During this period he was the originator of many improvements in the lathe design, as is evidenced by the fourteen or more U. S. patents that have been granted him covering many novel and valuable features of lathe design.

Although Mr. Runge had specialized in lathe design, he was nevertheless a versatile mechanic and was unsatisfied with anything that engaged his attention until he had carried it at least one step nearer perfection. His finer sense of the appropriate would not permit him to identify himself with anything impractical or mediocre. Fabrication of parts interested him no less than the design, and consequently many improved tools and methods were introduced by him for the production of tools and machinery. He quietly and persistently followed his ideals, worked out his conceptions and left his impress on things, always for the better.

He is survived by his wife, Elizabeth Garling Runge of Seneca Falls, N. Y., and two brothers, Fred W. Runge of Painted Post, N. Y., and Ernest A. Runge of Paterson, N. J.

HENRY ATWATER, a prominent manufacturer for the past forty years in Bridgeport, Conn., died at the Bridgeport Hospital March 19. Mr. Atwater was 77 years old. He came to Bridgeport in 1879 to start the Bridgeport Malleable Iron Works, now a subsidiary of the Eastern Malleable Iron Co. of Naugatuck, Conn., and he was a director and also secretary of that concern up until 1906, when he retired from the business. Mr. Atwater is survived by his wife and one son, Fred Atwater, secretary of the Columbia Nut and Bolt Co. of Bridgeport.

ELIE MILLETT, inventor of the Millett-Core Oven and also founder of the Millett Brass Co., now the Harley Co. of Springfield, Mass., died at his home in Springfield on March 19 after a long illness. Mr. Millett was 69 years old and had been a resident of Springfield for the past fifty years. He was well known throughout the East in manufacturing circles.

ALBERT H. WOLF of New York, a well known engineer, died at Atlantic City, N. J., on March 13. Mr. Wolf had been active in many railroad and marine engineering enterprises, prominent among which was the construction of the Eads bridge acros sthe Mississippi River at St. Louis.

CHARLES SILBERZAHN died at his home at West Bend, Mich., on March 12. He was 92 years old. In partnership with his son he conducted a foundry and machine shop business at West Bend. He was well known in that section of the country as a machine builder and designer.

ADDISON STEVENS HODGES, for two generations a leading figure in the foundry and hardware business in New England, died last week at Somerville, Mass., in his ninetieth year. He was engaged in the foundry business for seventy years, first at the Wheeler foundry in Worcester and later in Hyde Park, Chelsea, Somerville and Lynn, Mass.

ANDREW J. CORCORAN, founder and president of A. J. Corcoran, Inc., Jersey City, N. J., died on March 9. He was a pioneer in the foundry and machine building industry in New Jersey.

Forthcoming Meetings

The National Metal Trades Association will hold its annual convention at the Hotel Astor, New York, on April 20 and 21. Homer D. Sayre, Peoples Gas Building, Chicago, Ill., is secretary.

The fifth annual convention of the American Gear Manufacturers Association will be held in Cincinnati, Ohio, April 27, 28, 29 and 30.

The ninth annual meeting of the Chamber of Commerce of the United States will be held at Atlantic City, April 27 to 29, with headquarters at the Traymore Hotel.

The annual meeting of the American Welding Society will be held in the Engineering Societies Building, 29 West 39th St., New York, on April 28.

The Society of Industrial Engineers will hold its national convention in Milwaukee, Wis., on April 27, 28 and 29. Geo. C. Dent, 327 So. La Salle St., is business manager.

The National Foreign Trade Council will hold its eighth annual convention in Cleveland, Ohio, on May 4, 5, 6 and 7. J. G. Hammond, care of the Council, 409 Park Bldg., Cleveland, is secretary.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

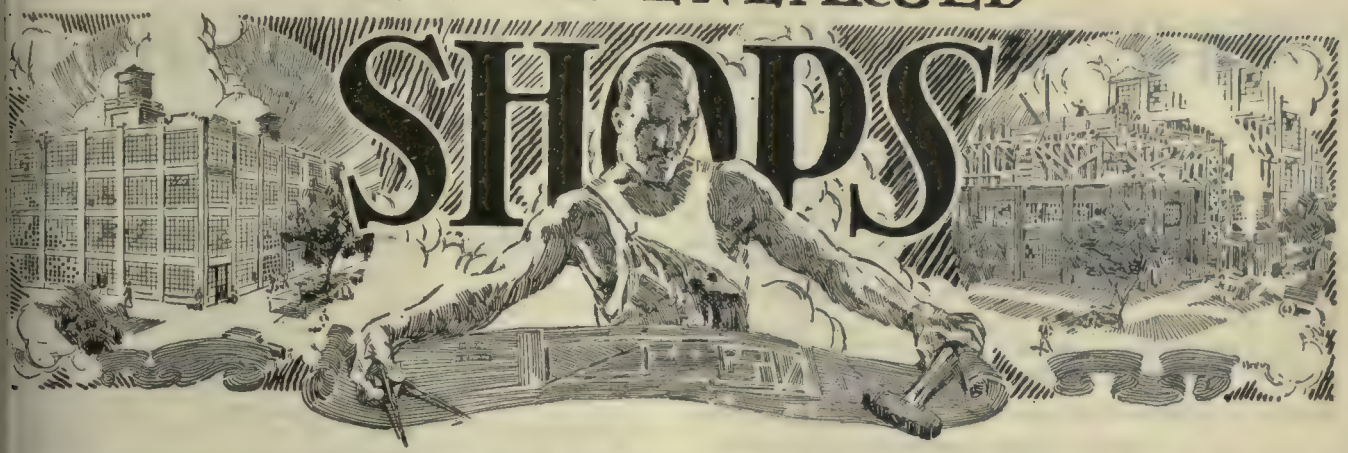
The spring meeting of the National Association of Manufacturers will be held in New York, May 16, 17 and 18 at the Waldorf-Astoria Hotel. The headquarters of the association is at 30 Church St., New York City.

Announcement is made that the regular spring meeting of the National Machine Tool Builders Association will be held in Atlantic City, N. J., on May 19 and 20. Headquarers will be at the Traymore Hotel. Ernest F. Du Brul, 817 Provident Bank Bldg., Cincinnati, Ohio, is general manager.

The spring meeting of the American Society of Mechanical Engineers will be held at the Congress Hotel, Chicago, May 23-26. Calvin W. Rice, Engineering Societies Bldg., 29 West 39th St., New York, is secretary.

The Society of Automotive Engineers, 29 West 39th St., New York announces that its summer meeting will be held at West Baden, Ind., on May 24 to 28 inclusive.

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Mass., Springfield — Genden Bros., 28 Organ St.—auto repair equipment.

Mass., South Walpole—The Bird Machine Co.—20 in. to 24 in. shaper.

Mass., Worcester—The Reed & Prince Mfg. Co., Duncan Ave., manufacturer of screws—one LaPointe No. 3 broaching machine and one No. 2 Brown & Sharpe surface grinder.

Mass., Worcester—The M. S. Wright Co., 5 Jackson St., manufacture of vacuum cleaners—1 beading machine for spinning beads on ferrules.

D. C., Washington—G. H. Rettew, 2357 Rhode Island Ave., N.E.—power bender for bending up to 1¼ in. reinforced bars, electrically driven, prefer without motor.

N. J., Harrison—The New Jersey Tube Co., Kingsland Ave.—6 buffing jacks with tight and loose pulley to take at least a 4 in. belt and one 1½ Bliss Toggle double action press.

N. Y., Buffalo—J. J. Bresnaham Heating and Plumbing Co., 462-464 Elk St.—pipe cutting machine to cut from 1 in. to 6 in. pipe, also shafting and pulleys for same (new or used).

N. Y., Buffalo — W. A. Franklin, 243 Crescent Ave.—
One planer with table 6 ft. or 8 ft. long 48 in. or 54 in. wide.
One 20 or 24 in. lathe 10 ft. between centers with taper attachment.
One 16 in. shaper.
One medium horizontal milling machine.
(First class used equipment preferred.)

N. Y., Carthage—D. J. Renaud & Son, Inc., D. J. Renaud, Purch. Agt.—foundry and machine shop equipment.

N. Y., Gouverneur—J. Russell, West Main St.—drill press, 16 in. back geared engine lathe (new or second hand), and miller.

N. Y., Watertown—The Watertown Steam Dyeing Wks., W. F. Rogers, Purch. Agt.—one 16 in. engine lathe.

Ga., Austin — Austin Bros., Greenwood Ave. and Southern Ry. E. C. Knodel, Jr., Engr.—cranes, punches, shears and power riveters.

N. C., Wilmington—Carter's Production Works., 210 South Water St., O. Carter, Mgr. —one 6 x 15 four side planer.

Ill., East St. Louis — The Dependable Truck & Tractor Co., 231 Collinsville Ave. —lathes, drill presses and cranes.

Ind., Wabash—The Service Motor Truck Co.—complete equipment for the manufacture of motor trucks and auto parts.

Mich., Detroit—F. Laskowski, 3134 East Jefferson St.—16 x 6 screw cutting lathe with compound rest.

Mich., Howell—The Howell Washing Machine Co.—lathe, drill press and automatic stoper.

O., Lorain — Longs Garage — 16 x 18 lathe, No. 2 Brown and Sharpe grinder, 20 in. drill press (used).

Wis., Milwaukee—The Badger Machinery Co., 270 4th St., F. Kebbekus, Purch. Agt. —additional machine shop equipment for the manufacture of tools, dies, etc.

Wis., Milwaukee — E. A. Krause, 2908 North Ave. manufacturer of auto springs —power punch, drop forge and emery wheel.

Wis., Milwaukee—The Snap-On-Wrench Co., 1266 South Pierce St., W. Stideman, Purch. Agt.—punch press, drill press and grinders.

Ia., Ottumwa—The Ottumwa Iron Wks. —one No. 2 or No. 3 Long and Allstøtter double end punch and shear (second hand).

N. B., Moncton—The Record Fdry. and Machine Wks.—machinery.

Tex., Waco—The Fox Sharpener Co., J. Nelson, Treas.—die casting or drop forging specialties for use in the manufacture of safety razor blade sharpeners.

Ont., Ottawa—The Bd. of Control—tools for proposed work shop and garage.

Ont., Ottawa—The city—some machine shop tools.

Machinery Wanted

N. J., Camden—The Bd. of Freeholders, Camden Co.—bakery, kitchen and ice refrigerating equipment, etc., for proposed almshouse and infirmary at Asyla (Grenlock P. O.).

N. J., Trenton—The Trenton Poster Advertising Co., Lambert St. — one electric paste mixer machine.

N. Y., Bridgeport—G. Phillips—saw mill equipment.

N. Y., Buffalo—The Rox Concrete Products Corp., foot of Ferry St., E. G. Roquemore, Pres. — automatic concrete block making machinery or partition tile machine, also helm or other automatic face brick machine (used).

N. Y., Chaumont—The Adams & Duford Co. manufacturer of crushed limestone, E. B. Johnson, Purch. Agt.—concrete mixer and limestone pulverizer.

N. Y., New York (Borough of Brooklyn)—J. Leisenheimer 54 Bogert St.—one 100 lb. hammer.

N. Y., Watertown—The St. Regis Paper Co., Trust Co. Bldg.—special machinery for the manufacture of fibre shipping cases.

Fla., Tallahassee—The Tallahassee Lumber Co., D. M. Lewis, Vice-Pres. and Genl. Mgr.—one 14 x 18 in. or 16 x 20 in. timber sizer; two 6 x 15 in. planers and matchers; one 6 x 8 in. moulder (outside) and one 24 in. circular resaw.

S. C., Embree—The Edisto River Lumber Co., D. A. Gardner, Mgr.—complete equipment for 8 or 9 ft. band saw mill.

Ill., Chicago—The Ford Roofing Products Co., 2339 LaSalle St.—one No. 6½ or No. 7 style D Reeves Drive.

Ill., Mineral — The Bd. Educ. — manual training equipment for high school.

Ill., Winchester—The Bd. Educ.—manual training equipment.

Wis., Milwaukee—J. Dabs, 1341 40th St. —wood-working machinery.

Wis., Milwaukee—J. R. Lamboy, 16 Mack Blk.—portable saw mill.

Wis., Milwaukee—D. Tuft, 2447 Brown St.—planer about 12 ft. to 14 ft. long and 3 ft. wide for cut stone shop.

Wis., Two Rivers—The Wisconsin Textile Mfg. Co., c/o G. C. Hirst, Mgr.—power machinery and machinery for the manufacture of textile supplies.

Ont., London—The Utilities Bd.—equipment for proposed smelting plant.

Ont., Stayner—The Georgian Bay Milling & Power Co.—equipment for its proposed flour mill.

Ont., Wallaceburg—The Wallaceburg Cut Glass Ltd.—equipment for proposed glass manufacturing plant.

Que., Montreal — The Imperial Knitting Mills, 200 Waha Roche St.—equipment.

Que., Montreal—The Maisoneuve Box & Board Co., Maisoneuve St.—equipment.

Que., St. Hyacinthe—A. St. Germain—biscuit and confectionary making machinery.

Metal Working

NEW ENGLAND STATES

Conn., Hartford — T. R. Forrestere, Charter Oak Pl., will soon award the contract for the construction of a 2 story, 24 x 50 ft. garage and a 2 story, 12 x 50 ft. addition to bottling plant. Estimated cost. $18,000. B. R. Sellew, 223 Asiyum St. Archt.

Conn., New Haven — F. Teitelman, 146 State St., has awarded the contract for the construction of a 1 story, 45 x 60 ft. garage with a 30 x 50 ft. ell, on Howard Ave. Estimated cost, $20,000.

Mass., Boston—E. G. Isenbeck, 120 Milk St., is having revised plans prepared for the construction of a 2 story, 90 x 300 ft. garage on Boylston St. J. C. Spofford, 36 Bromfield St., Archt. and Engr.. Noted Nov. 11.

Mass., Boston—Pope & Cottle Co., 140 Carter St., will soon award the contract for the construction of a 1 story, 50 x 65 ft. garage. Estimated cost, $20,000. Monks & Johnsoon, 99 Chauncey St., Archts. and Engrs. Noted March 17.

Mass., Brockton—A. Oppenheim, 20 School St., Boston will build a 1 story, 70 x 100 ft. garage on Montello St., here. Estimated cost, $30,000. Noted March 31.

Mass., Danvers—The Romer Motor Sales Corp., 51 Cornhill St., Boston, plans to construct a 2 story, 100 x 800 ft. paint and assembly building and a 1 story, 100 x 500 ft. manufacturing plant on Water St.

Mass., Lowell—Katz Bros., c/o Tuck & Gilman, Archts. and Engrs., 34 School St., Boston, are having plans prepared for the construction of a 1 story, 100 x 112 ft. garage.

THE WEEKLY PRICE GUIDE

This Week's Market

No price changes either in Chicago or Cleveland. Prices at New York warehouses lower for cold finished steel, hoop and strip steel, floor plates, machine bolts and structural rivets. Copper nickel ingots are now 45c. per lb. instead of 52c. as formerly. Solder, half and half, is down 1c. per lb., to 18c.

The metal market is stronger than last week. Copper, tin, lead and zinc have all advanced from ½c. to ¾c. per lb.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$30.50
Northern Basic	27.52
Southern Ohio No. 2	30.50
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	36.51
BIRMINGHAM	
No. 2 Foundry	26.50
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75 sil.	27.00
Virginia No. 2	*28.00
Basic	†26.25
Grey Forge	*27.00
CHICAGO	
No. 2 Foundry local	26.00
No. 2 Foundry, Southern, sil 2.25@2.75	33.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26.96
Basic	26.86
Bessemer	27.00

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago
Structural shapes	$3.23	$3.33	$3.58	$3.58
Soft steel bars	3.13	3.23	3.34	3.48
Soft steel bar shapes	3.13	3.23	3.48	3.48
Soft steel bands	4.18	4.28	6.25	....
Tank plates	3.23	3.33	3.78	3.78

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.25@$2.35
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	4.12

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.20@3.55	4.23	4.00	4.68
No. 12	3.25@3.60	4.28	4.05	4.73
No. 14	3.30@3.65	4.33	4.10	4.78
No. 16	3.40@3.75	4.43	4.20	4.88
Black				
Nos. 17 and 21	3.75@4.15	4.80	4.70	5.55
Nos. 22 and 24	3.85@4.20	4.85	4.85	5.60
No. 25 and 26	3.90@4.25	4.90	4.90	5.65
No. 28	4.00@4.35	5.00	5.00	5.75
Galvanized				
No. 10 and 11	4.25@4.70	4.43	5.00	6.10
No. 12 to 14	4.35@4.80	4.53	5.10	6.20
Nos. 17 and 21	4.65@5.15	4.83	5.40	6.50
Nos. 22 and 24	4.80@5.25	4.98	5.55	6.65
No. 26	4.95@5.40	5.13	5.70	6.80
No. 28	5.25@5.70	5.38	6.00	7.10

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$4.73	$5.25	$4.84
Flats, squares and hexagons, per 100 lb	5.23	5.75	5.34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	50%
Cleveland	50%
Chicago	50%

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 5/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	6.00	8.00	9.00
Spring steel (light)	8.00	7.00	12.00
Coppered Bessemer rods	8.50	8.00	7.00
Hoop steel	4.38	4.04	4.18
Cold rolled strip steel	8.50	8.25	9.25
Floor plates	5.50	4.00	6.03

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Steel Inches	Steel Black	Steel Galvanized	Iron Inches	Iron Black	Iron Galvanized
⅜ to 3	57½%	44%	⅛	15½–16½%	+10½–11½%
			¼	19½–20½%	1½– 2½%
			⅜ to 1¼	24½–25½%	8½– 9½%

LAP WELD

2	50½%	38%	2	20½–21%	6½– 7%
2½ to 6	53½%	41%	2½ to 6	22½–23%	9½–10%
7 to 12	50½%	37%	7 to 12	19½–20%	6½– 7%
13 to 14	41%	....			
15	38½%				

BUTT WELD, EXTRA STRONG PLAIN ENDS

⅜ to 1¼	55½%	43%	⅜ to 1¼	24½–25½%	9½–10½%
2 to 3	56½%	44%			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	48½%	37%	2	21½–22½%	8½– 9%
2½ to 4	51½%	40%	2½ to 4	23½–24%	11½–12%
4½ to 6	50½%	39%	4½ to 6	22½–23%	10½–11%
7 to 8	46½%	33%	7 to 8	14½–15%	2½– 3%
9 to 12	41½%	28%	9 to 12	9½–10%	+2 –2½%

Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅜ to 3 in. steel butt welded	44%	28%	42½%	33½%	57½%	44%
2½ to 6 in. steel lap welded	39%	24%	44½%	29½%	53½%	41%

Malleable fittings. Classes B and C, Banded, from New York stock sell at plus 6%. Cast iron, standard sizes, 15% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13.50@13.75
Tin in 5-ton lots	31.50
Lead	4.75@5.00
Zinc	6.50@6.75
ST. LOUIS	
Lead	4.35@4.60
Zinc	6.10@6.35

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.00	21.50	23.50
Copper wire (carload lots)	15.00	17.50	20.00
Brass sheets	17.25	24.00	24.50
Brass pipe	21.00	22.00	20.75
Solder (half and half) (case lots)	18.00	20.50	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	15.25
Cleveland	19.00
Chicago	18.75

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill + less 8% for carload lots..... 11.50

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	13.70	14.30
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	5.50@6.00
Chicago	6.25
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	10.00
Copper, heavy, and wire	9.00	9.50	9.00
Copper, light, and bottoms	8.00	9.00	8.00
Lead, heavy	3.25	4.00	3.50
Lead, tea	2.00	3.00	3.00
Brass, heavy	6.00	7.00	9.00
Brass, light	4.50	5.00	5.00
No. 1 yellow brass turnings	5.00	5.50	5.50
Zinc	3.00	3.00	3.10

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.1@28.2	24.50	30.00

COPPER BARS—From warehouse sell as follows in cents per pound. for ton lots and over:

	Current
New York (round)	22.00
Chicago	20.50
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	46.00	35.00
Commercial	30.00	16.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$1.00	+1.15
Hot pressed hexagon	List	1.00	+1.15
Cold punches hexagon	List	1.00	+1.15
Cold punched square	List	1.00	+1.15

Semi-finished nuts, $\frac{1}{16}$ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	70%
Cleveland	70%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50–10%	60%	50%
1½ and 1¼ in. by 3 in. up to 12 in	50%	50%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $3.50 Chicago..... $2.50
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $4.00 Chicago..... $4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	40%	50%	40%
Larger and longer up to 1 in. by 30 in.	40%	40%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel $\frac{7}{16}$ and smaller	50%	50%	45%
Tinned	45%	50%	30%

Structural, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.85 Cleveland...$5.00 Chicago....$5.08 Pittsburgh..$3.90
Boiler, same sizes:
New York...$4.95 Cleveland...$5.10 Chicago....$5.18 Pittsburgh .$4.00

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	25.50
Brass	21.00	24.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ½-2 in., inclusive in rounds, and ½-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$8.50 per 100 lb.; New York price is 8c.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	10.00@13.00	13.00	14.25
Colored mixed	7.00@11.50	10.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$4.75@$5.25
Prompt foundry	5.50@6.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$0.80
Cleveland	100-lb. bag	1.05

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.73	$0.90	$0.80
5-gal. cans	.76*	1.15	1.05

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.05

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

Mass., Malden—E. Atlas, 47 Nevada St., Winthrop, will soon award the contract for the construction of a 1 story, 100 x 110 ft. garage on Main and Clinton Sts., here. Estimated cost, $50,000. Private plans.

Mass., Springfield—Ashley & Peterson, 387 Main St., have awarded the contract for the construction of a 1 story, 40 x 125 ft. garage on White St. Estimated cost, $25,000.

Mass., Springfield—Chaplin & Chaplin, 374 Main St., will build a 1 story, 49 x 110 ft. garage on Belmont Ave. Estimated cost, $20,000.

Mass., Springfield—Genden Bros., 28 Morgan St., will soon award the contract for the construction of a 1 story garage. Estimated cost, $25,000.

Mass., Worcester—R. H. Long Co., Framingham, is having plans prepared for the construction of a factory, for the manufacture of shoes and auto bodies, to include a 6 story, 75 x 600 ft., 6 story, 75 x 300 ft. and 6 story, 75 x 100 ft. buildings, on Milbrook St. along the tracks of the Boston & Maine R.R., here. Estimated cost, $1,500,000. F. H. Clark, c/o owner, Engr. S. H. Pitcher Co., 44 Front St., Associated Engr.

MIDDLE ATLANTIC STATES

N. Y., Depew—The Magnus Steel Co. Inc. has awarded the contract for the construction of a 2 story, 42 x 120 ft. mill for the manufacture of brass car journals. Estimated cost, $30,000.

N. Y., Geneva—The Geneva Automobile Co. plans to build an addition to its plant on Castle St. Cost between $30,000 and $35,000.

N. Y., New York (Borough of Brooklyn)—The Constant Motor Service Corp., c/o Ebling, Magmusen & Kleinart, Archts. and Engrs., 52 Vanderbilt Ave., New York City, will build a 1 story, 165 x 400 ft. garage on 66th St. and 5th Ave. Estimated cost, $100,000.

N. Y., New York (Borough of Bronx)—H. Froebe, c/o J. DeHart, Archt. and Engr., 1041 Fox St., has awarded the contract for the construction of a 2 story, 75 x 100 ft. garage on Intervale Ave. Estimated cost, $75,000.

N. Y., New York (Borough of Bronx)—The Hattic Realty Co., 1398 Clay Ave., has had plans prepared for the construction of a 1 story, 100 x 100 ft. garage on 135th St. near Southern Blvd. Estimated cost, $30,000. Springstein & Goldhammer, 32 Union Sq., New York City, Archts. and Engrs.

N. Y., New York (Borough of Manhattan)—S. Wachatinsky, 308 East Bway., is having plans prepared for the construction of a 3 story, 145 x 250 ft. garage on Broome and Tompkins Sts. Estimated cost, $350,000. L. A. Sheinart, 194 Bowery, Archt. and Engr. Noted March 31.

N. J., Trenton—The City Comn. plans to build a garage on Commerce St. Estimated cost, $17,000. A. Swan, Sr., 30 Wilkinson Pl., Archt.

Pa., Philadelphia — The city will soon award the contract for the construction of a 1 story, 160 x 200 ft. machine and repair shop on Clearfield and 27th Sts. Estimated cost, $120,000. J. P. B. Sinkler, City Hall, Archt.

Pa., Philadelphia—T. J. Slattery, 1008 South 46th St., will soon award the contract for the construction of a repair shop and fifty 1 story garages, on 59th St. and Baltimore Ave. E. Perot, Parkway Bldg., Archt.

Pa., Williamsport—The McCormick Motor Car Co., West 3d and Locust Sts., has awarded the contract for the construction of a 2 story, 130 x 190 ft. garage, on 3d and Hepburn Sts. Estimated cost, $75,000.

MIDDLE WEST STATES

Ill., East St. Louis — The Dependable Truck & Tractor Co., 231 Collinsville Ave., will soon award the contract for the construction of a 1 story, 100 x 250 ft. truck plant at Washington Park. Estimated cost, $250,000. Riester & Rubach, Murphy Bldg., Archts. Noted April 7.

Ill., Vandalia — The Smith Bros. Garage Co. has awarded the contract for the construction of a 3 story, 57 x 69 ft. garage. Estimated cost, $75,000.

Ill., Winthrop Harbor—The Austin Machinery Corp., Chicago manufacturer of trenching machines, backfillers, draglines, cranes, steam, gas and electric shovels, etc., plans to rebuild its plant here which was recently destroyed by fire.

Ind., Indianapolis—The F. Wood Transfer Co., 216 North Meridan St., plans to build a 3 story, 80 x 120 ft. garage on West Vermont St. Estimated cost, $80,000. Vonnegut, Bohn & Mueller, 610 Indiana Trust Bldg., Archts.

Mich., Detroit — The Bd. Educ., 1354 Bway., will soon award the contract for the construction of a 7 story, 155 x 200 ft. addition to Cass Technical High School and a 2 story, 50 x 200 ft. gas engine laboratory, on 2d and High Sts. C. A. Gadd, Business Mgr. Malcomson, Higginbotham & Palmer, 404 Moffat Bldg., Archts.

O., Cleveland — A. Horwitz, 326 Society for savings Bldg., has awarded the contract for the construction of a 1 story, 28 x 78 ft. garage on East 134th St. and Woodworth Rd. Estimated cost, $40,000.

O., Dayton—The Duplex Motor Car Co., South Perry St., plans to construct a 2 story, 40 x 160 ft. garage and auto sales building. Estimated cost, $50,000.

Wis., Cedarburg—The Lauterbach Sales Co. has awarded the contract for the construction of a 2 story, 59 x 150 ft. garage, repair shop and machine shop on Washington St. Estimated cost, $75,000.

Wis., Fond du Lac—W. H. Krug, Lakewood Beach, has awarded the contract for the construction of a 1 story, 40 x 170 ft. garage and repair shop on North Main St. Estimated cost, $42,000.

Wis., Kenosha — The Long Motor Co., 464 Park Ave., is having preliminary plans prepared for the construction of a 2 story, 72 x 132 ft. garage and repair shop on Sheridan Rd. Estimated cost, $60,000. C. O. Augustine, Archt.

Wis., Oshkosh—The Hollister Auto Co., 33 Algoma St., will soon award the contract for the construction of a 2 story, 80 x 117 ft. garage and repair shop. Estimated cost, $60,000. Auler & Jensen, F. R. A. Bldg., Oshkosh, Archts.

STATES WEST OF THE MISSISSIPPI

Minn., Faribault—J. M. Foss is having plans prepared for the construction of a 2 story, 66 x 132 ft. garage and sales building. Estimated cost, $50,000. H. H. Livingston 55 South 8th St., Minneapolis, Archt.

Minn., Minneapolis—The Western Body Mfg. Co., 763 3d St., N., is having plans prepared for the construction of a 3 story addition to its factory. Estimated cost, $45,000. C. M. Sticker, Secy. Bell & Kinports, 1620 Harmon Pl., Archts.

WESTERN STATES

Cal., Los Angeles — The Pacific Mutual Life Insurance Co., 6th and Olive St., has had plans prepared for the construction of a 2 story, 60 x 348 ft. garage at 539 South Olive St. Estimated cost $100,000. Dodd & Richards, 905 Brack Shop Bldg., Archts.

Cal., Los Angeles — E. B. Rivers, c/o Noerenberg & Johnson, Archts., 762 Pacific Electric Bldg., has had plans prepared for the construction of a 2 story, 100 x 160 ft. store and garage on 7th and Central Sts.

CANADA

N. B., Moncton—The Record Fdry. and Machine Wks. will soon receive bids for the construction of a plant to include warehouse, machine and casting shops. Estimated cost $100,000.

Ont., London — The Service Truck Co., Wabash, Ind., will open bids April 30 for the construction of an auto factory, to include three 1 story, 110 x 300 ft. buildings and power house, on Chelsea Green. Estimated cost, $300,000. Private plans.

Ont., London—The Utilities Bd. plans to establish an electrical smelting plant for the manufacture of fittings. Estimated cost, $10,000. E. V. Buchanan, City Hall, engr.

Ont., Ottawa—The Bd. of Control will soon award the contract for the construction of a 2 story, 60 x 123 ft. work shop and garage on Chamberlain Ave. Estimated cost, $60,000. A. J. Macallum, City Hall Engr.

General Manufacturing

NEW ENGLAND STATES

Mass., South Braintree—The Monatiquot Rubber Wks., Hancock St., will build a 1 story rubber manufacturing plant to replace the one which was recently destroyed by fire. Estimated cost, $70,000.

R. I., Woonsocket—Jarratt Bros., Mason St., have awarded the contract for the construction of a 2 story, 80 x 165 ft. addition to their textile mill. Estimated cost, $90,000.

R. I., Woonsocket — The Lafayette Worsted Co., Hamlet Ave., has awarded the contract for the construction of a 1 story, 103 x 170 ft. addition to its worsted manufacturing plant. Estimated cost $50,000.

R. I., Woonsocket—The Leputre Bros. Co. will soon award the contract for the construction of a 3 story, 100 x 135 ft. textile mill on Manville Rd. Estimated cost, $150,000. Private plans.

Vt., Burlington—The Bd. of Trustees of the University of Vermont, plans to build a dairy on campus. Estimated cost, $100,000.

MIDDLE ATLANTIC STATES

N. J., Trenton—The Adamantex Brick Co., 47th St. and Bay Parkway, Brooklyn, N. Y., incorporated with $1,000,000 capital stock, plans to build a brick plant, here.

N. Y., Buffalo—H. J. Hutchins, 93 Elk St., has awarded the contract for the construction of a 2 story, 70 x 100 ft. laundry. Estimated cost, $20,000.

N. Y., New York (Borough of Manhattan)—W. D. Hannan Shoe Co. will alter its 6 story factory at 55 Duane St. Estimated cost, $500,000.

MIDDLE WEST STATES

Ill., Chicago—The Mickelberry Food Products Co., 641 West 47th St., has awarded the contract for the construction of a 1 story, 85 x 125 ft. factory. Estimated cost, $35,000.

Ind., South Bend—The South Bend Bait Co. plans to build two 2 story bait factories on West Colfax St. Estimated cost, $50,000. Private plans.

Mich., Detroit—Friesema Bros., Shelby and Larned Sts., are having plans prepared for the construction of a 3 story, 100 x 100 ft. printing plant on Shelby St. A. Kahn, 1000 Marquette Bldg., Archt.

O., Canton—The Continental Clay Co., Zinninger Bldg., will receive bids about May 1 for the construction of a sewer pipe factory. Estimated cost, including equipment, $350,000. Noted March 3.

O., Columbiana—F. Sebring, Sebring, plans to build a 1 and 2 story pottery plant, here. Youngstown bankers will aid in forming a $450,000 corporation.

Wis., Cedarburg—E. J. Groth plans to build a 2 story, 60 x 200 ft. limestone crusher mill, etc. Estimated cost between $75,000 and $80,000.

Wis., Milwaukee—The Atlas Bread Co., 927 Central Ave., is having plans prepared for the construction of a 2 story bakery. Estimated cost, $150,000. McCormick Co., Inc., Century Bldg., Pittsburgh, Pa., Archts. and Engrs.

Wis., Sheboygan Falls—The Falls Roller Mills Co., c/o E. Gonzenbach, Pres., is having plans prepared for the construction of a 2 story, 60 x 210 ft. roller mill, on Main St. Estimated cost, between $75,000 and $100,000. Juul & Smith, Imig Bldg., Sheboygan, Archts. E. Juul, Imig Bldg., Sheboygan, Engr.

CANADA

Que., Drummondsville — The Butterfly Hosiery Co., Providence, R. I., is having plans prepared for the construction of an addition to its factory, here. Estimated cost, $200,000.

Ont., Ottawa—The Slinn Bread Co. plans to rebuild its bakery on Catherine St., which was recently destroyed by fire. Estimated loss, $125,000

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665

Some Unusual Machine Operations on Textile Machinery

Textile Machinery in a Class by Itself—Unique Methods of Grinding, No Solid Wheels Used—Cutting Hardened Steel Blades with a Soft Iron Disk

By ELLSWORTH SHELDON
New England Editor, *American Machinist*

TO THE MECHANIC whose education in matters pertaining to his trade has been acquired by association with iron-working machinery, there is much that is of interest in the shops that build only those machines used in the textile industry; and many operations in the latter that seem to him peculiar, and perhaps performed without due regard for economy either in time and material, are found after a little study to be fully warranted and justified by the conditions which govern them. Textile machinery, though of an extremely diversified character, may be roughly divided into three classes: preparatory machinery, by which the raw material, be it wool, flax, cotton, or other of the many fibers that are woven or spun, is made ready for the process that transforms fiber to fabric; weaving machinery, by which the transformation is made; and finishing machinery that takes the newly made bolt of material from the looms and shears, naps, brushes, irons out, polishes, folds, presses, stamps, or otherwise adds one or more of the many operations that are necessary to make it a marketable product. Textile working machines are not usually considered to be in the class of precision machinery. Built, as many of the parts are, of wood, of rough castings, or of unfinished forgings, the machines as a whole are sometimes looked upon in a rather deprecatory way by mechanics who have been taught that the one-thousandth part of an inch is a very considerable fraction indeed, and any machine the parts of which permit and even demand variations amounting to several thousandths in order to do their work properly is necessarily a rather crude device.

Yet, to build a drum four or five feet in diameter, cover its periphery with finely set points of steel wire to the number of hundreds of thousands, and then revolve that drum three or four hundred turns a minute with two-thirds of its peripheral surface inclosed within an almost stationary blanket composed of similar steel points that must clear the surface of the moving drum by a distance of not over 0.005 in., yet never touch it, involves calculations as exact and workmanship as careful as would be required in the building of a measuring machine. To increase the distance between the opposed surfaces would cause the machine to deliver faulty or incomplete work; to bring them in contact would almost inevitably bring about the complete destruction of the machine and possibly even more serious damage by setting fire to the dust and lint with which the working space is filled. Yet this condition exists in every carding machine in a cotton mill, and trouble from faulty workmanship is very rare.

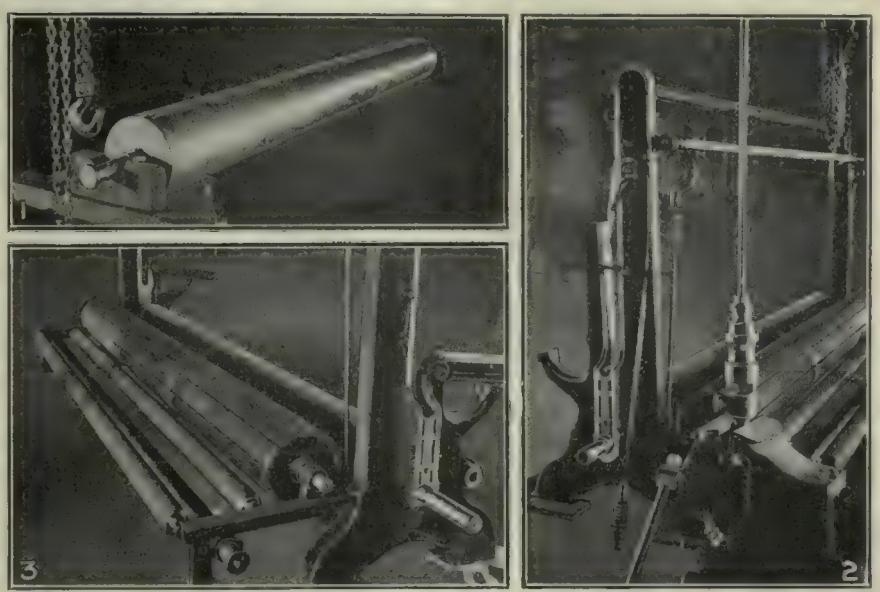


FIG. 1. A CALENDER ROLL. FIG. 2. THE STEAM SIPHONS. FIG. 3. A PARTLY ASSEMBLED CALENDER

Disconnected Operations Discussed

No attempt is made in this article to correlate the various machines discussed in accordance with the class to which each belongs, nor to carry through a description of the machines or of the processes by which they are made. Rather is it the writer's intention to take up a few disconnected operations that are different from operations performed upon other machinery, even though similar results are sought. The photographs and data were secured in the shops of Curtis & Marble, Worcester, Mass., through the courtesy of E. H. Marble.

In Fig. 1 is shown one of a pair of calender rolls the purpose of which is to press and smooth a web of cloth

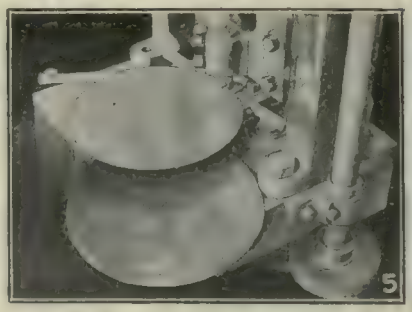
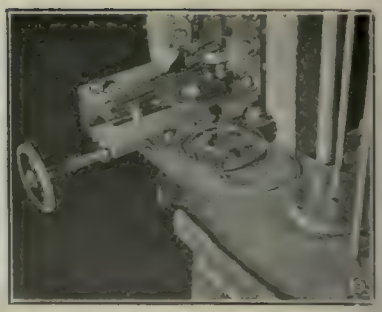




FIG. 4. "BURR" CYLINDER OR BURR ROLL. FIG. 5. NOTCHING SHEET-IRON RINGS FOR BURR ROLL.
FIG. 6. SHEARING OFF THE RINGS

as the latter passes between them in the calendering machine, exactly as a laundress would smooth a freshly laundered garment by passing a hot iron over it. The rolls are of cast iron with walls about 1 in. in thickness —for they are required to withstand a considerable steam pressure—cast in dry sand molds as open-end tubes. The tubes are cast on end and special care is exercised to secure homeogeneous iron to avoid blow-holes and porous places. The core must be carefully placed and anchored, else the roll will distort under the influence of heat and be anything but round and straight.

Rolls are Hollow for the Introduction of Steam

In the machine shop the casting is swung up in a lathe and the ends bored true for a distance of 6 or 7 in., and turned plugs of cast iron are then forced into the bores. The plugs are in turn bored to receive the steel trunnions, or "gudgeons" as they are called in the shop, that become the journals upon which the rolls turn in the machine. One of the gudgeons is hollow for the purpose of introducing and exhausting steam.

In Fig. 3 may be seen one of the calendering machines, partly assembled, and in Fig. 2 the siphons which convey the steam and water. In the latter illustration one of the siphons is shown leaning against the machine frame and another is held upright in the bench vise. There must be one siphon for each roll in the machine. The gland that is threaded to screw into the hollow gudgeon of the roll is a part of a packed joint that permits the gland to revolve with the roll while the siphon itself remains stationary. Steam is admitted through the angular opening near the outer end of the siphon and passes to the interior of the roll through the small round holes to be seen in the conical surface at the upper end of the siphon.

A brass tube, long enough to reach nearly to the opposite end of the roll, completes the device; the farther end of the tube being bent downward in relation to the roll so that it just clears the inner surface of the latter at its lowest point. With the angular opening connected to the steam main and the central (outer) opening to a steam trap a circulation is established that will keep the roll filled with live steam and fairly clear of water.

The machining of the roll up to the point of starting the finishing cuts is done in the same way that a similar job would be done in any machine shop but from that point onward it becomes a special operation. The gudgeons are finally turned true and the roll is swung into bearings in specially constructed steadyrests; running thenceforward upon its own journals, and driven by a flexible connection from the driving plate of the lathe. A siphon is screwed into the hollow gudgeon, connected to the steam main, and the steam turned on.

When the roll has reached the temperature at which it will be required to work it is finished, turned and ground without removing it from its position; the grinding being accomplished by a wheel mounted upon the carriage of the lathe. The roll, when cold, will probably be neither round nor straight but the assumption—borne out by years of experience—is that every time it is heated to a temperature corresponding to that at which it was finished it will resume the characteristics possessed by it when the grinding wheel left it.





FIG. 7. ASSEMBLING THE BURR ROLL. FIG. 8. A 114-IN. CARPET SHEAR.
FIG. 9. "REVOLVERS" FOR SHEARING MACHINE

Even with all the precautions taken it is not an easy matter to secure a perfect roll. Sometimes a roll will be found to be out of true when it is placed in the calendering machine; and such a roll quickly makes its defects known, as there will be variations of pressure upon the cloth as the roll revolves and these variations are manifested by streaks upon the cloth. In such cases the roll is reheated and allowed to cool several times and then reground. It is sometimes necessary to repeat this process several times, and occasionally a roll has to be discarded because it will not come true.

The rolls of a calendering machine are usually geared to revolve together, but with slightly differing surface velocities; the differential speed being secured by making them of slightly different diameters, by using differential gears, or both. The relative surface speeds are not uniform for all fabrics nor under all conditions for the same fabric. Neither are all calenders used hot. For a cold calender the rolls would, of course, be finished in a corresponding condition.

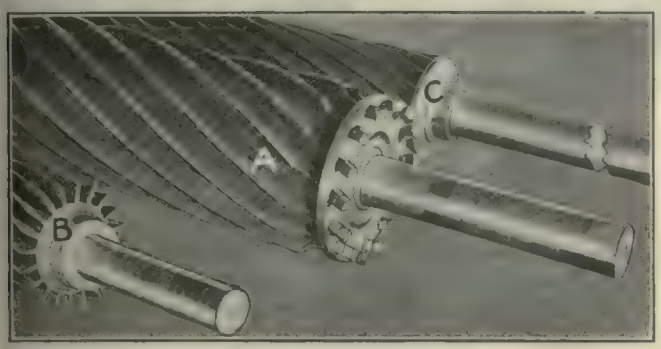


FIG. 10. AMERICAN AND ENGLISH CONSTRUCTION

The roll seen in Fig. 1 is 160 in. long and something over 12 in. in diameter. It is the upper one of the pair that belongs to the partly assembled machine seen in Fig. 2. In this machine the bolt of cloth rests upon the cradle of small rolls seen at the left and the web passes over the sectional wooden roll—called the spreader—to the calender rolls. Passing between these latter rolls, where it is ironed and pressed, it goes to a winding roll at the top of the machine and assumes the form of the original bolt.

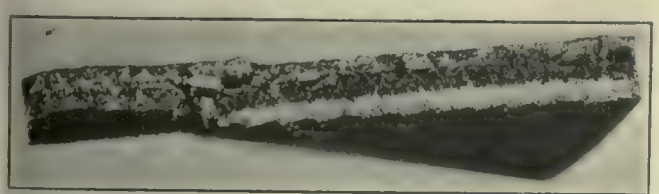


FIG. 11. SECTION OF SHEAR BLADE STOCK, ENLARGED

The Spreader Roll

The spreader roll is an ingenious device for keeping the web tightly spread widthwise so that wrinkles may not pass to the calender rolls. The middle section of the spreader, comprising about one-third of its length, is permanently fastened to the shaft and has no movement apart from a rotative one. The outer third at each end is made up of separate slats arranged to slide endwise for the distance of an inch or two, being supported at suitable intervals by spiders in which are milled bearing surfaces to take care of the endwise movement.

Each end section is independently governed by a roller running in the groove of a fixed cam attached to the frame of the machine so that as the whole roll revolves by reason of the web of cloth being drawn tightly over it, the sliding sections upon the upper half of the circumference are continually moving outward toward the end of the roll, the return toward the center taking place during the lower half of its rotative movement when no cloth is in contact with it. The periphery of those parts of the roll that are made up of sliding sections is cut with coarse grooves or serrations resembling file teeth so that as the sections move outward under the cloth all wrinkles are smoothed out and the web evenly spaced just as it enters between the calender rolls.

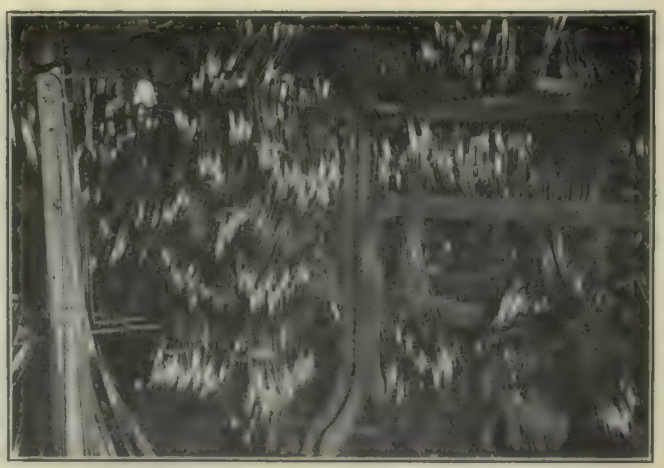


FIG. 12. A CORNER OF THE BLADE STOCKROOM

Burr Cylinder, or Burr Roll

Another part for a textile machine, the simplicity of which is not apparent until its construction is studied, is that shown in Fig. 4, called a burr picker roll, or simply a burr roll. The burr picker is in the first, or preparatory, class of textile machinery and is usually, though not necessarily used in connection with the preparation of wool fleece for the felting process. Its office is to remove burrs (hence its name) or other undesirable foreign material quite likely to be found in the fleece.



FIG. 13. THE GROOVING MACHINE

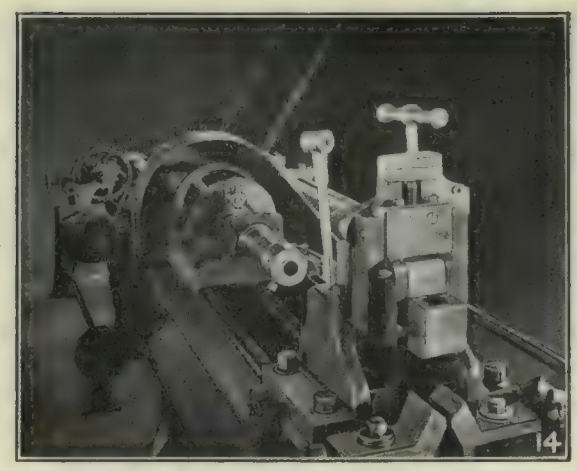


FIG. 14. DETAIL OF HEADSTOCK AND CARRIAGE



FIG. 15. FINISH GRINDING A "REVOLVER"

The basis of the burr roll is a wooden drum glued up in quartered construction and mounted upon a central shaft provided with cast-iron heads or flanges that are pinned to the shaft. The serrated surface is made up of a large number of rings of sheet iron in the periphery of which notches, resembling the teeth of a circular saw, have been cut.

Notching Rings for Burr Rolls

The manner of cutting the notches in the rings is quite ingenious and involves the minimum amount of waste. Starting with a disk large enough to make a ring for the largest size roll, the teeth are cut by a punch and die in the press to be seen in Fig. 5. In the center of each disk is pierced a triangular hole that fits over the correspondingly shaped stud of the indexing device. This stud is the upper end of a vertical shaft that carries at its lower end a ratchet, operated through bevel gearing from the crankshaft of the press. The distance of the stud from the tools is adjustable to accommodate different sizes of rings.

The press runs very rapidly and the indexing movement is automatic. The operator has only to lay a disk in position upon the stud with the edge under the tools and depress the treadle; holding his hand upon the disk to prevent it from becoming accidentally displaced as it is stepped around the circle. Each stroke of the machine after the first one adds a complete tooth until the cycle is complete and the press stops.

Shearing Off the Ring

The notched disk is then passed to the next operator, who puts it upon a machine similar to the first except that the notching tools are replaced by a pair of shear blades shaped to the circle of the disk which is to be cut. One complete revolution of the disk under these tools shears the ring from the disk and leaves the latter all ready for the notching operation and in turn to become a ring for the next size smaller burr roll.

The shearing operation is shown in Fig. 6 with the press stopped after the disk has made about half a revolution. As each center cut out becomes a disk from which to make a ring for a smaller sized burr roll there is no waste of stock except the corners of the square sheet (which is made round by the same means) and the last center, which has become too small to be used for the smallest diameter of roll.

The complete burr roll is made up of these toothed rings, alternating with plain rings of a smaller diameter, forced over the wooden drum and held by endwise pressure between the two cast-iron heads. The rings are put under compression by means of the screw press shown in Fig. 7, the number of rings to each roll being so calculated that the taper-pin holes previously drilled in the upper head and in the shaft will coincide at the same time that the pressure exerted by the press reaches the predetermined amount.

The Shearing Machine

One of the many finishing processes through which a fabric must pass before it is ready for the market is the shearing, which reduces the "nap" to a uniform length and gives to the surface the smooth and uniform appearance that it would not otherwise possess. The shearing is done by a revolving drum carrying a series of helically disposed blades running against a straight stationary blade. The shearing machine is so constructed that the fabric is drawn sharply over a fixed guide located in front of and below the stationary blade, and as it passes the blade the projecting fibers are swept off to a uniform height, dependent upon the adjustment of the machine, by the swiftly moving blades of the rotating cutter.

"Revolvers" Not Necessarily Firearms

These cutters, called "revolvers" in the shop where they are built, are seldom more than 6 or 8 in. in diameter but are quite likely to be very long in proportion and are a rather difficult proposition to handle by any common manufacturing operation. In Fig. 8 may be seen a 114-in. carpet shearing machine which, as its name indicates, performs this operation of shearing upon carpets or rugs up to 9½ ft. wide.

The machine has many moving parts in the way of rolls, drums, brushes, etc., but these are merely for the purpose of handling the material through the machine; the vital part, and the one that requires the most careful workmanship, is the revolver, seen at *A* near the top of the machine. Though this revolver is supported upon bearings more than 10 ft. apart, has twenty helical blades running its full length, and turns 1,000 r.p.m. against a stationary blade, so carefully is it made and adjusted that it will cut tissue paper cleanly at any part in the length of any blade. This test is regularly applied in assembling the machine and no machine is allowed to leave the floor of its builders until it is perfect in this respect.

In Fig. 9 are shown two of the revolvers: one built

in the shops where the photographs were taken and the other from an English machine, sent in for repairs. Fig. 10 shows an enlarged view of the ends, denoting the difference in construction. The one shown at *A* in Fig. 10 is the English cutter. It is made of heavy iron pipe ground true on the outer surface, and the blades are held in place only by tension, being drawn tightly by the locknuts outside the collars at each end. Both ends of each blade are forged down to a round section and threaded for the nuts. Because of the insecurity of this method of fastening, the blades are often displaced and repairs must be made by inserting collar head screws at intervals on each side of the loose blade.

English Blades Not Fastened to Core

The English construction naturally requires a blade of T-section to furnish a comparatively broad base to bear upon. The angular advance of the helix must also be less than the American construction will permit for the reason that the blades are not, originally, fastened to the pipe. A nick in this form of cutter necessitates the removal of the whole blade and the substitution of a new one or the reforging of the damaged blade.

The blades used in the American construction are of rectangular section and are set into helical grooves planed in a core of solid steel. Blades may be set at any helix angle desired or even parallel with the axis of the core, for the angle of the blade has nothing to do with holding it in place. If a blade is broken by accident, only the broken part need be cut out and replaced, without disturbing the undamaged portion.

Grooves are cut into the core about $\frac{1}{16}$ in. deep (varying somwhat with the size of revolver), and the blades are driven tightly into the grooves. The soft metal of the core is then swaged with a staking tool along the whole length of each blade. At *B* in Fig. 10 is shown one of the American type of revolvers without the protecting collar at the end, and at *C* the same type of blade ready to go in the machine.

The cores, or centers of the American built revolvers are, as before mentioned, solid bars of cold rolled steel, fluted to correspond with the number of blades and the helix angle desired. They may be from 2 to 6 in. in diameter and of any length up to 160 in. Blades may be (and in some forms are) parallel with the center-line, or they may be disposed in a helix at angles that vary from one turn in 77 in. to one turn in 22 inches.

The blades are of composite steel. A strip of high carbon steel is first welded to a backing of softer material and it is then forged and rolled to exact shape and size, as well as to the correct helix angle, before hardening. A section of blade, somewhat enlarged, is shown in Fig. 11. As the blades are very hard and quite brittle, the necessity for forming them before hardening is obvious.

As the revolvers are made in various diameters, lengths, and twists to meet differing requirements, and as only a blade that matches the core in every respect can be used, it follows that a comparatively large stock of the blades must be carried and the blade stock room therefore presents a rather bewildering array to the eye of one who is not used to seeing steel stock in this shape. A photograph of a corner in the stockroom is shown in Fig. 12.

Each twist, or helix angle, is found to be best adapted to some particular fabric. Silk, from which it is necessary to remove only a few loose or projecting fibers, requires a very different form of blade from that used for shearing velvet or carpet, where the shearing machine is depended upon to produce a smooth and even surface.

Obviously the job of putting from 10 to 36 helical grooves in a bar of steel nearly 14 ft. long is not one for any standard machine unless it be a thread milling machine; and a special machine for this purpose was at work long before the thread milling machine became a commercial possibility. It is shown in Fig. 13. Thread milling machines have been tried for this work and found to be unsatisfactory for the reason that they will leave the groove slightly larger at the top than at the bottom, making it impossible to hold the blade firmly.

The grooving machine has the characteristics of both lathe and planer without quite being either. The bed is in the shape of a lathe bed and it carries a footstock and at least part of a headstock. The usual form of shear on a lathe bed is replaced by a pair of deep V-grooves, common enough on any small planer, and the lathe carriage or planer table, whichever it may be, slides in these grooves, being pulled back and forth by a chain running over sprockets at each end of the bed.

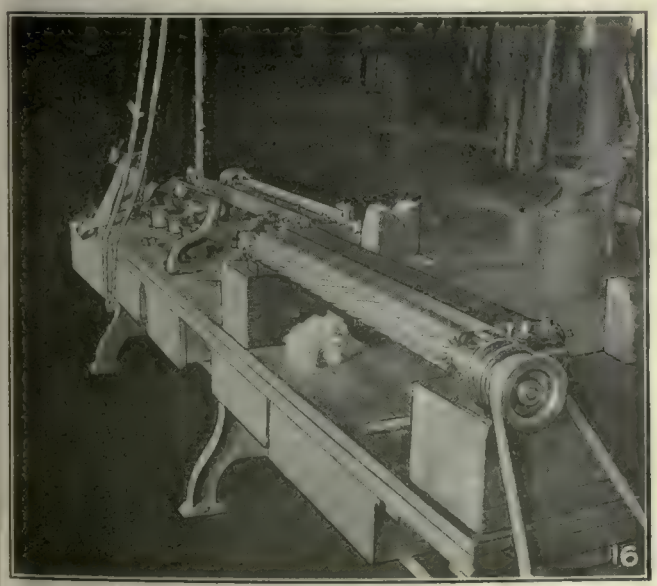


FIG. 16. THE FINAL LAPPING



FIG. 17. "GRINDING" THE STATIONARY BLADE

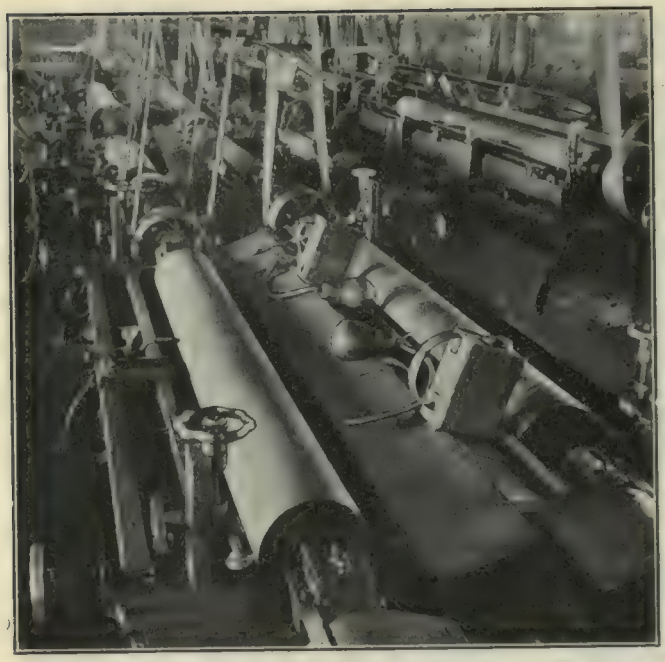


FIG. 18. SECOND GRINDING OPERATION ON STATIONARY BLADE

One of the sprockets is driven by a reversing belt drive, exactly like that of many planers. From this drive a small shaft runs the whole length of the bed and at the farther end carries the first of the change gear train by which the machine is set to cut different pitches. No cross-slide is provided on the carriage but in its place is the vertical sliding head of a planer, arranged to swivel in the vertical plane to correspond to any required helix angle. Directly beneath the slide are adjustable V-blocks that serve as follow rests and support the weight of the long bar as well as the pressure of the cut.

A closer view of the carriage of one of the machines is shown in Fig. 14, and in this view the indexing mechanism for setting the machine to cut the different numbers of grooves may also be seen. At the time the photograph was taken the machine was set up to cut parallel instead of helical grooves.

Setting the Blades a Hand Operation

Putting the blades in the grooves is strictly a hand operation; the only tools used being a hammer, a lead mallet, and sundry blocks of wood, for the blades are extremely brittle and must be handled with great care. They are just sufficiently flexible in long lengths to allow them to be wrapped around the core. The workman, starting at one end, follows along the blade with his lead mallet, driving it down a little at a time until the entire blade is in place. It is a job in which skill and experience is imperative. Short bends must be avoided, particularly widthwise of the blade, for it is a very easy matter to start a crack that will later develop a lot of trouble. Every blade, too, must be driven solidly to the bottom of its groove; and this is a condition the skillful workman knows only by the sound of the blade as it is struck.

Grinding the Revolvers

After all the blades are in place and staked in, the revolver is ready for grinding. It is in this operation that the greatest departure from standard practice is noted; for no solid grinding wheels, and except for the first rough grinding, no wheels at all are used. For rough grinding, walrus leather wheels, or wheels with wood centers covered with leather are used. The reason for this is that when an ordinary vitrified wheel is used there is a slight tremble, or chatter, to the blade when the unyielding surface of the wheel strikes it that has the effect of destroying the cutting edge. The cushion wheel produces the same effect to a much lesser degree for the reason that it is the wheel instead of the blade that yields.

The rough grinding is depended upon only to make the revolver round and straight, and to bring the blades to a uniform height. The finish "grinding" is a lapping operation in which the revolver is slowly rotated in contact with a cylinder of cast iron of its own length while emery and oil is flowed upon it, charging the cast iron with the abrasive and making it in effect a cylindrical lap.

A Lapping Process

The lapping cylinder must be of the same length as the revolver with which it is used, else shoulders or offsets would be worn into it that would defeat its purpose. It is given a slowly reciprocating motion that carries it slightly beyond the end of the work at each cycle and thus prevents the formation of shoulders.

As the revolvers are made in various lengths up to 160 in., it follows that the grinding room must be equipped with a large number of machines. Several of the longer ones are shown in Fig. 15; one of them with a revolver undergoing the operation. A special mixture of grinding compound that corresponds to about number 90 emery is commonly used at this stage to be followed later by the process known in the factory as lapping, in which operation the revolver is run at high speed against the identical stationary blade with which it is to run in the shearing machine; and flour emery is the abrasive used.

Finish Lapping

The lapping is shown in Fig. 16. No machine is required. The lapping bench has a shaft beneath it with a conveniently located pulley to deliver the power, but there is nothing on top of the bench but some wooden blocks. The part seen in Fig. 16 is a complete unit ready to go into place on the shearing machine, and has, in fact, been so placed; for the lapping is the last operation before taking down the assembled machine for shipment.

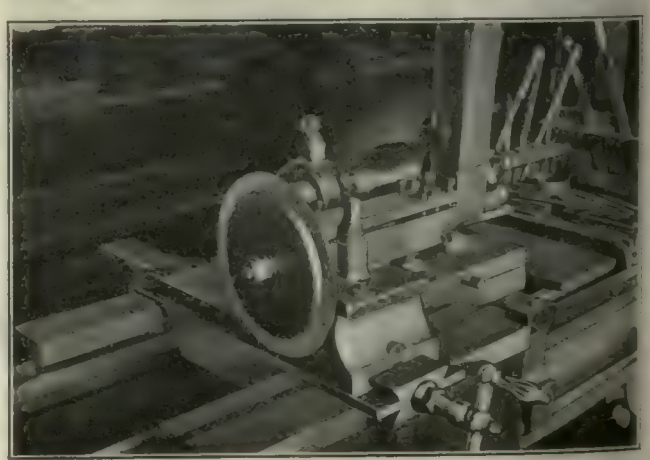


FIG. 19. "SAW" FOR CUTTING THE HARDENED STEEL BLADES

The whole bracket is placed upon the movable blocks, the belt thrown over the pulleys, and the bracket drawn forward until the belt is tight enough to drive. It is not fastened in any way and the rotation may be stopped at any time by a slight backward push upon the end nearest the belt. Flour emery and oil is fed to the revolving blades by means of a brush, and the movement is stopped from time to time to test the condition of the cutting edges with tissue paper. A revolver is not considered ready for its machine until all the blades will cut tissue cleanly at any part of any blade.

Grinding the Stationary Blades

The stationary blades pass two grinding operations besides the lapping that they get in contact with the revolver. The machine shown in Fig. 17 grinds the back bevel that reduces the blade to a very thin section near the cutting edge. "Here" the reader will say, "is a 'regular' grinding machine," but he will be wrong. The "wheel" of this machine is a cast-iron drum covered with lead and the grinding medium is emery and oil, fed through the hopper on the front of the hood.

The blades are finally brought to a cutting edge on the same class of machines that are used to finish grind the revolvers. Each blade is attached to the bracket that is to support it in the shearing machine and the bracket is set in the grinding machine in such a way that the weight of the bracket and blade rests upon the top of the revolving cylinder. Additional pressure is brought to bear by hanging the pear-shaped weights seen in Fig. 18, upon the blade.

A "Cold Sawing" Operation

In a preceding paragraph the writer spoke of "cutting out" a damaged section of blade and as the blades have been said to be exceptionally hard, the reader may be pardoned for being skeptical about cutting them. However, it is done very readily with the device shown in Fig. 19.

The "saw" shown in this illustration is a disk of *soft iron* without teeth. The arbor is mounted in a bracket that may be bolted to the toolblock of the lathe in place of the toolpost. It is driven from a long wooden drum overhead, so that it may be used at any part of the lathe bed.

The peripheral speed of the disk is 1,200 ft. per minute, and though when in action it brings forth a shower of sparks that would do credit to a Fourth of July exhibition, it cuts the hardened blade very cleanly and much more rapidly than a cold saw would cut a similar section of soft steel, and does not draw the temper.

A peculiarity of this saw is that it must be of a certain kind of iron; some sheet iron stands up better than others, while a disk of steel will not do the work at all.

The Odd-Jobs Man

By George Gilbert

In the factory of A., B. & Co., wages are a shade higher than in the factory of D., E. & Co. nearby. Work is fairly steady and the shop is well equipped. The hands are called upon for labor that requires a high degree of skill, speed, accuracy and individual initiative. But all through the factory of A., B. & Co. there is a grouch. It is apparent in shafting that has "end-shake," in hot-boxes and in other things. It is apparent in the frequency with which tools are spoiled or work done sloppily; it is apparent in a petty, nagging irritation that runs throughout the works.

In D., E. & Co.'s factory wages do not rank so high as in the other. It does about the same class of work. Work is steady and the shop is well equipped. The men are also called upon for skill, speed, accuracy and initiative. All through the factory, however, there is a smoothness and a co-operative spirit that is apparent to the casual observer. Men sing at their work, whistle and "grouse" each other. The equipment runs smoothly; tools are not spoiled and work is not damaged. Neither shop is large. Apparently they are on a parity in all respects except atmosphere and spirit. What makes the difference? Why should one shop in a small town be all at sixes and sevens and its neighbor noted for its good will?

In the first shop no provision is made for the doing of all those odd jobs that inevitably arise and that are "nobody's business." No one person is responsible for keeping the steam radiators piping hot all winter; no one is responsible for keeping the place cleaned up, belts taut, shafting smooth-running and the like. The concern is just large enough to have these odd jobs assume irksome proportions and not large enough, the general manager thinks, to warrant having them done and done right. So it happens that in the midst of some delicate operation, one of the hands will find it necessary to leave his machine to do some petty job that a man at half his pay should handle. Men try to dodge these unwelcome services and friction arises. Most of the ill will can be traced to arguments over who should or should not have done this or that so-called "roustabout" job. Most of these jobs are not done until they must be and that often means they have been left undone at the cost of money, time and *temper*.

Insurance Against Ill-Will

In the second shop, while there are not enough of such odd jobs to keep one man busy, a man *is* doing them all the time. He gets good pay. It took time to find a man who could and would attend to the heating plant, keep the place clean, oil the shafting, run little chance errands and take all the small, nagging details off the minds of the working force. But he was found, and because he is paid for doing such work he feels responsible for it and he does it. The men like him and treat him well. His coming has taken the grouches out of the outfit. This factory has a waiting list of would-be employees at all times and no labor troubles. The odd-jobs man has oportunities to sit down during the day, but the superintendent does not mind that, so long as his work is done on time. The odd-jobs man gets $25 a week, and if his work were measured in actual labor, he earns about $18 or $20 of it. He knows he has an easy thing of it and the company does too, but it figures that it would cost $18 or $20 a week to get the work done in any event and more if it were left to higher-priced men to do it grudgingly in time taken from their own work. The company just figures that the $5 to $7 a week loafing-time the odd-jobs man has is an insurance against grouches and ill will. And it is a hold-fast to keep such a shock-absorber on the job in its organization.

The possibilities of the odd-jobs man are not well understood by some employers. Study him a bit, sirs. He will repay it an hundred-fold.



Methods in a Shipbuilding Plant

FRED H. COLVIN
Editor,
American Machinist

THE Union Iron Works Plant of the Bethlehem Shipbuilding Co., in common with other shipbuilding plants on the Pacific Coast, has been extremely busy during the past four years. As a result many interesting methods have been developed, and while all of them are not new they are suggestive of what may be done along different lines and contain ideas which may be developed for other kinds of work. Drilling sheets for water-tube boiler steam drums is quite a proposition. As some of the boilers contain about 3,000 tubes, it will be seen that drilling the holes warrants special appliances for making it easy to handle both the work and the machine.

Ships are generally looked upon as having been built rather than manufactured, but herein is the record of a shipyard where manufacturing methods have been introduced in so far as possible. Special machines together with work-holding fixtures and many labor-saving appliances are in use.

One of the drilling methods is shown in Fig. 1, where a small drum is being drilled on a special 22-spindle machine. The spindles are worm driven, in pairs, and can be adjusted to any desired position along the upper rail. The drum is held in the supports *A* and the drilling fixture is shown at *B*. With



FIG. 1. SPECIAL MULTIPLE DRILLING MACHINE FOR DRILLING STEAM DRUMS

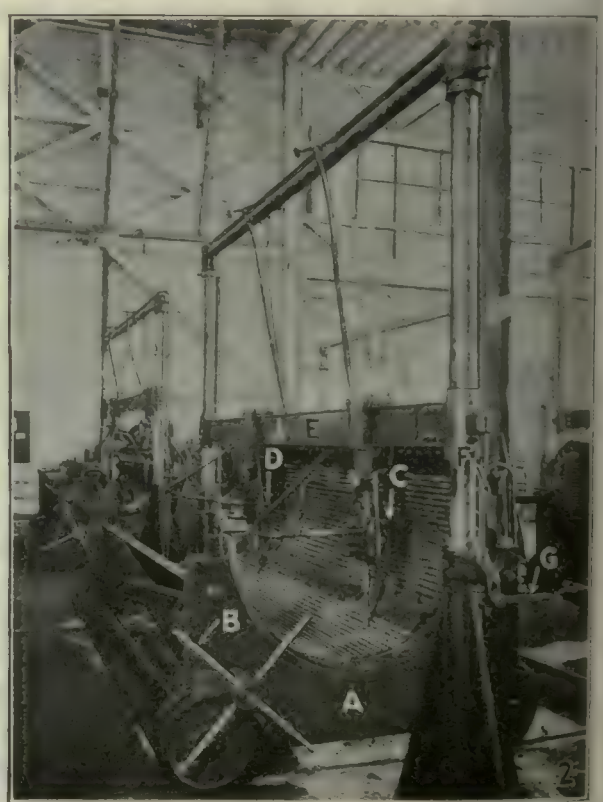


FIG. 2. MACHINE FOR REAMING TUBE HOLES IN ANOTHER TYPE OF DRUM SHEET

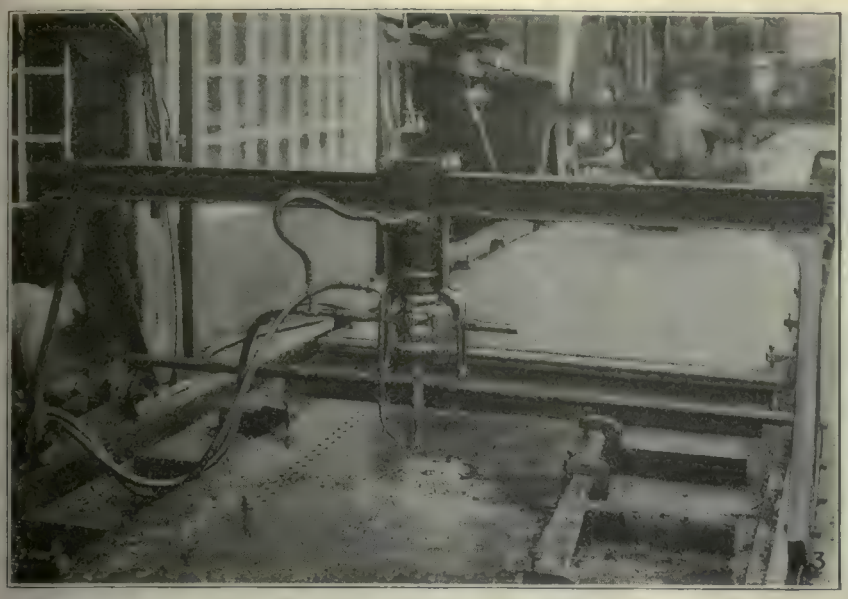


FIG. 3. DRILLING BOILER SHEETS



FIG. 4. SMALL SPECIAL RIVETER

the arrangement shown it is easily possible to drill the holes at the proper angles, comparatively few of them being radial. The machine is known as the Neitzel multiple drilling machine, being named after its designer.

Reaming the holes in another type of drum sheet is shown in Fig. 2. The cradle *A* is mounted on a four-wheel truck which runs on the track shown, the movement of the truck being controlled by the pilot wheel *B*. The reamers are driven by the pneumatic drills *C* and *D*, suspended from the cross-rail *E*, so that they can be easily moved to any desired position. The air-hose connections can be readily seen.

The cross-rail *E* can be adjusted vertically on the two uprights shown by means of screws at each end as at *F*, the screws being connected by bevel gearing and moved by the handle *G*. Having two drilling heads allows two men to work on each machine and enables the reaming to be rapidly done.

Another device for facilitating the use of the air drills, is shown in Fig. 3. Both this device and the reaming machine previously shown, bear the name of Chapman, for the designer who was previously superintendent of this plant. Fig. 3 requires little explanation as it can be readily seen how the air drill is suspended from the I-beam which is in turn supported by the triangular ends, each end carrying two wheels for easy movement lengthwise over the sheet being drilled. The end pieces are made from plates, cut and welded by oxy-acetylene and braced by the round bar shown over one of the wheels. Another device of Mr. Chapman's, shown in Fig. 4, is a small riveting machine with quite a deep gap for easily handling light tank work as suggested by the sheets behind the riveting machine itself. This is virtually a combined pneumatic hammer and holder-on, mounted in the proper relative position for convenient work. The operation requires no description.

A somewhat similar device, known as the Simpson riveting rig, is shown in Fig. 5. Here a regular air hammer is guided at *A* and a set of holder-on at *B*. The lever *C*, which is both padded and has a spring cushion, is used to hold the hammer to its work. The air control is by the foot lever at *D* and it will also be noted that a comfortable, but substantial seat is provided at *E*. This makes a very convenient and substantial rig for small riveting work, such as shown in the illustration and is fairly common to many industries.

A machine for trimming the ends of the boiler tubes before putting them in place in the boiler, is shown in the foreground in Fig. 6. The milling heads *A* and *B* are adjustable along the bed so as to accommodate the different lengths of tubes used. After trimming, the ends of the tubes are annealed by being passed through the furnaces *E* and *F*, by means of the slowly moving chain conveyors *C* and *D*. A gap has been cut in each side of the furnace to allow tubes of varying lengths to enter sufficiently on each end to be thoroughly annealed during their passage through the heated chamber. Bending pipes and tubes for hand railings and other purposes, is one of the problems of shipwork and comes in play in some other lines as well. The work is done on a device known as the McKay handrail bending machine and shown in Fig. 7.



FIG. 5. RIVETING WITH SPECIAL HAMMER

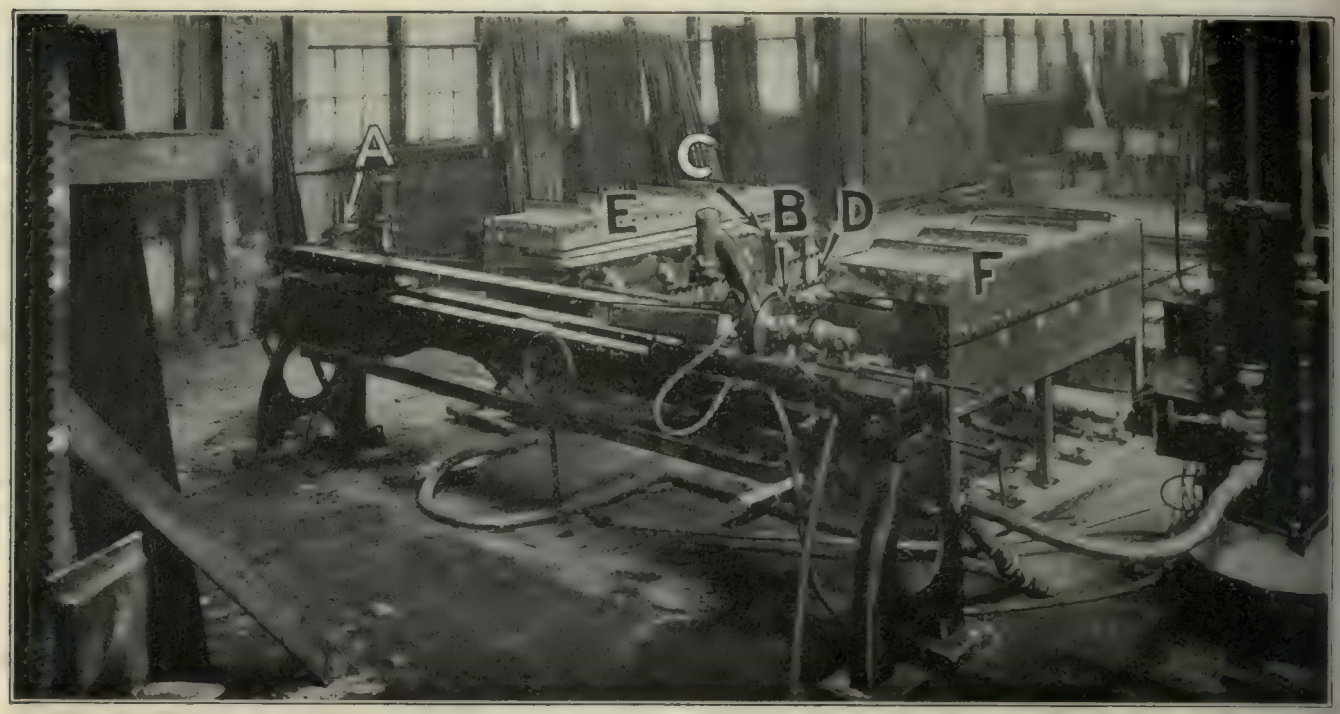


FIG. 6. TRIMMING AND ANNEALING FLUES

The pipe to be bent is placed between the rollers *A* and *B* and through the clamp *C* which is operated by the air cylinder *D*. The air motor *E* drives a pinion which engages a gear inside the table *F*, and for bending turns it in the direction of the arrow. This movement swings the roller *B* around the center roller *A* and carries the end of the pipe with it until it has been bent to the desired angle. A little experience in carefully manipulating this device enables almost any kind of a bend to be made. Nor are these bends confined to one direction, provided there is sufficient room to turn the ends of the first bend up in the air while the next bend is made at any desired angle.

A bending device for angles is shown in Fig. 8, being known as the Ronald. It consists primarily of an old vertical boring mill of comparatively small dimensions on the table of which a suitable bending form has been fastened, as at *A*. The end of the angle to be bent is clamped in position on the desired step of the form *A*, and one of the wheels, *B* or *C*, brought in contact with it. By revolving the boring mill table the angle is forced between the form and the roller and is given the desired bend as it turns. Some experience is required to secure satisfactory operation but the machine has given good service since it was rigged up.

A Few Turbine Details

Although there are many interesting details in connection with the manufacture of steam turbines, only a few can be shown at this time. The method of boring the main bearings in the turbine casings is shown in Fig. 9. The machine consists mainly of two substantial heads for carrying the boring bar. The heads are mounted on a suitable floor plate, on which the turbine casing is supported, after which the boring bar is mounted in place and the cutters inserted, the bar

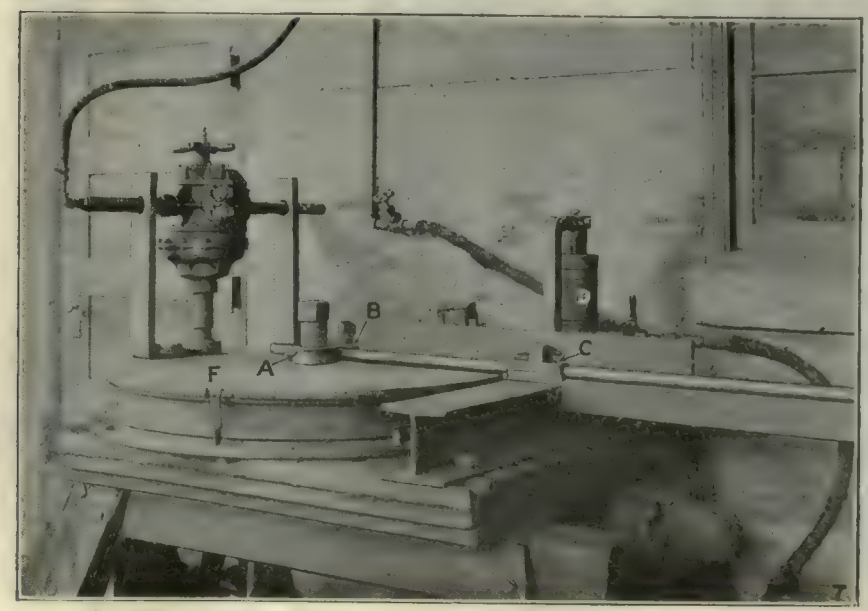


FIG. 7. HAND RAIL BENDING MACHINE

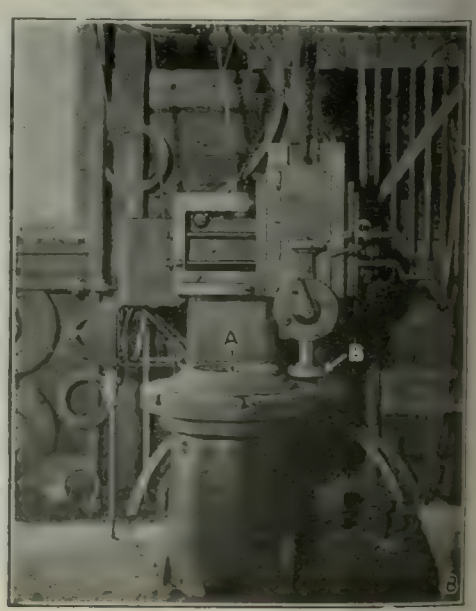


FIG. 8. BENDING ANGLE IRON

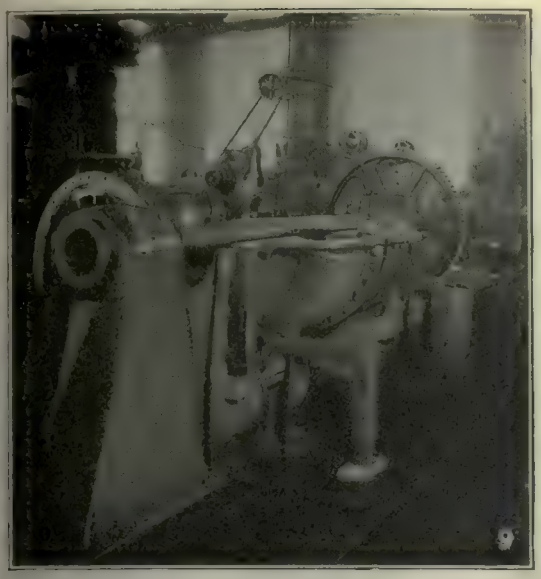


FIG. 9. BORING TURBINE CASINGS

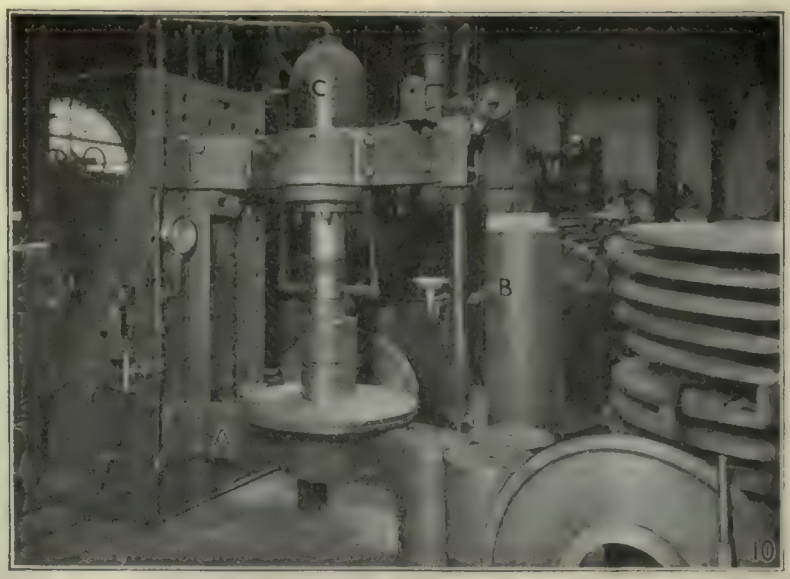


FIG. 10. SPECIAL HYDRAULIC PRESS

being driven by the worm gear shown at the far end.

In Fig. 10 is shown the way in which the turbine rotor which carries the blades is pressed on its mandrel for machining. The machine used is a very substantially made hydraulic press, having a short stroke, as can be seen. The supporting beam *A* is made up of heavy flat plates, bolted to the base of the angle plate at one end, and supported on the outer end by the lower part of the tie-rod *B*. The hydraulic cylinder *C* is mounted in a somewhat similar framework at the top of the press, the ram being counterweighted, for convenience. The counterweights are protected in the usual manner.

Hydraulic presses for sizing the inner or dovetailed ends of the turbine blades are shown in Fig. 11. The press tools need no description, as it can be readily seen how the punch *A*, which is shaped to the contour of the blade, forces the blade through the plate *B*, sizing the dovetail so as to insure a proper fit in the rotor.

Fig. 12 shows a machine for setting the blades in the rotor, which is mounted on the spindle shown. This machine is practically an ordinary triple-geared lathe-head, with the addition of the wormwheel *A* for driving, the worm being actuated by an electric motor handled by the controller *B*. The lever *C* handles a brake on the lathe cone while the tool *D* spins the metal firmly over the dovetail in the side of the blade as the rotor revolves. The whole machine is readily controlled by the operator who stands so as to readily handle both controller and brake.

Planing Propellers

A method of planing propeller blades is shown in Figs. 13 and 14. The propeller machining attachment has been adapted for a 12-ft. Bement boring mill and has a number of interesting features. The propeller is mounted on a worm-driven table *A*, the blades being supported by the special struts or jacks *B*, to prevent

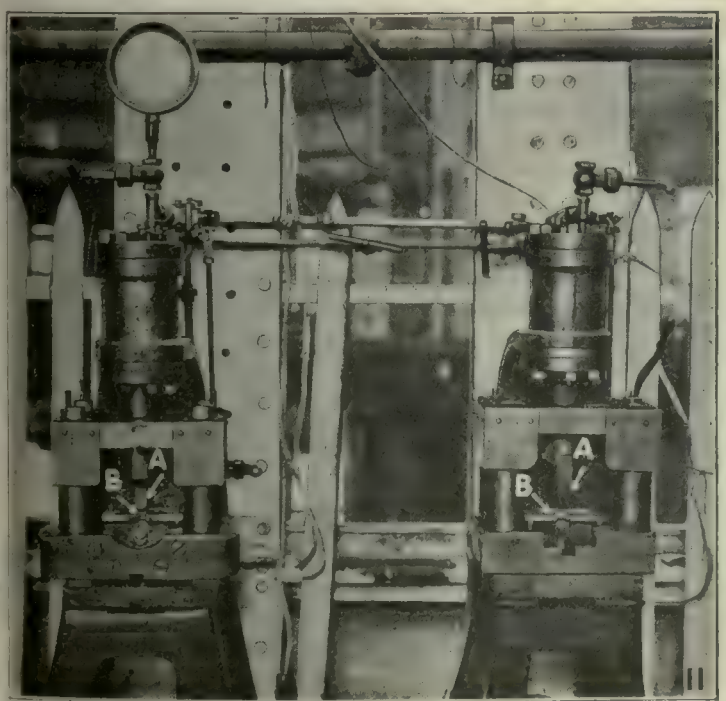


FIG. 11. SIZING TURBINE BLADES

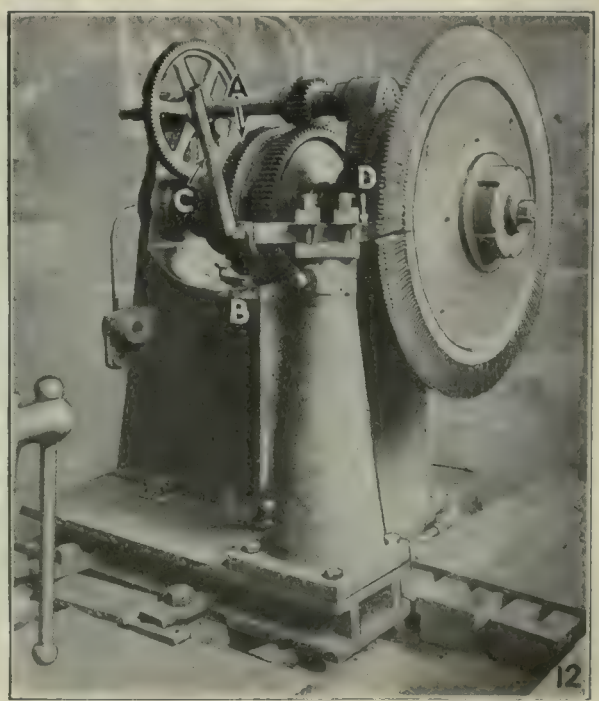


FIG. 12. BLADE SETTING MACHINE

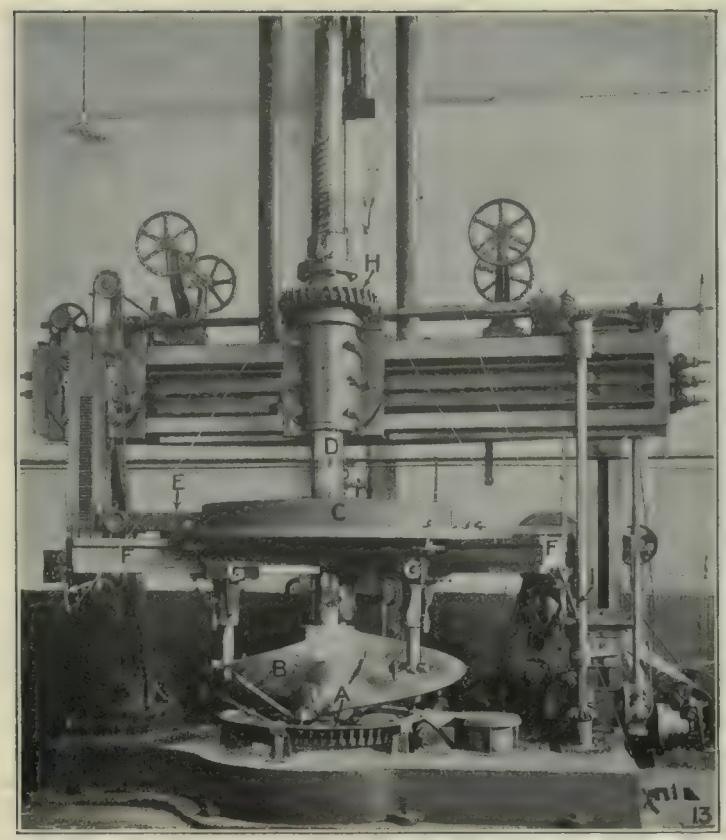


FIG. 13. MACHINING A THREE-BLADED PROPELLER

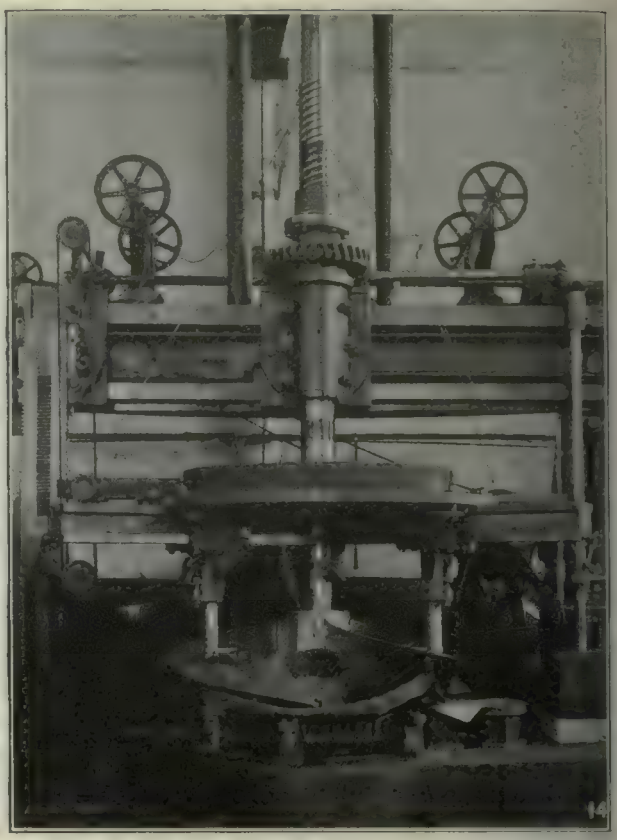


FIG. 14. AT WORK ON A LEFT-HAND PROPELLER

vibration. These jacks bear against the substantial projections left for the purpose and shown at the upper end of *B*. The machining head *C* is centered by the spindle *D* and supported by the cross-beam *E*, the whole being counterweighted so as to move up or down readily as the tool feeds or returns. The toolhead *C* carries the beams *F*, these supporting and driving the tool heads *G*, which in turn support the cutting tools as can be seen. As this propeller has three blades, three arms are used, but the number of arms used can, of course, be changed so as to suit the propeller which is to be machined.

The wormwheel *H* controls the downward feed of the head carrying the cutting tools, and as both *H* and *A* are driven from the same source, as can be seen at the rear left, they always feed in unison. The tool heads are fed in along the bar by ratchet levers *I*, these being fed by the movement of the nut *J* on the return stroke.

Fig. 14 shows a left-hand propeller being planed, no detailed reference being necessary, as the operation is the same as before except for reversing the direction of the cut.

Getting Closer to Your Men

By George Boardman Perry

One of the most vital and important qualifications of an executive, and one which will quickly stamp him as a success or a failure, is his method of handling his men.

There are two general classes of help, namely, those who must be driven, and those to whom driving is fatal and who must be led. The men of the first-named class rarely ever amount to anything, but those of the second class, those who take an interest in their work, and who do the best they can, are generally active, high strung, and with more or less "pep." This type of man resents the bully executive, or using a more common term, "driver."

The efforts of good men are usually stifled by executives of this type. I call to mind an executive who is a perfect gentleman but who labors under the delusion that, to produce, he must drive all men alike. He is forever finding fault and never has a word of commendation for his men.

Suggestions and Moral Force of Rank and File Make Real Success

This type of man, be he foreman, superintendent, or manager, is never a real success, for he is stifling the very elements which are necessary for his success and the success of his department—the suggestions, ability, and moral force of the thinking men under him. He rarely is able to pick a man capable of better things in his own organization, but must go outside to get one, for he cannot reach his men nor draw out the best that is in them.

It behooves every man who aspires to be a factor in the business life of today to study human nature, create an atmosphere of understanding with his men, commend those who deserve it and be firm when necessary, though always mindful that judicious commendation will get more results than all the "call downs" in the world, and there are few men whose efforts are so poor as to merit no commendation whatever.

It is a fact that under one manager, men will show only ordinary ability, while under another, under the same conditions and in the same shop, they will develop and be ready for the next rung of the ladder when it is available to them.

If we had more executives of the last-named type, we would not have to worry so much about industrial unrest and bitterness against employers.

Construction and Repair of Sugar Machinery

How the Huge Rolls and Other Parts Are Made and Conveyed to the Mill—Loam-Mold and Core Making—Making the Tools

BY FRANK A. STANLEY

AT VARIOUS times the writer has had the opportunity to visit different engineering plants engaged in the production of sugar machinery, and in plantation and mill repair shops he has seen something of the methods followed in overhauling certain parts of the heavy equipment through which cane is passed for the extraction of its juices and the conversion of them into raw sugar.

One of the plants whose methods have been referred to in earlier articles is that of Dibert, Bancroft & Ross, at New Orleans. The very heavy character of the work handled there in connection with the building of sugar machinery is well brought out by the view in Fig. 1, which illustrates a variety of mill members undergoing machining operations or awaiting the time when they will be wanted on the erecting floor. Fig. 2 shows the massive housings and rolls used in this class of equipment.

Sugar mill rolls are made in various forms. Some have surfaces like the one at the top of the housings (Fig. 2), with staggered or herring-bone grooves and ribs running longitudinally across the roll face, which serve to break up the cane and crush it as it starts into the machine. The roll seen in the lathe in the foreground of Fig. 1, will, after it has been turned to the proper diameter, be grooved straight around its circumference with V-shaped grooves; the pitch will depend upon whether or not the roll is for the finishing set.

This roll has a cast-iron body in the form of a big shell which was cored out in the foundry, bored to suit the steel center or shaft on which it is pressed tightly, then finished by turning and grooving around the surface.

Such a roll is made up as indicated in Fig. 3. The outside diameter of the cast-iron body is 36 in. and the diameter of the forged steel central shaft is 20 in.; this leaves a thickness of wall at each side of 8 in.,



FIG. 2. ERECTING A SUGAR MILL

except for the cleared portion at the middle which is cored slightly oversize. With a roll face 7 ft. wide, the bearing left at each end to fit on the shaft is approximately 26 to 30 inches.

These roll shells are forced onto their shafts under very high pressures. The actual diameter of the shaft fit at the leading end is a little less than that of the other end of the fit, say $\frac{1}{8}$ in. or so. This enables the shaft to be slipped well through the bore of the shell before the fitting surfaces come together and the total length of the pressed fit is reduced materially.

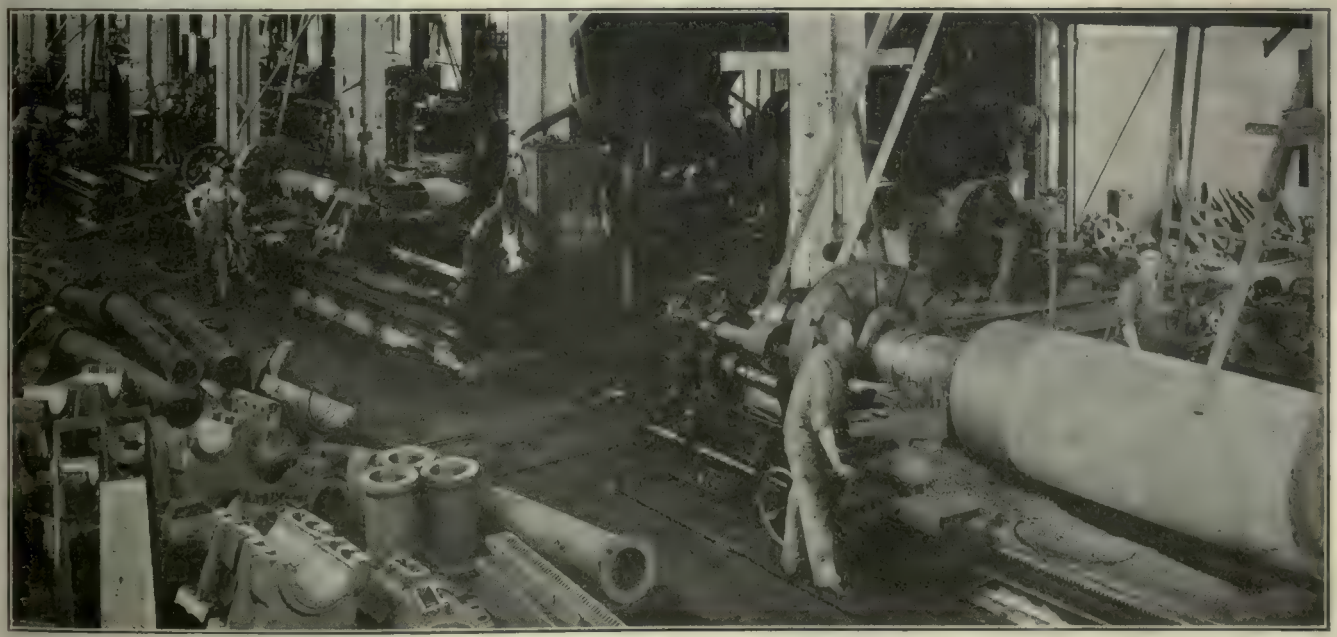


FIG. 1. MACHINE SHOP IN A CANE-SUGAR PLANT

A long horizontal press is used for the purpose and its capacity is indicated by the fact that the roll members are forced together under a mounting pressure of 500 tons or more, reaching in some cases as high as 550 or 600 tons total pressure.

A roll of the dimensions given in the preceeding paragraph will weigh 15 or 16 tons at least, and, taking its length and diameter into consideration, it makes a pretty substantial piece of lathe work.

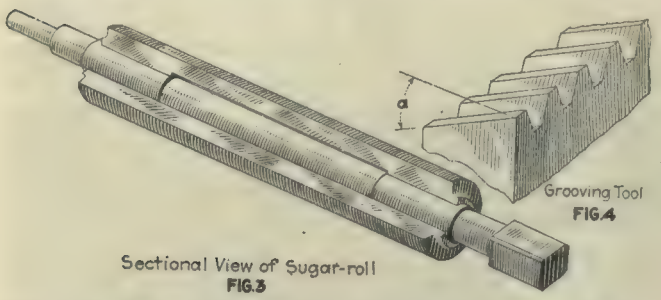


FIG. 3. SECTIONAL VIEW OF SUGAR MILL ROLL. FIG. 4. SECTION OF TOOL USED FOR GROOVING ROLL

Making the Tool for Grooving the Roll

The grooving of the face is usually accomplished with a form tool 2 or 3 in. wide across the face so that several grooves are cut simultaneously. The teeth in this tool are produced by a regular forming process and as the tool wears it is ground flat across the top like any flat form tool, without altering the form. The cutting edge of the tool is not unlike a section of a gear rack, as shown in Fig. 4.

There are several ways of making such grooving tools accurately. The blank for the tool can be placed in the shaper vise and the table adjusted sidewise for the successive teeth or a multiple tooth cutting tool can be used in the shaper post to do away with indexing for teeth. The blank is held in the vise at an angle equal to the front clearance of the tool and the shaper tool is set at the same angle. This requires considerable care if the tool is to be satisfactory and the job is to be done in a reasonable time. Both the cutting tool and the form tool must be firmly supported against the cut. There should be as little overhang as possible, the tool should be held in a short, rigid toolpost and the tool being cut should be firmly held in a substantial vise. Only in this way can we be sure that the correct form of the shaper tool will be reproduced in the cutter being made as any appreciable spring will change the form and alter the rake or clearance of the tool. When the grooving tool is used in the lathe, the form is maintained for the entire depth to which the tool may be ground in resharpening.

Another way of handling such tool work is to use the milling machine. The teeth in the tool can be roughed out with any cutter which is fairly close to the proper contour and finished with a fly cutter, or the fly cutter can be used for the whole process. For finishing, the cutter arbor is locked as in Fig. 5, and the table fed back and forth past the tool, by hand. The accuracy of the table adjustments with the micrometer dials is such that it is an easy matter to index the position of the cutter blanks for each tooth to be cut.

Whether the shaping or milling method is used depends, of course, upon the shop equipment or the machine which may be available at the time the job is to be done. Then, too, different men have preference as to machines or are more familiar with one than the other. In either case stiffness and rigidity should be borne in mind.

Some may question the need for accuracy in this comparatively rough work, but all the conditions must be understood to make the work clear. The question of accuracy in the roll grooves would amount to little if one roll were used by itself, and little trouble would be required in making the grooving tools good enough even though there were some variation from one groove to the next; but with two long rolls meshing over their entire widths of face, it is desirable to maintain close dimensions between successive grooves in order that there shall not be interference at any point in the grooves in the roll.

Where the grooves are cut to a very coarse pitch, a single point tool is usually used for roughing down to within $\frac{1}{32}$ in. of final depth. The tool grooves are then correctly spaced by locking the nut on the feed screw and turning over the screw by hand the required amount to move the table the required distance, the feed gear

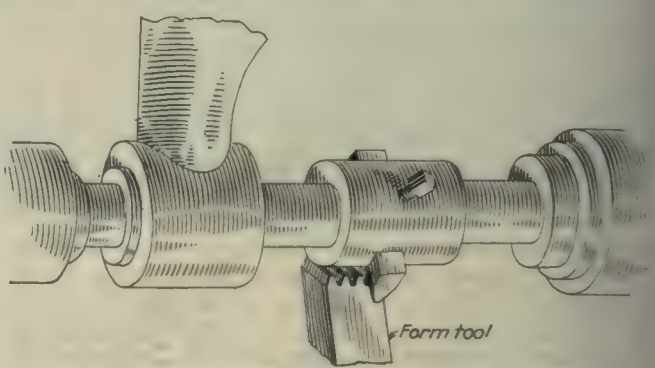


FIG. 5. GROOVING CUTTER IN MILLING MACHINE SPINDLE

on the screw being indexed the necessary number of teeth for this dimension.

The big journal boxes and pillow blocks in Fig. 1 are planed on the bottom and for the cap fits by placing a number in a row on the planer and finishing all at once. After the seats for the bearings have been bored, the bearing shells are fitted into place, these having been bored to diameter on the horizontal boring machine.

The Foundry

One of the most interesting departments of the plant referred to is the foundry, two views of which are presented in Figs. 6 and 7. At the left in the first of these views a big mold is under way for the driving gear of a sugar machine, and in the immediate foreground are molds being set up for casting rolls of the kind just described. A great deal of loam molding is done here similar to the mold shown in the center of the view, Fig. 7. Before describing this, reference may be made briefly to the job of molding at the right of the photograph. Here is shown the finishing of the mold for a big housing for the crushing rolls of a sugar machine, the job being rammed up in metal flasks. The pattern as drawn from the sand is shown resting on top of the pile of round flasks at the left.

The loam work at the center of the floor is a cylinder mold consisting of a brick and loam shell for the outside of the mold and a similar construction for the core. The brick wall for the mold is lined with loam or sand about 1 in. thick and a similar thickness is used around the brick construction for the core.



FIG. 6. FOUNDRY OF SUGAR PLANT

Fig. 8 is an illustration showing the start on the building-up of the core shown in Fig. 7. The sweep is not in place in the photograph but its spindle, when in use, is set central with the cylindrical job and the striking board and sweep swung about as a gage to bring the sand covering to true form. The interior brick work is clearly seen in the view.

After the mold has been built up, both members, mold and core, are lifted by the overhead crane onto a car and run into the core oven, where they are baked through the night. The car and core oven are seen to the left in Fig. 7. The size of the oven is suggested by the area exposed by the opened door. The car-frame is of steel I-beams some 15 ft. in length, and these carry heavy cross-rails upon which the work is deposited by the crane.



FIG. 7. LOAM MOLDS FOR SUGAR MACHINERY

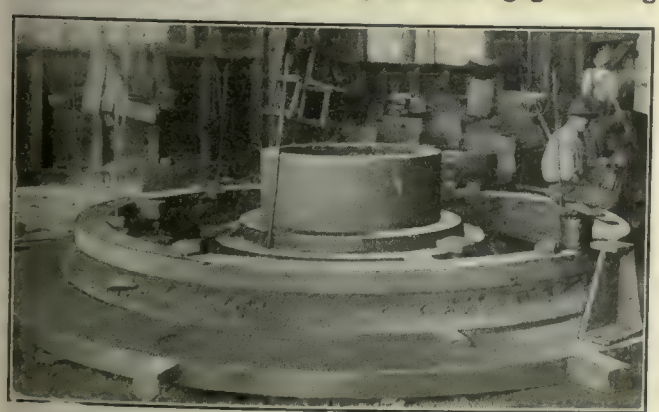


FIG. 8. BUILDING UP A CORE FOR A LOAM MOLD

Work in Other Plants

The views which follow are from other plants and shops engaged in the construction, erection and repair of sugar machinery. The equipment of a sugar plantation and mill is diversified, and includes many items which present more or less of a problem when it comes to the process of installation. This work of installing equipment is a most interesting and important phase of engineering and can best be appreciated by those who



FIG. 9. TRAIN LOAD OF TWENTY-SIX SUGAR CRYSTALLIZERS. WEIGHT, 16,000 LB. EACH

are familiar with the heavy character of the machinery itself and with the local facilities for aiding in the handling of such apparatus.

In Fig. 9 is shown a train load of crystallizers built by the Honolulu Iron Works for a big sugar mill in Hawaii. These crystallizers, twenty-six in number, weigh 8 tons each. They measure 20 ft. in length by 8 ft. in diameter and their shells are of $\frac{3}{8}$-in. boiler plate with $\frac{1}{2}$-in. heads. Each crystallizer carries a longitudinal shaft running through the center from end to end, with a series of blades which agitate the cane syrup during the process leading to crystallization. The shaft is driven by a worm and wheel at the front end of the cylinder. The process of hoisting the crystallizers into the mill is shown in Fig. 10. An A-frame, set up in front of the building, supports a rail at the top which extends into the building. The hoisting tackle carried by this monorail is shown attached to the slings around the crystallizer by which it is to be lifted from the flat car into the second story of the building.



FIG. 10. CRYSTALLIZER READY FOR INSTALLING

The work of hoisting was accomplished by the steam plowing engine shown in Fig. 11, a part of the plantation equipment. This machine carries a drum below its frame around which a cable was wound and led back through suitable blocks to the hoisting rigging suspended from the overhead rail.



FIG. 11. STEAM PLOWING ENGINE USED FOR HOISTING CRYSTALLIZER INTO MILL

After swinging the crystallizer into the mill it was lowered onto a flat car as in Fig. 12, to be drawn along an industrial track to its approximate position in the series of units making up the crystallizer battery. Reaching this point, the big cylinder was again hoisted from the car, swung around to clear and lowered onto rollers as in Fig. 13, so that it could be skidded back into final position.

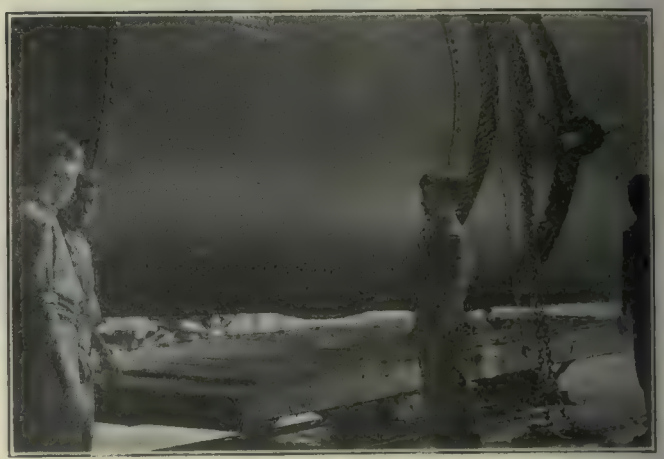


FIG. 12. LOWERING CRYSTALLIZER ON TO PLATFORM IN MILL

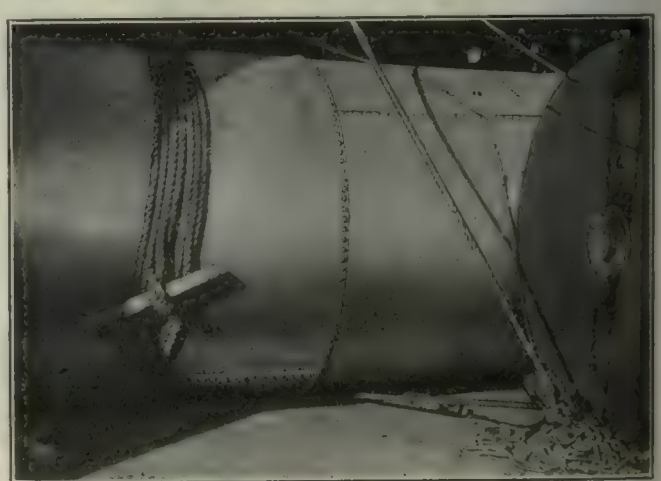


FIG. 13. MOVING CRYSTALLIZER ON ROLLERS

These views have been presented to illustrate some of the processes of getting big equipment located in sugar factories. The handling of old materials out of the plants and new parts in, necessitates a good display of judgment on the part of the engineers, and some convenient form of powerful hoisting apparatus is an essential. In Fig. 14 a hoist with trolley on structural supports is illustrated which is quite similar to the arrangement sometimes employed around railroad shop yards for mounting and dismounting trucks from wheels. This structure is a sturdy affair of lattice uprights with heavy top girders for carrying the hoist and rails. It is very useful in picking up and swinging big sugar crushing rolls and other heavy parts.

For lifting rolls a handy device is applied in the form of a pair of heavy I-beams made to equal in length the widest faced roll, and equipped at each end



FIG. 14. HOISTING TACKLE FOR MOVING HEAVY PART

with swivel attachments or clevises through which rope slings are passed to attach to the roll necks. The I-beam arrangement serves as a spreading device for the slings and the distance between the ropes is varied to suit the roll length by adjustment of the swivels through which the ropes are led; that is, the span is changed at will according to the distance between roll necks. At the middle of the I-beam rig is a swivel member which is hooked directly onto the crane so that when the roll is lifted it is well balanced and may be



FIG. 15. SUGAR MILL ROLL ON TRUCK DRAWN BY 8-MULE TEAM

swung about from either end so that it will come into proper position for placing in the cane mill or for removing to any point desired.

Protecting Sugar Rolls from Injury

Sugar rolls must be handled with reasonable care or serious bruising may result, necessitating repairing of journals or of the roll grooves themselves. The weight is such that they must be placed carefully, whether in loading or unloading from trucks, or in handling about the mill in and out of machines. A method of protecting such rolls for trucking from machine shop to sugar factory is illustrated in Fig. 15. The working face of the roll is well protected by the heavy lagging strips across the entire width of face, and the journal necks are guarded in similar fashion. Suitable shoes and wedges secure the roll against the possibility of shifting in transportation.

Sugar mills as a rule have their own repair shops, where will usually be found lathes and planers of



FIG. 16. MOUNTING CURVED BLADES ON SHAFT

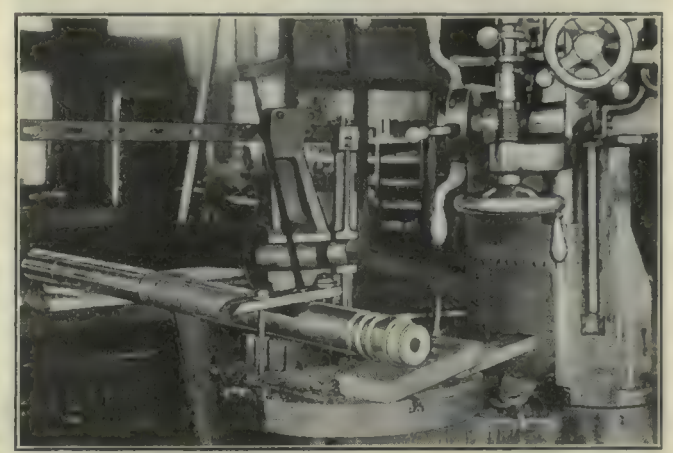


FIG. 17. DRILLING OUT SHAFT FOR CUTTING KEYWAY

moderate size, a shaper or two, a drill press, a radial drill for working over the face of castings too large and heavy for handling under upright drills, pipe machines of various kinds, etc. Some special tools are also used in such places and directly in the mills themselves. Certain jigs are required for work on jobs that are regularly replaced in the mill's own shop, and such apparatus as may be required for keeping rolls in condition is also found in the place. A device used for turning operations on the rolls is a long guide, which in appearance is like a cross-rail for a planer and which

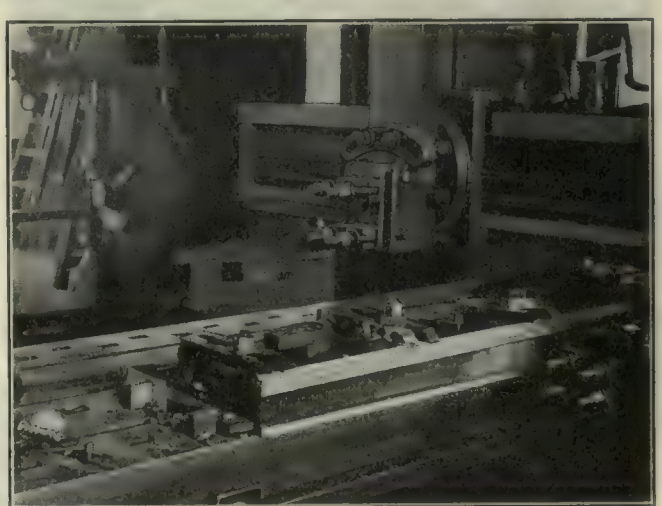


FIG. 18. PLANING A REPAIR PART

carries one or two saddles with toolposts. The saddles, or carriages, are operated by feed screws to give the necessary side or longitudinal travel along the roll or journals, and handwheels are used on cross-screws to supply the in-and-out movement of the tools.

Assembling a Cane Chopping Knife

The curved blade revolving knife in Fig. 16 is used for chopping cane as it passes down to the rolls. There are a dozen or more of these sets of blades fitted to hubs on the shaft. The method of building up the series is



FIG. 19. CUTTING A THREAD

indicated in the photograph. The backs or flanks of the curved blades are secured in staggered recesses in the faces of the disks, which are bored out to fit closely on the driving shaft. The shaft with its driving pulley is placed in the wooden frame and one disk after another is fitted up with blades until the set is finished.

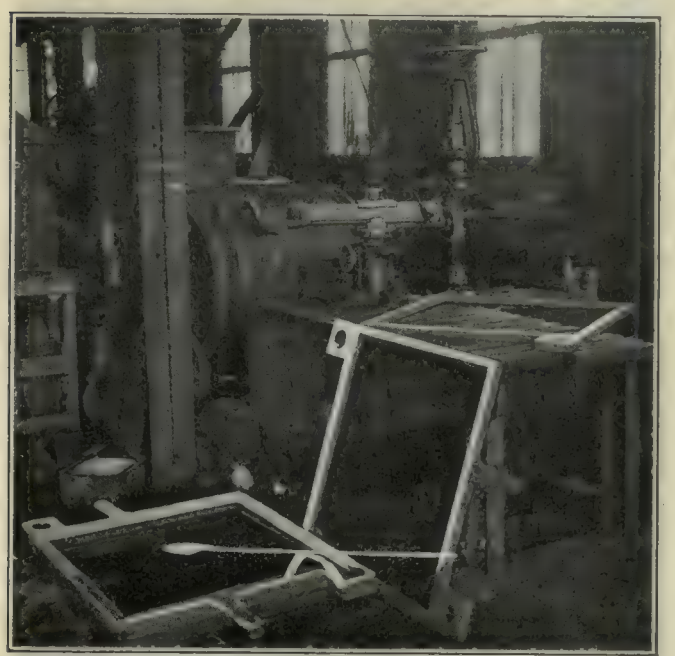


FIG. 20. DRILLING SMALL HOLES IN A METAL FRAME

The mill machinery forms only a part of the work coming to the repair shop. There are tractors, narrow gage locomotives, trucks, engines and pumps, and a host of other apparatus, some parts of which are taken care of in the shop. The appearance of some of these shops is quite like that of a general jobbing plant or the repair shop of a lumber mill, small railroad, or mine. There is a good deal of smith work, pipe work and general forge and bench work in addition to the regular machine operations. Typical repair shop views are presented in Figs. 17 to 20.

The shaft in Fig. 17 requires a keyway, and in the absence of a suitable milling machine the drill press is used to drill a row of holes for chipping out to the necessary key fit. The planing operation in Fig. 18 is on a straight bar of material required for a repair. Fig. 19 shows the cutting of a thread on a large tie rod or through bolt, with the work grasped at the end in the chuck while the outer end is supported in the steadyrest. The tailstock is drawn back for trying on the nut to test the screw-thread for fit.

The job shown in Fig. 20 is that of drilling small holes in some light frame castings. The drill is mounted on a form of support which permits adjustment in all directions over the face of a table, which is slotted at close intervals to provide convenient use of clamps, parallels and so on.

One Year of the Shop Council System in Germany

BY OUR BERLIN CORRESPONDENT

It is now one year since the German Shop Council Bill came into force. It provides a representation for the manual workers, one for the clerical workers and a joint board of both for every establishment in which the number of employed exceeds five. Although its scope is very wide and practically covers working organizations of every description, its originators had in view chiefly the manufacturing establishments. The basic idea is to create co-operation between employers and employed in dealing with all disputes arising from and all regulations pertaining to employment conditions, and also in all matters aiming at better and more economical production.

The experience gained in the first year is, of course, not sufficient for drawing final conclusions. The auspices under which the Shop Council Bill started were favorable. The election of council members resulted, in the majority of cases, in the defeat of the political radicals, and the bodies elected were mostly taken from the best elements of the workers. The only palpable effect of the bill has so far been a steady rise of wages, which in several cases has amounted to 100 per cent and more. It must be said, however, that cost of living progressed in a parallel line, and on the average exceeded the increase in wages. No political strikes have taken place since the shop councils commenced their activity, but it is not clear whether and how far this can be attributed to the new institution.

In one of their main tasks, which is to prevent strikes and to settle all disputes by means of arbitration, they have not succeeded, at least not in all cases. Large organized strikes have not taken place, but a great number of so-called "wild strikes" are recorded. Increase of wages and other betterments have been demanded frequently, while agreements between employers and employed regulating such matters for a certain period were still in force. A strike was proclaimed if the demands were not immediately conceded. In many other cases the workmen did not abide by the decisions of the arbitration boards. This lack of discipline may, however, be only transitory. It is not unreasonable to hope that wild strikes will gradually become more scarce, not entirely as a beneficiary result of the shop councils but also on account of the progressive "pacification" of the workmen.

If the opinion of the employers with regard to the benefits of the shop councils in the matter of labor disputes is divided it is unanimous as far as their collaboration in the matter of production is concerned. This opinion is absolutely negative. Practical help from the shop councils in this respect has been recorded nowhere. On the other hand cases of unreasonable interference have been frequent.

Sheet-Metal Shop Equipment for Railroad Work

Modern Power Shears, Presses and Brakes Save Time and Effort—Ingenious Machines Designed and Built in the Railroad Shops

By J. V. HUNTER
Western Editor, *American Machinist*

THE sheet-metal shops of too many railway systems have been slighted in their machine and tool equipment, so that men are kept busy doing tasks by hand that could be handled in a fraction of the time by proper machinery. In the shops described in this article two factors—good equipment and standardization of sheet-metal work—have reduced actual shop time to a minimum and left the men freer to work on jobs at the pits.

Like all other departments in a railroad shop, the sheet-metal shop can show marked reduction in cost of work when it is properly equipped with machines and tools. The sheet-metal department of the Beech Grove shops of the Big Four Railroad system, Indianapolis, Ind., can be cited as an example of a shop that has been properly equipped with standard machines and with special equipment built in the shop to care for special problems.

The machine section of this department is illustrated in Fig. 1 and shows several power-driven machines,

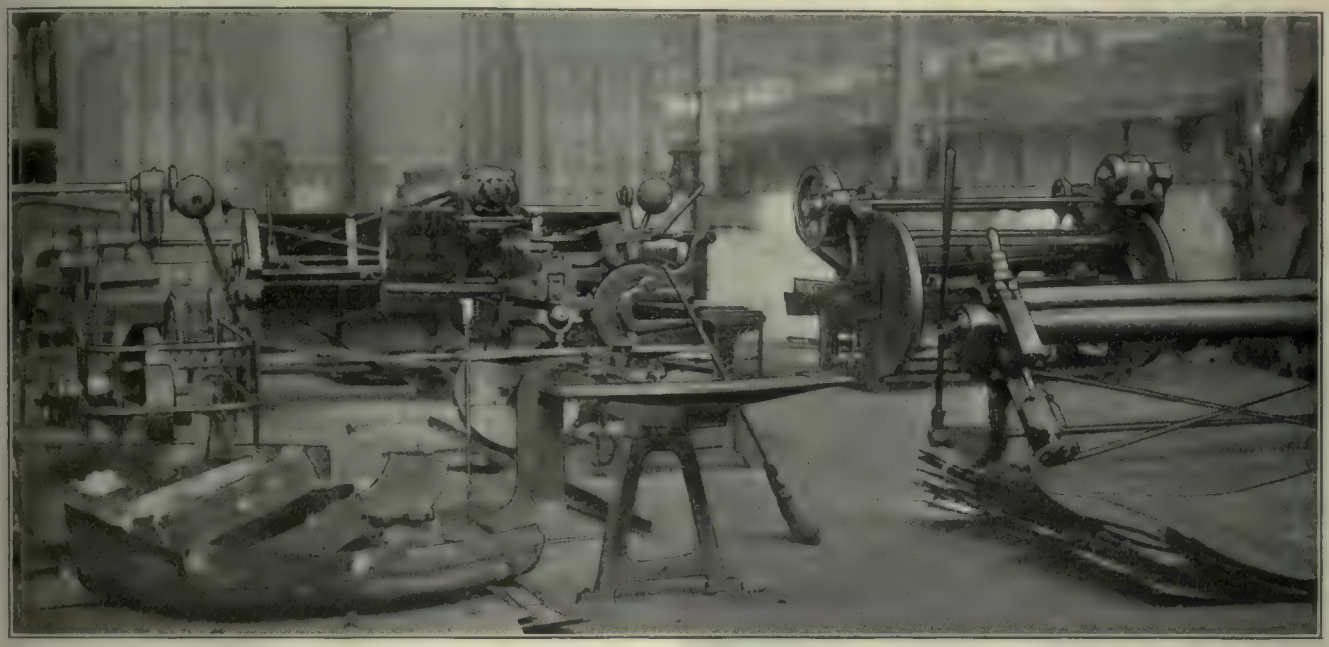


FIG. 1. POWER MACHINE EQUIPMENT FOR A SHEET-METAL SHOP

among which may be cited: an 8-ft. power shear, an 8-ft. power bending roll, power punch press, foot-power squaring shears, a heavy bending brake and a power-driven circle shear. The foregoing comprise but a portion of the standard equipment that aids in expediting the work of the shop, and in a near-by location are two power punch presses that have been well equipped with dies and tools for blanking and forming operations on many standard parts for cab and engine fittings.

Standardization of the sheet-metal work on locomotives has played a prominent part in the success of this department; and because this has been done systematically it has been possible to make some special equipment that still further simplifies the work. The seams of boiler jackets are an item that can be mentioned in this connection. In many shops they are riveted, but here the lock-seams are turned on the sheets with a very marked saving in the amount of labor required to do the work. Moreover, what counts even more is the production of a water-tight joint that saves the jackets by preventing them from being rusted through.

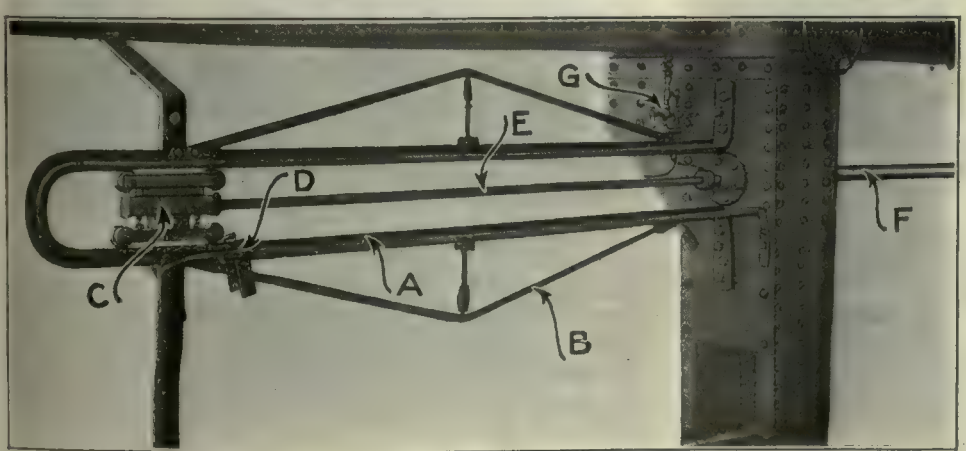


FIG. 2. SPECIAL DEVICE FOR LOCK-SEAMING LARGE BOILER JACKET SHEETS

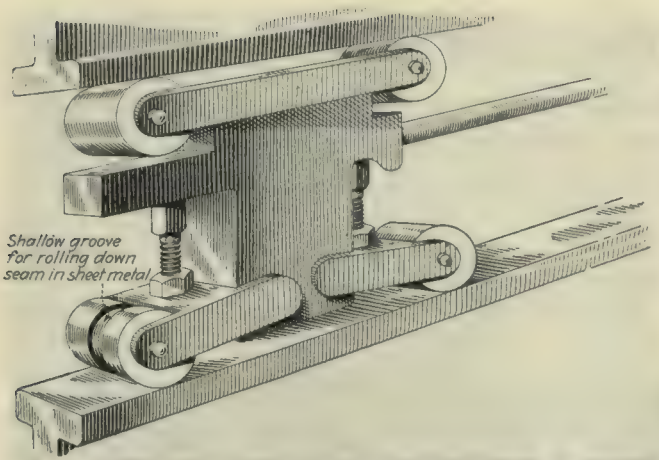


FIG. 3. OPERATING HEAD OF LOCK-SEAMING MACHINE

In making these lock-seams the edges of the sheets are turned over in the brake already noted. The double-locking is accomplished by the special seamer, shown in Fig. 2, that is mounted on an extension of the balcony under the crane runway. The frame *A* of this device consists of a length of T-rail from which the base has been cut before it was bent into its present deep U-shaped form. The center of each side is stiffened by the diagonal tension braces *B*. The seaming and locking is accomplished by the head *C*, which is shown in the starting position. The two turned-over edges of the sheets to form the seam are laid along the center of the lower rail up to the end stops *D*. In closing the seam the head *C* is drawn toward the right by the piston rod *E*, operated by a piston in the 3-in. air cylinder *F*. This air cylinder is made from a piece of new boiler tubing, the inside surface of which is smooth enough so that a cup washer on the piston will make an air-tight joint. The air is controlled by valves at *G*, arranged to admit the air to either end of the cylinder for the working or return stroke.



FIG. 4. SAMPLES OF FLANGED AND CRIMPED WORK

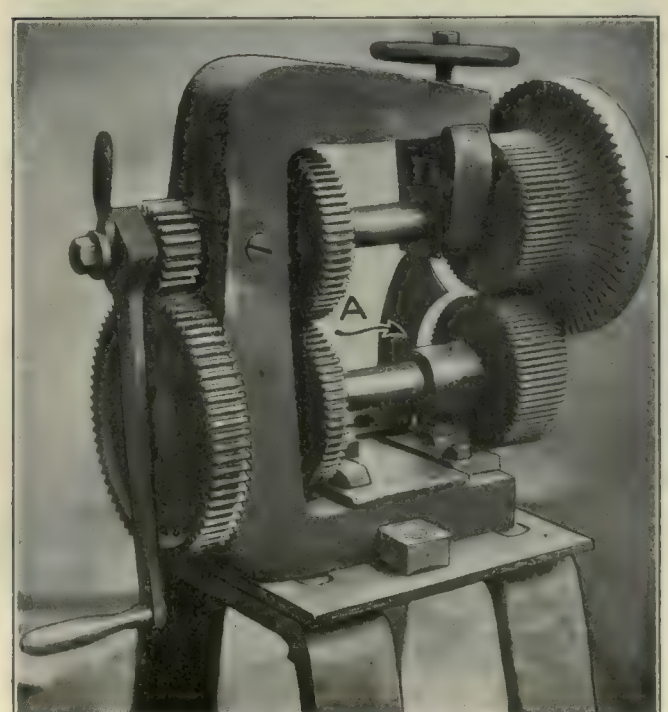


FIG. 5. CRIMPING DEVICE FOR FLANGING SHEETS

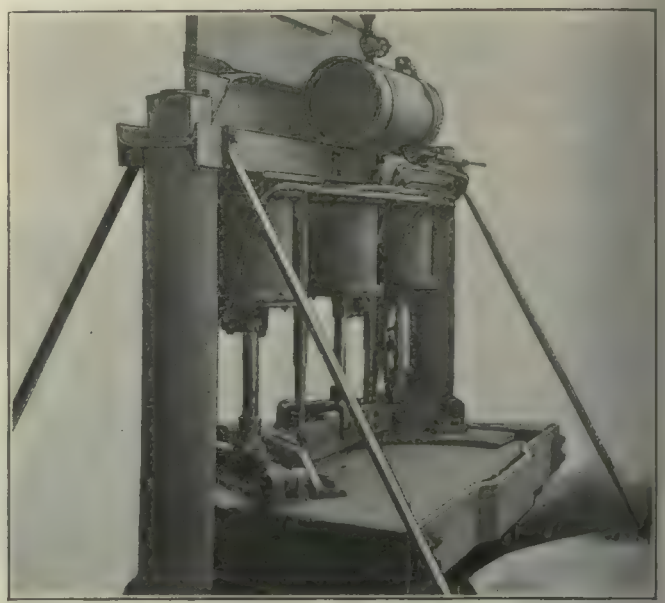


FIG. 6. FLANGING DEVICE FOR LARGE BOILER JACKET SECTIONS

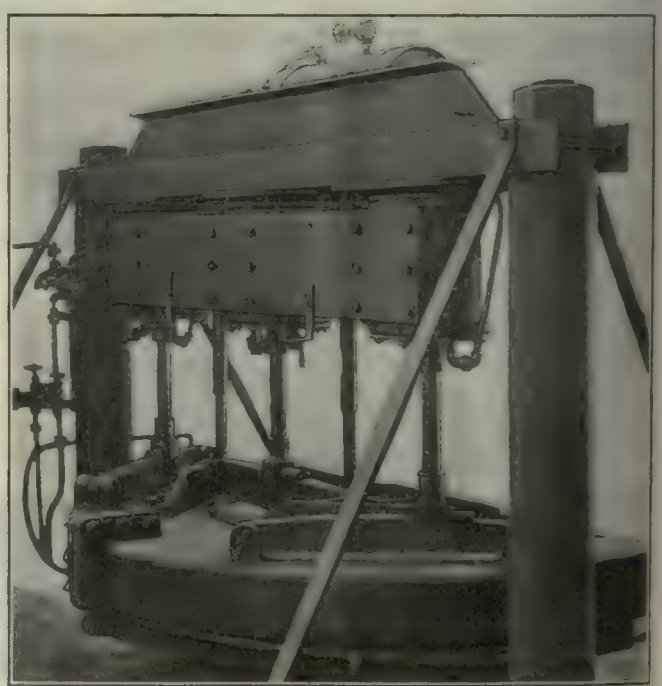


FIG. 7. REAR VIEW OF SHEET-FLANGING MACHINE

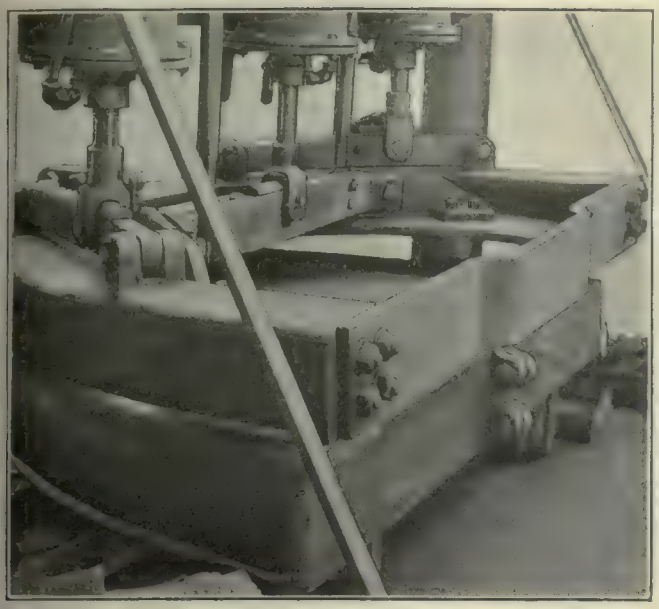


FIG. 8. DIES AND PRESSURE PLATE OF FLANGING MACHINE IN RAISED POSITION

The construction of the lock-seaming head is shown in Fig. 3. The upper rollers *A* serve merely to take the upward thrust of the head when it is rolling down a seam. The operating piston *B* is inserted in the main body of the head *C*. Of the two lower rollers, the one at the right, *D*, has a straight face that serves for closing down the seam. The roller at the left, *E*, is grooved for lock-seaming and completes the seam as it moves along to the right following the first roller. Both lower rollers are mounted on swinging arms *F* so that they may

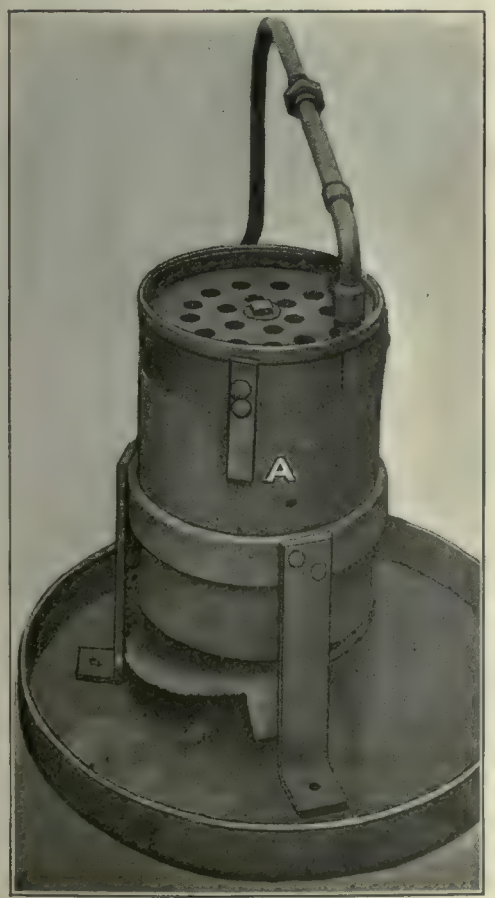


FIG. 9. GAS-GENERATING UNIT OF FLANGING PRESS

be set for different thicknesses of sheets by means of the adjusting screws *G*.

Flanging and shaping of curved sheets, such as are shown in Fig. 4, has been greatly simplified by the crimping machine shown in Fig. 5. This, together with the other special equipment, was designed by W. J. Moffet, foreman of the department. The crimping device serves particularly for such pieces as those shown in the foreground or left-hand side of the illustration, Fig. 4. These pieces were first flanged over in the brake and then the crimping operation was continued until they had rolled up to the desired radius. This operation takes the place of the peening and hand working of sheets formerly required to form curved jackets. Under the old system in many cases these sheets had to be built up of jointed sections as shown in the sample of old pieces lying at *A*.

The construction of the crimping device is simple enough so that little explanation is required. The C-shaped frame is a forging. The shaft for the small pinion runs in a pivoted bearing so that the shaft can

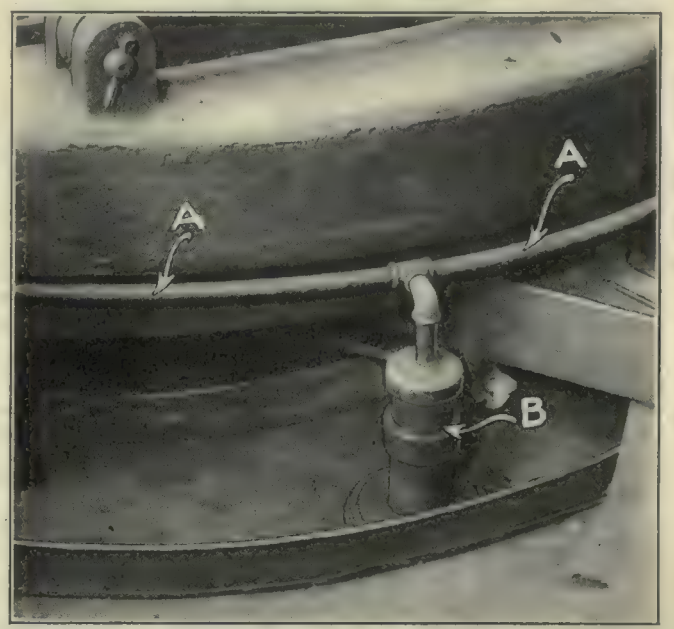


FIG. 10. GAS BURNER FOR HEATING HEAVY PLATES BEFORE FLANGING

tilt up or down when the pressure on the upper crimping roll is changed. The outer bearing of this shaft is raised and lowered for alternating the crimping pressure by the handwheel shown above the frame. The crimping rolls are made of tool steel and hardened. An adjustable guide *A*, at the back, can be set for any desired depth of crimped flange.

The flanging press shown in Fig. 6 serves for all semi-circular sheets such as shown at *B*, Fig. 4, the edges of which were crimped after flanging. The power unit consists of a set of three 10 x 12-in. air-brake cylinders fitted with heads having packing glands about the pistons. The two outer cylinders carry the upper flanging die, while the center one operates the holding-down (or pressure) plate. The columns of the machine are sections of steel pipe, through which extend heavy bolts to hold the upward thrust of the top cross-piece, which is composed of I-beams and carries the air-cylinders. The downward thrust on the dies is correspondingly taken up by another set of I-beams that pass beneath the bed-plate. The bases of the air cylinder are

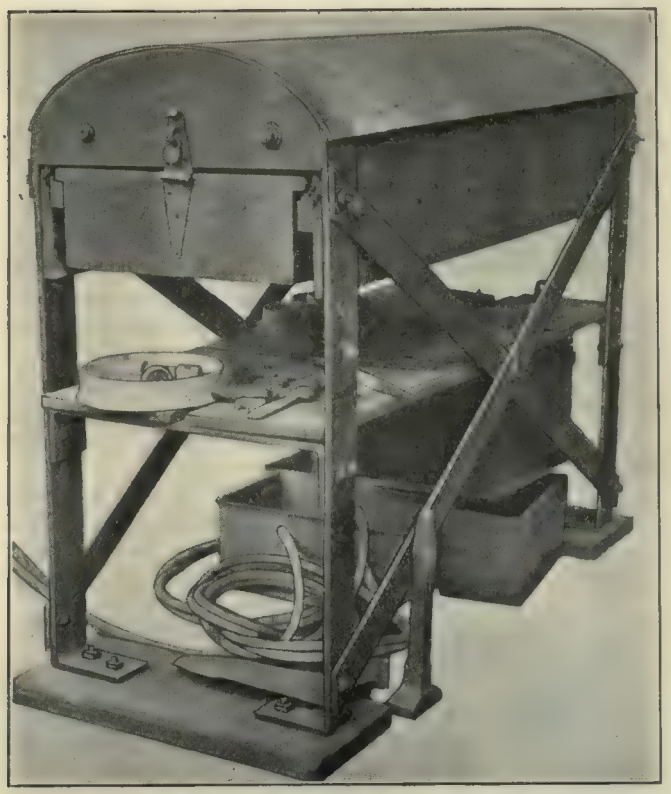


FIG. 11. LARGE STEEL-FACED FORM FOR WORKING SHEETS

bolted to a steel plate extending across between the two columns, as will be noted in Fig. 7. The equalizer bars connecting the pistons to the dies are for better balancing the latter so that they will lift and press evenly.

The center cylinder operating the holding down plate works independently, while the other two cylinders operate the flanging die. The position of the dies and holding down plate while inserting or removing work are shown in Fig. 8.

Heavier weights of sheet metal are flanged hot, and this involves another feature of the machine. An oil gas is made in the gas-generating device *A*, Fig. 9, by a system which Mr. Moffet now has under development. Kerosene oil is used as a fuel and is stored in a tank (on the top of the press, Fig. 6), from which a pipe conveys it to the gas generator. A portion of the fuel is employed for heating the generator and the heat is carried through it by a number of small tubes extending upward from the flame beneath. The generated oil-gas is carried around to the burner *A*, Fig. 10, by a pipe drilled with a long series of small holes, each throwing a jet of flame upward against the work. The burner is carried on a plunger operating in a small air cylinder *B* and when pressure is applied the plunger will rise and carry the burner up closer to the work. The air is turned off and the burner lowered out of the way before bringing down the flanging dies.

A large form for rounding up boiler jacket sheets is shown in Fig. 11. This is made of heavy wood blocks faced on the upper side with a piece of $\frac{1}{8}$-in. steel plate. It is supported by steel legs which loop over the top, the steel surfacing plate being riveted to the upper portion of the loop.

Campaign for Sixteen Million New Buyers

If sixteen million persons with substantial hoards of cash should begin buying the goods that now burden the shelves of retailers and fill the warehouses what would be the effect on business? This question is asked in the *Inter-Racial Council Chronicle*. The article continues:

It is evident that merchants would sell and order more stocks, the warehouses would be emptied, new goods would be required and the mills would be busy filling orders. Unemployment would diminish in proportion, and the fear of hard times, that discourages buying, would be relieved.

Now it is just such a new market for American goods that The Inter-racial Council purposes to develop; the 16,000,000 foreign born in this country who have been making big wages for years, and who have spent comparatively little.

This is the right time to begin a systematic campaign among the foreign born to circulate their hoarded money by investing in homes, sound securities and a larger proportion of the necessities and comforts of life. It is the right time to urge deposits in American banks, which will also serve to put hoarded millions into circulation.

The reason this is the right time is that the wives, children and parents of the immigrant are being brought to this country by the hundreds of thousands. People who grumbled at this, because it meant that many less laborers, and that many more dependents, failed to realize the important fact that this means new American households.

When the single man sends abroad for his family he is planning to make his home here, so the thousands of women and children mean far more business for the man who has worth-while commodities to sell.

Even the poorest excuse for a household in America represents greater buying potentialities than the bunk-house of a single man.

But there is no excuse for leaving the immigrant satisfied with the low standard of living of the past. There are enough comfortable and even luxurious homes owned by the foreign born to prove that the immigrant may develop into a liberal user of the best American goods.

A concerted effort should be made by all who manufacture or sell goods to make the best use of this foreign born element. From the retail clerk, who should be taught to show courtesy and patience to the immigrant customer, right up the line to the manufacturer, who should see to it that the immigrant learns about his product, and buys it, there should be aggressive effort to capture this "foreign market at home."

With the help of the foreign language newspapers, and other mediums of publicity, the idea is being spread that "Thrift is not Hoarding."

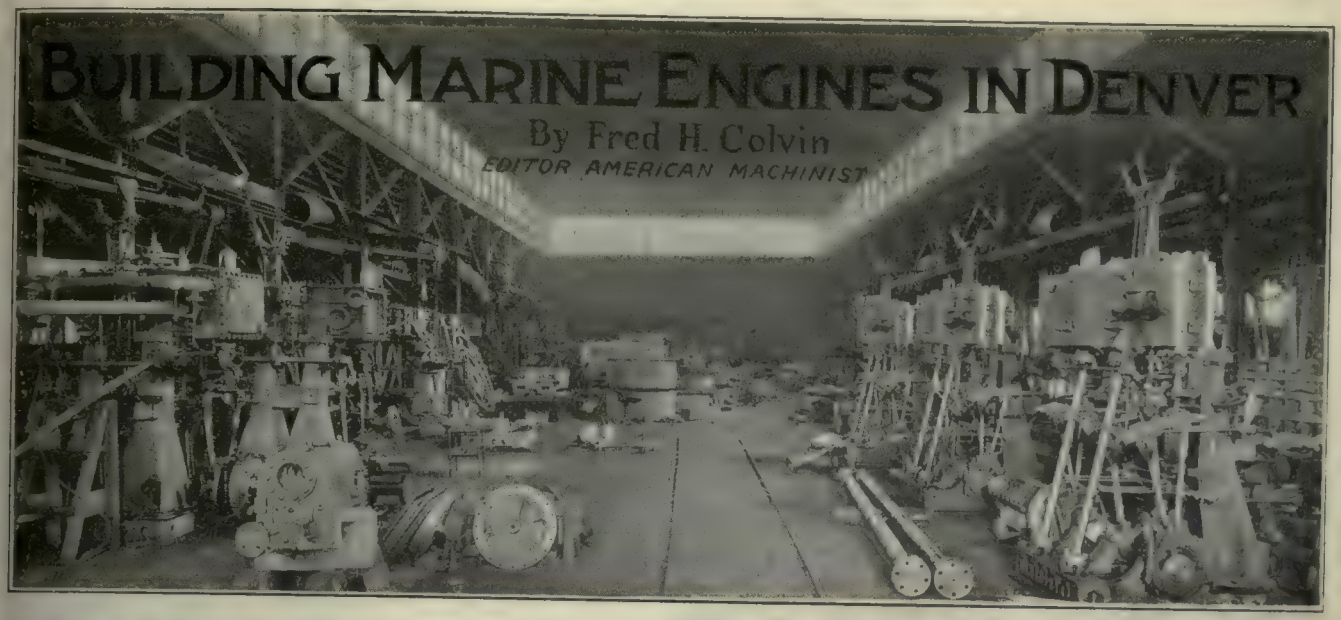
Thrift is intelligent investment and judicious spending of money, and this fact is to be thoroughly disseminated among the 16,000,000 foreign born in America, and their sons and daughters. This should have a prompt and beneficial effect upon business, and the co-operation of all business men is solicited in the campaign.

The value to the immigrants of raising their standard of living is apparent. When they secure good homes, furnish them attractively, enjoy books, music, good clothes and the other things that make life cheerful and worth while we will hear less rumblings of discontent and revolution.

American business and the foreign born buyer will both profit by coming together.

BUILDING MARINE ENGINES IN DENVER

By Fred H. Colvin
EDITOR AMERICAN MACHINIST



We usually think of marine engines as being built on the Coast and it is somewhat surprising to find that nearly a hundred large marine engines were built in Denver during the war.

THE Vulcan Iron Works, Denver, Col., is not a large shop as machine shops go but it has handled a lot of work. The headpiece gives a good idea of the main shop during the erection of some of the 96 marine engines built during the war. These engines were of different types, varying from the 350 hp. tug boat engines, shown at the right in the headpiece, to the 800 hp. engines built for the emergency fleet as shown in Fig. 1. There were 52 of the 800 hp. engines built, and as they weighed 87,000 lb. each, the total output represents considerable tonnage to go through a shop of this size. The 400 hp. engines weighed approximately 30,000 lb. each, and added materially to the total weight of metal handled.

In addition, there were built 1,000 cargo hoists, 62 steam steering engines, 500 sets of hand steering gears and between 500 and 600 16-in. engine lathes.

A group of the smaller engines assembled and ready for shipment is show in Fig. 2., these engines being rated at about 400 hp. each.

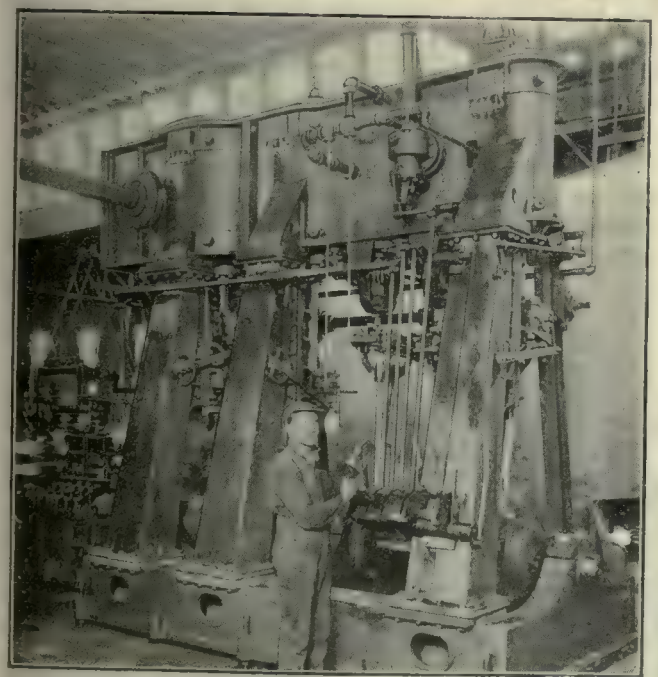


FIG. 1. (LOWER). ONE OF THE 800-HP. ENGINES

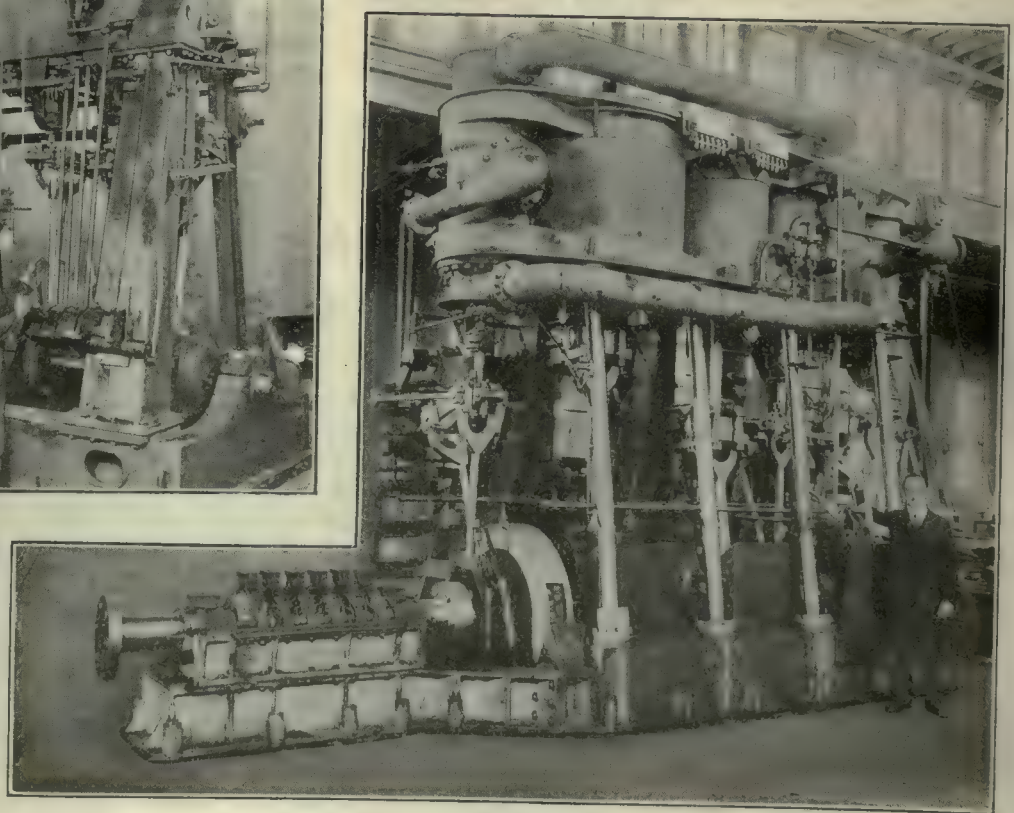


FIG. 3. (UPPER). A FRENCH 650-HP. ENGINE

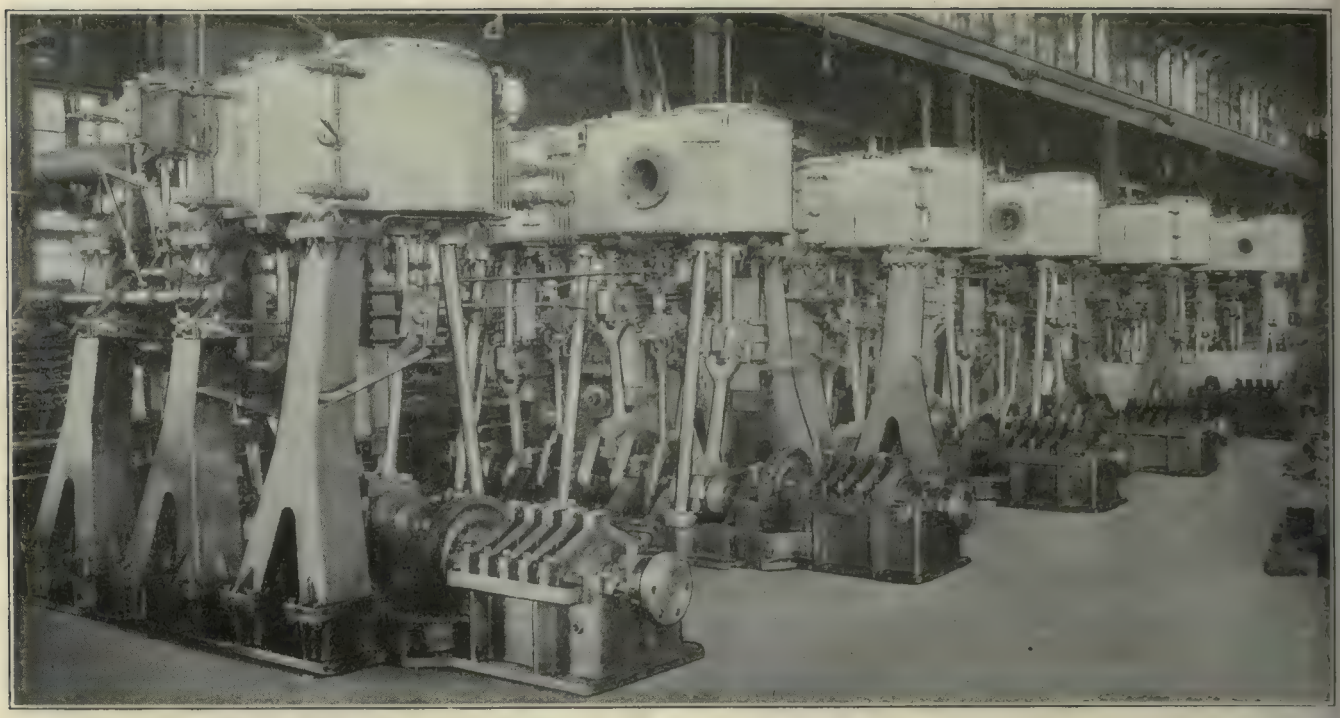


FIG. 2. A ROW OF 400-HP. ENGINES

Another type of engine is shown in Fig. 3, being of French design and rated at 650 hp. It is a triple expansion engine, with the high pressure cylinder at the extreme right, the high and intermediate piston valve chambers coming between it and the intermediate cylinder, which is directly in front of the middle column. The low pressure cylinder and its valve at the extreme left.

A Special Boring Rig

Fig. 4 shows a special boring rig, built for machining the cylinders of the French engine and is so arranged as to carry six boring bars in order that all the holes may be bored at the one setting. These bars are all driven from one end by means of worm gearing and each bar is provided with a star feed, as can be seen.

The complete boring machine, if it can be so called, is mounted on a concrete base and represents a good example of an emergency construction in machinery which has to be fairly accurate. The way in which the boring bar bearings are designed and constructed is well worth noting not forgetting the tie bar *A* and the small jacks *B* and *C*. The fact that this machine handled a large quantity of work with entire satisfaction, is all that need be said in regard to it.

Using Two Lathes on One Job

One of the ways in which this shop handled unusual work is shown in Fig. 5, where a shaft which was considerably longer than any lathe in the shop, had to be turned. This was done by taking the longest lathe

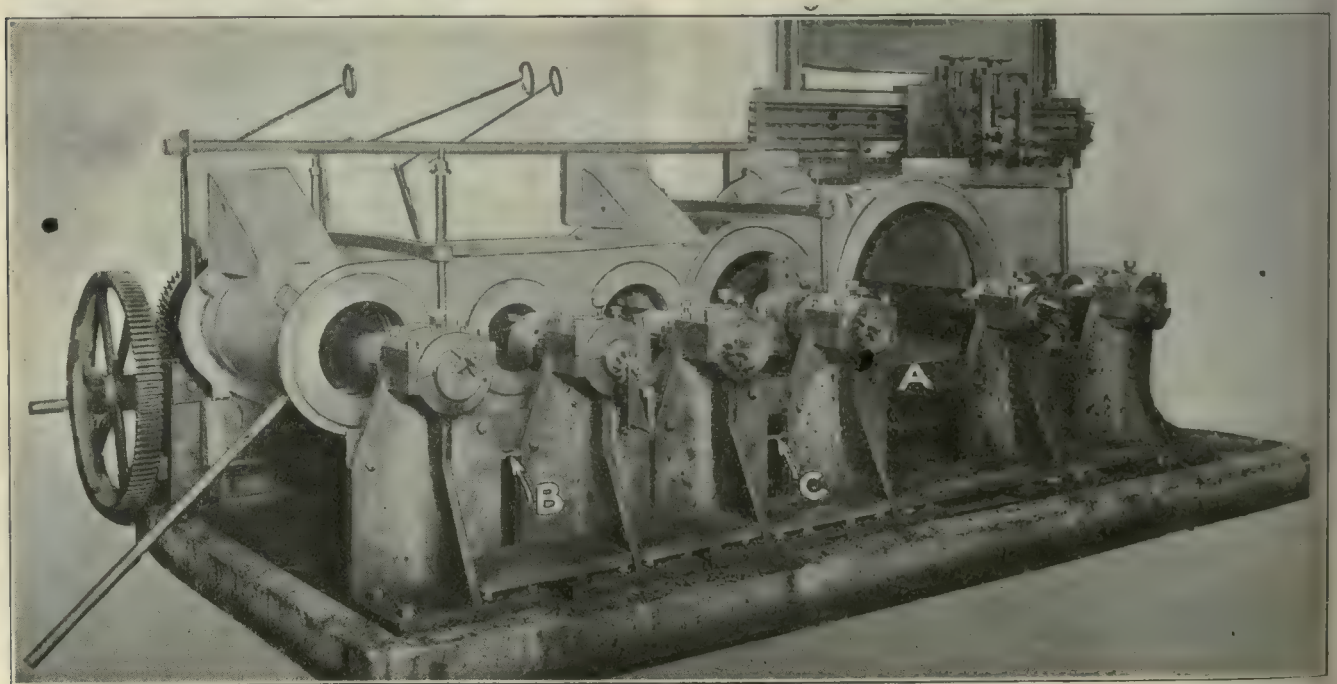


FIG. 4. A SPECIAL BORING MACHINE, CARRYING SIX BARS

available and removing the tailstock. Then another lathe, which would give the additional length necessary, was fastened to the long lathe by flat steel bars, after the headstock had been removed.

The tailstock of the second lathe was utilized as can

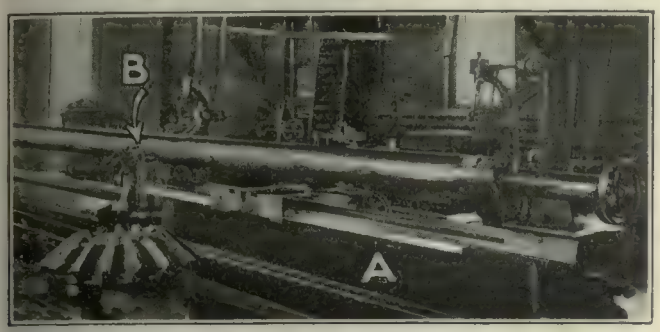


FIG. 5. TURNING A LONG SHAFT ON TWO LATHES

be seen at *A* and a steady rest *B*, at the end of the long lathe, supported the bar while the turning was done by the tool and carriage of the first lathe. It was, of course, necessary to have the center of the second lathe lined up with the spindle of the long lathe and this was easily accomplished in spite of the fact that the swing of the second lathe is considerable less than that of the first. This was one of the many makeshifts which had to be resorted to and the fact that this shop turned out such a large amount of work during the war is all the comment that is necessary concerning the equipment and methods.

Foreign Trade Financing Organization Developing Rapidly—State Legislatures Are Giving Support

The $100,000,000 Foreign Trade Finance Corporation which was recently organized for the purpose of supporting foreign trade and assisting American exporters is receiving the support of manufacturers, farmers and bankers throughout the country, as evidenced by the fact that two state legislatures have passed "enabling acts" permitting state banks and trust companies to purchase stock in this organization. A committee on "Policy" has been appointed to make a survey of world trade and to decide when the corporation should open its doors for business. This committee is composed of six members of the executive committee of the advisory council of the Federal Reserve Board, and was determined upon in view of suggestions which have been made that long-term credit should no longer be extended to foreign buyers of American merchandise until the machinery of the League of Nations, by which credits will be guaranteed, is perfected.

In regard to the immediate need of such facilities and such a volume of long-term credit as the corporation will provide, Mr. McHugh, chairman of the Committee on Organization, said recently, "There is a great volume of business awaiting American exporters, provided long-term credit is established to enable foreign buyers to finance their purchases. Evidence is in the hands of the organizers of the corporation, of weekly losses running into millions of dollars—losses suffered by American farmers, manufacturers, and exporters because of the absence of adequate banking facilities.

"In spite of the overwhelming testimony of foreign buyers for our goods, we have found among certain people a sentiment that foreign markets are not ready to take our goods, and that proper security to protect loans made in the interest of our exports is not readily available. Under the circumstances, therefore, we have invited a group of men whose judgment will readily be accepted by every farmer, business man and banker of the country, to make a frank and unbiased survey of the situation to the end that any existing fear regarding our international financial arrangements may be promptly and satisfactory answered."

Up to the present time the campaign for the flotation of the $100,000,000 stock of the corporation has been conducted along broad educational lines for the purpose of acquainting the general public with the form of banking authorized under the Edge Act. An intensive campaign for subscriptions will not be conducted until May, when it is hoped by the committee that the country will be sufficiently familiar with the purpose and scope of the corporation to give whole-hearted support to its activities.

Export Credits Arrangement

After consultation with the Minister of Commerce, the National Bank of Foreign Commerce has made public the following statement, says the *Fortnightly Survey of French Economic Conditions:*

The National Bank of Foreign Commerce has organized a special department which will deal with the granting of credits to exporters. These advances will be accorded to exporters on certain conditions and will be allowed only to exporters to certain countries, namely: Poland, Czecho-Slovakia, Jugo-Slavia, Roumania, Bulgaria, Turkey and Italy. They will be made against drafts accepted by the foreign buyer after the deposit of certain titles or against open drafts and bills of lading. The advances will be guaranteed by the exporter and certain definite guarantees made by the foreign buyer with local recognized banks, having the right to hold these guarantees either in the form of cash or as mortgages as security for the eventual payment of debt. Advances will be made up to 80 per cent of the value of the goods exported, the exporter taking the balance of 20 per cent himself. The maximum time limit of these advances will be three years. A commission will be allowed to the bank as against the advance which it will accord; the rate of this commission will increase with the length of the credit granted; it will be 3 per cent for the first year, 4 per cent for the second year, and 5 per cent for the third year. The advances accorded with the guarantee of the State will be funded by the Banque Nationale Française du Commerce Exterieur. Three-month notes, renewable until the due date of credit, will be subscribed for by the exporter, to the order of the bank, and will be immediately discounted by the latter to the exporter. The rate of discount will be the official rate of the Bank of France, increased slightly by a quarterly commission. The notes, which will bear two French signatures, will be discountable at the Bank of France. The guarantee of the state will result from an inscription on the draft or bill showing that it has been allowed under the law authorizing the state's endorsement of such bills.

Marking Tools by Etching

BY A. SCHLEIMER

Relative to the article by C. E. Hallen under the above title on page 511 of the *American Machinist*, I desire to say that if he will mix one part of nitric acid with one part of water, then carefully add three parts of sulphuric acid he will be able to accomplish his purpose. The acids used should be full strength and mixed in the order given. The action, however, will be much slower than usual as nickel is not so easily attacked by acids as are most metals.

Building a Korean Beet Sugar Factory

Plant Built in This Country for Japanese Interests—Machine Tool Equipment Required for a Sugar Factory—Construction of Equipment in an American Shop

WESTERN CORRESPONDENCE

THE manner in which American ideals of manufacturing can be transferred to the Far East is well illustrated by the recent erection in Korea of a complete American-built plant for the extraction

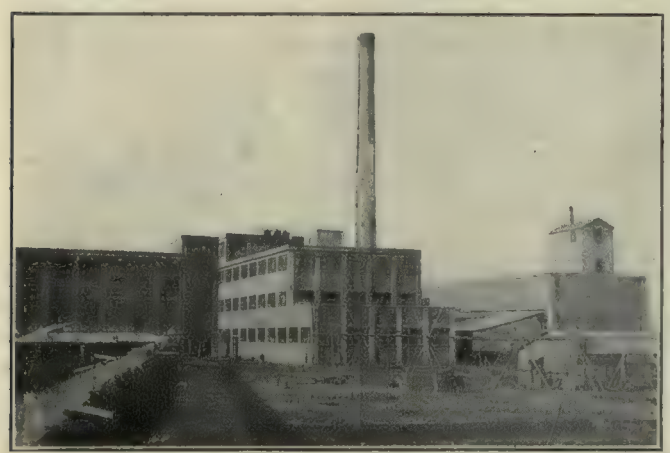


FIG. 1. AN AMERICAN-MADE KOREAN BEET SUGAR FACTORY

of sugar from sugar beets. This plant is the creation of American brains and the equipment was built, assembled and tested in this country and then torn down again for shipment abroad. The sugar plant shown in Fig. 1 is the design of the Cannon-Swenson Co., Chicago, Ill., and was erected at Haejo, Korea.

The erection of this plant is one of the outgrowths of the sugar shortage during the war that led to the direct encouragement of some of the Japanese sugar interests by their government. Their experiments showed that the climate and soil of Korea was suitable for the raising of sugar beets. However, owing to the pressure of war activities, the plant was not started until after the conclusion of peace and was finished and put into operation in November, 1920. The Cannon-Swenson Co. handled the work of designing and erecting



FIG. 2. KOREAN RIVER JUNKS LYING AT UNLOADING WHARF

the mill for the Japan Sugar Co., which acted through the export house of Mitsui & Co., Ltd., New York.

The factory will handle 600 tons of sugar beets per day, and is equipped to produce the quantity of granulated sugar that can be extracted from that weight of beets. During the off season for suger beets it is planned to use the plant for refining Java sugar. This development is the first beet sugar factory that has been constructed and put into operation in Korea; moreover, it is the first modern beet sugar factory that has been built in the Orient. A factory of German manu-



FIG. 3. MACHINE SHOP USED DURING MILL CONSTRUCTION

facture was built some years ago at Moukden, but it did not produce white sugar.

A touch of local color is given by the illustration, Fig. 2, showing the unloading dock provided for receiv-

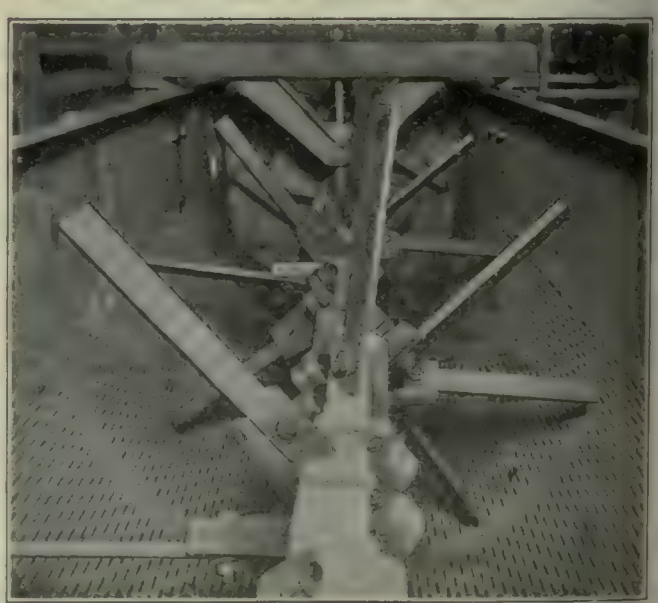


FIG. 4. WASHER FOR CLEANING THE BEETS

ing the sugar beets. Large quantities of the beets are floated down the river from the farming districts in Korean river junks such as are tied to the wharf. A locomotive crane runs out on the bridge (seen in the background) and is used for unloading the beets from the junks and dumping them in the storage bins.

Mechanical handling of the raw and finished product is employed almost exclusively in a beet sugar plant;

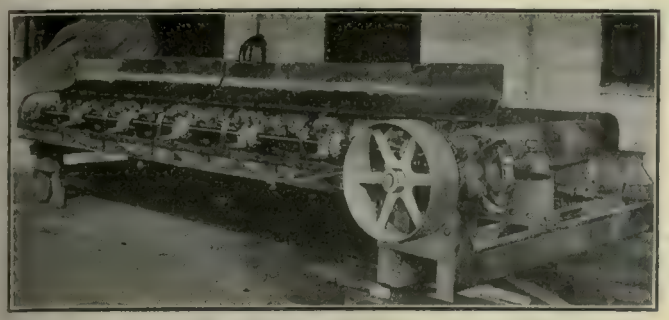


FIG. 5. ROLLER CONVEYOR AT PICKING STATION

it therefore requires a trained force for its maintenance and must have a fairly complete machine shop at its service. The small machine shop shown in Fig. 3 was erected temporarily during the construction of the plant. The countershaft of the lathe is driven by a small gas engine mounted on the same frame with a ditch pump. This indicates some of the difficulties that come to the pioneering machinist in primitive districts.

Machine-Tool Equipment

The machine-tool equipment furnished for the Korean sugar factory included: One heavy-duty, quick-change geared engine lathe with 18-in. swing and 8-ft. bed; one 12-in. pipe machine with die-heads and chasers; one 24-in. heavy-duty, back-geared crank shaper; one 20-in. upright drill press; one 18 x 17-in. power hacksaw and one electric floor grinding machine. The lathe was equipped with an extra chuck. All pipe threads cut for this work are right-hand, so the pipe machine was only equipped with right-hand dies and chasers. The power hacksaw is for cutting large pipes, shafting and for jobs of similar nature.

Two wood-working tools were also furnished: A 24-in. swing saw and a combination ripsaw and planer. A forge with a 10-in. power blower was supplied for the service of the blacksmith. During the sugar season the large power plant of the factory furnishes electric current, and a motor is used for driving the line shaft of the machine shop. However, the sugar season is short and most of the repair work and overhauling is done during the remainder of the year, so for driving during the off season a donkey boiler and engine are provided.

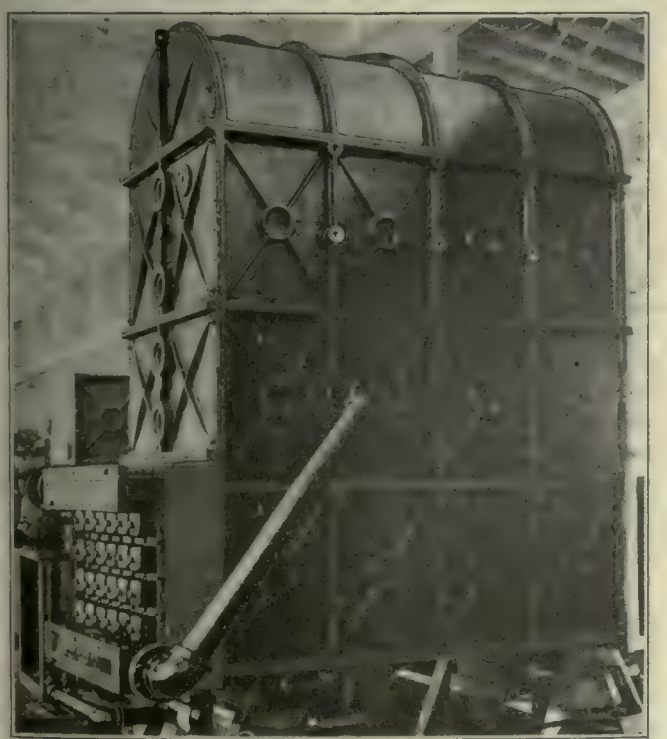


FIG. 6. PRE-EVAPORATOR FOR EXTRACTING SUGAR JUICES

Processes of Sugar Making

Following through the processes of sugar making shows something of the character of the machinery that must be kept in repair. The sugar beets are unloaded



FIG. 7. BATTERY OF EVAPORATORS



FIG. 8. ERECTION FLOOR FOR PRE-EVAPORATORS AND EVAPORATORS

into big bins, from which they are raked into a flume and floated by water to the beet washer, shown in Fig. 4. The revolving paddle bars in the washer keep the beets slowly moving toward the far end, and as they roll over and over the water carries the grit and dirt through the slotted openings in the bottom into a shallow compartment below, from which the dirty water is constantly withdrawn.

The beets are removed from the washer by a wheel with heavy cast-iron paddles and carried to a roller con-



FIG. 9. EVAPORATORS, CONES AND CATCH-ALLS

veyor similar to the one shown in Fig. 5. As they travel along this conveyor, workmen called pickers, stationed along the sides, pick out all pieces of stone or foreign matter that have not been removed by the washer. The gear guards along the near side of the machine have



FIG. 10. VACUUM PANS IN THE MACHINE SHOP

been lifted, exposing the drive, and showing the transmission equipment that is used.

From the conveyor table the beets are transferred to the slicer, where they are cut up into small strips called cossettes. The standard form of slicer consists of a revolving drum lined with knife blades, into which the beets are deposited. A stationary arm in the center



FIG. 11. CENTRIFUGALS FOR SEPARATING SUGAR CRYSTALS

of the drum holds the beets against the knives, and the cossettes fly through what resembles chip openings into the shell covering the drum. The knives are small blades with serrated edges. Foreign objects can damage these blades severely, therefore four or five extra sets are kept at hand for each slicer and are furnished to the machine packed in boxes. These blades have been adjusted in the machine shop for cutting the size of cossettes required. The setting and sharpening of the knives is a process requiring slow and careful attention, and special grinding machines have been developed for this purpose. It is necessary that the extra sets be always ready at hand, and these can be inserted in the slicer within a few minutes.

The general operations required in the maintenance of sugar mill machinery are similar to those involved in its manufacture, and as illustrations of these machines made since their installation are not yet available, they have been illustrated from photographs made in the American plant while they were being erected for test. Many parts of the equipment are made with shells, built up of cast-iron sections, and these must be machined on all abutting edges before assembly, so as to insure tight joints.

A piece of equipment of this character is the pre-evaporator or diffusion cell that is shown in Fig. 6. The diffusion cell has a vertical heater in its interior that assists in the extraction of the sugar juices. It is customary practice to have batteries of fourteen diffusion cells, of which twelve are kept in operation while one is being loaded and another is being discharged. The sugar liquor constantly passes from one cell to the next of the battery until it reaches the last, where it attains its maximum degree of concentration.

The evaporation of the sugar juices is a lengthy process and requires large installations of evaporators, similar to those shown in Fig. 7. They are made of cast-iron plates and require machine work in their construction and maintenance similar to that of the diffusion cells. Some large cast-iron cones for evaporators and similar equipment are shown in the foreground of the illustration. The flanges of these castings must be faced, with the result that some sugar mills which plan to do all of their own repair work have put in boring mills capable of machining work of this size.

The view of the interior of the shop, Fig. 8, gives an idea of some of the erection problems met in handling this equipment. Other cones, elbows and drums in process of erection are shown in Fig. 9; the cones are tops for strike pans and the drums are termed catchalls.

After the sugar liquor leaves the evaporators it is mixed with raw sugar and then goes into heating tanks. From this treatment it goes through filter presses that send out the liquor as a clear light-colored liquid. This liquid goes to the vacuum pans, where it is evaporated to such a degree of concentration that the crystals of sugar start to form. Machining and erecting operations of evaporators and vacuum pans are shown in Fig. 10.

When the sirup has been boiled to "grain" it is transferred to centrifugal separators, such as are shown in Fig. 11, and these extract the crystals of sugar from the sirup. The sirup from the centrifugals goes through another series of operations, similar in character to those that have been described, and is further concentrated so that the remaining sugar can be extracted.

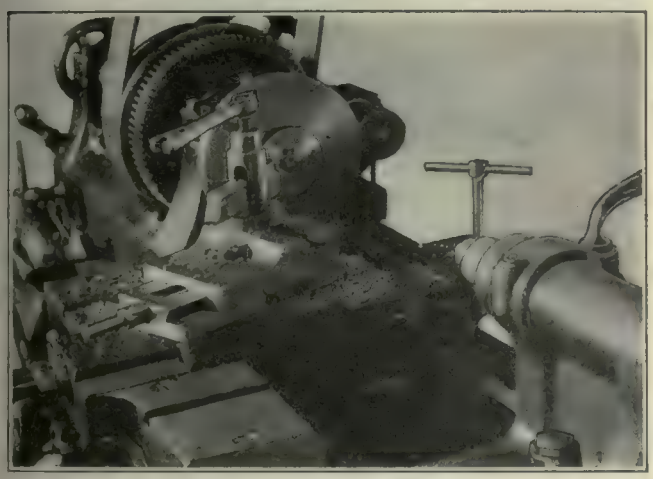
Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Expanding Stud to Hold Small Gear Blanks for Facing

By Milton Wright

The method shown in the picture was used for the purpose of facing quantities of mild steel gear blanks of small diameter. The blanks were the product of the turret lathe, faced on one side and with the hole reamed



AN EXPANDING STUD ARBOR

true with the facing. The problem was to get a boy to re-chuck and face the opposite side and have the blanks come somewhere near parallelism and uniformity of thickness. Absolute accuracy was not required.

The "stud chuck" was made to go in the spindle of an engine lathe, a tapered hole made at the center, the projecting end of the stud sawed in four places, and a draw-rod provided that could be pulled up in the usual way with a handwheel at the rear of the spindle.

Now a boy can push a blank over the stud, making sure that the true face is toward the faceplate, tighten up the draw-rod and run the facing tool over the outer surface. As the stud and the true-running faceplate insure accuracy in locating the blank, and the position of the tool with respect to its distance from the faceplate is not changed except to compensate for tool wear, we get all our blanks of the same thickness and within 0.001 in. of being parallel.

A Safeguard Index Plate Latch

By Amos Ferber

A safety lock for an index plate is shown in the accompanying illustration. The fixture is used for cutting pinions and is designed to cut three at a time, using three cutters on the arbor of the milling machine; but at the time the photograph was taken only the one in the central position was in use.

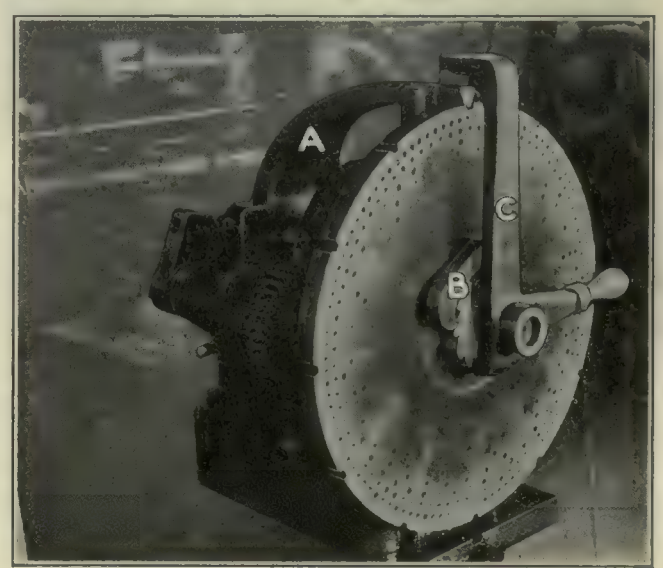
The index plate is keyed to the central work-holding spindle and this spindle moves the others, lying on either side of it, by means of gears. In order to eliminate error resulting from back-lash the central gear, though of the same width as the mating gears, is made in two parts; one part keyed to the spindle and the other part attached to the keyed part by means of screws in such manner that it can be turned (as far as the backlash will allow) with respect to the keyed part. This movement effects a slight offset of the teeth that effectually takes out all tendency to shake and rattle.

Two lugs, cast integral with the main frame of the fixture, form the fulcruming point for the swinging latch lever *A* which carries at its outer end the hardened steel locking tooth that fits into the notches on the periphery of the index plate. The lever is confined, near the plate, within a yoke that prevents any side movement of the lever due to springing of the parts.

A ratchet is fastened by screws to the plate and is moved by the pawl *B* attached to the hand lever *C*, which latter turns freely on the outer end of the spindle.

The vertical member of the hand lever is bent backward at its upper end and passes over the latch lever, holding the locking tooth to its seat in the index plate so that the latter can be turned only by a movement of the handle.

To step the work forward one notch the operator



A SAFE INDEXING DEVICE

raises the handle, thus swinging the hooked lever *C* away from the latch. The movement of the handle is continued until the pawl drops back on the next tooth on the ratchet, when the operator lifts the latch with

his disengaged hand and pushes the handle back to its original position, carrying the index plate with it, until the latch seats in the next tooth, the hooked lever at the same time riding over the latch and forcing it to its seat.

The top of the latch and the under side of the hook are beveled and so adjusted that the hook reaches the latch and rides over it just as the latter is falling to place.

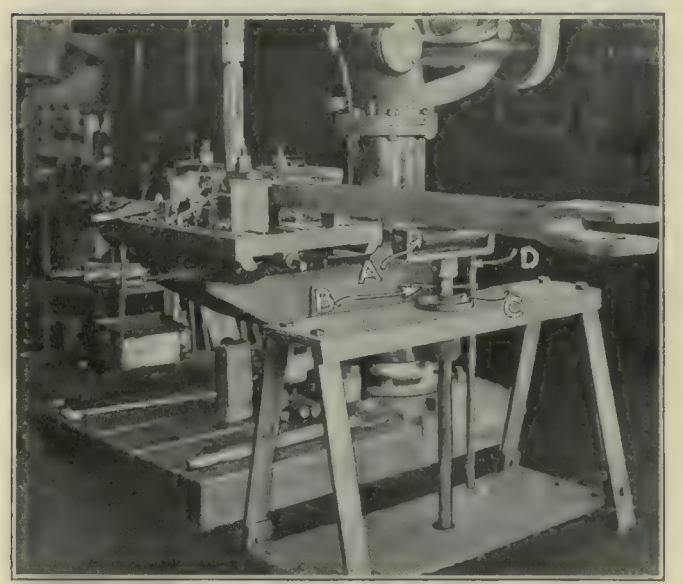
The indexing plate cannot be moved except by means of the handle provided for the purpose, nor can it be moved too far. A single complete movement of the hand lever, forward and back, to the limit of its movement serves to index the work without possibility of error. The holes shown in the plate are not used in connection with this job.

The fixture was devised by and used in the shop of Edwin E. Bartlett, Nashua, N. H.

An Adjustable Rest for Heavy Work

By J. H. Vincent

The illustration shows an adjustable workrest that was made in the Decatur shops of the Wabash Railway. It is of unusually sturdy construction and well qualified



WORKREST MADE FOR A DRILLING MACHINE

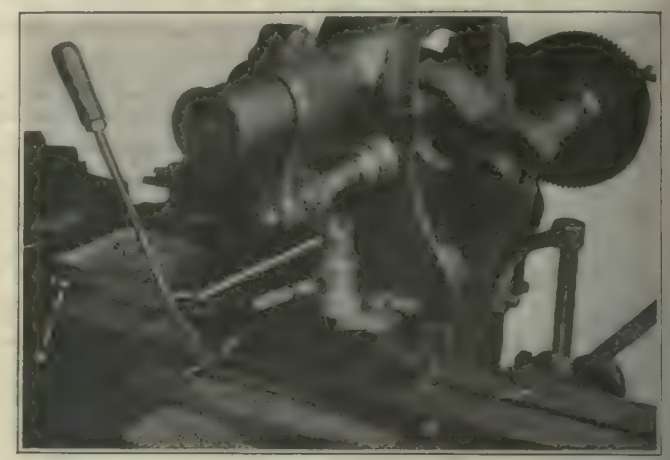
for holding the heavy pieces of work that are found in locomotive shops. It is here shown holding the outer end of a side-bar during a boring operation. The roller rest *A* in the center is mounted on a screw that can be adjusted for height by the spokes *B*. The screw has a threaded bearing in the bushing *C* mounted in the channel that forms the top-piece of the device. The roller rest is prevented from turning by the bar *D* that passes through the table. Usually, sufficient scrap material can be picked up around a shop so that such a work-supporting table can be made at little cost other than that of the labor required.

A Hand Milling Attachment

By Bernie Soule

Having in our small shop several thousand collar-head screws, the product of a hand screw machine, to be squared and no hand-milling machine available, the prospect of winding the table screw of a standard milling machine in and out upwards of twenty thousand times did not appear very inviting, so the job of simplifying the movement was considered.

This did not appear any too easy as long as we were



SCREW MACHINE CROSS-SLIDE ON TABLE OF MILLING MACHINE

looking at the milling machine itself, but when some bright guy suggested taking the cross-slide off the screw machine and putting it on the milling machine table our troubles were over.

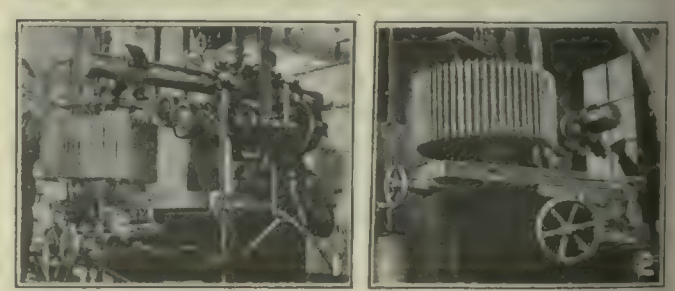
The illustration tells the whole story. It is one of those kinks that *anybody* would think of after he had seen someone else do it.

Unusual Gear Cutting

By William O. Strauss

The illustrations herewith show an unusual method adopted by the Novelty Machine Works, New Orleans, La., to cut some very large gears for sugar mill rolls. The gears are 38 in. in diameter with 18-in. face and one pitch. There is probably not a gear-cutting machine in that vicinity that would take care of this job so a Le Blond heavy-duty cone-driven milling machine was utilized.

As will be noted, the gears are mounted on the dividing head which has been set in a vertical position on one end of the table. To relieve the table of the excessive weight of the gears a counterweight was attached to the gears, as shown. It will be seen from



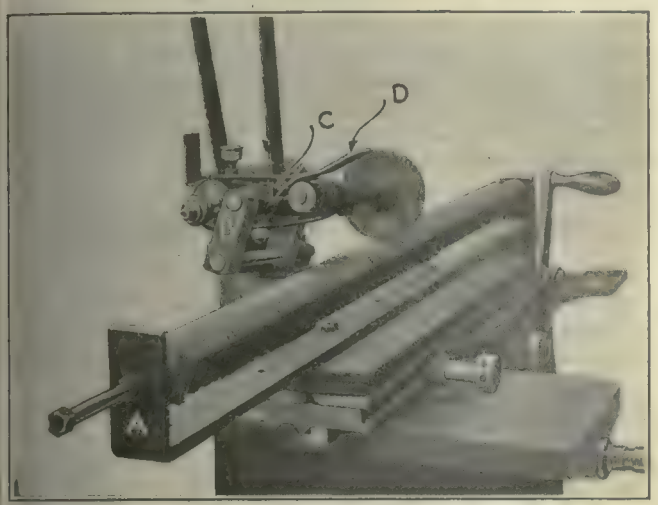
FIGS. 1 AND 2. CUTTING LARGE GEARS ON A MILLING MACHINE

Fig. 1 that a bracket has been applied to the column of the milling machine over the main spindle to which has been attached a pair of gears for driving the cutter arbor. This bracket has been thrown around to such a position as will permit the gears being cut to clear the over-arm and arbor supports when using the vertical feed.

An Improvised Machine for Grinding Broaches

By Eugene E. Henry

The grinding of broaches, especially large broaches, is in most shops a tedious and time-consuming operation. In our shop we had a considerable number



IMPROVISED RIG FOR GRINDING BROACHES

ranging from $\frac{5}{8}$ x $\frac{15}{16}$ x 30 in. up to $1\frac{7}{8}$ x $2\frac{7}{16}$ x 60 in., and as we strive to maintain the shape of the throat and so insure ample chip room and good cutting qualities, the grinding became a serious problem.

The device which we rigged up to grind our broaches is shown in the accompanying illustration. It is built upon a Greenfield cutter-grinding machine and is fitted up as follows:

A long flat bar of steel *A* is bent up at the ends and the upturned ends tapped to receive long pointed setscrews which serve as centers to support the broach while grinding. This bar is bolted to the table of the machine by T-head bolts, and when the broach to be ground is longer than the capacity of the table travel the position of the bar can be shifted so that the table can be again started from the limit of its movement. The rectangular piece *B* is one of a pair of uprights keyed to the round bar held in the adjustable work support of the machine and together with the casting *C*, these uprights form a hinged frame upon which the grinding wheel is carried. This hinged frame is so located as to bring the pulley on the wheel arbor in alignment with the driving pulley mounted in the place of the regular wheel in the head of the machine.

To maintain the front rake of the broach teeth the frame is tilted to bring the axis of the wheel arbor slightly out of parallel with the axis of the broach.

When the machine was first constructed we had a cam roller to ride on the following broach tooth and so maintain the proper relation between the wheel and the work, but we found that it required so much adjustment that it was later discarded and the wheel manipulated by means of the lever *D*.

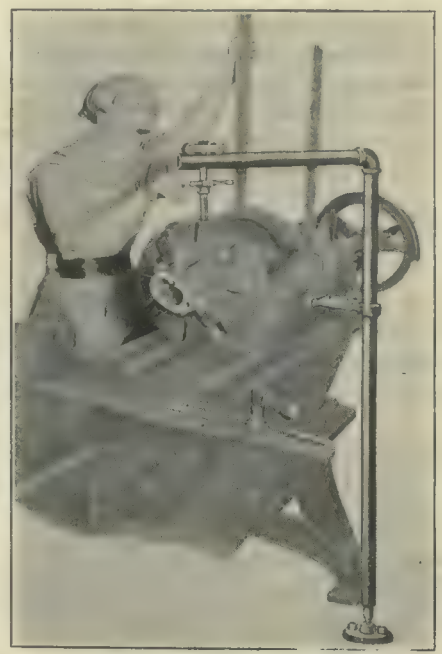
Because of the wheel being tilted to give the desired rake to the tooth the teeth are not ground quite regularly, there being a slight concaving of the tooth contour on the straight portions by reason of the tilted wheel being raised and lowered to correspond with the positions of the teeth. This concaving is the more noticeable as the tilting is increased, but is not detrimental to the action of the broach; being, in fact, beneficial because of the slight shearing action that results.

With the grinding head constructed in this way, the driving belt is tight only when the wheel is in grinding position. Lifting it out of contact with the work slackens the belt and automatically stops the wheel, which can then be laid over back against the head of the machine while the broach is taken out or necessary adjustments made. We use a saucer-shaped alundum wheel, grain 36, grade K.

Lathe Chuck Crane

By R. W. Beckman

The device shown in the illustration has been in use on all of our lathes for the past year, has paid dividends in clean chucks and has saved the spindle noses of the lathes from getting cut up by dirt that would get into the chuck threads. We have never seen or heard of a device like this and believe that other readers of the *American Machinist* will be glad to adopt it. The device is made from ordinary pipe, strong enough to hold the chuck, the size of pipe depending upon the size of the lathe. The bottom of the pipe has a plug with a 45-deg. point which rides in a plate fastened to the floor. The beam has an elongated slot near the end to permit the screw to slide back and forth, so that it can be made to come over a tapped hole in the chuck. All the alteration necessary to the chuck is to drill and tap a hole in it to take the screw in the crane. When the chuck is removed from the lathe the crane is swung out of the way, the chuck remaining suspended by the screw until wanted again. We found the biggest advantage of this device was that it relieved the operator of the heavy and cumbersome job of lifting the chuck to the lathe bed. Also, it avoided marring the shears and otherwise ruining the lathe, to say nothing of the factor of safety involved.



CRANE FOR HANDLING LATHE CHUCKS

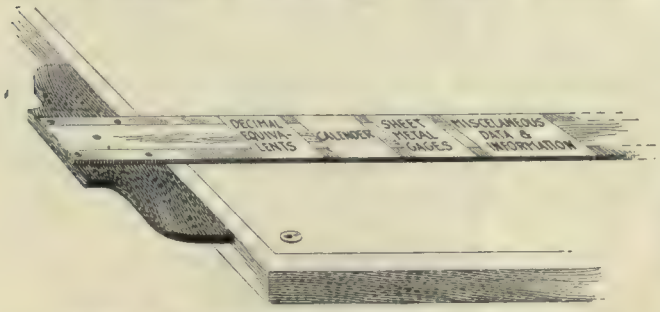
The T-Square a Convenient Place to Keep Drafting Data

By Waldo Ried

Of late I have been reading quite a good deal about tricks and stunts for draftsmen, so I thought that it might be well to contribute mine.

I have converted the top face of the blade of my T-square into a regular reference department. Just now

I have on it, as shown by the accompanying sketch, a decimal equivalent table, a small calendar, a table of wire and sheet-metal gages, and a number of commonly



TABLES OF DATA CONSPICUOUSLY PLACED ON BLADE OF T-SQUARE

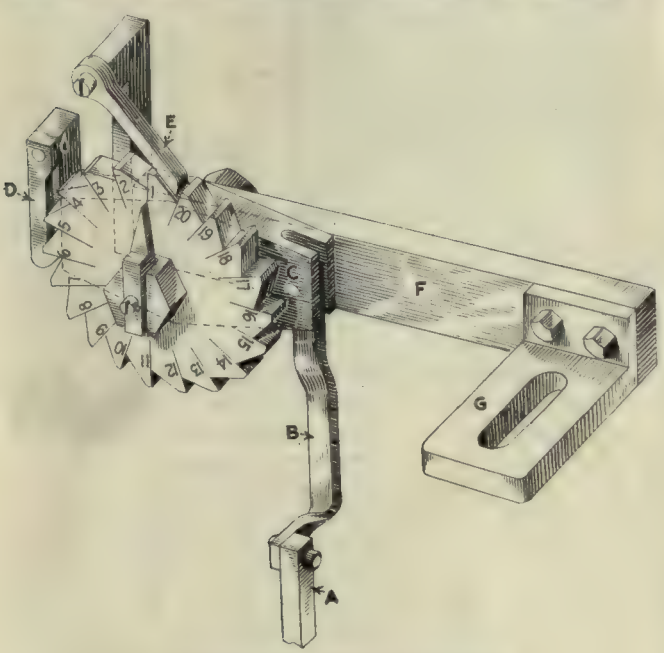
used trigonometric functions. A coat of shellac over the paper helps to keep it clean.

There is no limit to the possibilities. Most of the information can be obtained directly from catalogs, although other tables have to be made up to suit the conditions. I consider this method invaluable, as the information is in the most desirable place, directly in front of the draftsman all of the time.

A Telltale Indicator

By Clifford H. Johnson

In operating a Gould & Eberhardt No. 36-BT gear-cutting machine we had considerable trouble in telling when each set of gears was completed on account of



DETAILS OF THE INDICATOR

the volume of coolant used. Not being able to see the work the operator would sometimes run through one or more spaces that had been cut or he might miss cutting the last space, which would require turning the turret again. This would cause trouble and loss of time. Therefore I devised the telltale indicator shown in the sketch.

Part *A* is an index operating rod on the machine which is actuated by the travel of the cutter head. The rod travels $\frac{7}{8}$ in. and on the return stroke operates the indexing mechanism for spacing the teeth in the gears being cut. Link *B* is attached to rod *A* and also to ratchet operating device *C*; therefore each stroke of *A* operates *C* and the dog *D*, attached to *C*, advances the ratchet wheel one space. Pawl *E* holds the ratchet wheel in place on the return stroke. The ratchet wheel turns on a bolt in bar *F*, which is bolted on bracket *G*. The bracket is fastened to the top of the machine.

Since there are 18 teeth in the gears and 20 numbered divisions on the ratchet wheel which are plainly visible to the operator from any position it will be readily seen that when the set of gears is finished the ratchet wheel will be practically around to the starting point again. The operator sets it on No. 1 division while the turret is turning.

Steel Balls as an Aid in Measuring

By R. H. Kasper

In my toolchest I keep an assortment of steel balls of various sizes, as I have found them to be useful in laying out work and making measurements. It is

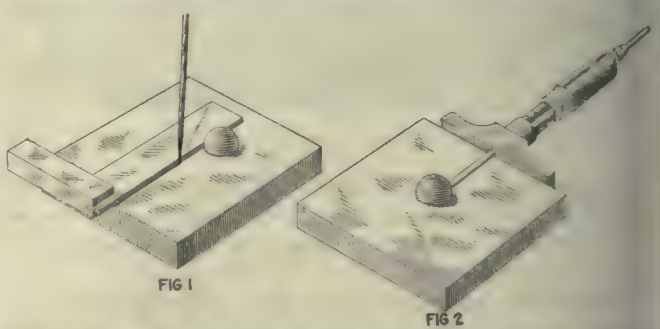


FIG. 1. FINDING CENTER-LINE OF HOLE. FIG. 2. LOCATING POSITION OF HOLE

sometimes necessary to make measurements from the center of a hole with a fair degree of accuracy. For this purpose, I select a ball slightly larger than the hole, and with a square held against one side of the ball, I scribe a line. Then, placing the square against the opposite side of the ball, I scribe another line. A line drawn midway between these two will pass through the exact center of the hole (Fig. 1).

If the position of the hole must be accurately measured, I use a micrometer depth gage, measuring from the edges of the work (Fig. 2).

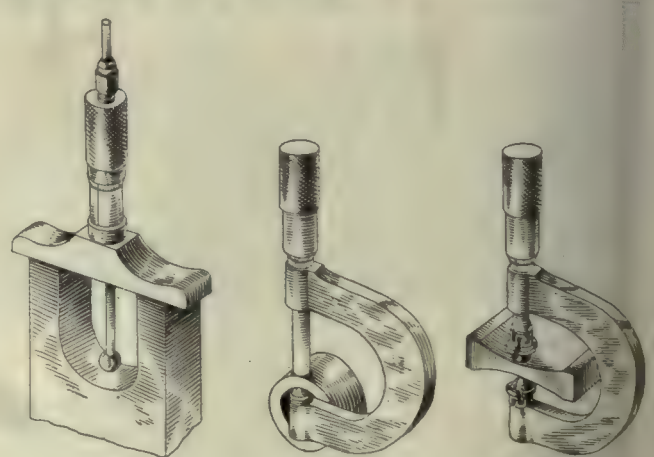


FIG. 3. MEASURING DEPTH OF HOLE HAVING ROUNDED BOTTOM. FIG. 4. MEASURING THICKNESS OF BUSHING WALL. FIG. 5. MEASURING THICKNESS THROUGH DOUBLE CONCAVE WEB

For measuring the depth of concave surfaces, the diameter of the ball added to the reading of the depth gage, will give the exact measurement at the lowest point (Fig. 3).

For measuring the thickness of a bushing, I use a ball having a flat ground on it. The ball is magnetized sufficiently to hold it in position on the micrometer, provided that it is handled with care (Fig. 4). The ball will find its own position at the lowest point.

When measuring double concave surface, it is necessary that the balls be held exactly in line. For this purpose I made a pair of sleeves to hold the balls in position. One sleeve slips on the micrometer anvil and the other on the spindle (Fig. 5). These sleeves are merely thin bushings, having saw slots alternating from opposite sides to give them elasticity.

Tools for a Taper Bearing

By C. Bernard

The writer had occasion to develop a taper bearing which as a unit had to be interchangeable. After the design of the different sizes of the bearing was under way, a set of standard taper gages was started. For this the old method of establishing the taper with two disks of known diameters, as shown in Fig. 1 where center distance *X* can be set by the vernier to secure any desired taper, was followed.

A master plate gage, shown in Fig. 2, was made and the adjustable blades *Y* were carefully set (using fine tissue paper as feelers) to the disks. From this a master taper gage was fitted and the ring gages were made from the master gage. A record of the disk center distance was filed away for any future correction of the master gage. The inner and outer races and rollers of the bearing were taken care of by plug and ring gages and the cage was handled as follows: The cage

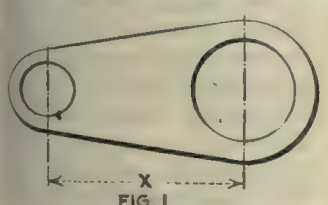


FIG. 1

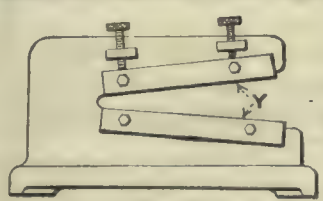


FIG. 2

FIG. 1. ESTABLISHING TAPER FOR ROLLER BEARING. FIG. 2. MASTER PLATE GAGE FOR MAKING MASTER MALE TAPER GAGE

shown in Fig. 3 was made of 0.010 in. thick sheet steel, the blanking and drawing was done with ordinary dies, after which the center *B* was punched out.

The channel shaped openings *C* were punched simultaneously with a sectional die, as shown in Fig. 4. *F* consists of a machine steel disk which on its downward movement forces the twelve punches *E* through the cage which is placed on the sectional die. A cross-section of the die, Fig. 5, shows the sections put together similar to a cross-section of an orange, which

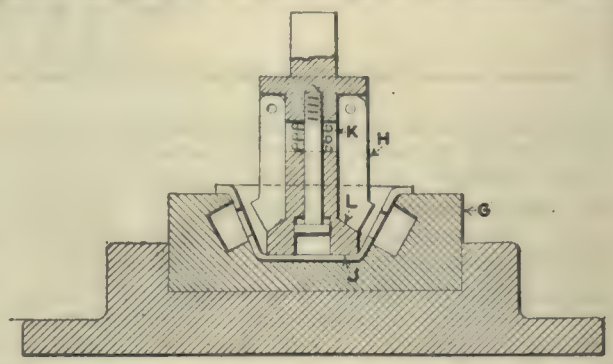


FIG. 6. PUNCH AND DIE FOR BENDING EARS OF CAGE FOR ROLLER RETAINERS

presented quite a difficult toolmaking problem, because of its minimum diameter (Fig. 3) which is 1½ in.

The bending out of the lips of the cage, so that they would just touch and hold a roller in its proper place between the inner and outer races, was accomplished by a bending punch as shown at Fig. 6.

The cage holder *G* was recessed to give clearance to the ears when bent out by punches *H*, the action being on the down stroke of the ram. The block *J* first touches the cage, as the stroke continues, punches *H* ride on block *J* until they reach projection *L* when an outward movement is given to the punches to bend out the ears. On the return stroke spring *K* pushes block *L* back, allowing punches *H* to withdraw.

An Inexpensive and Effective Dope for Bright Parts

By Carl J. Schumann

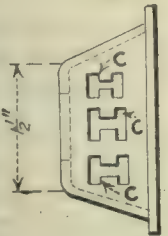
The "dope" suggested by E. A. Dixie under the above title on page 42 of the *American Machinist* is one which after having been applied a few days would not stay soft, but would oxidize so that it would be impossible to wash it off with either turpentine, kerosene or gasoline, as suggested. A mixture of this kind could only be washed off with amyl acetate, alcohol, benzole, or a varnish remover consisting of a mixture of benzole and alcohol.

The mixture suggested by Mr. Dixie if reduced with turpentine or gasoline so that a very thin coating is applied, would make a very good anti-rust lacquer for it will last for years. And it will also make a very good undercoat if used on parts which are afterwards enamelled, painted, or japanned.

A "dope" to be readily removed, with turpentine, kerosene or gasoline, must be a mixture which is very readily dissolved in these liquids. Such a dope would be made by dissolving common rosin in kerosene, adding if desired two or three gallons of lubricating oil to one hundred pounds of rosin. Such a mixture would prevent the rust for a few weeks.



FIG. 3



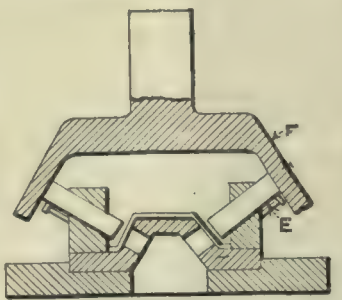


FIG. 4


FIG. 5

FIG. 3. ROLLER BEARING CAGE. FIG. 4. PUNCH AND DIE FOR CUTTING CHANNEL SHAPED SLOTS IN CAGE. FIG. 5. SHOWING CROSS-SECTION OF DIFFICULT DIE

IN THIS ISSUE

WE SAID last week that this issue would be devoted entirely to complete articles somewhat unusual in subject matter. To understand how our promise has been kept, consider for a moment the contents as a whole. The articles deal with textile machinery, shipbuilding, sugar machinery, sheet metal equipment, and marine engines. When we see an automobile, an airship, a locomotive, or some similar machine of intricate mechanism we very naturally think of the necessity of the plant responsible for its existence. But we seldom give the same thought to the necessity of the plant behind the clothes we wear, the paper we read, some of the things we eat and similar common commodities. Such plants are necessary and all of them employ machinery. It is to the equipment and processes in some of these plants that we have allotted the greater part of this week's space.

The first article, by Ellsworth Sheldon, is a description of some unusual machine operations on textile machinery. The building of textile machinery would probably, at first glance, not be considered to be close work, but that close work is required should not seem strange if we consider the delicacy and uniformity of some of the fabrics we have seen. Sheldon says: " . . . to build a drum four or five feet in diameter, cover its periphery with finely set points of steel wire to the number of hundreds of thousands and then revolve that drum three or four hundred turns a minute with two-thirds of its peripheral surface inclosed within an almost stationary blanket composed of similar steel points that must clear the surface of the moving drum by a distance of not over 0.005 inch, yet never touch it, involves calculations as exact and workmanship as careful as would be required in the building of a measuring machine." There are six and a half pages of this article but it is well worth the space.

The second article, page 672, deals with methods in a shipbuilding plant where "manufacturing" methods were introduced to an appreciable extent. It is one of Colvin's articles, enough of a recommendation in itself. Some of the details taken up are the drilling and reaming of sheets for water-tube boiler steam drums, trimming the ends of the tubes, machining propellers, and turbine work. Many illustrations supplement the text.

Stanley has supplied information on the construction and repair of sugar machinery, page 677. The illustrations give a very good idea of the size of sugar mill equipment and of the machines and tools necessary to handle it. That care in handling is important, as indeed it is with all machinery, is evidenced by the statement: "Sugar rolls must be handled with reasonable care or serious bruising may result, necessitating the repairing of journals or of the roll grooves themselves. The weight is such that they must be placed carefully, whether in loading or unloading from trucks, or in handling about the mill in and out of machines."

Hunter's contribution to this issue is on sheet-metal shop equipment for railroad work. In it he describes machines and devices that have been designed and built for the very necessary purpose of reducing costs. It furnishes a very good argument in favor of standardizing sheet metal work on locomotives wherever possible. So doing allows the men more time to work at the pits and makes possible the introduction of more refined devices from time to time to still further decrease the consumption of man and machine power. The article begins on page 683.

Colvin has a second article this week which tells of the building of marine engines in Denver. It is somewhat surprising to find that nearly a hundred marine engines, representing some six million tons weight, were built so far inland. Such accomplishments were necessary in time of war and it is indeed very much to the credit of American manufacturers that apparently difficult jobs were confidently undertaken. Under such circumstances it was only to be expected that unusual fixtures and methods, some of which are described, should be developed. The article begins on page 687.

On page 690 there is a second article on sugar mill machinery, supplied by a Western Correspondent. It is concerned with the process of making sugar, an interesting process from the point of view of those who understand machinery, and with the plant and equipment of a complete American-built plant that was erected in Korea. The equipment was built, assembled and tested in this country and then torn down and shipped abroad.

Coming Features

The report of Scovell, Wellington & Co. to the National Machine Tool Builders Association will be a feature next week. This report is the result of five regional conferences of the Association and of returns from questionnaires sent out by Mr. Scovell. The regional conferences were held at Chicago, Cincinnati, Cleveland, Worcester and New York for the purpose of discussing cost accounting systems and practice in the machine tool industry, and it is with the subject of cost accounting for the machine tool builder that the report deals.

We shall resume in the next issue the series articles which were set ahead this week—that on metal-cutting tools by DeLeeuw and that on the foreman and his job by Colvin.

Another series is to start, namely, "Tool Engineering, by Albert A. Dowd and Frank W. Curtis. The series as a whole promises to be just what tool designers and prospective tool designers have been looking for. The first article takes up the effect of design on manufacture, the selection of working points, and the relation of design to cost of machining.

EDITORIALS

"East Is West"

WITHIN the memory of men not so very old the connection of anything so modern as a machine tool with the Orient was utterly incongruous. China and India with their millions of poorly paid manual laborers seemed but poor fields for the machinery manufacturer to cultivate. Japan was just emerging from the isolation of centuries and Australia was a land of sheep and wheat fields.

Most of us were accustomed to looking eastward across the British Isles and Europe to get our impressions of Oriental countries, and with good reason. London had been the trade and financial center of the world for more than a century and before that the center had been farther to the east. The Netherlands and the Dutch East India Company, Venice and Genoa and their great trading fleets, Rome and her conquests, the farther back we go the farther to the eastward was the center of world trade and influence.

But the last generation has seen a tremendous change, an awakening to new thoughts and ambitions, an overthrow of old traditions. In the estimation of many observers the World War cost London her position as mistress of the commercial world. New York, the metropolis of the richest nation in history, succeeds to the crown and is beginning to look westward through the Golden Gate to Asia, the East Indies and Japan as a large and growing market.

With the passing of the clipper ships and the old American merchant marine came a host of obstacles to the activity of the American exporter. His goods had to be carried in foreign bottoms, and the foreign ship owner naturally favored his own countrymen, covertly, if not openly. The best freighters were put on other lines and American cargoes were always the last to be discharged at a foreign port.

The war gave us a modern merchant marine, not all we would like to have in many respects, but still the second largest in the world. New American steamship routes have been established all over the globe under the wise direction of the Shipping Board and the American manufacturer can now get direct service to the Orient from New York, Baltimore, Jacksonville, New Orleans, Philadelphia and San Francisco and other Pacific coast ports.

One other great handicap to American export trade is being rapidly overcome. Only a few years back practically all foreign trade was financed through London in sterling. London was fitted to render the necessary service and was justly rewarded with the business. But the big American banks were not slow to see their opportunity and, aided by wartime dislocation of established lines of action, opened branches and are making the dollar an international monetary unit.

Banking corporations with large capital resources have been founded for the sole purpose of financing foreign trade. The Chinese consortium assures us of an equal opportunity in the development of China. The War Finance Corporation has been revived to offer Governmental aid where it can be used to good advantage. Thus another serious difficulty in the way of our foreign trade expansion bids fair to be eliminated very soon.

Two great universal needs have been making themselves more prominent every day—the improvement and enlargement of existing transportation facilities and the reduction in costs of production.

With adequate means of transportation available everywhere the specter of famine could be laid to rest once and for all. The countries with goods to sell could deliver them to countries with needs to fill and commerce would grow apace. Working capital could be turned more rapidly and the whole world would be the gainer.

Better transportation facilities imply more and better railroads, good roads and more automobiles and motor trucks, airplanes suited for commercial work, steamers and cargo handling machinery. And back of all these there is the machine tool. It is inseparable from their manufacture and indispensable in their maintenance.

When it comes to manufacturing and the costs of production the modern machine tool is the keystone of the industrial arch. Primarily a labor saver, it has done its greatest work in the parts of the world where labor costs are high.

Labor costs in the Far East have been low for ages and as a consequence machinery has made but little progress in establishing itself as a substitute for man-power. But here again we are feeling the disturbing influence of the war. Labor costs in Japan have risen with the cost of living and risen tremendously. Chinese coolies have been in France and absorbed new ideas as to the methods of work. The Indian troopers have had their eyes opened to the ways of the white man and his reliance on machinery. Relatively few of the people of these overpopulated countries have been subjected to the germ of progress but each of them will pass it on to the people at home and its effect will multiply with increasing speed.

With higher ideals of living and a greater desire for the comforts of life will come bigger markets for the manufactured product and a demand for greater output from each productive worker. Not only that, but the worker himself will eventually come to see that to increase his wage he will need the machinery to multiply his productive ability. Competition will be keener than ever in the future and the successful manufacturer will be the one whose costs are lowest.

The present is beset with a Pandora's box full of war-born troubles and obstacles to trade but the wise builder will not allow his vision of the future to be obscured by these transitory difficulties. The raw materials of China, of India, of Australia, must be worked into usable products. The manufacturers of the Orient must have the tools and machinery to develop the full productive capacity of their workmen. Europe is awake to the possibilities of those almost unworked markets but has not yet recovered from the war. American business has here a remarkable opportunity and can establish a fruitful market if it will but make the most of it.

American Machinery and Foreign Markets

General Effect of Exchange Rates on Foreign Markets — Machinery Exports Have Been Holding Up—Looking Ahead with the Foreign Trade Finance Corporation

BY LEWIS E. PIERSON
Chairman of the Board, Irving National Bank, New York City

THE Frenchman gives us as many francs as he used to for a dollar's worth of goods, and he finds that he still owes 64c. The Italian has to pay four times as many lire as was once his custom. The Brazilian finds a premium of 55c. on every dollar's worth of his money expended for American goods. And the monies of other countries have likewise fallen in purchasing power in American markets. Chinese money is now worth but 62 per cent of its normal value, Belgian but 37, English 80, Canadian 87, Japanese 96, British Indian 80. And in these countries have been our best customers for machinery.

The result of the adverse exchange rates is that the American exporter, in most commodities, is being left out of foreign dealings. He has a large part of the gold of the world within his country, and the foreign customers that once were his, find that it is to their advantage to trade among themselves, exchanging goods made in their countries of depreciated currency for the depreciated money of a country in the same plight. The way to reduce that $4,000,000,000 debt that we hold against the commercial traders of the world is not to be found in the further purchase of American goods. And much less are foreign customers inclined to buy from us when they, in their temporary embarrassment, see other countries willing to sell to them on reasonably long credit, while the best that the American exporter can do is to defer payment for 90 to 120 days.

It is such a condition as this that has been the cause of a decrease in our exports in the past few months. And it is such a condition that has added to our unemployment, that has left 300,000 freight cars idle on their sidings, that has placed a large part of our merchant marine uncargoed within our ports.

MACHINERY IMPORTATION INCREASING

In the exportation of machinery there has been no falling off. That tremendous impetus that was given to the American machine industry during the war has had little to impede its march. From 1910 to 1915 our exports of machinery of all classes hovered generally about $100,000,000 annually. In 1918 they had risen to $278,213,008. The next year they were $374,291,973, and for last year the total had reached $454,406,099. If the rate set in the first month of the present year is to be continued throughout the year, our machine exports will jump to nearly $700,000,000.

Looking at the recent months, the same thing is indicated as from a study of the years. The falling off of exports in other commodities, that has resulted in overwhelming surpluses in our warehouses, has not spread to the exportation of machinery. Last August the value of exported machinery of all sorts was $35,542,796. In September, a temporary slump was registered, the total falling to $26,008,016. But in the next month not only had the loss been recovered, but the second preceding month's total had been bettered; the exportation of American machinery in October amounted to $40,587,520. For the next two months steady increases were shown, the figures being $41,659,698 and $50,321,644 respectively. For January of 1921, the last month for which the Department of Commerce has announced export totals, the value of machine exports was $56,151,382.

It is apparent that whatever may have happened to the wheat and cotton market, the slump has not hit American machinery. But that it will not, unless something may be done to bring about a more favorable condition of buying for the foreign purchaser, is more than one dares to say. For it was long ago even while our exports were still in their war-time vigor, that a committee of the American Bankers' Association predicted that, unless we were willing to build a firmer credit basis for our foreign trade market, we could not hope that the vacuum of the world would continue to attract our goods without great effort upon our part.

NECESSITY FOR LONG-TERM CREDITS

And in the two years that have passed since that time, the prediction for many commodities has been fulfilled. But at equal pace with the coming of the day when other countries should have absorbed all of our goods that their exchange rates and their temporary embarrassment in finances could tolerate, they have been developing plans for the furnishing of long term credits for those purchasers abroad who would continue to buy from us if they were only able to set off the day of payment not three or four months but three or four years.

Other countries had had the means of granting long term credits to the foreign purchasers of their goods and it was to fill this need in our own country that Congress passed the Edge Law in December, 1919, authorizing corporations for the financing of foreign trade through the extension of long-term credits. Several corporations have organized or are organizing under this law. The largest of them, the Foreign Trade Financing Corporation, is now selling its capital stock upon which the sale of debentures will rest. With its total possible resources provided by both these sales, it will eventually have a capacity equal to one-quarter of the four-billion-dollar foreign trade balance; that such a credit base will have sufficient magnitude to relieve the conditions that have lately operated against our foreign trade is a certainty to the bankers, the manufacturers, and the farmers who sponsor the organization.

The men forming the corporation have seen the predictions fulfilled in regard to many commodities. That the evil day has been warded off until the present is only because the countries of the world have been slow in the recovery of their industries and because they had long ago placed orders to be filled in the future. But that there has been some cancellation

old orders and a noticeable decline in new ones is clear to anyone who has made even a pretense of studying the trade situation.

The United States, with its vast resources of metals and coal is alone unhandicapped in the race for machine-industry supremacy by a foreign trade situation that is not as favorable as our balance of shipments would indicate. But Belgium, Germany, Sweden, Scotland, and Canada are bidding for a world trade in machinery, and unless we would contract our expansion of the past few years, it may be well for us to provide a firmer base for our maintenance and development in the future. It may be well for us to finance our goods a little further toward the consumer in the foreign country. It may be well for us to take the investor into the foreign trade market, allowing him to furnish immediate payment for the exporter and accept the good securities of the foreign importer. Only thus shall we be assured of the future of our existence on those waters that our prows first whitened during the war.

Some Comments on the Report of the National Screw Thread Commission

By E. C. Peck
General Superintendent, Cleveland Twist Drill Co.

There seems to be an erroneous impression prevalent in the manufacturing world regarding some features of the National Screw Thread Commission's report. At least there is some haziness which ought to be cleared up so that engineers will start the use of the system without prejudice.

It should be distinctly understood that the report is for the purpose of manufacturing screw thread products on a strictly interchangeable basis. It should also be understood that the system is intended for use where the engagement is not more than one and one half diameters long and not shorter than one half diameter long. The errors of lead enter so materially into the fits that the compensation for these errors would produce undesirable fits if the lengths of engagement were not limited. Hence the tables are for the great bulk of screw thread products which have a length of engagement between the above limits.

The minor diameter of the tapped holes given in the tables provides for a depth of thread between 75 and 83⅓ per cent of the theoretical full depth and this will be found to be good practice for average material where the length of engagement is between one-half and one and one-half diameters long. It should be understood, however, that this minor diameter should be larger for long tapped holes and smaller for short ones. Some attention should be given to the size of the hole to be tapped in metals that flow considerably under action of the tap as this is sometimes quite a factor. The intention of the commission's report is that the minor diameters will be within the limits given in the tables after tapping.

One of the outstanding features of the report is the fact that for all classes of fits the minimum pitch diameter of the threaded hole is basic or standard size which means that the same standard threaded plug gage will check all the threaded holes regardless of the kind of fit against interfering with a basic screw. Saying it another way, the "Go" gage for the threaded holes of all fits is the same and the tolerance is all above the basic size.

One of the things not clearly understood by the first reading of the report by many mechanics is that the commission's report does not specify any particular system of gages or gaging as evidenced by the following extract from the report:

For the production of interchangeable threaded parts in large quantities, as provided for by specifications given under the subject of "Classification and Tolerances," it will be necessary to employ an adequate system of measuring or gaging the parts produced.

It is not the desire of the commission, nor is it wise at the present time, to lay down hard-and-fast specifications of a gaging system to meet the requirements of various manufacturers. To do this would not only cause hardship in certain lines of industry, but also would tend to limit progress in this important subject connected so closely with quantity production. It is felt, however, that inasmuch as at the present time the use of gages is the only known means of securing interchangeability, it is wise, especially in view of the experience and education gained during the recent World War, that certain fundamentals should be adopted which will serve as a unification of various gaging systems now in use by manufacturers in this country. A complete gaging system which has been found adequate in the production of war material is specified in detail in Appendix 6.

(a) Fundamentals.—(1) Standard Master Gage is the gage to which all other gages and all dimensions of the mating parts are ultimately checked or referred, either by direct check or by comparative measurements.

It clearly establishes the low limit of the threaded hole and the high limit of the screw at the point at which interference begins between mating parts.

(2) The tolerance limits of the component as physically represented by the Limit Master Gages must never be exceeded as a result either of errors or wear of the gages.

(3) "Go" gages are absolutely essential to prevent interference of mating parts.

(4) "Not Go" gages are essential to prevent excess shake, play, or looseness of mating parts as determined by the extreme component limits.

(b) Gage Classification: (1) Standard Master Gage.—The Standard Master Gage is a threaded plug representing as exactly as possible all physical dimensions of the nominal or basic size of the threaded component. In order that the Standard Master Gage be authentic, the deviations of this gage from the exact standard should be ascertained and certified by the National Bureau of Standards and, when used, its known errors should be taken into account.

2. Limit Master Gages.—The limit master gages are threaded plugs representing as nearly as possible the exact limiting physical dimensions of the threaded mating parts as established by the specified tolerances. (For further information on limit gages see Appendix 6.)

A complete set of Limit Master Gages, in the form of threaded plugs, representing the maximum and minimum screw and nut dimensions for both the coarse and the fine series, and for all classes of fit, should be standardized by and kept at the National Bureau of Standards for use in settling any controversies that may arise with reference to the dimensions of other Limit Master Gages. The maximum ("Not Go") gages should be made to the maximum pitch diameter only. The major diameter and minor diameter should not be greater than the minimum specified for the minimum ("Go") gages. (See Appendix 6 (c) (5).)

3. Inspection Gages.—Inspection gages are for the use of the purchaser in accepting the product.

4. Working Gages.—Working gages are those used by the manufacturer to check the parts produced as they are machined.

(c) Standard Temperature.—Gages and product should have their correct nominal dimensions at 68 deg. F.

The point desired to be brought out is that for interchangeable manufacture the report states distinctly that "an adequate system of measuring or gaging the parts produced" is necessary. Any system that will measure the parts to conform to the dimensions given in the tables when referred to the standard master gage

satisfies the conditions laid down in the commission's report, and any such system may be used.

For large scale production of strictly interchangeable parts a system is offered in the Appendix 6, which was found satisfactory during the war but it is not stipulated that this must be used. Indeed, many manufacturers of screw thread parts which will be interchangeable for their own shop and for their own machinery or product will employ only the working gages which will be checked against standard master gages. In this case the working gages will be allowed to wear to master gage dimensions. Many shops will use only the "Go" gages and will depend entirely on the shake in the gage to determine the looseness of the fit of the mating parts and this will no doubt produce the kind of work they want but it will not be interchangeable except in one feature—an interference is prevented in mating parts. "No Go" gages or their equivalent must be used to check the mating parts from being too loose. The Screw Thread Commission realized that only those experienced in the use of gages and who realized their ultimate economy for large scale production of interchangeable parts would use the complete gaging system offered. The system was described so that anyone in need of it could proceed with the worked-out plan that had been successful.

It is therefore obvious that anyone intending to use gages may obtain the fundamental principles involved by a study of the commission's report and then use those gages best adapted to the scope of his work. If he elects to use only working gages which shall be checked by master gages he may use the sizes given for working gages or he may use those given for inspection gages, depending on the amount he desires to allow for gage wear. A manufacturer soon learns that small gage wear allowance increases the gage cost without an equivalent reduction in production cost. There is a point at which gage cost offsets the increased cost of production due to robbing the tolerance and this is the wear limit that should be allowed. In any case, no matter what gages are used, they should never from any cause, due either to wear or errors, accept product that the master gages will reject.

The Automotive Industry in Japan

In spite of the handicap of bad roads Japanese enterprise is being turned toward the automobile field. Japanese engineers are in this country and in England to become acquainted with the construction and manufacture of automobiles by modern methods with a view of getting into production by the end of the current year. It is their intention to utilize, so far as possible, the machine-tool equipment already on hand from various war enterprises.

The present plans are to manufacture a small four-cylinder car carrying two or three passengers, with a motor rated at about 12 hp. The success of the enterprise is believed to have been made possible by the general awakening to the necessity for better roads, which are now being constructed.

It is also the desire of the promoters of this enterprise to manufacture steel balls and possibly ball bearings for other industries in Japan and the Far East. It is likewise their intention to manufacture, so far as possible, such parts as radiators, and, in fact, practically the entire car with the exception of tires.

The same company is interested in the development of airplane motors and aircraft generally, and small trucks of one- and two-ton capacity are among the contemplated products.

Although Japanese labor is cheap as compared with American labor, it has increased in cost materially during the past few years and is becoming more of a factor in production. On this account, the use of old and abandoned machinery may not be found as advantageous as it now appears. If production costs have to be seriously considered, and in all probability this will be the case, it will soon be found that more or less special machinery will be necessary to secure production at a fair cost and in this way a market will be opened up for a number of machines which can be used on a variety of work, but are at the same time in a distinctively high production class. The new enterprise is, we understand, to be conducted under the auspices of the Tokyo Gas and Electric Engineering Co., Ltd., in Tokyo.

Cost Accounting*

By B. C. Moise
Secretary of The National Tube Co.

Modern industry is highly specialized and extremely complex, and in order to obtain the best results under such conditions, it is essential that the old-fashioned system of taking an inventory once every year and determining the results of the business by the difference between the inventory and the amount of purchases be eliminated. From the selling standpoint, costs are essential. Under such a system, or rather lack of system, a manufacturer making several classes of goods might be losing huge sums on one or more classes and more than making such losses up by abnormal profits on other classes, in total ignorance of the fact that if he had really known what his costs were for each class of goods, he would have been in position to increase his profits largely and at the same time, in case of need, to cut his prices and thus secure more business on some classes of his product. On the other hand, a company having a good cost system is in position to decline or discourage the sale of unprofitable classes of goods.

But, important as costs are to the proper conduct of the sales end of the business, good costs are far more important to the production end. It is impossible for any factory or mill to manufacture to the best advantage without knowing its costs. It does not know what materials are best suited for use in its particular lines of manufacture. A good factory or mill manager may know what materials are easiest to handle, but unless he knows the cost of his product he does not know whether some other materials not quite so easy to handle but available at a decreased price would not more than compensate in dollars and cents for the extra difficulty or labor cost involved. Similarly, if the purchasing agent always buys the cheapest article, it may be that the excess cost of manufacture involved through the use of that article will many times offset the difference in price between the article in question and a higher grade of material. It is evident, therefore, that even to the purchasing agent, proper costs are necessary.

To the factory or mill manager, costs are absolutely essential. He cannot determine whether a certain method of manufacture will lower or increase the cost of the product; he cannot determine whether it is

*Abstract from a paper read before the Pittsburgh Section of the Industrial Cost Association, Feb. 23, 1921.

advisable to re-use his waste materials; he cannot even determine a proper operating schedule with reference to the manner in which the length of runs on various classes or sizes of product affect the profits of the company, without adequate and detailed cost data.

From the standpoint of keeping on its toes all the time, costs are essential. Where a company has more than one mill or department engaged in production, there is nothing to compare with competitive costs for keeping the operators and department heads on the job all of the time. Such a condition leads to the most careful and intensive study on the part of each official, with the result that they overlook no bets in the interest of cheap costs and improved product. And since each department is working as a unit to better the record of that department, it leads not only to an intense competition, but results in an esprit de corps which is of inestimable benefit to the company as a whole.

Inter-Plant Transportation

SPECIAL CORRESPONDENCE

Inter-plant transportation, or the handling of material from one part of a plant to another is becoming an increasingly important problem. Every kind of shop transport from the hand truck to the huge overhead traveling crane has its limitations in the modern shop and it requires excellent judgment to know where to employ each particular method. The motorized shop truck is receiving more and more attention as is the problem of avoiding the re-handling of material. The use of platforms or carriers which can be loaded without keeping a truck waiting, and then be picked up and transported from one department to another and there deposited, leaving the motor units free to perform other useful work, is a system much to be desired. This should also be possible whether the two departments are on the same or different floors, or even in the same building.

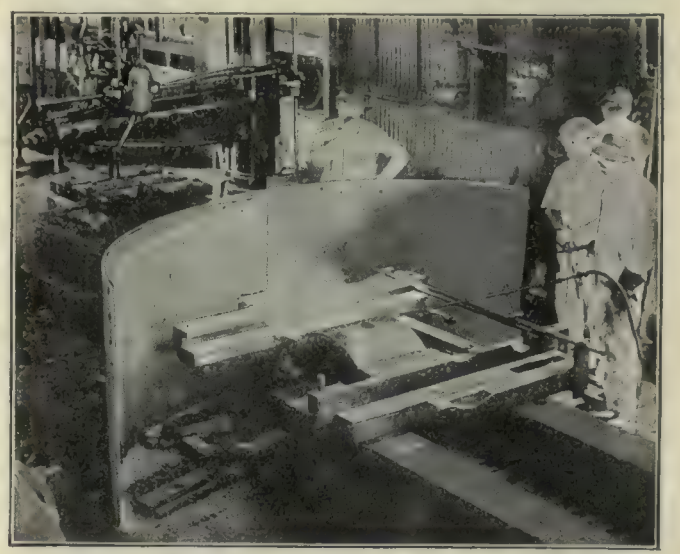
The illustration shows three views of a truck of this kind in the shipyard of the Fletcher Co., Hoboken, N. J. Fig. 1 shows a shipyard repair resting on a platform ready to be carried to the ship, when needed. In Fig. 2 a similar repair part is shown being conveyed along a crowded dock. Fig. 3 shows the truck used as a means of hoisting the piece of work on board the ship by means of the rope shown and suitable pulley blocks.

The main object to be observed in using motor trucks of this kind, is to keep them constantly at work instead of waiting for loads. With a view of finding out exactly what service is being obtained, each truck is equipped with an odometer and its daily mileage carefully checked. This record gives a very definite idea as to the economical use of such a means of transportation.

The Terminal Engineering Co. of New York has devised special types of platforms for various purposes, including chemical fire apparatus, emergency ambulances, compressed air and vacuum cleaner sets, portable derricks and the like. They represent a comparatively small investment as they do not contain the motor truck units. When needed, the nearest truck available can pick them up and run them to the point needed at the rate of ten miles per hour. These trucks have a capacity of 5,000 lb., a speed of ½ to 7 miles per hour with full load and up to 10 miles an hour light.

Welding a 48-In. Lathe Carriage

The extent to which the industrial plants of the Antilles are keeping in touch with modern methods of shop-practice is shown by the accompanying photo-



ACETYLENE WELDING A BROKEN LATHE-CARRIAGE IN CUBA

graph. This shows an interesting repair in progress on the carriage of a 48-in. lathe at an industrial plant at Felton, Cuba. The big machine was partly dismantled, the carriage remaining in place, where the picture shows it in process of pre-heating preparatory to welding with the oxy-acetylene blow-pipe. The steel plates shown in the picture were set up merely as a shield.

The job was completed in short order and upon inspection was found to be in perfect alignment and satisfactory in every way. An Oxweld blow-pipe was used.

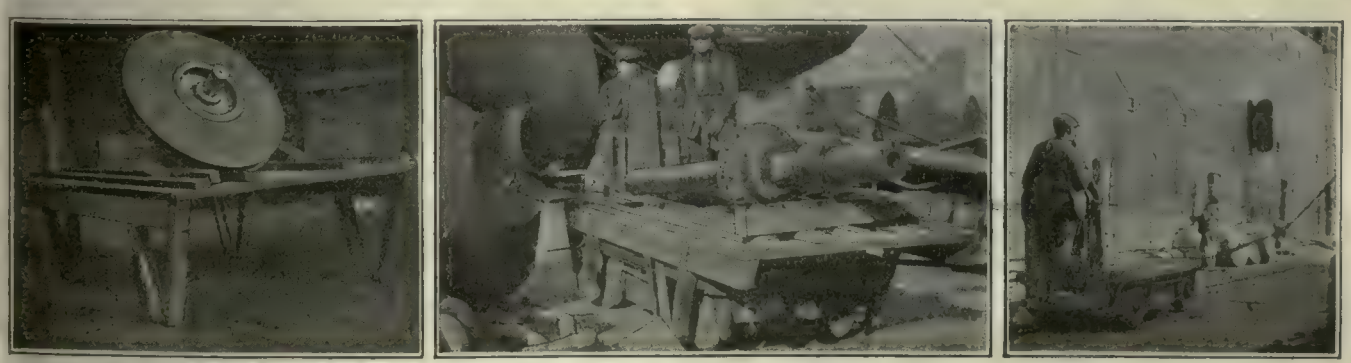


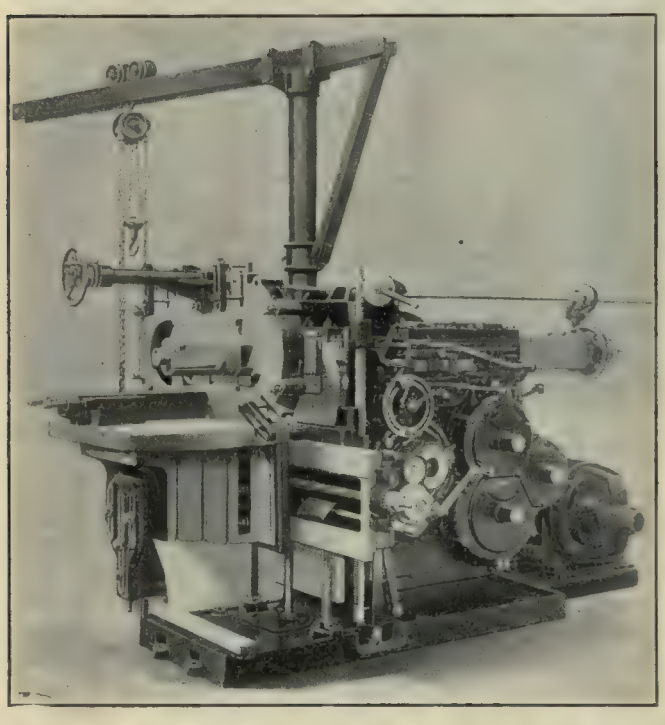
FIG. 1. WAITING FOR THE TRUCK. FIG. 2. ON THE WAY TO THE SHIP. FIG. 3. HOISTING ON BOARD SHIP

Shop Equipment News

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval. Brief descriptions appear later in Condensed Clipping Index in both American and European editions.

Morton Heavy-Duty Draw-Cut Special Railroad Shaper

The Morton Manufacturing Co., Muskegon Heights, Mich., has developed for use in railroad shops the heavy-duty draw-cut shaper shown in the illustration. The machine is intended for rapid production work on driving boxes, crown brasses, shoes and wedges, and connecting-rod brasses. Rapid production is said to be obtained by means of the convenience of operation, the simplicity of control and the ease and rapidity possible in changing the machine from one class of work to another. On work within the range of the tool, it is said to remove metal as fast and as accurately as a planer, although it consumes one-third less power than a planer and takes half as much floor space.



MORTON HEAVY-DUTY DRAW-CUT SPECIAL RAILROAD SHAPER

Specifications: Maximum stroke, 36 in. Maximum distance; ram to top of knee, 24 in.; ram to top of vise, 14⅜ in.; ram to floor, 50 in. Ram to top of table; maximum, 21½ in.; minimum, 3½ in. Maximum movement of table; horizontal, 40 in.; vertical, 18 in. Table working surface, 38 x 30 in. Ram section, 7 x 7 in. Cutting tool, 1¼ x 2 in. Maximum feed of tool in head, 8 in. Feed per stroke; horizontal, 0.01 to 0.5 in.; vertical, 0.005 to 0.25 in. Vise; jaws, 18 x 3⅞ in.; opening, 14 in. Ratio of gearing, 15.5 to 1 in. Quick return ratio, 2 to 1. Horsepower required; D. C. motor, 10; A. C. motor, 15; belt drive, 10. Motor speed recommended; D. C., 750 to 1,500 r.p.m.; A. C., 600 to 1,200 r.p.m. Floor space, 10 ft. x 16 ft. 8 in. Floor space served by crane, 14 ft. diameter. Capacity of crane, 2,000 lb. Approximate weight; net, 13,000 lb. for belt drive, 14,100 lb. for electric motor drive; crated, 13,400 and 13,700 lb.; boxed, 15,000 and 16,100 lb. Cubic contents of box, 363 cu.ft.

The taking of the cut on the back stroke, giving the draw-cut principle, is said to greatly increase the capacity of the machine, because the ram is in tension, so that the tool can adjust itself to inequalities in the surface as it is drawn across the work. The thrust of the cut is transferred through the adjustable back bearing to the face of the column, and it tends to pull closer to the column the crossrail and the parts supporting the work.

The column is of heavy box section and provided with square rail bearings. The crossrail is raised and lowered by means of screws and can be clamped quickly in any position. It is provided with gibs adjustable for wear. A counterbalance is furnished on account of the weight of special attachments often fitted on the table. The saddle is fitted to square rail bearings on the crossrail, angular gibs being provided to give adjustment for wear. The table is made with a box section, and two sides of it are finished and provided with T-slots. A heavy steel swiveling vise is provided, the movable jaw being controlled by means of two screws. The adjustable back bearing is mounted on a post bolted to the crossrail, its purpose being to transfer the thrust of the cut on the work directly to the column of the machine. An auxiliary backbearing intended for use with the driving box attachment is also provided. Both of the backbearings can be swung out of the way when their use is not required.

The ram is made of steel, is square in section and cast hollow. It has bearing surfaces on all four sides throughout the length of the column, except for a small oil space in the center where the rack is lubricated. Rack teeth are cut on the bottom surface. A bronze strip, inserted centrally in the rack, supplies the bearing surface for the bottom side of the ram. Wear can be taken up at the sides by adjusting the taper gibs, and at the top by lowering the ram cap. The rotating arbor is a hollow steel forging, fitting inside the ram and revolving in it in order to give the circular feed to the rotating head when cutting the crown fit in driving boxes. The shaper head is made of steel, and is threaded on to the end of the ram. It is graduated and can be swiveled to any angle desired. The reciprocating motion of the ram is obtained by the use of compound-disk friction clutches, running inside the column in a bath of oil. The reversing action of the machine is controlled by means of a revolving cam. The machine can be started and stopped by means of a clutch, independent of the driving motor. The ram may be moved as little as ⅛ in. at a time.

The length of stroke is adjusted by tappets on a circular disk, and can be changed while the machine is in operation. The feed motion is relieved automatically, the adjustment for both the horizontal and the vertical feed being obtained by the moving of tappets on a disk. The feed screws have coarse-pitch Acme threads. A rapid power traverse is furnished for raising and lowering the crossrail and for moving the saddle. The

splash system of oiling is used for the clutches and for all shaft bearings which are subjected to heavy strains. When the machine is running, oil is pumped to the ram from a tank in the column.

The belt-driven machine is furnished with a two-speed countershaft. For motor drive, the motor is mounted on a separate base with a sliding table, which provides adjustment for the belt tension. A d.c. variable-speed motor with an automatic push-button control is recommended. A controller stand which guards the electrical control apparatus is supplied for motor-driven machines. The crane and hoist are for use when handling the vise, the attachments, and work which is too heavy to be moved by hand. The hoist has two speeds, so that small loads can be lifted quickly. The machine is controlled entirely from the right-hand side, all levers being within easy reach of the operator. It is adaptable to many jobs without special attachments. Fixtures for use on railroad castings can be provided, a double chuck being furnished for driving boxes. Other attachments, including a rotating head and a double cutting head can be provided.

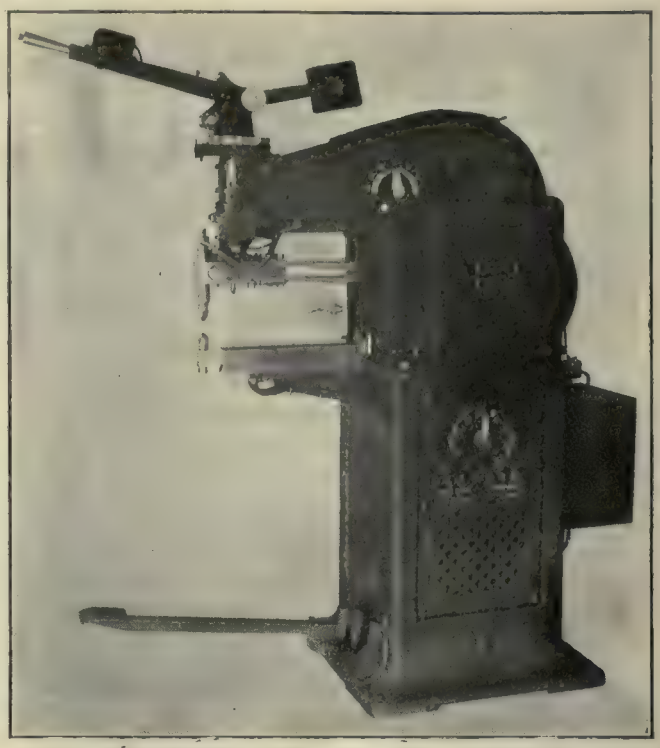
Taylor Series-4 Spot-Welding Machine

The Taylor Welder Co., Warren, Ohio, has placed on the market the Series-4 spot-welding machine, shown in the illustration, for welding together pieces of sheet steel from $\frac{1}{64}$ to $\frac{1}{4}$ in. thick. The operation of the machine is by hand lever and treadle, used either together or independently of each other. When using the automatic switch the electrodes are brought in contact with the work under spring pressure, further movement of the hand lever or treadle turns on the current, the work heats immediately to a welding temperature, and continued movement of the lever or treadle turns off the current and applies pressure to the molten metal to complete the weld.

The non-automatic switch is operated by a button in the end of the hand lever, the electrodes being brought into contact with the work under pressure applied by the lever. Additional pressure may be obtained by means of the treadle. The hand lever will swivel 90 deg. from each side of center and can be locked in any position. It is not necessary to make any disconnections when changing from hand lever to treadle operation. The travel of the hand lever and treadle can be regulated to seven different positions. The treadle swivels to either side and can be removed when not in use. The pressure on the work may be changed by the adjusting screw in the center of the upper electrode holder. Changing from the automatic to the non-automatic switch is accomplished by moving a small lever on the front of the head. The head has square slides and steel caps instead of the round spindle formerly used, so that the head maintains proper alignment, and looseness due to wear may be taken up by removing shims from under the caps. Water circulates through both electrodes, prolonging their life.

A 25-kw., 33-kva. transformer is used for the smaller machines and a 35-kw., 47-kva. transformer on the larger. The machine can be adapted to 220 or 440-volt, 25 to 60-cycle, single phase alternating current. A 10-step self-contained regulator is provided for adjusting the current. Automatic and non-automatic auxiliary switches operate a magnetically controlled switch on the rear of the machine.

The distance between the lower horn and the copper



TAYLOR SERIES-4 SPOT WELDING MACHINE

bands on the regular machine when closed is 6 in. On sliding-horn machines with the horn at the top of the slide it is 6 in., and with the horn at the bottom, 26 in. The distance from the floor to the welding electrodes is 42 in., the greatest movement of the upper electrode being 3 in. One set of $1\frac{1}{4}$-in. water cooled electrodes, 2 straight, 2 offset and 1 flat, are standard equipment. On sliding-horn machines a 20-in. box post is furnished.

Twin Steering Wheels for Mercury Tractor

The Mercury Manufacturing Co., 4118 S. Halsted St., Chicago, Ill., is putting on its line of tractors for industrial haulage, the type of steering wheel shown in the illustration. This steering arrangement is desig-



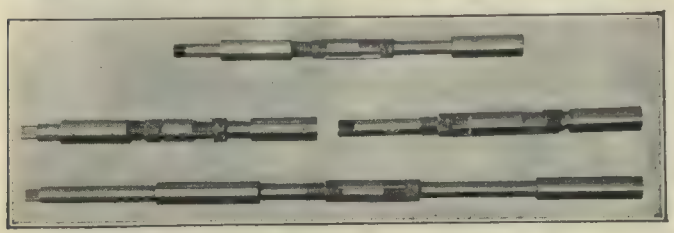
MERCURY TRACTOR WITH TWIN STEERING WHEELS

nated as the "Twin-Three" and is shown applied to a type "L" tractor. It consists of two wheels mounted on a very short axle, which is attached to a bracket by a semi-elliptic spring.

The bracket supports the front of the chassis and its trunnion is directly attached to the steering lever. The steering is accomplished in the same manner as though there was a single wheel carried in a fork. This design provides the same simplicity in steering and the short turning radius obtained with a single steering wheel, and allows for spring suspension of the frame.

New Britain Line-Reamer

The New Britain Tool and Manufacturing Co., New Britain, Conn., has added to its line of expansion reamers the tools shown in the illustration. They are called "line reamers," and are intended primarily for use in



NEW BRITAIN TOOL AND MANUFACTURING CO.'S LINE REAMERS

the garage and automobile repair shop, for the purpose of reaming to a standard oversize the worn holes in pistons and connecting parts of automobile engines. All parts are of tool steel, hardened and ground to size.

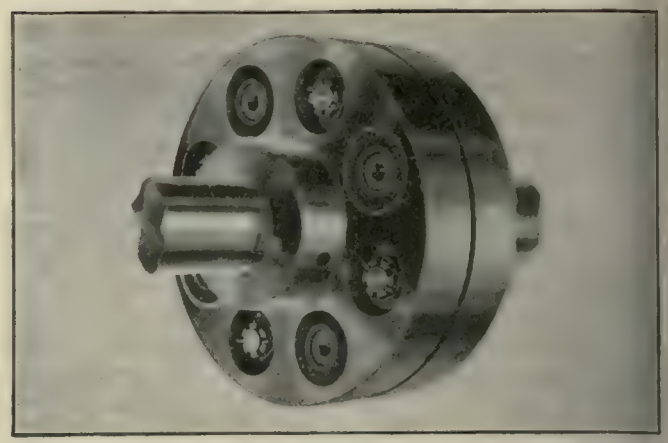
The cutting part of the tool is not different from the regular expansion reamer made by the same concern, except that it is placed in the middle of a long shank to which adjustable bushings are added, so as to guide the cutting portion when reaming holes that are worn out of size or shape. It is said to be the maker's intention to keep in stock sets of these reamers in sizes suitable to some of the more popular makes of cars.

Ajax Flexible Coupling

A flexible shaft coupling has been recently placed on the market by the Ajax Flexible Coupling Co., Westfield, N. Y. It is simple in construction, being made of two flanges into which are fitted hardened steel bolts projecting from one flange to the other and entering oilless bronze bearings, the heads of the bolts being on alternate sides. The bolts pass through flexible members, each consisting of a brass sleeve into which is compressed Para rubber surrounding the bronze bearing. The bolts have free endwise movement through the bearings.

The coupling can be put on the shaft assembled or, if space does not permit, the bolts can be driven into position and the nuts tightened after the flanges are in place. There are no projections from the body of the coupling. The parts are interchangeable.

The coupling permits the connected shafts to float freely in their own bearings, compensating for both endwise movement and angularity between the shafts. The coupling is said to operate under all conditions without noise, and with no lubrication. It is intended to care for high-speed, intermittent action, and shock. It is stated to be adapted to almost all classes of service and drive. It is insulated, which makes it suitable for



AJAX FLEXIBLE COUPLING

electric drives. Free end movement permits the armature to run in its own magnetic center.

Scalbom Combination Die Square and Bevel Gage

The Scalbom Manufacturing Co., 11 S. Desplaines St., Chicago, Ill., has recently placed on the market the combination die square and bevel gage shown in the accompanying illustration. The tool is intended for use in laying out tapers and angles on dies and similar work, the body of the tool being held while the blade is swivelled to the desired angle. A locknut is provided for clamping the blade in position. The tool is of steel throughout, hardened and ground and the blades are furnished in a variety of thicknesses.



SCALBOM COMBINATION DIE SQUARE AND BEVEL GAGE

Erratum

Under the heading of the "Miner Spring Toolholder" on page 624 of the *American Machinist* the address of the Miner-Fuller Co. was given as Plainfield, Conn. This is an error, as the concern is located at Plainville, Conn.

Women Engineers

The steps taken by the Women's Engineering Society to utilize the considerable number of women who were trained in various branches of the engineering industry during the war period, are now leading to definite results. The Atalanta Co., Ltd., has been formed to acquire the works at Loughborough which were opened on a small scale two or three months ago, and it is hoped that the scope of operations will now be considerably extended. At the present time contracts are in hand for bottling machinery, atomizers used in oil mining, and it is reported that considerable attention is being given to a new invention, the precise character of which has not been disclosed. Not only are the whole of the employees women, including the works manager, but practically the whole of the capital is being found by women.—The *Engineer* (London).

German Industrial Conditions Resulting from the Failure of the London Conference

Unemployment Increasing—All Forms of Industry Striving to Break Away from Government Control—Railroad and Shipbuilding Industries in Best Shape

By H. O. Herzog

THE imposing of the sanctions has put German industry in a very critical position. During the weeks preceding the London conference, a gradual decline could be observed in most branches, several factors combining to put a check on enterprise. A hopeful tone prevailed, however, with regard to the outcome of the conference. Some ruptures were anticipated, but it was expected that a compromise would ultimately be reached. Meantime, buying for home consumption and export was practically suspended. The export business reacted sharply to the proposed export levy. Confusion with regard to future iron and steel prices added to the uncertainty. These prices were to be readjusted at the end of February by the Iron Control Board, (Eisenwirtschaftsbund), and a reduction was commonly expected in accordance with the slump in foreign markets and the lower price of ore. Trade and consumers withheld orders in this expectation with the result that stocks accumulated in the iron works.

In February it happened for the first time in many years that a portion of the pig iron output was left on the hands of the producers. If prices had been lowered, fresh life would, perhaps, have been put into business, for producers as well as consumers. Instead of that, the decision was postponed and existing prices were left in force. The consumer's reserve has continued, although stock has meanwhile run low in most factories. The establishment of a customs' barrier along the Rhine, therefore, finds many manufacturers in a particularly embarassing position. Many of them are short of raw material and find themselves separated from their sources of supply. Instead of lower prices they will have to pay duty into the bargain. The announcement of the sanctions has, therefore, resulted in a great rush of shipments across the Rhine, in both directions.

The situation was further aggravated by the approach of the Upper Silesian plebiscite. As soon as its date was fixed definitely, buying between the Upper Silesian works on the one hand, and the rest of the German industry on the other, came to an almost complete halt. Orders already placed have frequently been cancelled, or made contingent upon Upper Silesia remaining with Germany.

Such circumstances, coupled with the dullness of most foreign markets, could not fail to depress business. They more than balanced a number of other circumstances, which might have been a stimulus to enterprise. The difficulty of obtaining a supply of raw material has disappeared. Much of the complaint about the coal shortage has likewise ceased. This is now openly admitted. In this connection it may be mentioned that even in January the writer could find no traces of shortage of coal or raw material in the several factories he visited in the various parts of the country. Only the South German manufacturers were complaining of lack of power, but their case is different. They are mostly supplied from hydro-electric power plants which were suffering from the exceptionally low level of water during the winter months.

The coal production has improved from month to month, and in all parts of the country. The February production of the Ruhr district, for instance, exceeded that of January by 6,500 tons daily. Some imports are made, too, of English and American coal, but their volume is insignificant, at least it is out of proportion to the noise made about them.

The improving coal production is at present threatened by the Westphalian miners declining to continue overtime work on account of over-exertion. The last word has not been said in the matter, however, and better wages will probably right the situation. The inevitable rise of the miners' wages will no doubt cause an increase in coal prices. Strong forces are at work to raise coal prices to the world market level, an attempt which might now succeed in view of the greatly reduced margin between the two.

The iron and steel industry shows, as has been outlined already, a decline of business in almost all branches. Only railroad material, chiefly rails, is in demand, on account of large orders for the state railroads. The export business of the industry in the first months of the current year has fallen even below last year's standard. The industry is complaining of the competition in foreign markets, by the English, American and Belgian industry, mainly by the latter. The situation is overripe for a reduction of prices, for export and home consumption but it is not at all certain that such a reduction will be made. The producers have increased their influence on the Iron Control Board. Their aim is to remove the differentiation between export and home market prices. They can only be forced by compelling circumstances. The present market conditions are dull, but not weak enough to force this exceedingly rich industry.

What an enormous wealth it accumulated, has recently been demonstrated by two instances, that of the Eisenhüttenwerk Thale, which last year made a profit largely exceeding the whole capital stock of the company, and the purchase of the controlling interest of the largest Austrian mining- and iron-producing company, the Alpine Montangesellschaft. The latter event is specially notable because it practically completes the movement to get the Austrian iron and steel production under German control. It is again Hugo Stinnes, who is responsible for these transactions.

The Austrian iron production has up to now chiefly gone to Czecho-Slovakia in exchange for coal and coke. With a supply of 600,000 tons of coke per year, the Austrian company, on account of its rich possessions of iron fields, would be able to increase its production far beyond the needs of the Austrian industry, leaving a large surplus for export. Stinnes is quite capable of furnishing this amount of coke which constitutes only

2 to 3 per cent of the German production. This transaction not only makes the German industry more independent of the supply of foreign ore, but enables it to extend its influence over the present and perhaps also the former markets of the Austrian iron industry.

Conditions of Machine Building Industry

In contrast to such expansions stands the retrenchment noticeable everywhere, especially in the machine building industry. The decline of business which could be observed during January following the recovery of the last months of the previous year, has become more marked in February for reasons explained already. That the decline has not been more rapid—as it well might have, considering the powerful combination of adverse circumstances—must be attributed to the general relief anticipated to result from the expected settlement, after which it was confidently hoped a universal revival of business would take place. Preparations were made for this event, as the increasing number of inquiries makes evident. This helped to preserve optimism, in spite of the scaracity of actual orders. The home market found its chief support in large government orders for railroad rolling stock, and for public utility works in general. Most private business which is transacted, can be traced back to such orders.

The locomotive and car building works are by far the best employed in the country. The bulk of their business is furnished by the requirements of the German State Railroads and by a number of large foreign orders. To the first Russian order of 102 locomotives has lately been added one for even a larger number, placed with Hentschel & Co., and an order for 139 locomotives with tenders from the Spanish State Railroads, which the German works have obtained in strong competition against Spanish, American, English, French and Belgian firms. This order has been given at a price of from 3,75 to 4,40 pesetas per kg., for the locomotives, and 2,50 to 3,00 pesetas per kg., for the tenders. The whole order amounts, in the aggregate, to over 500,000,000 marks. Nearly all German locomotive firms are participating in it.

The car building works also have large foreign orders on hand, foremost of which is an order for the French railroads consisting of 20,000 trucks. The interest shown in the future of this branch of industry is exhibited by the merger recently concluded between the largest German car building works, the Linke-Hofmann Werke in Breslau, and the A.E.G. (General Electric Company). The latter company puts at the disposal of the former its extensive foreign sales organization. The main aim is, to act as general suppliers for the electrification of foreign railroads.

Next to the former works, as regards employment, rank the factories for mining machinery, which are profiting by the development of mining in most countries. The electricity works, which might be classified thereafter, have lately suffered a strong reverse. Orders for motors are coming in slowly and in small numbers. The demand for electric railroad equipment from abroad has also diminished. The best employed are the telephone and telegraph works.

The extensive use of substitutes for copper by this industry had greatly handicapped its export business. Copper being now available in sufficient quantities, it is going back to the old standard. The imported copper comes mostly from America. The largest deal of this kind which has been transacted for a long time is the purchase of 1,500 tons of American copper at a price of $42,000,000.

The shipbuilding industry is employed fairly well but not to its full capacity. Foreign orders have, during the last few months, been very scarce. A hopeful outlook prevails, however, in view of the bill which has just been passed settling the indemnity of the shipping concerns in connection with the reconstruction of the German mercantile fleet. The arrangement concluded will keep the industry busy for several years.

The exceedingly bad situation of the motor car industry still continues. The expectations of better business to come from the decontrol of gasoline, which has just taken place, were not justified, as the use of motor cars is still controlled by licenses, which are difficult to obtain.

The situation of the machine tool industry has changed very little. Where changes have become noticeabe, they are decidedly for the worse. The weakening of the second-hand market, which could be observed for some time past, has become more pronounced. A number of dealers, evidently overstocked, are trying to realize regardless of price and this aggravates the situation of the manufacturers. Inquiries have rather increased but the percentage of orders materializing therefrom has dropped. Prices of high-class tools are stubbornly maintained, but underbidding has become stronger in the case of inferior makes.

Germany to Cultivate Russian Markets

This was the situation when the London conference came to an abrupt end, followed by the announcement of the sanctions. This announcement was received in a spirit of defiance, mixed with apathy. The first impression was, that the steps taken by the Allied countries would lead to the ruin of German industry, but, as nobody would benefit by this ruin, and as it would defeat the purposes of the Allies, no one believes in the long duration of the present situation. Nevertheless, preparations are being made to ward off the evil effects of the sanctions as far as possible. The markets of the Allied countries are considered to be lost, but efforts will be made to find compensation in other markets. There is no doubt that Germany under the stress of circumstances and cut off from her Western markets, will now devote much attention to her Eastern neighbors, mainly Russia, where large opportunities are open. A trade agreement with the Soviet Republic is near conclusion. Even Poland is drawn into the sphere of consideration, and it is argued that after the Upper Silesian plebiscite there will be no more cause for friction between the two countries, but, on the contrary, an urgent need of industrial co-operation.

The number of unemployed, which has increased by 100,000 to a round million in February of this year, will thus be further increased. The government is preparing measures to provide relief work by extending operations in the construction of large public utility works. The large shipbuilding program already spoken of is also believed to be helpful. The industry, too, is preparing itself for combating the coming hardships. Its first efforts are directed against the government control of exports and all red-tape fetters and restrictions in general. Strong pressure is being brought to bear on the government in favor of extensive decontrol. The industry has set to work to gain all the elbow room it wants, toward the coming of a better era which it is believed can not be so very far off.



NEWS SECTION

Dutch East Indies Promise Rich Iron Ore Deposits

It is expected that the Netherlands Indian government or private enterprise will undertake to develop the iron resources of the Celebes in the near future, states the *Far Eastern Review*. Government engineers have studied extensively the possibilities for iron mining and iron and steel manufacture. The largest ore field investigated, lying near Towoeti Lake in the Larona district of central Celebes, showed 16,000,000 tons of ore. This field is 25 miles from a deep-water bay on the coast and may be worked by electricity generated from falls of the Larona River. The ore is close to the surface, the vein varying from 4 to 22½ meters. The iron content of the ore varies from about 45 to 50 per cent, while the manganese content is 1.19 per cent and the nickel 0.38 per cent. Incomplete analyses as to the sulphur content indicate about 0.14 per cent. This field holds the best promise for early and profitable development.

Stockvis Company Gets Large African Order

R. S. Stockvis & Sons, Inc., 17 Battery Place, New York City, announce that they have just received specifications for approximately 250 machines for a railroad project in Africa. The following machines are included:

8½ in. double centering machine; axle lathe, height of centers 8 in., between centers 100 in.; vertical lathe to take 40 in., two heads; vertical lathe to take 44 in., two heads; car wheel lathe, height of centers 24 in.; hydraulic forcing press; 18 in. extension gap lathes, between centers 6 ft. and 8 ft.; semi-automatic turret lathes, 2½ in. diameter bar; 20-in. shapers; high speed drilling machines, 2½ in. capacity; planers, quick return, 40 ft. x 40 in. x 10 ft.; 14 in. slotting machines, horizontal milling machines, table feeds 28 in. x 10 in. x 19 in.; double reaming machine; shearing machine; forging machine for ¼ in. to 1½ in. nuts; semi-universal forging machine for 2½ in. bolts; bulldozers, 20 in. stroke; steam hammer, capacity 8,000 lb.; double frame steam hammers; compressed air hammers; spring leaf shaping machine; leaf bending machine; hydraulic presses; universal shearing and punching machine; double shearing and punching machine; plate straightening machine; rotary shearing machine; hydraulic flanging press for boiler heads; double end grinding machine; radial drilling machine, 5 ft. capacity; 8-spindle drilling machine, 1 in. capacity; double-head bolt threading machine, 1 in. capacity; bolt pointing machine, 2 in. capacity; 4-spindle nut tapping machine; 14-in lathes, distance between centers 3 ft.; facing lathes, height of centers 23 in.; vertical drilling, reaming and grooving machine; No. 3 heavy universal milling machine; milling machine, planer type, 24 in. x 24 in. x 8 ft.; grinding machine, 16 in. x 60 in.; vertical grinding machine; universal tool grinding machine; twist drill grinding machine, 2 in. capacity; disk polishing and grinding machines; universal radial drilling machine, 5 in. capacity, portable.

The same company announces that during the past ten days it has received from the Cincinnati district, eight car loads of machinery, consisting of lathes, radial drilling machines and a boring mill.

Electrification of Tokyo Railway Lines

Plans of the Imperial Government Railways to establish electric car service connecting Tokyo, Sakuragicho, Ofuna, Yokohama, Maita, and Yokosuka, will greatly benefit residents of Tokyo and Yokohama, particularly business men, and those foreigners who have summer homes in the peninsula south of Yokohama. Basing estimates upon present conditions, it will require about four years to perfect these plans. Further plans of the government railways include the installation of electric train service to displace steam on many lines near Tokyo by the end of 1926, with the possibility of a complete electrification of the nation's railways in view. A new power station is to be constructed on the bank of the Shinano River near Ojiya, Niigata prefecture, capable of furnishing 65,000 kw. of electric power and at an estimated expenditure of 40,000,000 yen. This is only one of the proposed improvements in Japanese transportation systems.

Manchuria Offers a Diversified Market for American Goods

In order to best utilize the commercial possibilities of Manchuria it is necessary that the characteristics of the market should be studied and an adaptation made to local conditions. As frequently emphasized practical demonstration is an important factor in trade, and as Manchuria is essentially agricultural a demand for agricultural implements might easily be created if their utility and practicability were witnessed by the natives. In view of the cheapness of manual labor and the limited area of land worked by individual farmers only the sale of man or animal power devices can be affected. Various hand machines, such as corn huskers and varieties of hand mills should find a ready sale. Among some of the best selling articles which are now being imported into Manchuria are steel butt hinges, door locks and bolts, galvanized iron washers, iron sheets and steel wire, iron plates, files of various shapes, lathes, 6 to 12 ft.; machine shop tools of assorted sizes; pumps, 3 to 7-in. cylinder; screw-cutting machinery, iron safes and cash boxes of various sizes, iron rails, saws, planes, hammers, and belts for machinery, 1 to 40 in. wide, 200 ft. per roll. Terms of credit in Manchuria are usually granted on a two months' basis and, as native dealers have little knowledge of foreign trade methods, it would be unsuitable to introduce the f.o.b. method of doing business.

American Rolling Stock for Chinese Railways

A part of the $6,000,000 recently advanced by the Chinese banking group to the Peking government for the purpose of obtaining railway equipment for various Chinese railroads, is being used to purchase rolling stock in the United States, according to *China Trade*. Some of the conditions of the loan are that the banks will receive one-fourth per cent of the purchase price as fee; the banks will appoint experts to examine cars purchased; and facilities will be given to the banks for semi-annual examinations of the cars to see that they are kept in good condition.

Business Conditions as the Big Banks of the Country See Them

Guaranty Trust Co. of New York Discusses Financial and Business Conditions in the United States

With the arrival of an extra session of Congress, at which many matters of business and financial importance will be presented for consideration, the economic atmosphere has been to some extent clarified by a declaration of the new administration's attitude toward the Versailles Treaty of Peace and the League of Nations Covenant. Germany has been told frankly that she must accept responsibility for the war and that such settlement as may be made between her and this country will be predicated upon that acceptance. At the same time the United States will not enter the League of Nations as now constituted, but will formulate a separate peace with Germany, such peace, however, to indicate very clearly this country's recognition of the interdependence of all nations and its determination to assert its utmost influence hereafter in preventing international war. These declarations of policy, as yet not fully elaborated, are being received by the business men of the country as indications of a desire to have the major uncertainties of the present readjustment period removed as quickly as possible. It is believed that a settlement of this country's relations to the new order in Europe will go far toward stabilizing world conditions, upon which a revival of industry in this country so greatly depends.

This matter of American prosperity in its relation to world affairs was emphasized recently by Francis H. Sisson, vice-president of the Guaranty Trust Co., in an address before a joint meeting of the Illinois Manufacturers Association, the Chicago Association of Credit Men, and the Chicago Association of Commerce. Declaring that Americans are too prone to think in terms of what the United States means to the remainder of the world, he said:

"It is high time for us to realize fully what the rest of the world, and especially Europe, means to this country. We have lately put too much emphasis on our help to other nations; we need to understand that we require their assistance.

"For the first time, perhaps, our people as a whole are beginning to visualize, if not completely to comprehend, that economic conditions in Europe have their reactions here, and vice versa; that, consequently, we must think of Europe in terms of American conditions. In brief, we are just awakening to the realization that, while we did not annex a square foot of Europe politically in the war, we annexed, almost unwittingly, a large part of that continent economically, and find now that we cannot withdraw from it, if we would, except at the sacrifice of our own prosperity—except, indeed, at the fearful cost of great economic loss here.

"The reactions here of economic disturbances in Europe are beginning to manifest themselves so plainly that every element of our body politic—the business man, the banker, the manufacturer, the farmer and the laborer—cannot fail to see and feel them. The most potent and perturbing evidence of those reactions is the present unemployment in the United States, unquestionably due in considerable degree to world-wide conditions."

The second quarter of the year opens with an appreciable gain in business confidence. Irregular and contradictory as they may at first glance appear, the reports from various sections of the country are on the whole indicative of an improved situation. Certainly conditions are no worse than they were a month ago, and, indeed, the element of greater stability is so pronounced as to lead to a prediction that before midyear a definite turn for the better will be demonstrated. There has been a slight increase in railroad traffic, and an improvement in the railroad labor situation because of the policy of retaining efficient workers only. Automobile manufacturers are reopening their plants. Building operations are on the increase. Farm products are being disposed of under pressure of a large new crop and the inability of the banks to carry both the hold-over and the new products. Secretaries Hoover and Mellon, backed by Governor Harding of the Federal Reserve Board, have told the cotton raisers that they cannot expect the Government to assume all the risks of financing the exportation of cotton, and it appears that something like personal initiative is to come to the rescue of the unhappy situation which has throttled the cotton industry in the South.

Pre-War Purchasing Power of Dollar Returning, Says National Bank of Republic, of Chicago

The prosperity habit of the American people is hard to break. The greatest factor which has prolonged the readjustment of business has been the stubborn belief in too many quarters that the recession in trade and industry was only a temporary stagnation, similar to that of the post-armistice period, and that activity and prices would speedily return to the high levels of early 1920. This has hindered the acceptance of inevitable losses, has retarded the adjustment of prices in distributing channels and has made labor unwilling to accept lower wages. It must be recognized that the present business depression is not the usual phenomenon of supply overtaking demand, but is a much broader movement toward the restoration of the purchasing power of the dollar, whether that purchasing power be expressed in goods or services—prices or wages.

This restoration of the purchasing power of money, in other words the deflation of prices, has attained world-wide scope, the only exceptions to the trend appearing in Germany and Austria, and these due to political rather than to economic conditions. Wholesale prices in this country have now retraced a large part of the inflation gained during the war years, and now stand only 25 per cent above the level of 1913. Hence the dollar, with respect to wholesale prices, has advanced to roughly 80 per cent of its pre-war purchasing power. Due to the slower and less extensive fall in retail prices, to the stationary position or the advancing tendency of such things as rents, fuel and light, the fall in the cost of living, or the increase in the buying power of the dollar as applied to the family budget, has been far less marked than in the case of wholesale prices.

Automobile production has made slow but substantial progress during the past two months, with the revival more marked in passenger cars than in trucks. Carload shipments of automobiles in February were fully 50 per cent greater than in January. Great inroads have been made on the accumulation of unsold cars which, it is estimated, on January 1 amounted to approximately 15 per cent of the total 1920 output. While this accumulation would not be considered excessive under normal conditions, the fact that automobile sales in the South are practically non-existent, and in the other agricultural states are far below accustomed volume, has made the liquidation of unsold cars the determining factor in the resumption of manufacturing operations. As fast as the accumulations have found an outlet in sales plants have reopened or increased production in anticipation of a swelling seasonal demand which usually starts at this time and reaches its peak in June. Thus far very few manufacturers have reached 50 per cent of capacity, as measured by the 1920 schedules, while the average for the industry as a whole is probably not much more than 30 per cent. While a few manufacturers expect to repeat their 1920 performance, the outlook is for a total production in the industry of not much more than a million cars as compared with nearly twice that number built in 1920.

Opportunities for American Sugar Machinery in India

Trade Commissioner W. H. Rastall has this to say about the possibilities of an Indian market for American sugar-making machinery:

India devotes more acreage to sugar cane than any other country in the world, but in spite of this the country is a very heavy importer of sugar. The government of India has adopted a definite policy of industrializing the country, and very active steps are being taken to encourage improvements in all technical matters wherever possible. In this connection special efforts are being made to modernize the entire Indian sugar industry, which is a difficult undertaking, as the problem in this industry is extremely complicated and changes materially from province to province. The scarcity of water, the peculiar system of land tenure, and the conservatism and suspicious nature of the farmer make the growing of cane a difficult matter, especially when efforts are made to secure the land required by a first-class sugar central. On the other hand, there are other locations where it would probably be possible for those interested to secure a sufficient acreage of suitable land that could be irrigated to adequately meet the requirements of modern sugar production.

Industrial Equipment

It seems evident that it will be necessary to carry on the industry on both a small and a large scale, and there will probably be a very heavy demand for all kinds of sugar machinery from the three-roller mills driven by steam, animal, and water power to the larger plants of the complete modern central. A new policy of the government to make India as nearly self-supporting as possible will encourage the local manufacture of this machinery in so far as possible. Though iron and steel have been produced in India at what are understood to be attractive prices, especially in connection with the Tata Steel Works, it does not seem possible that all the plant needed could be locally manufactured, especially as the country produces only pig iron and a few qualities of steel, so that a great many materials normally needed in the manufacture of sugar machinery would not be available. Furthermore, the expense involved in developing designs and patterns for this quality of equipment would probably be prohibitive on account of cost and time.

Organization of a Corporation

In order to study this subject and discover the ways in which improvements could be made to the best advantage, the government of India appointed a special committee which has been engaged on the subject about two years. This committee should soon be ready to report its final conclusions, as practically every province in the Indian Empire has been visited and a very large number of witnesses interviewed. From information so far ascertained it has been learned that the sugar committee has decided to organize a corporation capitalized at 50,000,000 rupees for the purpose of manufacturing machinery for the sugar industry thoughout India. The committee is trying to arrange suitable connection with either an American or British engineering company of extensive experience in the sugar business who could provide the necessary technical knowledge for this enterprise. Although it is obvious that the government of India would prefer to have this connection made with a British firm, the possibilities for a successful American connection of this sort and deserving of the most active and careful attention on the part of those who are interested in undertaking such a venture. It is evident that engineers who make this connection will be in a position to supply such machinery as cannot be produced in India.

Action Required

This is a matter which should be handled promptly if it is to be successful, and it is strongly recommended that those who are prepared to go after the project do so on a large scale, aggressively and effectively, as the conditions in the Indian market, not only in connection with this particular project but in the case of most undertakings, require this kind of treatment.

Secretary of Commerce Meets Business Paper Editors in Washington

On Tuesday evening, April 12, Mr. Hoover, Secretary of Commerce in the Harding Cabinet, dined with the principal editors of most of the leading business papers of the country. The purpose of the meeting was to discuss the problems of the Department of Commerce and to consider the ways in which the business papers could be of assistance in solving some of them.

The matter of industrial and commercial statistics was gone into in considerable detail and it was felt that a good deal might be done by the business press in improving and speeding up the collection and dissemination of information of this nature. Further meetings with Mr. Hoover will be held and the contact established by them should be of considerable value both to the Department of Commerce and to the papers and the industries they serve.

Visited Efficiency Bureau

During the afternoon the editors visited the United States Bureau of Efficiency and listened to an explanation of its workings by the director, Herbert D. Brown. The reorganization of the government departments as recommended by this department and proposed in the McCormick Bill was gone into in some detail by Mr. Brown and his assistant, Mr. Graves.

U. S. Steel Corporation Reduces Prices

A reduction in prices averaging almost 20 per cent has been made by the United States Steel Corporation. The reduction affected almost the entire list of the finished and semi-finished steel products manufactured by the leading interest, which in point of volume makes up approximately 45 per cent of the country's entire output. The new prices are not as low as those quoted by the independents.

In making the announcement Judge Elbert H. Gary, chairman of the United States Steel Corporation, stated:

"After consultation with the presidents of subsidiary companies and careful consideration of the whole subject we have decided to substantially reduce the base selling prices of our commodities, f.o.b. Pittsburgh, to take effect April 13, 1921."

Following are the new prices compared to the old:

	New	Old
4 x 4 and heavier billets, per gross ton	$37.00	$47.00
Slabs, per gross ton	38.00	46.00
Sheet bars and small billets, per gross ton	39.00	47.00
Bars, per 100 pounds	2.10	2.35
Plates and structural, per 100 pounds	2.20	2.65 and 2.45
Wire rods, per gross ton	48.00	57.00
Plain wire, base	3.00	3.25
Wire nails, per keg, base	3.25	3.25
Tin plate, per base box	6.25	7.00

The statement makes no mention of a cut in wages or salaries, though Judge Gary has made recent statements from which it was inferred that he took the position that no reduction in prices would be possible unless wages were also reduced.

A. S. T. M. Bulletin Makes First Appearance

The first number of the "A. S. T. M. Bulletin" was issued from the headquarters of the society at Philadelphia, on April 1.

With the rapid growth of society activities, in itself and in co-operation with other societies, a greater need was felt for a better means of communication with the members. The bulletin will be issued at quarterly intervals and will contain a wealth of valuable information for the engineer.

This month's bulletin announces the dates for the annual convention which will be held at Asbury Park, N. J., on June 20 to 24. From present indications this year's meeting will be the largest the society has ever held. The program has not yet been definitely decided upon but will probably be announced in a few weeks.

American Machinery in China

Business men of Canton, China, are organizing a company for the erection of a cotton mill, according to "Millard's Review." It is capitalized at $2,000,000. Two Chinese engineers, recently graduated from an American institution, are the promoters and the machinery used will be American made.

A Tribute to George E. Merryweather

Taking advantage of the presence in Cleveland of many machine-tool builders who were attending the convention of the National Machine Tool Builders' Association, the many friends of George E. Merryweather surprised him with a testimonial dinner on the evening of February 24, 1921. Although hurriedly arranged and informal in every sense, it was all the more enjoyable on that account and showed more than words can tell, the deep regard, the confidence and real friendship of his friends in the machine-tool and allied industries.

While perhaps a bit belated as a recognition of his services in Washington as Chief of the Machine Tool Section of the War Industries Board, it was a rare tribute to the excellence of his work there, to the fairness with which he handled all matters pertaining to his office and to the assistance he rendered the country and the industry in the most critical period. This was amply proved by the informal tributes of many of the guests whose war activities brought them into intimate contact with George Merryweather and his work at that time.

It was in fact a day of surprises for George, for thanks to the tactful co-operation and strategy of Mrs. Merryweather, his friends were able to smuggle complete furnishings for his den into the house and to get him into the room without his knowing of the transformation. It being impossible for all his friends to be at the house, the dinner gave them an opportunity to pay tribute and to express their feelings in an informal manner. The illustration shows how well they enjoyed the celebration, which was held in the banquet room of the Hotel Cleveland.

American Association of Engineers at Buffalo

The seventh annual convention of the American Association of Engineers will be held at Buffalo, N. Y., on May 9, 10 and 11. Headquarters will be in the Lafayette Hotel and all meetings will be held there. There will be stationed at this hotel an exhibit booth for manufacturers of engineering machinery, equipment, materials and supplies. This booth will be in charge of an engineer who will distribute catalogs, leaflets, data sheets, etc., for the various manufacturers. The advertising is in charge of G. S. Hallenbeck, Buffalo Chapter A. A. E., 511 Brisbane Building, Buffalo, N. Y.

Meeting of Worcester Section, A. S. M. E.

The Worcester Section of the A. S. M. E. held a well attended meeting in Mill No. 7 of the Norton Co's. plant on New Bond St., Worcester, Mass., on the evening of Thursday, April 7.

Mr. Dietz, sales manager of the Norton Co., gave a very interesting talk on the manufacture of grinding wheels, illustrating his remarks with samples of abrasives and bonds. He showed how the various materials were screened, graded, and mixed to produce wheels of definite characteristics, and explained the manner in which the mixtures are cast in molds, fired in kilns for certain lengths of time, and finally bored, bushed with lead, turned, faced, graded, inspected, and made ready for the market.

Mr. Lindsay, also of the Norton Co., read a paper on the methods used in cylindrical grinding and showed by means of charts the relative efficiency of various forms of grinding machines from the introduction of grinding as a commercial process up to the perfection of present standard machines.

Charles H. Norton followed with a talk on precision grinding, touching upon its application to many industries and explaining how some of them are dependent upon the grinding machine to make their product a commercial possibility.

The meeting closed with a practical demonstration of the Norton type B-10 cylindrical grinding machine, showing its capabilities as a remover of surplus metal, reducing round work to a given diameter within very close limits of accuracy and in a minimum of time.

Some Hoover Views

Exemption of American business men engaged in business in foreign countries from taxation was approved by Secretary of Commerce Hoover. Mr Hoover expressed himself as favoring this action by Congress following the visit of a delegation from the American Chamber of Commerce at Mexico City which explained the handicap upon American business interests when competitors from other countries are exempt from such taxation in their home countries.

Secretary of Commerce Hoover believes that German manufacturers are operating at a loss and do not know it. Discussing the remarkably low prices quoted by Teuton firms in their effort to re-establish their world trade, Mr. Hoover said today that he was at a loss to explain how they do it.

The only apparent explanation he said, is that due to inflation caused by large issues of paper money, the manufacturers themselves do not know the actual cost of production.

While their books may show what appears to be a profit at this time, Mr. Hoover expressed the belief that they are operating at a big loss.



TESTIMONIAL DINNER TO GEORGE E. MERRYWEATHER, FEBRUARY 24, 1921

Business Items

The Lanyon Manufacturing Co., of New Haven, Conn., has just been organized and incorporated with a capital stock of $100,000 to engage in the manufacture of screw machine products, etc. The incorporators are R. M. Lanyon, C. S. Reed and B. E. Hoffman, all of New Haven.

The Houston Manufacturing Co., of Houston, Tex., has organized with a capital stock of $100,000. The company will manufacture the recently invented "Wonder" rotary pump, the work of J. F. Smith, a mechanic now employed by the company. Officers of the company are: C. P. Spilman, president; C. C. Young, vice-president; H. W. Hyde, secretary-treasurer; L. F. Smith, B. A. Killson, T. J. Baker and I. W. Clark, trustees.

Connecticut Gears, Inc., of Waterbury, Conn., has recently been organized and incorporated with a capital stock of $50,000 to engage in the manufacture of gears, etc. The incorporators are Tyler Clark, W. E. Thomas and C. C. Hincks, all of Waterbury, Conn.

F. G. Street & Co., of Dover, Del., has incorporated with a capital stock of $2,070,000, to manufacture machinery. The incorporators are A. W. Britton, S. B. Howard and A. H. Smith, of New York.

The Shea-Clancy Castings Co., 232 Fifth St., Bridgeport, Conn., has changed the name of the concern to the Shea Foundry and Machine Co. The company makes castings and forgings.

The Strand & Sweet Manufacturing Co., Inc., of Winchester, Conn., has recently been incorporated with a capital stock of $50,000 to manufacture wire, etc. The incorporators are R. E. Strand and J. E. Sweet, both of Winsted, Conn., and Joseph Edelene, of Chicago, Ill.

The U. S. Coal Machinery Co., of Dover, Del., has incorporated for the manufacture of coal drilling machinery. Directors are W. A. McCoy of Pittsburgh, Pa., and M. W. Cole and Frank Jackson of Dover.

The Edward Valve and Manufacturing Co. announces the removal of its general offices from West Adams St., Chicago, Ill., to the factory at East Chicago, Ind. It is requested that all matters be referred to this new address.

Crocker-Wheeler Co., of Ampere, N. J., has moved its Boston office to larger quarters at 171 High St. (Cornhill Square) Boston, Mass. L. S. Howland will continue as district manager.

The H. S. Manufacturing and Plating Co., of New Haven, Conn., engaged in mechanical engineering at 548 State St., New Haven, Conn., recently incorporated with a capital stock of $50,000. The officers elected are: president, Nicola Murano; secretary, James Murano; and treasurer, Florie Palermo.

The fire in the Winthrop Harbor, Ill., plant of the Austin Machinery Corporation, manufacturer of trenching machinery. mixers, etc., on Tuesday night, March 22, while extensive at this plant, will not, according to officials of the corporation, in any way interfere with production and prompt delivery of machines, as practically all lines are also being built at the plant at Muskegon, Mich., as well as at the former plant of the Toledo Bridge and Cane Co. at Toledo, Ohio.

Beginning April 1 the Arrow Tool Co., Bridgeport, Conn., began business under the name of Arrow Tool and Manufacturing Co. There will be no change in the business other than the addition of a fully equipped press department enabling it to take orders for light and medium sheet-metal stampings and light manufacturing. The company will, as in the past, continue to make tools and special machinery of every description.

The Winchester Repeating Arms Co., of New Haven, Conn., has recently filed with the Secretary of State of Connecticut a certification of the increase of the capital stock of the company from $1,000,000 to $10,000,000.

All You Neighbors That Have Been Waiting for the Frost To Get Out of the Ground Better Be Getting Your Seed In!



J. N. Ding in New York Tribune

Personals

WILLIAM H. BENNETT, superintendent of the bar mills of the Clairton mills of the Carnegie Steel Co. has been made assistant superintendent of the Gautier rolling mills of the Cambria Steel Co., under D. S. Muckley. Mr. Bennett is a graduate of Carnegie Tech and has served the Carnegie company for seventeen years.

O. H. WHARTON was elected a director of the Crucible Steel Co., Pittsburgh, Pa., to replace A. W. Mellon, resigned. Mr. Wharton was also elected vice president.

ERNEST T. CLARY, who recently resigned his position as assistant treasurer and works manager of the Whitcomb-Blaisdell Machine Tool Co., of Worcester, Mass., has accepted a position as assistant works manager of the plant of the Whitin Machine Works, at Whitinsville, Mass.

JESSE B. MCKEON, who has been with the New York City Lines for the past 29 years, has severed his connection with that road and has become identified with the Rider Ericson Engine Co., of New York City. Mr. McKeon will have a large part of the New York State territory.

Trade Catalogs

Roller Bearings. American Roller Bearing Co., Pittsburgh, Pa. Bulletin No. 1005, pp. 27, 6½ x 9½ in. This bulletin describes and illustrates the standard and heavy duty Type "C" roller bearings.

Electrical Drills, Grinders and Buffers. The Cincinnati Electrical Tool Co., 1501-5 Freeman Ave., Cincinnati, Ohio. Catalog No. 14, describes and illustrates a complete line of portable electric drills, grinders and buffers. It also gives several machines which this company recently brought out. The catalog will be mailed upon application.

Cupola. Whiting Corporation, Harvey, Ill., Bulletin No. 55, pp. 30, 6 x 9 in. This bulletin gives a list of users of the Whiting cupola.

Knurling Tool. A. D. Knurling Tool Co., 120 E. 128th St., New York, N. Y. One-page circular describing the latest type of A. D. Knurling tool as produced by this company.

The Trackless Train. The Mercury Manufacturing Co., Chicago, Ill. Catalog Vol. III, No. 3. Fourteen pages of illustrations and text showing the use of the trackless train in several factories and freight stations.

Diesel Oil Engines. Fulton Iron Works Co., St. Louis, Mo. Catalog, thirty-one 8½ x 11-in. pages, covering the line of Diesel oil engines as manufactured by the Fulton company. The booklet is fully illustrated to show the various types of engines, and several charts showing the cycles of operation are included.

Reed-Prentice Lathe. Reed-Prentice Co., Worcester, Mass. A seven-page illustrated catalog describing the latest model 14-in. geared-head high-speed lathe. Detail drawings and specifications are included.

"Oliver" No. 75 Pattern Milling Machine. Oliver Machinery Co., Grand Rapids, Mich. Circular showing a group of metallic patterns finished on this machine. Several views of the machine in operation are also shown.

"Gladiator" Toolholder Bit. Hercules Electric Steel Corporation, 137 Lafayette St., New York, N. Y. Six-page folder describing special features of the "Gladiator" high-speed toolholder bits.

Keller Pneumatic Tools. Keller Pneumatic Tool Co., Grand Haven, Mich. A convenient 8½ x 11-in. folder describing and illustrating the various Keller hand-portable products including riveting hammers, chipping hammers, drills and grinders. A set of master specifications for these tools is also given.

High-Speed Steel. Vanadium-Alloys Steel Co., Latrobe, Pa. Catalog, pp. 67, 3½ x 6½ in. This catalog describes and illustrates heat-treatment, its uses, etc.; it also includes a special section, showing tables of weights, and information concerning the grinding of high-speed steel. A copy of this catalog will be sent upon request.

Porcelain Enameling Furnaces. Chicago Flexible Shaft Co., Roosevelt Rd., and Central Ave., Chicago, Ill. Catalog No. 80, 8½ x 11 in. This catalog is profusely illustrated with halftone photographs of porcelain enameling furnaces and also gives a complete description of those shown.

Locomotive Cranes and Shovels. Victor R. Browning, Cleveland, Ohio. Catalog, eight 8½ x 11-in. pages, containing illustrated and descriptive information on a line of cranes and shovels for use on railroad cars. Several types of crawlers, cranes and shovels are also included, a separate booklet being devoted to each.

American Gasoline Locomotive. The Hadfield-Penfield Steel Co., Bucyrus, Ohio. Eighteen 8 x 10-in. pages, profusely illustrated, describing the several models of the "American Gas-O-Motive." The construction and operation of the machines are thoroughly explained and the general specifications are included.

Ball Bearing Engineering Data. New Departure Manufacturing Co., Bristol, Conn. Announcement is made that the issuing of the N. D. Ball Bearing Engineering Data Bulletins will be resumed this month. The service is free and the bulletin will be sent to all who apply.

Earle Centrifugal Pumps. The Earle Gear and Machine Co., Philadelphia, Pa. Catalog No. 71, twenty-two 6 x 9-in. pages, illustrating and describing the several types of centrifugal pumps; motor, belt and turbine drive models are covered. Charts of operations are included in the data.

Tenso Die Castings. Barnhart Brothers & Spindler, Chicago, Ill. Circular describing the line of "Tenso" die castings produced by this company. Illustrations and specifications are included.

Oil Driven Compressors. Chicago Pneumatic Tool Co., Chicago, Ill. Bulletin No. 607, thirty-two 6 x 9-in. pages, containing a comprehensive description and several interesting applications of pneumatic oil engine driven compressors, both stationary and portable types. Two pages are devoted to a comparison of their operating cost versus steam-driven compressors.

Yarway Junior Seatless Valve. Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa. Circular No. 2, supplement to Bulletin B-410. Describing this latest type of valve for use under high pressure steam or turbine drips, superheater drains, water columns, blow off, etc.

New Publications

The Modern Motor Truck. By Victor W. Page, M.E. Nine hundred sixty-two 5½ x 8¾-in. pages, illustrated with numerous photographs and drawings. Published by the Norman W. Henley Pub. Co., New York City.

A volume outlining the principles of construction and operation of the various types of motor trucks, and giving details concerning the more popular makes. The working parts of the several types of motors are described in detail, and directions are given for their care and maintenance. Wheels, bodies and hoisting mechanisms are discussed, together with the uses and advantages of each. A chapter on the cost of operation is included, in which the elements of cost are explained and charts outlined whereby the truck operator can determine and record his operating costs. An idea of the scope of the work can be gained from the list of chapter headings, which follows:

Motor Truck Types; The Motor Truck Power Plant; Motor Truck Fuel and Carburetion Systems; Truck Motor Cooling and Lubrication; The Motor Truck Electrical System; Motor Truck Clutch and Gearbox; Motor Truck Drive Systems; Motor Truck Chassis Parts; Motor Truck Loading and Operation; Special Truck Applications and Body Designs; Road Troubles and Truck Maintenance; Gasoline Truck Repair and Adjustment; The Electric Truck Construction; Construction, Care, and Charging of Truck Batteries; Driving and Maintenance of Electric Trucks; Truck Operating Cost Determination.

This book should be of invaluable assistance to everyone connected with the operation or supervision of motor-hauling equipment, and also to the firm or individual who is looking for information which may serve as a guide for future investment in transportation units.

Forthcoming Meetings

The fifth annual convention of the American Gear Manufacturers Association will be held in Cincinnati, Ohio, April 27, 28, 29 and 30.

The ninth annual meeting of the Chamber of Commerce of the United States will be held at Atlantic City, April 27 to 29, with headquarters at the Traymore Hotel.

The annual meeting of the American Welding Society will be held in the Engineering Societies Building, 29 West 39th St., New York, on April 28.

The Society of Industrial Engineers will hold its national convention in Milwaukee, Wis., on April 27, 28 and 29. Geo. C. Dent, 327 So. La Salle St., is business manager.

The National Foreign Trade Council will hold its eighth annual convention in Cleveland, Ohio, on May 4, 5, 6 and 7. J. G. Hammond, care of the Council, 409 Park Bldg., Cleveland, is secretary.

The seventh annual convention of the American Association of Engineers will be held at Buffalo, N. Y., on May 9, 10 and 11, with headquarters at the Lafayette Hotel.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The spring meeting of the National Association of Manufacturers will be held in New York, May 16, 17 and 18 at the Waldorf-Astoria Hotel. The headquarters of the association is at 30 Church St., New York City.

Announcement is made that the regular spring meeting of the National Machine Tool Builders Association will be held in Atlantic City, N. J., on May 19 and 20. Headquarers will be at the Traymore Hotel. Ernest F. Du Brul, 817 Provident Bank Bldg., Cincinnati, Ohio, is general manager.

The Taylor Society will hold its Spring Meeting at the Hotel Statler, Cleveland, Ohio, May 19 to 21.

The spring meeting of the American Society of Mechanical Engineers will be held at the Congress Hotel, Chicago, May 23-26. Calvin W. Rice, Engineering Societies Bldg., 29 West 39th St., New York, is secretary.

The Society of Automotive Engineers, 29 West 39th St., New York announces that its summer meeting will be held at West Baden, Ind., on May 24 to 28 inclusive.

The American Railway Master Mechanics Association will hold its Spring Meeting at the Drake Hotel, Chicago, Ill., on June 15 and 16.

The 1921 annual meeting of the American Society for Testing Materials will be held at Asbury Park, N. J., on June 20 to 24, with headquarters at the New Monterey Hotel. C. L. Warwick, Engineers Club, Philadelphia, Pa., is secretary.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Reamer, General-Purpose, Adjustable, Kylin
Foster-Johnson Reamer Co., Elkhart, Ind.
"American Machinist," Feb. 10, 1921



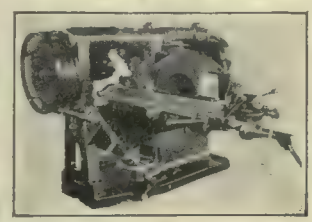
A feature of the reamer is that its size may be adjusted by turning a single nut on the shank end of the body. This nut is graduated in thousandths of an inch. A helical spring is used on the lower end of the tool to back up the blade collar. It is claimed that the uniform compression obtained by the use of the spring permits closer adjustment, prevents springing or distortion of the blades, and prevents the blades from collapsing. The spring compresses slightly as the diameter over the blades is expanded, and when the reamer is contracted the spring causes the blades to move inward as they travel upward on the body. The compression on the spring can be regulated.

Tractor, Industrial, Gasoline, "Powerox"
Barrett-Craven Co., 169 N. Ann St., Chicago, Ill.
"American Machinist," Feb. 17, 1921



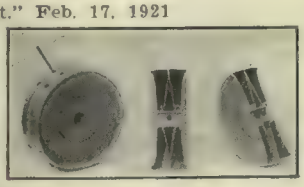
The machine is intended for heavy duty in factory or interplant service, where a small unit is needed. It is adapted to pushing or pulling trucks or trailers. Bodies of different types, such as stake, box and dumping, can be furnished, as well as different kinds of trailers. The machine is driven by a gasoline engine, having L-head cylinders cast *en bloc*, and equipped with a magneto and a speed governor. Carrying capacity, 3,000 lb. Horsepower of motor, 25. Cylinders; four, 3⅜ x 4⅛ in. Speeds, 3 forward, 1 reverse. Wheels: front, 20 x 3½ in.; rear, 20 x 5 in. Tread, 36 in. Wheel base, 60 in. Width overall, 46 in. Length overall, 98 in. Turning radius, 10 ft. Shipping weight, 2,500 lb.

Milling Machine, Opposed-Spindle, Semi-Automatic
Ford-Smith Machine Corporation, Ltd., Hamilton, Ont., Can.
"American Machinist," Feb. 17, 1921



The machine is intended for the finishing simultaneously of opposite parallel surfaces, being here shown adapted to the milling of transmission covers. The machine has the general characteristics of a knee-type milling machine; but the special features make it primarily a single-purpose production machine. One spindle is driven directly by a belt on a cone pulley. The other spindle, held in place by a heavy overarm and the outer support, is driven from the first by means of gears and a connecting shaft. There is a flywheel on each spindle. The table is low and is provided with a revolving fixture, or turntable, on which two pieces of work can be mounted. While one piece is being machined the finished piece is removed and a rough casting put in its place.

Pulley, Sheet-Steel, "Presteel"
Worcester Pressed Steel Co., Worcester, Mass.
"American Machinist," Feb. 17, 1921



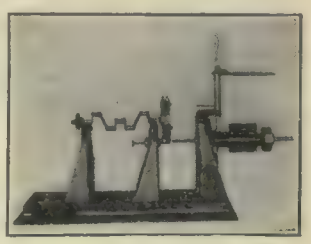
The pulley combines the advantages of lightness and strength with convenience of manipulation when taking it off or putting it on a shaft. The pulley presents a smooth web on each face, leaving no projecting parts to constitute a source of danger to workmen, and having no spokes to cause windage, and raise dust. The pulley is entirely self-contained, having no loose parts to fall out. Except for the bolts that hold the halves together on the shaft it is built entirely of cold-drawn sheet steel. The illustration shows both the pulley assembled and the two halves which, when joined together, make a complete pulley. The clamps that hold the two parts together, when on the shaft are steel stampings, with nuts welded in place so that they cannot turn when the bolts are tightened or withdrawn. The pulleys can be furnished in all standard diameters from 6 to 18 in. and in any width of face.

Shafting Cleaner
American Metal Products Co., 72 Adams St., Chicago, Ill.
"American Machinist," Feb. 10, 1921



The device consists of a ring which fits loosely on the shaft and, due to the rotation of the latter, travels back and forth on it, keeping it clean and polished. The device is made of heavy-grade nickel-plated sheet zinc in four duplicate stampings. The joints are spaced 90 deg. apart, the parts being locked together by four wide staples of the same material as the rings. The staples are clinched by means of a pair of pliers when the ring is installed. The cleaner can be put on shafting that is already in place, and it is easily removable. The swelled portion at the inner diameter is filled with felt, which distributes along the shaft any oil that strikes it.

Balancing and Drilling Machine, Sundstrand, Style "C"
Rockford Tool Co., Rockford, Ill.
"American Machinist," Feb. 17, 1921



The machine is especially intended for balancing and drilling flywheels that are attached to the crankshaft. Another application is for similar operations on flywheels that are carried on a mandrel and supported between the two standards. In this case the drill spindle can be brought up to the first standard and the drill passed through it, so as to reach the flywheel. Capacity, 2,000 lb. Maximum swing of wheel on 1-in. shaft, 47¾ in. Drilling radius: maximum, 18 in.; minimum, 5 in. Maximum distance between standards, 39 in. Spindle traverse, 8⅝ in. Spindle bored for No. 3 Morse taper. Width of belt, 2¼ in. Countershaft speed, 375 r.p.m.; to run spindle, 300 r.p.m. Floor space, 24 x 97 in. Net weight, 1,135 lb.

Fluting Center, Single-Spindle, No. 5
Miller & Crowningshield, Greenfield, Mass.
"American Machinist," Feb. 17, 1921



Two work-holding centers are carried on a block, which is intended for attachment to the table of a milling machine. The block is pivoted at the center on a rocker that is bolted to the table, and it is clamped at the footstock end. In order to set the center so that a taper will be cut on the work, one end of the fixture can be raised. Change gears can be provided, so that it is possible to index the correct amount for work having any number of flutes up to twenty, by means of one full turn of the indexing handle. Swing, 3¾ in. Maximum distance between centers, 18 in. Length, 36 in. Width, 6 in. Taper in head center, No. 10 B. & S. Net weight, about 200 lb.

Boring Bar, Small, "Independent"
M. B. Hill, 10 Eden St., Worcester, Mass.
"American Machinist," Feb. 17, 1921



The bar can be used in any lathe, independent of the carriage or cross-slide. The sleeve shown in the illustration is turned to fit the taper of the live spindle of the lathe in which it is to be used, the bore of the sleeve being a running fit for the forward end of the boring bar. The cutter is made from high-speed steel, has rack teeth in one side and can be adjusted for position by a small pinion set in the bar. The taper sleeve remains in the lathe spindle and furnishes a bearing for the bar, which is supported and fed forward by the tail center, as in the case of a twist or flat drill.

Clip, paste on 3 x 5-in. cards and file as desired

THE WEEKLY PRICE GUIDE

This Week's Market

The outstanding feature of the week is the price decrease by the United States Steel Corporation, by which structural shapes are reduced $5 per ton; plates $9; plain wire $7; sheets and small billets $4; 4 x 4 and heavier billets $1.50, and tin plates $15, all f.o.b. Pittsburgh. This has not lowered warehouse prices, for the reason that the warehouse decrease announced two weeks ago was made on the basis of $2 per 100 lb. at mill. There has been a warehouse price adjustment on steel sheets in New York, by which black and galvanized sheets were raised 15c. and 87c., respectively. Sheets dropped in Cleveland and Chicago, as did also cold finished steel.

The slight activity in the metals market was only temporary. Copper is obtainable at 13.62½c. per lb. in less than carloads, and at 12.70c. in large quantities. Lead and zinc are both off.

The market for bolts, nuts, etc., is very soft, and prices are being shaded generally.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$29.50
Northern Basic	27.52
Southern Ohio No. 2	28.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	35.26
BIRMINGHAM	
No. 2 Foundry	25.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75 sil	26.25@28.50
Virginia No. 2	*28.00
Basic	†26.25
Grey Forge	*27.00
CHICAGO	
No. 2 Foundry local	26.00
No. 2 Foundry, Southern, sil 2.25@2.75	32.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26.96
Basic	26.86
Bessemer	27.00

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse	New York Delivered Jersey City	Cleveland	Chicago
Structural shapes	$3.23	$3.33	$3.09	$3.23
Soft steel bars	3.13	3.23	2.99	3.13
Soft steel bar shapes	3.13	3.23	3.48	3.13
Soft steel bands	4.18	4.28	6.25	
Tank plates	3.23	3.33	3.78	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	4.25	3.85	4.13
No. 12	3.15	4.30	3.90	4.18
No. 14	3.20	4.35	3.95	4.23
No. 16	3.30	4.45	4.05	4.33
Black				
Nos. 17 and 21	3.75	4.95	4.60	5.20
Nos. 22 and 24	3.85	5.00	4.65	5.25
No. 25 and 26	3.90	5.05	4.70	5.30
No. 28	4.00	5.15	4.80	5.40
Galvanized				
No. 10 a·d 11	4.00	5.30	4.70	5.70
No. 12 to 14	4.10	5.40	4.80	5.80
Nos. 17 and 21	4.40	5.70	5.10	6.10
Nos. 22 and 24	4.55	5.85	5.25	6.25
No. 26	4.70	6.00	5.40	6.30
No. 28	5.00	6.25	5.70	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$4.73	$4.63	$4.25
Flats, squares and hexagons, per 100 lb	5.23	4.63	4.75

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	65%
Cleveland	50%
Chicago	50%

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	4
Ingots	38	Cold rolled rods (base)	5
Sheet bars	40	Hot rolled sheets (base)	5

Special Nickel and Alloys	
Malleable nickel ingots	4
Malleable nickel sheet bars	4
Hot rolled rods, Grades "A" and "C" (base)	6
Cold drawn rods, Grade "A" and "C" (base)	7
Copper nickel ingots	3
Hot rolled copper nickel rods (base)	4
Manganese nickel hot rolled (base) rods, "D"—low manganese	6
Manganese nickel hot rolled (base) rods "D"—high manganese	6

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b New York: 5/32, 8½c. per lb.; ¼, 8c.; 5/32 to ½, 7½c. Domestic iron sells at 12c. per lb

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.50	8.00	8.25
Spring steel (light)	8.00	7.00	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.20
Hoop steel	4.38	3.69	3.83
Cold rolled strip steel	8.50	8.25	7.90
Floor plates	5.50	3.09@3.40	5.78

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Galvanized	Inches	Iron Black	Galvanized
⅛ to 3	57½%	44%	⅛	15½–16½%	+10½–11%
			¼	19½–20½%	1½– 2½%
			⅜ to 1½	24½–25½%	8½– 9½%

LAP WELD

2	50½%	38%	2	20½–21%	6½– 7%
2½ to 6	53½%	41%	2½ to 6	22½–23%	9½–10%
7 to 12	50½%	37%	7 to 12	19½–20%	6½– 7%
13 to 14	41%				
15	38½%				

BUTT WELD, EXTRA STRONG PLAIN ENDS

⅛ to 1¼	55½%	43%	⅜ to 1½	24½–25½%	9½–10½%
2 to 3	56½%	44%			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	48½%	37%	2	21½–22½%	8½– 9%
2½ to 4	51½%	40%	2½ to 4	23½–24%	11½–12%
4½ to 6	50½%	39%	4½ to 6	22½–23%	10½–11%
7 to 8	46½%	33%	7 to 8	14½–15%	2½– 3%
9 to 12	41½%	28%	9 to 12	9½–10%	+2 –2½%

Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅛ to 3 in. steel butt welded	44%	28%	42½%	33½%	57½%	44%
2½ to 6 in. steel lap welded	39%	24%	44½%	29½%	53½%	41%

Malleable fittings. Classes B and C, Banded, from New York stock sell at plus 6%. Cast iron, standard sizes, 15% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13.62½
Tin in 5-ton lots	29.75
Lead	4.62½
Zinc	5.50

ST. LOUIS

Lead	4.22½
Zinc	5.10

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.00	21.50	23.50
Copper wire (carload lots)	15.00	17.50	20.00
Brass sheets	17.25	24.00	24.50
Brass pipe	21.00	22.00	20.75
Solder (half and half) (case lots)	18.00	20.50	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	15.25
Cleveland	19.00
Chicago	16.75

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill + less 8% for carload lots 11 50

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	13.70	14.30
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.25
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	10.00
Copper, heavy, and wire	9.00	9.50	9.00
Copper, light, and bottoms	8.00	9.00	8.00
Lead, heavy	3.25	4.00	3.50
Lead, tea	2.00	3.00	3.00
Brass, heavy	6.00	7.00	9.00
Brass, light	4.50	5.00	5.00
No. 1 yellow brass turnings	5.00	5.50	5.50
Zinc	3.00	3.00	3.10

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.1@28.2	24.50	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.00
Chicago	20.50
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	40.00	35.00
Commercial	30.00	15.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$1.00	1.60
Hot pressed hexagon	List	1.00	1.60
Cold punches hexagon	List	1.00	1.60
Cold punched square	List	1.00	1.60

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	50%
Cleveland	70%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50-10%	60%	50%
1½ and 1¼ in. by 3 in. up to 12 in	50%	50%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $3.50 Chicago..... $4.00
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $4.00 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅜ by 6 in. and smaller	40%	50%	40%
Larger and longer up to 1 in. by 30 in.	40%	40%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	50%	50%	45%
Tinned	45%	50%	30%

Structural, ⅜, ½, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.85 Cleveland...$5.00 Chicago....$4.88 Pittsburgh..$3.90
Boiler, same sizes:
New York...$4.95 Cleveland...$5.10 Chicago....$4.98 Pittsburgh..$4.00

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	25.50
Brass	21.00	24.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ⅛-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$8.50 per 100 lb.; New York price is 8c.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	10.00@13.00	13.00	14.25
Colored mixed	7.00@11.50	10.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	1½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$4.00@$5.00
Prompt foundry	5.00@ 6.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$0.80
Cleveland	100-lb. bag	1.05

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.73	$0.90	$0.71
5-gal. cans	.76*	1.15	0.95

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Conn., Bridgeport—Chapin & Bangs, 353 Water St., manufacturers of heavy hardware—
One 8 or 10 ft. shear for sheet metal.
One 37 in. or 38 in. slip forming or plane forming roll for sheet metal.

Conn., Bridgeport—Miller & Isaacs, Inc., 220 North Washington Ave. (automobile truck dealers), C. G. Miller, Purch. Agt.—electric portable drill for truck repair use.

Mass., Cambridge — DeWitt-La France Co., 23 Church St., manufacturer of fountain pens and pencils, P. La France, Purch. Agt.—No. 1 or 2 milling machine, lathe with 10 in. swing and a 5 ft. to 6 ft. bed, etc.

Mass., East Boston—(Boston P. O.)—A. H. Marshall, 209 Prescott St., cabinet maker—machinist lathe, complete, 6 in. x 12 in. or 15 in. swing-screw feed taper attachment.

Mass., Fitchburg—The Union Screen Plate Co., 146 Water St.—a 22 in. x 22 in. x 5 ft. Putnam used planer.

N. Y., Buffalo—The Pinck Spring Wks., 654 Michigan Ave., manufacturer of wagon springs—one belt driven power hammer for welding pieces 2½ in. to 4 in. in width.

N. Y., Buffalo—The Simmons Machine Co., 86 Exchange St.—Brightman turning machine for turning 1 in. to 4 in. round steel bars, either belt or motor driven, also a new 36 in. x 36 in. x 18 ft. planer.

N. Y., Syracuse—H. H. Franklin Co., 302 South Geddes St., manufacturer of motor cars—No. 33-5 spindle New Britain automatic chucking machine.

N. Y., New York—(Borough of Manhattan) R. S. Stokvis & Sons, Inc., 17 Battery Pl.—
One 8½ in. double centering machine.
Axle lathe, height of centers 8 in., between centers 100 in.
Vertical lathe to take 40 in., two heads.
Vertical lathe to take 44 in., two heads.
Car wheel lathe, height of centers 24 in.
Hydraulic forcing press.
Eighteen in. extension gap lathes, between centers 6 ft. and 8 ft.
Semi-automatic turret lathes, 2½ in. diameter bar.
Twenty in. shapers.
High speed drilling machines, 2½ in. capacity.
Planers, quick return 40 ft. x 40 in. x 10 ft.
Fourteen in. slotting machines.
Horizontal milling machines, table feeds 28 x 10 x 19 in.
Double reaming machine.
Shearing machine.
Forging machine for ⅜ in. to 1½ in. nuts.
Semi Universal forging machine for 2½ in. bolts.
Bulldozers, 20 in. stroke.
Steam hammer, capacity 8,000 lb.
Double frame steam hammers.
Compressed air hammers.
Spring leaf shaping machine.
Leaf bending machine.
Hydraulic presses.
Universal shearing and punching machine.
Double shearing and punching machine.
Plate straightening machine.
Rotary shearing machine.
Hydraulic flauzing press for boiler heads.
Double end grinding machine.
Radial drilling machine, 5 ft. capacity.
Eight spindle drilling machine, 1 in. capacity.
Double head bolt threading machine, 1 in. capacity.
Bolt pointing machine, 2 in. capacity
One 4 spindle nut tapping machine.
Fourteen in. lathes, distance between centers 3 ft.
Facing lathes, height of centers 23 in.
Vertical drilling, reaming and grooving machine.
No. 3 heavy universal milling machine.
Milling machine, planer type, 24 in. x 24 in. x 8 ft.
Grinding machine, 16 in. x 60 in.
Vertical grinding machine.
Universal tool grinding machine.
Twist drill grinding machine, 3 in. capacity.
Disc polishing and grinding machines.
Universal radial drilling machine, 5 in. capacity, portable.

N. Y., Norwood—W. E. Fletcher—miller, lathe and drill press (new or second hand), for machine shop.

N. Y., Watertown—O. P. Martin, 248 Paddock St.—Canton auto floor crane, air compressor and tank, lathe (16 in. engine), and arbor press for machine shop.

Pa., Jersey Shore—The Jersey Shore Mine Car Co., Harris St.—equipment.

Pa., Philadelphia—H. M. Kolb, Widener Bldg.—One ⅛ x 8 in. boltheader.

Pa., Pittsburgh—The Dept. of Supplies, Bd. Educ., Fulton Bldg.—one 3 hp. vertical hollow chisel mortiser for the Westinghouse High School.
Four 9 in. screw cutting engine lathes, two 4 in. universal 3 jaw chuck no plate attachment, two 6 in. independent 4 jaw chuck no plate attachment and one bandsaw machines with accessories for the Allegheny High School.
Six 9 in. screw cutting engine lathes, one taper attachment for above and 1 draw in chuck attachment for above, three 4 in. universal 3 jaw chuck no plate attachment, six 6 in. independent 4 jaw chuck no plate attachment, one tool center grinder, one 16 in. crank shaper, one 20 in. drilling machine and one bending saw machine for the Ralston School.

S. C., Greenville—The Climax Specialty Wks., manufacturer of storm sash and awning frames—wire straightener, and one Van Bramer wire cutter with circular attachment and gage.

W. Va., Charleston—The Charleston Bolt & Forging Co.—machinery for the manufacture of iron and steel machines, carriage and truck bolts, etc.

Ill., Chicago—The Advance Auto Accessory Co., 4344 Wentworth Ave.—16 in. shaper, used preferred.

Ill., Chicago—The Chicago Metal Mfg. Co., 313 South Clinton St.—punch press, 30 in. bed.

Ill., Chicago—The Chicago & Northwestern R.R., 226 West Jackson St., F. J. Berck, Purch. Agt.—material and supplies in connection with oxyacetylene welding and cutting for year ending April 30, 1922.

Ill., Chicago—L. G. Neff, 1045 West Washington Blvd.—No. 10 and No. 12 Zeh & Hahnemann patent percussion power press.

Ill., Harrisburg—The Bd. Educ., G. Davenport, Pres.—manual training equipment.

Ill., Heyworth—The Bd. Educ.—manual training equipment for proposed school.

Ill., Peoria—The Bd. Educ., G. Mitchell, Pres.—forge and sheet metal shop equipment for manual training high school.

Ill., Sandwich—The Bd. Educ., Dist. 402—manual training equipment for proposed school, here.

Ind., Indianapolis—The Amer. Boiler & Sheet Metal Wks., 1347 Van Buren St.—bending rolls for corrugating.

Mich., Detroit—Lamb Co., 404 East Jefferson Ave.—miscellaneous equipment for making hardened carbon steel products.

Mich., Grand Rapids—The Hayes Ruppel Co., manufacturer of metal closet tanks—equipment for its plant at Amherstburg, Ont.

Mich., Hastings—The Viking Corp.—No. 1 garvin or similar topping machine for No. 13 tops, (used).

O., Akron—The Imperial Electric Co., 64 Ira Ave.—One 30 ton Lucas vertical press.
One No. 4 Bliss geared double crank press. (Used.)

O., Cleveland—The Amer. Steel & Wire Co., 1230 Marquette St.—One 16 in. heavy duty engine lathe with 18 ft. bed and taper attachment.
One 24 in. heavy duty engine lathe with 16 ft. bed and taper attachment.
One 36 in. stroke crank shaper.
One full universal radial drill press with 6 ft. arm.
One 8 ft. vertical turning and boring mill similar to the King mill.

O., Columbus—Tullis & Puskar, Pittsburgh, general auto repairers and manufacturers of auto springs—lathe, probably 24 in., drill presses, probably two grinders and milling machines, for its machine shop at 205 East Copeland St., here.

O., Ironton—The Ironton Stove Mfg. Co.—machinery.

Wis., Granton—The Finnegan Garage Co., C. Finnegan, Purch. Agt.—drill press.

Wis., Milwaukee—E. Schulz, 232 Northwestern Ave.—drill press and lathe for auto repair work.

Mo., Springfield—The Ampco Metal Products Co., 301-2-3 Woodruff Bldg.—sheet metal machines and foundry and machine shop equipment.

Mo., St. Louis—The Excelsior Mfg. Co., 819 North 11th St. (light sheet metal workers), H. Seltzer, Mgr.—die for No. 8 tin wash boiler cover 12 in. x 22 in. oval shape.

Mo., St. Louis—The Mueller Mfg. Co., 4950 Tyrolean Ave. (boat builders), C. Mueller, Purch. Agt.—1 wood turning lathe, 8 in. wing 7 ft. long.

Ont., London—The Pub. Utilities Comn., E. V. Buchanan, Hydro Bldg., Engr.—electric furnace and equipment for the manufacture of malleable castings.

Que., Montreal—P. Labelle, 721 Dorchester St., W.—equipment for garage and repair station.

Machinery Wanted

Ala., Lafayette—The Lafayette Cotton Oil Mills—6 in. spiral conveyor in 10 ft. lengths; single shaker for use in oil mill, prefer steel frame, 10 ft. long overall and clothed with perforated metal for first hulling; 30 in. knife huller, Carver or Chandler make; set of crushing rolls, 36 in. long, 5 high, plain or ballbearing.

Fla., St. Petersburg—The Biltwell Furniture Co.—modern wood-working machinery for all kinds of furniture.

Fla., Tampa—The Florida Grower, Inc., 513-17 Maxwell Ave.—equipment for proposed publishing plant.

S. C., Gaffney—W. U. Campbell—two or four magnetic separators.

Ill., Chicago—The Natl. Lumber & Timber Co., 6 North Michigan Ave.—equipment for proposed saw and planing mill.

Mich., Detroit—Joyce Wrecking Co., 71 Monroe St.—circular saws, crosscut and ripsaws for lumber, gasolene engine driven (used preferred).

Wis., Peshtigo—The Peshtigo Pulp & Paper Co.—traveling crane.

Wis., Two Rivers—The Wisconsin Textile Mfg. Co., O. Alberts, Purch. Agt.—wood-turning machinery.

Mo., Springfield—The Welsh Packing Co. packing house operating machinery.

Ont., Kincardine—Tiverton Creamery Co., A. Garber, Purch. Agt.—complete modern creamery equipment for proposed creamery, here.

Cal., San Francisco—The Pacific Fruit Express Co., 65 Market St—refrigerating machinery for its plant at Council Bluff, Ia.

Ont., Toronto—The Toronto Veneer Co., 1100 Queen St., W.—wood-working equipment for plant at Southampton.

Metal Working

NEW ENGLAND STATES

Conn., Hartford—S. Maislen, 356 Windsor Ave., has awarded the contract for the construction of a 1 story, 25 x 48 ft. garage and service station on Windsor Ave. Estimated cost, $10,000.

Conn., Southington—Peck, Stow & Wilcox Co., Railroad Sq., plans to construct a 1 story, 70 x 180 ft. hardening building, a 2 story, 56 x 156 ft. grinding building and a 1 story, 60 x 100 ft. forge shop addition to its hardware plant. Estimated cost, $300,000.

Mass., Cohasset—The South Shore Garage Inc., Fuller Terrace, has awarded the contract for the construction of a 1 story, 28 x 76 ft. and 45 x 80 ft. additions to garage. Estimated cost, $20,000. Noted Dec. 23.

Mass., Lawrence—The Harig Motor Co. will soon award the contract for the construction of a 2 story, 80 x 150 ft. sales building and garage on Hampshire St. Estimated cost, $125,000. Ashton & Huntress, Blakeley Bldg., Archts.

Mass., Roxbury—(Boston P. O.) Duncan & Donahue Co., 462 Brookline Ave., will soon award the contract for the construction of a 2 story garage on Peabody St. Estimated cost, $100,000. McLaughlin & Burr, 88 Tremont St., Boston, Archts. Noted Sept. 24.

Mass., Springfield—W. Sacks, Chestnut and Liberty Sts., has awarded the contract for the construction of a 2 story, 95 x 99 ft. garage. Estimated cost, $75,000.

Mass., Springfield — Tetreault & Chase, 1174 St. James Ave., has awarded the contract for the construction of a 1 story, 50 x 104 ft. garage on State St. Estimated cost, $25,000.

Mass., Worcester—H. Glick, 36 Portland St., is having plans revised for the construction of a 1½ story, 65 x 134 ft. addition to his garage. Estimated cost, $50,000. E. T. Chapin, State Mutual Bldg., Archt. Noted Jan. 27.

Mass., Worcester — R. H. Long Co., Framingham, will build a factory for the manufacture of auto bodies and shoes, to include a 6 story, 75 x 600 ft. main building, 6 story, 75 x 300 ft. and a 6 story, 75 x 100 ft. buildings, on Millbrook St. Estimated cost, $2,000,000. Noted April 14.

R. I., Providence—W. A. Muiry Co., 97 Empire St., will soon award the contract for the construction of a 1 story, 120 x 135 ft. garage, sales room and service station, on Elmwood Ave. and Russell St. Estimated cost, $75,000. B. T. D. Martin, 86 Weybosset St., Archt. Noted April 7.

MIDDLE ATLANTIC STATES

N. Y., New York—(Borough of Manhattan) L. M. Gerry, c/o L. A. Sheinart, Archt. and Engr., 194 Bowery, has had plans prepared for the construction of a 3 story, 80 x 100 ft. garage at 195 Stanton St. Estimated cost, $85,000.

N. Y., New York—(Borough of Manhattan) H. I. Stitler, Inc., 529 Washington St., will soon award the contract for the construction of a 2 story, 82 x 100 ft. garage on Washington and Bethune Sts. Estimated cost, $50,000. Rouse & Goldstone, 512 5th Ave., Archts. and Engrs. Noted April 7.

N. Y., Utica—The Utica Motor Car Co., Kent St., will soon award the contract for the construction of a 2 story, 50 x 250 ft. garage and service station. Estimated cost, $250,000. L. Kinne, Mayro Bldg., Archt.

Pa., Bradford—Bovaird & Seyfang Co., manufacturer of boilers and engines, will soon award the contract for the construction of a 1 story, 150 x 187 ft. and 87 x 110 ft. factory buildings. Estimated cost, $100,000. Private plans.

Pa., Jersey Shore — The Jersey Shore Mine Car Co. will build an addition to its plant on Harris St., to include a blacksmith shop, assembly room, etc. C. R. Herritt, Genl. Mgr.

Pa., Philadelphia—A. W. Box & Co., Front and Poplar Sts., manufacturer of hoisting machinery, is having plans prepared for the construction of a 1 story, 110 x 300 ft. factory on Trenton and Tioga Sts. Estimated cost, $110,000. C. Wunder, 1415 Locust St., Archt.

Pa., Philadelphia — J. Epplers Machine Wks., 629 Filbert St., will build a 2 story, 40 x 80 ft. machine shop on North American and Buttonwood St. Estimated cost, $10,000.

Pa., Philadelphia — Mastbaum Bros. & Fleisher, 1424 South Penn Sq., are having plans prepared for the construction of a 2 story, 44 x 160 ft. sales and service station at 2011-13 Market St. Estimated cost, $125,000. Hoffman-Henon Co., Finance Bldg., Archt.

Pa., Philadelphia—T. Slattery, 1008 South 46th St., has awarded the contract for the construction of community garages, 1 story, 67 x 337 ft. and 27 x 30 ft. repair shop, on Redfield and Baltimore Sts. Estimated cost, $30,000. Noted April 14.

SOUTHERN STATES

La., New Orleans—Crane Co., 836 South Michigan Ave., Chicago, Ill., manufacturer of plumbing supplies, pipes, valves, etc., has acquired a site on Haiennie St. between Front and South Peters Sts., here, and plans to build a 7 to 10 story store room and manufacturing plant. E. Weil, 1312 Whitney Bldg., Consult. Archt.

Va., Hampton Roads — The Bureau of Yards & Docks, Navy Dept., Wash., D. C., will receive bids until April 27 for the construction of a machinery and carpentery shop, here.

W. Va., Charleston—The Charleston Bolt & Forging Co., organized with $200,000 capital stock, plans to build a factory for the manufacture of iron and steel machines, carriage and truck bolts, etc. Estimated cost, including machinery, $100,000.

MIDDLE WEST STATES

Ill., Chicago—A. Nielsen, 7938 South Laflin St., will soon award the contract for the construction of a 1 story, 100 x 255 ft. garage on Exchange and Phillips Aves. Estimated cost, $75,000. J. Kocher, 806 West 79th St., Archt.

Ill., Chicago—H. J. Schlacks, Archt., 721 North Michigan Ave., will soon award the contract for the construction of a 1 story, 75 x 175 ft. saw and planing mill on Bryn Mawr and Elston Aves., for the Natl. Lumber & Timber Co., 6 North Michigan Ave. Estimated cost, including equipment, $150,000.

Ill., La Salle—L. G. Olmsted, 4 Corners, has awarded the contract for the construction of a 1 story, 125 x 152 ft. garage on 2d and Wright Sts. Estimated cost, $120,000.

Mich., Petoskey—The Northern Auto Co., Mitchell St., has had plans prepared for the construction of a 1 story, 100 x 138 ft. sales and service station. Estimated cost, $40,000. Smith, Hinchman & Grylls, 710 Washington Arcade, Detroit, Engrs.

O., Cincinnati—The Quick Service Auto Laundry Co., 16-20 West Court St., plans to build a 1 story, 90 x 178 ft. garage and service station, at 2410 Gilbert Ave. Estimated cost, $75,000.

O., Cleveland—The Craig Motor Co., 1914 Euclid Ave., has awarded the contract for the construction of a 2 story, 75 x 210 ft. garage at 3800 Euclid Ave. Estimated cost, $75,000.

O., Cleveland—The Kadlecek Plumbing & Heating Co., 5365 Bway., has awarded the contract for the construction of a 3 story, 50 x 80 ft. commercial and light manufacturing building on McBride Ave. and Bway. Estimated cost, $50,000.

O., Cleveland—J. E. Mannen Co., 2241 St. Clair Ave., (sheet metal contractors), will soon award the contract for the construction of a 1 story, 72 x 132 ft. factory on East 21st St. and St. Clair Ave. Estimated cost, $40,000. W. Koehl, Park Bldg., Archt.

O., Cleveland—The Sterling Brass Co., 4610 St. Clair Ave., is having plans prepared for the construction of a 2 story, 75 x 90 ft. foundry and machine shop on East 93d St. and Catherine Ave. Estimated cost, $80,000. S. L. Weil, Pres. A. Sogg, 319 Hippodrome Bldg., Archt.

O., Columbus—Tullis & Puskar, Pittsburgh, leased a building at 205 East Copeland St., here, and plans to establish a machine shop, etc.

O., Ironton—The Ironton Stove Mfg. Co., manufacturer of gas heaters, plans to rebuild its plant which was recently destroyed by fire. Estimated loss, $150,000.

O., North Dayton—(Dayton P. O.) The G. & W. Mfg. Co., c/o Brownell Co., North Findlay St., plans to build a 2 story factory for the manufacture of by-product machinery. Estimated cost, $50,000.

Wis., Antigo—The Antigo Buick Co. has awarded the contract for the construction of a 1 story, 88 x 100 ft. garage. Estimated cost, $40,000.

STATES WEST OF THE MISSISSIPPI

Ia., Waterloo—The Illinois Central R.R., 135 East 11th Pl., Chicago, will soon award the contract for altering its shop, here. Estimated cost, $40,000. D. F. McLaughlin, 109 12th St., Chicago, Archt. F. L. Thompson, c/o owner, Engr.

Kan., Wichita—W. E. Brown, 1103 North Topeka St., has awarded the contract for the construction of a 2 story, 100 x 140 ft. garage. Estimated cost, $170,000.

Minn., Grand Rapids—C. Chalberg plans to build a 2 story, 50 x 140 ft. garage. Estimated cost, $40,000.

Mo., St. Louis—The Axelson Machine Co., Boyle Ave., Los Angeles, Cal., has awarded the contract for the construction of a 1 story, 70 x 360 ft. factory on Eichelberger St. along the tracks of the Missouri Pacific Ry., here. Estimated cost, $90,000. Noted Jan. 20.

Mo., St. Louis — The Power Truck & Tractor Co., Beard and Goldsmith Sts., will build a 1 story, 25 x 300 ft. assembly building on Goodfellow and Wabash Sts.

Mo., Springfield—The Ampco Metal Products Co., 301-2-3 Woodruff Bldg., plans to build a 60 x 120 ft. sheet metal product plant and foundry. Estimated cost, $10,000. W. K. King, Secy. and Treas.

Okla., Okmulgee — The Rebold Knock Down Tank Co. will build and equip a factory. Estimated cost, $50,000.

Tex., Dallas—The Berger Mfg. Co., 711 Trust Bldg., has awarded the contract for the construction of a 1 story, 180 x 220 ft. factory, on Pearl and Corinth Sts., for the manufacture of metal building materials. Estimated cost, $35,000.

WESTERN STATES

Cal., Los Angeles—The All-In-One Co., 504 Marsh Strong Bldg., is having plans prepared for the construction of one 3 story and seven 1 story factory buildings, on Slauson Ave. and Downey Rd., to include a 50 x 200 ft. pattern shop, 200 x 200 ft.

foundry 50 x 200 ft. cleaning room, 75 x 200 ft. enameling building, etc., for the manufacture of bath tubs and plumbing fixtures. Estimated cost, $350,000. J. C. Peterson, Peoples Bank Bldg., Sacremento, Archt.

CANADA

Ont., Ottawa—The city will soon award the contract for the construction of a 1 story workshop and machine shop on Chamberlain Ave. Estimated cost, $60,000. A. F. Macallum, City Hall, Engr.

Ont., Toronto—The Auto Repair Parts Co., 144 Simcoe St., will soon receive bids for the construction of a 1 story, 30 x 50 ft. garage. Estimated cost, $18,000.

Que., Montreal—P La Belle, 721 Dorchester St., W., will receive bids until April 27 for the construction of a 3 story garage and automobile repair station on Argyle Ave.

General Manufacturing

NEW ENGLAND STATES

Conn., Hartford — Aetna Brewing Co., 537 Windsor St., has awarded the contract for the construction of a 2 story, 35 x 50 ft addition to its ice cream plant. Estimated cost, $10,000.

Conn., Thompsonville—Hinsdale, Smith & Co., 324 Main St., plans to build a 2 story addition to its tobacco factory on Central St Estimated cost, $50,000. Private plans.

Me., South Portland—(Portland P. O.) Monks & Johnson, Archts and Engrs., 99 Chauncey St., Boston, will open bids about May 1 for the construction of a 6 story, 60 x 120 ft canning factory and wharf, on Front St., here for the W. Underwood Co., 52 Fulton St., Boston. Estimated cost, $250,000.

Mass., Brockton—The Puritan Shoe Co., 88 Main St., has awarded the contract for the construction of a 1 story shoe factory on North Main St Estimated cost, $45,000.

Mass., South Braintree—(Boston P. O.) The Monatiquot Rubber Wks. Co. will build a 1 story rubber factory on Hancock St. Estimated cost, $200,000. Noted March 24.

Mass., Worcester—M. K. Smith Co., 31 Central St., has awarded the contract for remodeling its 2 story woodworking factory. Estimated cost, $20,000.

R. I. Arkwright—(Fiskeville P. O.) The Interlaken Mills will soon award the contract for the construction of a 1 and 2 story textile finishing mill and weave shed. Estimated cost, $150,000. C. R. Makepiece & Son, Butler Exch. Bldg., Providence, Engrs.

R. I., Providence — The Sunshine Ice Cream Co., 372 Cranston St., is having plans prepared for the construction of a 2 story, 40 x 80 ft. ice cream plant, etc, on Cranston and Diamond Sts Estimated cost, $75,000. F. Chiaverini, 117 Bway, Archt.

R. I., Woonsocket—The Sydney Worsted Co., Mason St., has awarded the contract for the construction of a 2 story, 80 x 166 ft. mill. Estimated cost, $100,000.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Julo Bottling Co., Galveston, Tex., subsidiary Southern Beverage Co., 200 West Camden St., has awarded the contract for the construction of a 1 story, 30 x 60 ft. bottling plant on North Ave., here. Estimated cost, $20,000. Noted March 3.

N. Y., Buffalo — The Dohn Fisher Co., 1340 Niagara St., has awarded the contract for the construction of a 2 story, 85 x 122 ft. planing mill. Estimated cost, $24,900

N. Y., Buffalo—The Kurtzmann Co., 526 Niagara St., plans to build a piano manufacturing factory and warehouse on Genesee St. Cost to exceed $100,000. H. E. Plumer, Ellicott Sq Bldg., Engr.

N. Y., Chaumont—Adams & Duford Co., manufacturer of crushed limestone, plans to build a 2 story, 40 x 60 ft. addition to its plant. Cost between $15,000 and $20,000. Address E. B Johnson, Purch. Agt.

N. Y., Geneva — The Geneva Preserving Co., 55 North St., plans to build a 3 story, 190 x 200 ft cold storage plant. Cost between $60,000 and $70,000. Address E. S. Thorne, c/o owner.

N. Y., Ithaca—The New York School of Agriculture, Albany, will soon receive bids for the construction of several dairy buildings at Cornell University, here. Estimated cost, $40,000. L. F. Pilcher, Hall of Records, New York City, Archt. and Engr.

N. Y., New York (Borough of Brooklyn)—The Brooklyn Butchers Corp., 3285 Fulton St., has had sketches prepared for the construction of a 3 story, 130 x 135 ft. refrigerating plant, on Atlantic Ave. and Ft. Greene Pl Estimated cost, $250,000. Jallade, Lindsay & Warren, 129 Lexington Ave., Archts. and Engrs.

N. Y., Pyrites—The De Grasse Paper Co will soon award the contract for the construction of a 4 story, 36 x 50 ft. addition to its paper mill. Estimated cost, $30,000.

N. Y., Tonawanda—J Spaulding & Sons have awarded the contract for the construction of a fibre and paper plant, to include one 5 story building and seven 1 story buildings. Estimated cost, $500,000.

N. J., Trenton—The Trenton Poster Advertising Co., Lambert St, will soon award the contract for the construction of a 3 story, 40 x 80 ft factory. W. A. Klemann, 1st Natl. Bank Bldg., Archt.

Pa., Lebanon—The Keystone Macaroni Co., 8th and Water Sts., will receive bids about April 26 for the construction of an 8 story, 85 x 121 ft. factory. Estimated cost, $75,000. H. T. Hauer, 829 Cumberland St., Archt.

Pa., Philadelphia — Bodenstine & Kuemmerle Co., 1041 North Lawrence St., manufacturer of chairs, will soon award the contract for the construction of a factory on Lawrence and Cambridge Sts. C. E. Schermerhorn, 430 Walnut St., Archt.

SOUTHERN STATES

Fla., St. Petersburg—The Biltwell Furniture Co. is building a 1 story, 50 x 160 ft. furniture factory on 17th St. and 5th Ave. Estimated cost, $10,000. T. H. Kards, Pres. and Genl. Mgr.

Fla., Tampa—The Florida Grower, Inc., 513-17 Maxwell Ave., plans to build a 2 story, 50 x 100 ft. publishing plant on Grand Central Ave. Estimated cost, $40,000.

Va., Richmond—The Kingan Packing Co., 15th and Cary Sts., has awarded the contract for the construction of a 3 story, 65 x 90 ft. factory. Estimated cost, $37,000.

MIDDLE WEST STATES

Ill., Centralia—The Amer. Rubber Co., 1526 South Wabash St., Chicago, has awarded the contract for the construction of a 2 story, 70 x 360 ft rubber factory and power plant, here. Estimated cost, $150,000.

Ill., Chicago—The Kosmos Ice Cream Co., 5820 South Halsted St., will soon award the contract for the construction of a 2 story, 50 x 100 ft ice cream factory. Estimated cost, $65,000. M. R. Carpenter, 72 West Washington St, Archt.

Ill., Chicago — The Creamery Package Mfg Co., 61 West Kenzie Ave., will open bids about May 1 for the construction of a 4 story, 200 x 400 ft factory on Curtis Ave. and Division St. M. Tullgren & Sons, 425 East Water St, Milwaukee, Archt. Noted Feb. 10.

Ill., Harrisburg—The Bd. Educ. is having plans prepared for the construction of a 2 story, 140 x 140 ft. school, to include a manual training room. Estimated cost, $300,000. G Davenport, Pres. A. L. Barnes, 1329 Birchwood Ave., Chicago, Archt.

Ill., Winchester—The Bd. Educ. plans to build a 3 story community high school, to include a manual training department. Estimated cost, $140,000. M. Glase, 728 North Main St., Quincy, Archt.

O., Grove City—The Grove City Co-operative Milling Co. is having plans prepared for the construction of a 2 story mill. Estimated cost, $40,000. Agricultural Eng. Co, Columbus, O. Engrs.

O., Massillon—The Northern Ohio Butterine Co., c/o F. G. Harrison, Mgr., plans to build a 3 story, 60 x 90 ft. factory. Estimated cost, $40,000.

Wis., Milwaukee—The Random Lake Ice Co., 64 Locust St., has awarded the contract for the construction of a 130 x 140 ft. ice manufacturing plant. Estimated cost, $80,000

Wis., Two Rivers—The Wisconsin Textile Mfg. Co., c/o G. C. Hirst, Mgr. will soon receive bids for the construction of a 1 and 2 story. 60 x 180 ft. plant on Main St. Estimated cost, $50,000.

STATES WEST OF THE MISSISSIPPI

Col., Silverton—The Red Mountain Silver Mining Co., 150 West 47th St., New York City, has awarded the contract for the construction of a reduction mill, here. Estimated cost, $100,000.

Ia., Cedar Rapids—The Sawyer Biscuit Co. plans to build a bakery. Estimated cost $250,000. R. Hatchitt, Pres. Architect not announced.

Ia., Council Bluff—The Pacific Fruit Express Co, 65 Market St., San Francisco, Cal., will build a 1 story, 200 x 300 ft. refrigerating plant, here. Estimated cost, $700,000.

Ia., Des Moines—S. Binghams Sons Mfg. Co., 609-611 Chestnut St., has awarded the contract for the construction of a 3 story, 50 x 120 ft. factory at 1027 West 5th St., for the manufacture of printers' rolls. Estimated cost, $45,000.

Ia., Sioux City—The Nolen Laundry Co., 411 Jackson St., is having plans prepared for the construction of a 4 story, 50 x 150 ft. laundry, at 508 Jackson St. Estimated cost, $110,000. J. A. Duffy, Pres.

Minn., Bemidji — The Bemidji Concrete Mfg. Co. is having plans prepared for the construction of two 2 story, 50 x 120 ft. factory buildings. Estimated cost, $60,000. M. L. Morse, Mgr.

Minn., Carlton—The Zenith Concrete Gravel Co. is having plans prepared for the construction of a washing and screening plant, etc. Estimated cost, $50,000. H. H. Kelly, Mgr.

Minn., Minneapolis—The Sanitary Mattress Mfg. Co., 511 1st Ave., N. E., is having plans prepared for the construction of a 2 story, 65 x 140 ft. factory and office building on Bway. and Tyler Sts., N. E. Estimated cost, $40,000. G. A. Schnabel, Pres.

Minn., Ottertail—The Ottertail Creamery Assn. has awarded the contract for the construction of a 2 story, 54 x 62 ft. creamery. Estimated cost, $28,000. Noted Nov. 4.

Mo., St. Louis — C. P. Curran Printing Co., 102 South 8th St., has awarded the contract for the construction of a 2 story, 100 x 115 ft. printing plant on 7th and Gratiot Sts. Estimated cost, $100,000. Noted April 14.

Mo., Springfield — The Welsh Packing Co. is having plans prepared for remodeling old plant and constructing a 3 story, 120 x 160 ft. packing plant. Estimated cost, $75,000. M. P. Burt & Co., Mempnis, Tenn., Engrs.

CANADA

Ont., Brockville—The Laing Produce & Storage Co., Water St., plans to build a tin can factory. Estimated cost, $30,000. J. R. A. Laing, Mgr.

Ont., Port Hope—The Port Hope Hospital Trust will soon award the contract for the construction of a 2 story, 40 x 77 ft. laundry. Estimated cost, $50,000. Ellis & Ellis, Manning Chambers, Toronto, Archts.

Ont., Stayner—The Georgian Bay Milling & Power Co. plans to rebuild its flour mill which was recently destroyed by fire. Estimated loss, $120,000.

Ont., Trenton—The Chemical Products of Canada, 36 Toronto St., Toronto, has awarded the contract for the construction of a 120 x 340 ft. acid sulphate plant, here. Estimated cost, $200,000.

Ont., Wallaceburg—The Wallaceburg Cut Glass Ltd. plans to construct a glass grinding factory and a plant for the manufacture of cut glass.

Que., Montreal—The Maisoneuve Box & Board Co. will soon receive bids for the construction of a box manufacturing plant on Maisoneuve St. C. Abee, Pres.

Que., Montreal—St. Lawrence Flour Mills Ltd., has awarded the contract for the construction of an addition to its mill on Notre Dame St. Estimated cost, $25,000.

Que., St. Hyacinthe—A. St. Germain will soon award the contract for the construction of a 45 x 100 ft. biscuit factory. E. Richer, 240 Girouard St., Archt.

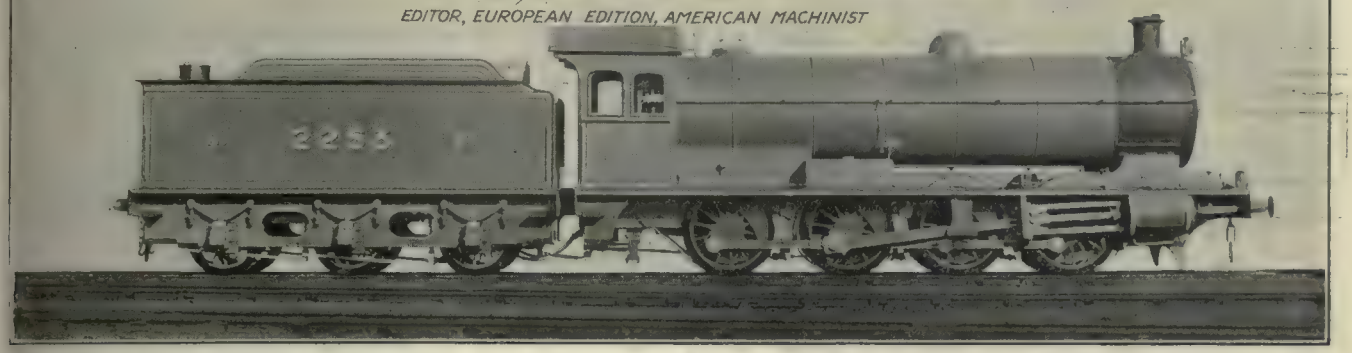
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Locomotive Building in an English Shop

By I. Wm. Chubb

EDITOR, EUROPEAN EDITION, AMERICAN MACHINIST



IN GREAT BRITAIN probably no class of manufacturers returned from war to peace production with the same celerity and efficiency as the organizations generally known as the armament firms. From the first they showed an understanding of world requirements far in advance of that of most other manufacturers. In particular Armstrong, Whitworth & Co., Ltd., saw what would be wanted very clearly when it set out to build locomotives at Scotswood, near Newcastle, in shops where previously it had been turning out shells, some 15 millions of which were produced, ranging from 10-pounders to 18 in., not counting bombs, star shells and other munitions. In December, 1918, this particular works contained 2,216 machines with six 1,000-ton, two 800-ton, four 500-ton, four 300-ton, twenty-four 250-ton, six 100-ton and six 50-ton presses and in addition four pumping-engine plants, all of which had to be removed before work on locomotives could be commenced. Fig. 1 is an airplane view of the works. The area available is some 34 acres, the frontage on the river Tyne being about one-third of a mile. The locomotives are produced complete except that the boiler shop (not dealt with here) is at Elswick 1½ miles or so away.



FIG. 1. AIRPLANE VIEW OF WORKS

Production was at first necessarily slow, about a year having elapsed before the first locomotive was completed. In the next 6 months, 19 locomotives were completed and delivered. Within the following 2 months 23 locomotives were similarly produced, the rate finally reached being about 200 a year. The works as a whole are regarded as capable of an annual output of 300 locomotives.

It must be recalled that the firm had never previously built locomotives and that it had to re-equip many of its shops; to gather together the necessary skilled and experienced staff and to educate and train much of the labor employed. The shops are divided into sections, each section dealing with its own process or locomotive detail.

A control chart is used to follow the material from the offices through the works. Placed against a wall of the production office, a board measuring about 12 x 6 ft. is divided into 16,000 $\frac{1}{8}$-in. squares. Each vertical column represents a day, the board covering about 6 months. The board is divided horizontally by about 90 lines and has two wooden runners sliding in grooves at the top and bottom. One runner contains the names of the unit assemblies, while the other one is divided in the same manner horizontally, but vertically according to the orders in hand, each main order being subdivided. Thus, on the second runner are three sets of celluloid disks. The disks are placed on springs driven into the board, this applying both to the particular runner now being described and to the main board. Each main order has disks of 4 colors, the form depending on the order. A yellow disk on the runner shows by figures the number of sets of details for that particular part actually delivered to the erecting shop. Similarly, blue disks show the number of sets of details for that part delivered to the stores, and red disks indicate by the figures on them the number of that particular unit in process of manufacture. A white disk marked "nil" will show that no such part is needed on the particular engines.

The Control Board

On the main board are a number of green disks which show for each day the number of the particular units which should arrive on that day in the erecting shop.

For the control of the production department, charts are made out and placed on the adjoining wall, giving

Page.....

Sir W. G. ARMSTRONG, WHITWORTH & Co, Ltd

Department .....

DETAILED LINE UP.

Working No ..... Order No..... For..... Section.....

Date Commenced..... Date Completed.....

G Z.6

Detailed Schedule Number.	Drawing No.	Material. From	Material. Date Due.	Shop No.	Working No. A/c No.	Working No. Order.	Working No. Section.	Working No. Mark.	Description of Detail.	Detail. Per Set.	Detail. Per Order.	Operation. Item.	Operation. Nature.	Operation Check Card Number.	Estimated Time.						

FIG. 2. DETAILED LINE-UP SHEET

lists of the main orders with the number of engines, name of the railway, dates when drawings are required, when planned, when detail line-up was issued, when estimates of time were issued and also the order of and under each column is the number of locomotives delivered, engines sent to the paint shop, tenders to paint shop, engines steamed, boilers received, locomotives delivered, and the mileage finished.

RECORD OF PROGRESS.

BLACK—Day Work. GREEN—Night Work. RED—Credits.

	No.	Total to Date.	No.	Total to Date.	No.	Total to Date.	No.	Total to Date.	No.	Total to Date.	No.	Total to Date.	No	Total to Date.	No.	Total to Date.	No.	Total to Date.	No.	Total to Date.	No.	Total to Date.	No.	Total to Date.
No Completed.																								
Time Taken.																								
No. Completed.																								
Time Taken.																								
No. Completed.																								
Time Taken.																								
No. Completed.																								
Time Taken.																								
No. Completed.																								
Time Taken.																								

FIG. 3. BACK OF LINE-UP SHEET

priority. These charts are divided into squares and white disks show the numbers of drawings issued, etc. Spare part orders are tabulated in the same way.

Another chart is divided vertically into main orders

SIR W. G. ARMSTRONG, WHITWORTH & CO. LTD.

LOCOMOTIVE DEPT.

OPERATION CHECK CARD. No.....

SHOP NO..... Folio.....

L.M.D. 3.

as 10436-3

Dr. & Wkg. No.	Name of Piece	No. of Pieces per Engine.
Issue No.	Operation	No. of Engines on Order.
Item No.	Price	Pieces in Order.

Board No.	Name of Operator.	Date.	Time Taken.	No. Completed	Total Completed	Foreman's Signature.

FIG. 4. OPERATION CHECK CARD

A program is set out for three months and sent to every person concerned, giving dates for various orders, dates for materials for machining and final delivery dates.

The production department takes charge of the planning of material; of the issuing of working orders and instructions in shops; of estimates for machining time and the securing of tools and jigs.

Usually material dates are spread over 38 days, machining dates over 24 days and erecting over 18 days. The chart enables orders to be issued to time, as for any particular unit, a rod corresponding in length to the time necessary can be placed on the corresponding springs and with one end over the erecting shop date shows on the other end the date on which orders should be placed for delivery. Thus the chart acts as a material control. The dates, of course, relate to unit assemblies and the production department can give a definite date for any given detail between the limits mentioned.

Every morning a meeting of the superintendents of

the various shops is held in the production office, with the official responsible for the ordering of material and his chaser; the production engineer and anyone likely to be interested, such as the toolroom foreman.

JOB TICKET. No.....

Date.... ..... 19.....

NAME ... .

BOARD NO ... ... CARD NO.... ... .

JOB TO BE DONE.

Quantity.	Name of Part.
Drg. No.	.....
Wkg. No.	Operation
Detail No.	.....

Day Work

Piece Work..... .....each

..... FOREMAN.

This Ticket to be retained by Employee

L.M.D. 7A

FIG. 5. JOB TICKET

At this meeting reports are discussed, the work planned is brought under observation and in short the meeting acts as a clearing house for shop difficulties.

Each order has its own letter symbol according to class and number. The complete locomotive is divided into units each with its own letter, being further divided into items shown by a number after the unit letter. Thus *A* might stand for the boiler, while *A6* would represent the dome and cover. Similarly *C* would stand for the frame, *C7* for the axle box and lubricator, *D* for wheels, and so on. The component parts for each unit assembly are recorded in a book. This method is also adopted when a schedule of operations is got out. The drawing officials are given a time by the production engineer for their work and they provide a schedule as to quantities, etc., for every part, this schedule being placed on each drawing so that the whole gives a complete schedule of parts to be ordered. A copy is issued to the stores to record the movements of material, the production office having previously given dates for material supply.

NAME OF PIECE **PLANNING OPERATION SHEET** SECTION ORDER

SCHED. ISSUE No.	DRAWING No.	SHOP No.	MATL / OPERATION	EX	No. PER ENG. SET.	No. OF E.S.	No. OF PIECES

FIG. 7. PLANNING OPERATION SHEET

It is a further duty of the production department to set out the detailed line-up or instruction sheet (Fig. 2). This sheet shows the materials required for a given detail, also the shop at which the work is to be done, the nature of the work being set out by operations. A copy of each line-up sheet is kept in the production office, another goes to the department concerned and another is sent to the accounting office, to eventually show the actual cost of each operation and actual-against estimated machining time. Progress is entered daily on the back of the line-up sheet, Fig. 3. With this sheet is issued an operation check card (Fig. 4) to act incidentally as a piece card if piece-

SIR W. G. ARMSTRONG, WHITWORTH & CO. LIMITED

Shop No. ... Section ... Order and Working No. ... Contract ...

Schedule Issue No. ... Drawing No. ... Ref. No. ... No. per Engine ...

No. of Engines ... No. of Pieces in Order ... Material ...

Name of Piece ...

Description of Operation ...

Date of Estimate ... Estimated by ... Approved by ...

Estimated Time for ... Pieces ... Hours ... Minutes

... Piece Work Price for ... Pieces ... £ ... s. ... d.

Table of Operations	Calculation.	No. of Mins.
Setting		
Gauging		
Tools		
Table		
Machine		
Take Out		
Net Estimated Time		
Allowance		
Total		
Actual Time Taken		

No. of Cuts	R.A.	F.	Cutg. Speed	Ft. per min.	Feed	R.A.	F.

PIECE WORK ESTIMATE No.

FIG. 8. PLANNING FORM

work is employed, while a job ticket (Fig. 5) is given to the workmen to verify the price, one being also sent to the production department, the price not being put on the operation check card. The latter being too small

SIR W. G. ARMSTRONG, WHITWORTH & CO., LTD.

GANG WORK CARD.

Shop No.... Gang No.....

Week Ending.....19.... Pay No.....

DESCRIPTION OF WORK..... PRICE.....

Board No.	Names.	Wed.	Thur.	Fri.	Sat.	Sun.	Mon.	Tues.	Total	Rate.	Details.	Piece Work.	War Bonus.	% Bonus.	Total.

Quantity Done..... At.....per..... Amount to Allocate

Foreman's Daily Signature

Time.	Work Card.	Estimate	Check	Per Cent

.....Asst. Supt.

FIG. 6. GANG WORK CARD



FIG. 9. COKE FIRE IN SMITH SHOP

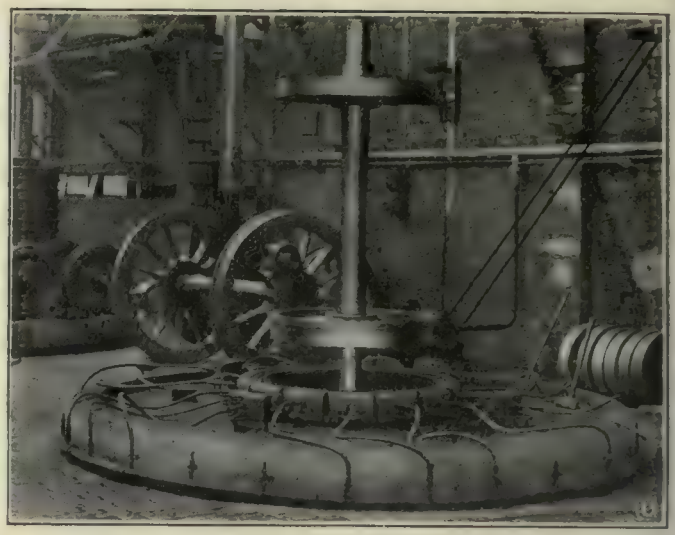


FIG. 10. HEATING TIRES FOR SHRINKING

where a number of men are working on the job, the gang card (Fig. 6) is then used and the information is transferred to the operation cards from the details thus available. The operation check card is issued by the shop foreman as authority to proceed.

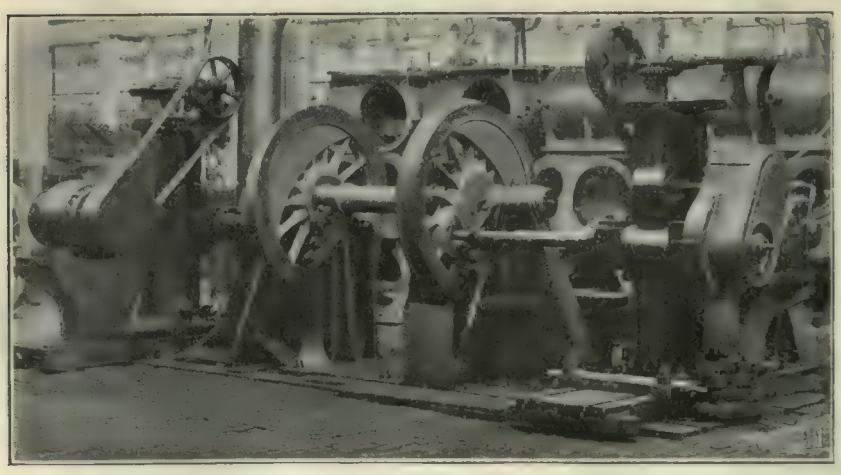
"Hollerith" cards stamped out in the tabulating machine show the time taken, piecework, day work, and other costs, etc. The planning engineer works under the direction of the production engineer, using card indexes of the capacity of the machine tools in the shops and noting any special jigs, fixtures, etc., wanted, stating also the number of parts to be machined in a batch. A jig list is sent to the production department drawing office. The planning form is sent out in duplicate, one copy for the time-estimating section and the other for the line-up typist, and all prices are typed on a special machine, kept locked when not in use. The time estimator works beside the planner and controls the piecework. He shows for every part on a sheet the time required, etc. The usual methods of time estimating are by straight calculation on average machining times or by means of machining charts. The planning engineer controls the line-up and the sheets collected for each shop form an instruction to the shop as to procedure from which no departure is, as a rule, permitted. The shop foreman will help the planner if he is in doubt as to order of machining.

Thus far it has not been the practice to nominate work for individual machine tools: This is the province of the shop superintendent and his foreman. But an attempt has been made to balance the machine loads, the total machine hours estimated as required on a given number of individual jobs being divided by the number of machines available of the required kind to find the time ratio for the processes. This is done for the different classes of tools and if the same ratio is obtained balance results. Out of balance loads in one section should cancel similar loads in other sections.

In the following account no attempt is made to deal adequately with the works organization, equipment or methods, but a number of notes on some of the more interesting details are offered.

In the smithy, coke furnaces (Fig. 9) are employed for some of the heavier work in place of the ordinary forge furnaces. The blast is admitted above the plate and a space below is left for clearing. The space is filled with coke, and brickwork is built up to suit the job, this being done every time the fire is used. Thus practically a coke furnace is formed. As regards the workers the advantage is that the smithy is not so hot as with the ordinary forge furnace.

Cylinders are tested for porosity under water pressure of 275 lb. per square inch, though this varies according to the order. Cylinders for locomotives for India have to be tested according to requirements either with boiling or cold water. The cylinder-boring



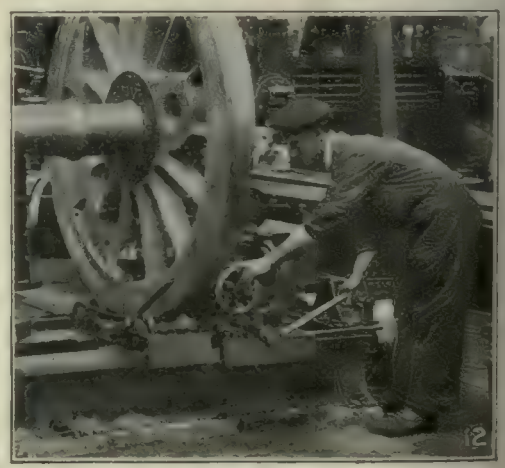


FIG. 11. BORING DRIVING WHEELS FOR CRANKPINS. FIG. 12. DRILLING AND TAPPING FOR STUDS TO SECURE TIRE TO WHEEL CENTER

machines will each bore and face a pair of cylinders 20 x 26 in. in 8 hours.

Regarding pressures employed for force fits for axles the allowance is about 8 to 10 tons per inch of diameter. In crankpins the usual total pressure is about 60 tons, and as regards the contraction of tires 0.001 in. to the inch in diameter is the allowance.

Shrinking Tires on Driving Wheels

For shrinking tires on wheels the axle and wheel centers are suspended vertically above the tire (see Fig. 10), and the tire itself lies on a circular cast-iron bed built up on concrete. Round the bed is a gas and compressed air ring, from which supply is taken through rubber pipes to a series of about 18 bunsen burners with baffles to insure that the heat is directed on to the tire. The tire is heated for about 20 minutes to half an hour when the center is lowered in and the tire allowed to cool.

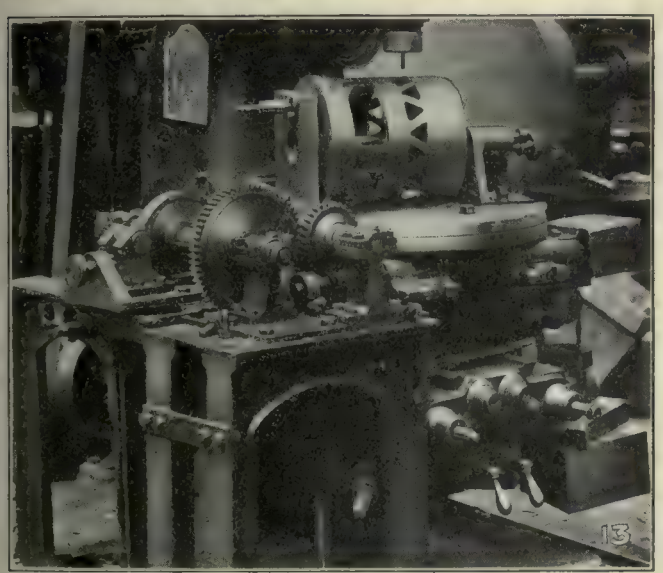
Wheels are turned in pairs, both sides being faced down simultaneously so that four cuts are in operation, the speed being 35 ft. per minute on rolled cast steel. The wheels are then shifted to another lathe to be turned on the tread, a wide form tool being employed. Axles are rough-turned in lathes and finish-ground both as to wheel seats and journals, including radii. The cast-steel wheel centers are turned, faced and bored in one operation in vertical mills and the axles are forced in by three-ram hydraulic presses, the rams working independently or together.

A double-ended quartering machine for boring crankpin holes in wheels holds the axles between centers, as illustrated in Fig. 11, the center brackets being adjustable according to the axle lengths. The position of the boring bar is adjustable vertically and horizontally, and it is supported in brackets, as illustrated. The necessary taper is given by carrying the boring-toolholder in an inclined groove, a screw and star wheel giving the feed. Two cuts are taken, roughing and finishing, and holes are bored to fixed caliper gages, the pins being turned to suit the holes. The first pair of wheels of a set are marked-off; the quartering machine is set-up to the marking-off and the wheels are bored and examined at the marking-off table. If the result is found correct the rest of the set are machined in the same way.

The drilling machine used also for tapping holes for studs for securing the wheel centers to tires is illustrated (Fig. 12). The wheels, with axle in place, are carried on rollers on a horizontal bed. The drilling head, with belt feed, is carried on an arm which projects between the spokes and drills a vertical hole. The hole is afterward tapped by the same machine. When this has been done the drill or tap is raised and the head slides back clear of the wheel, which can then be rotated to the next stud position.

Milling Triangular and Rectangular Holes

The piston-valve liners have a series of triangular and rectangular slots milled in them and the appliance devised for this work, as shown in Fig. 13, can be attached to any vertical drill or vertical milling machine. On the circular table of the machine is another table which carries the work by means of a fixture containing a dividing head bringing the liner into position for each slot. The loose table on the circular table provides adjustment for the series of two opposing triangular slots that have to be formed. Separate from the machine and carried on pedestals at the side is a horizontal shaft, bearing cams which control the position of the liner longitudinally. At the same time the circular table can revolve, thus producing the triangular or other form of slot required. The camshaft is driven by worm gear and by means of a cone clutch it can be adjusted independently for setting the cams to suit the work.



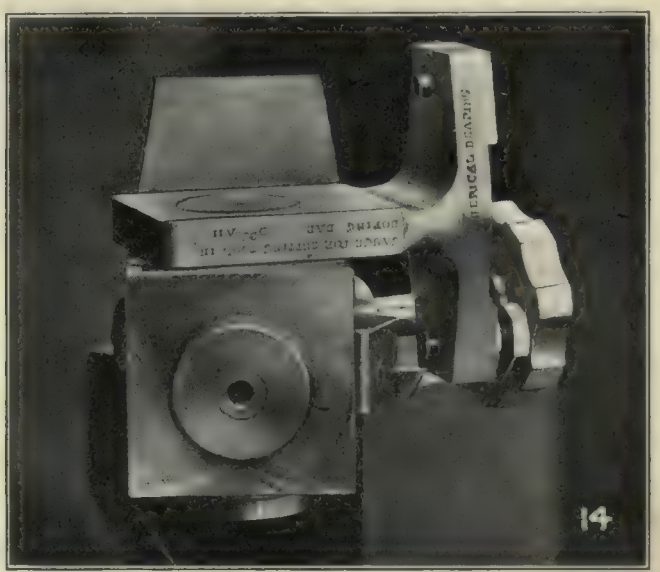


FIG. 13. ATTACHMENT FOR MILLING TRIANGULAR AND RECTANGULAR SLOTS. FIG. 14. BORING TOOL FOR SPHERICAL WORK

A boring tool for spherical bearings as used in the turret lathe is shown in Fig. 14. The necessary swing is given to the tool by worm gearing operated by the knob shown. The gage is applied for setting the tool itself.

For the machining of such details as the saddle-frame stay placed under the boiler at the smokebox end, the appliance shown in Fig. 15 is used. It is fixed on the cross-rail of a planer. A circular plate carries a long arm to which is secured a tool, set to the required radius. The center of the swing can be adjusted by moving the saddle along the cross-rail. The arm is

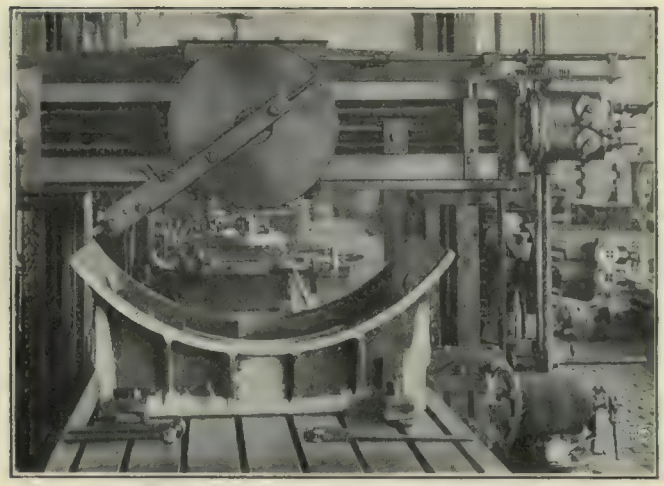


FIG. 15. MACHINING A CIRCULAR JOINT

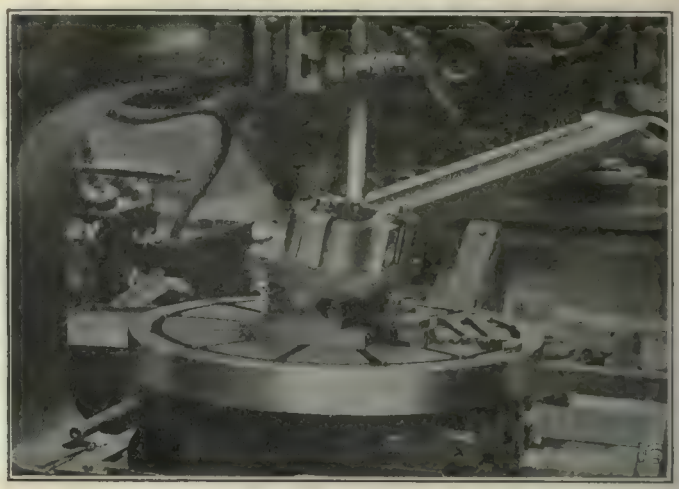


FIG. 16. ADJUSTABLE ANGULAR PLATE

given circular motion by worm gearing, the table of the machine being stationary during the cut. The feed is by hand. Cuts ¼ to ½ in. deep with 1/16-in. feed are possible for roughing and 1/16 in. deep with ⅛-in. feed for finishing in cast steel.

The tilting device used for giving the required angle when slotting a connecting rod end for the block taking up the wear of brasses is shown in Fig. 16. A couple of brackets are pivoted to each other in such a way as to hold the work at angles in two directions.

A tool for undercutting in connection with the lubricator machined solid with the coupling-rod end is illustrated in Fig. 17, the tool forming a reservoir for oil. First of all trepanning is undertaken by a tool which is half a hollow cylinder in cross-section. This tool leaves a central tit forming the oil pipe. The work is done in an ordinary vertical drilling machine.

Holes for gudgeon pins in rod ends are reamed by taper reamers of the type illustrated in Fig. 18. The taper employed is 1 in 8, and the reamers with a spacing collar between, are built up similar to the firm's inserted-tooth milling cutters.

Holes for coupling rods are machined in duplex machines to marking-off and when bored the centers are never more than 0.001 in. out.

Much slab milling is done in the works, and with cutters 6 in. in diameter by 20 in. wide running at 35 r.p.m., cuts ¼ in. deep are taken in mild steel with feeds of 1¼ to 2 in. per minute.

The Frame Shop

In the frame shop, plates up to 35 ft. in length are received rough-machined to shape. Three frame-plate slotting machines are employed, each having triple heads. The plates are slotted 20 at a time, that is, 10 sets of frames 1 in. thick. In batches of four they pass to triple-head drilling machines where they are drilled to templets. The frames are straightened by a pneumatic hammer which reduces the number of marks on them as compared with hand-hammer straightening.

In the tender shop, which is in three bays, the work proceeds to some extent in parallel, all parts needing machining passing down one bay; plates to be straightened and drilled going down a second bay, while plates and angles requiring flanging pass down a third bay. At the end of the shop the tanks are tested and then moved on to the first bay when they join frames and wheels, etc., and are completed, being finally painted in the erecting shop.

In the tender section, a friction saw is used for cutting up tees, angles, etc., 4 x 6-in. channel steel being

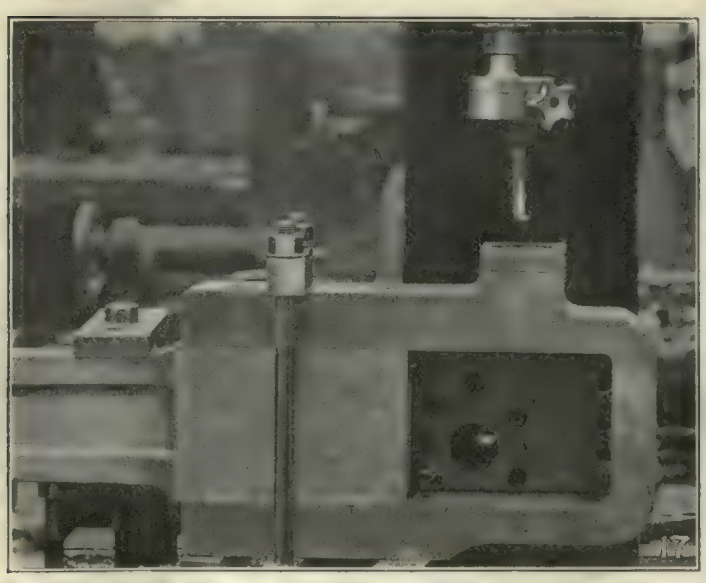


FIG. 17. AN UNDERCUTTING TOOL

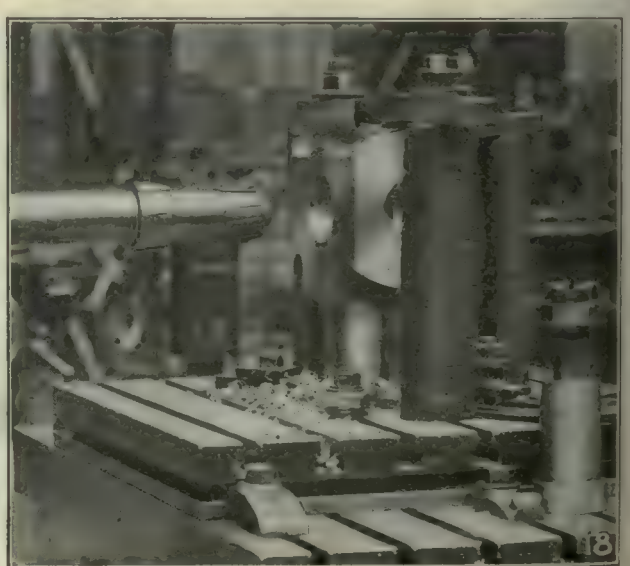


FIG. 18. TAPER REAMING GUDGEON HOLES

cut off in 10 seconds. The saw is 4 ft. in diameter by ¼ in. wide and runs at 2,900 r.p.m. The center, 3 ft. diameter is of mild steel. Over the center is shrunk a rim of hard cast steel which is firmly secured by four dowels.

The Erecting Shop

The erecting of locomotives is done on the gang system, there being ten gangs, each with a responsible leader. The work is unit erection, and the various gangs are concerned respectively with frames, boilers, cylinders, and platforms, cabs and splashers, fire boxes, motions and steaming; the last gang stripping the engine after the trial runs, when it goes to the packing gang, another gang also being concerned with delivery of the locomotive. As an example of the erection of details it may be mentioned that crosshead guides are erected on their own back covers as on the engine, central for the crosshead, and then passed on with liners and crosshead complete, ready as a unit for final erection. The erection of the locomotive is, in fact, a three-stage business as work on frames and axle boxes



FIG. 19. HOME-MADE LENGTH COMPARATOR FOR COMPARING LENGTHS UP TO 10 FT.

goes on together; similarly, boilers and cylinders, with foot plates are dealt with simultaneously, also smoke boxes and cabs. Then wheeling and motions are attended to, with finally steaming, stripping and packing. Insulation goes on with the boiler in position. For painting the spray is being used in place of the brush, an ordinary specification for British locomotives being one coat of lead color, five coats of mineral filling, one coat of lead color, two coats of drop black, one coat of black japan and four coats of copal varnish, the work being rubbed down between the coats.

Toolroom Equipment

The toolroom is in three sections, gage-making, tool-making and jig-making, and in each section the machine tools employed are arranged according to their class. A home-made comparator is illustrated in Fig. 19. The bed is an I-beam planed on top and carries two headstocks and supports for the piece to be measured. In use a standard rod is placed between the headstocks, that on the right-hand being set to zero. Then by means of the micrometer device on it, measurements are made to 0.01 mm. or the equivalent in inches. It should be explained that the firm have to work both to inch and metric measurements. The appliance is handy for toolmakers comparing lengths up to 10 ft. and can readily be protected by a box cover. A 13-ft. vernier divided in subdivisions of both inches and meters is employed for more accurate measurements. It is the endeavor to avoid unnecessary pattern-making, and all complicated jigs are built-up with a view to the component parts being used to suit other like parts by the addition or subtraction of locating pieces. The button system is worked to, and standard bushings are employed. The jig stores are divided into bays, in each of which the jigs, templets, etc., for a given order are collected according to a detailed list which hangs conveniently in the bay.

Light cylindrical and taper gages are formed from I-beams, the flanges being bent over somewhat by the blacksmith and then turned to diameter. Gages of this form are employed in sizes ranging from 2½ up to 8 in. in diameter.

Drawings and Blueprints

A note may be made on the recording and distribution of drawings. For workshop purposes blueprints are made on linen and are kept in a separate department, the prints being in drawers folded-up with the numbers showing. Index cards showing the drawings for each order are got out, one set of cards for the stores and one set for the shops. A general card shows all the details for each order. Of the blueprints there are three sets, for manager, shop, and production office respectively. To obtain the required drawing the workman gets from his foreman an order and in return for the drawing gives a receipt. A card index in the drawing stores shows where the drawing is, and of the 800 drawings in circulation recently, none had been lost and the location of each was known. In each shop the drawing received by that shop and the machine on which it is being used are recorded in a book kept for the purpose.

A New Institution of Traffic Science in Cologne

Little attention has hitherto been given to the study of traffic problems in Germany. A few universities had introduced lectures on railroad traffic and shipping, without, however, treating the traffic problems as a whole. Various kinds of transportation, such as motor and aërial traffic, have not been touched.

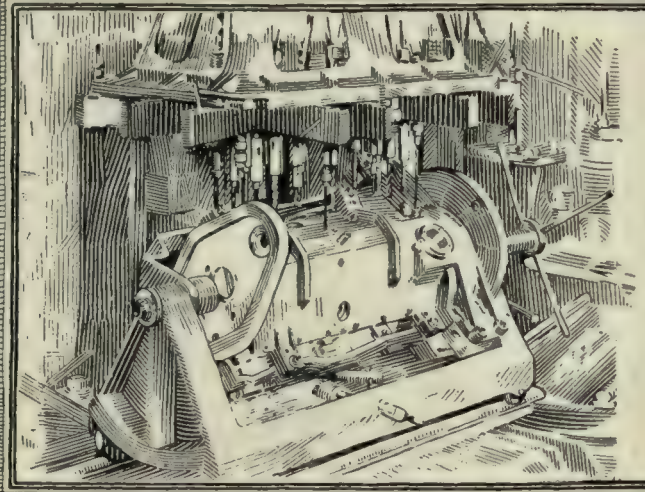
German forwarding agents have now combined in the formation of an Institution for Traffic Science, at the suggestion of Privy Councillor Prof. Dr. Harms, president of the Institution for International Traffic, at Kiel.

The seat of the institution will be Cologne, which, on account of its commercial university, provides excellent accommodations. Another consideration in favor of Cologne was the fact that many prominent German shipping firms have settled down there, thus providing exceptional facilities for the students to round out their theoretical education by acquiring practical experience.

The idea has met with ready approval by the municipality of Cologne, which will probably grant a subsidy of 50,000 marks a year toward the maintenance of the institution, and by the Cologne Chamber of Commerce and Trade, which has likewise set aside an amount of 25,000 marks per annum for the same purpose. Several other public bodies throughout Germany have promised similar help.

The institution will also maintain a library of works dealing with all traffic problems.

On successfully completing their course, students will be awarded a diploma, and eventually, when taking a specially extended course, the degree of Doctor of Political Science may be awarded them.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Effect of Design on Manufacture—Consideration of Limits of Accuracy—Selection of Working Points—Relation of Design to Cost of Machining

THE science of tool engineering as it is now practiced dates back comparatively few years and very high production tooling is of even more recent date. A few years ago when production was small the majority of jigs were made as cheaply as possible, no great attention being paid to upkeep, because production was not sufficiently high to warrant it, except in the case of products which had been to some extent standardized, such as military rifles, army pistols, sewing machines, and similar work. The usual practice in the old days was to make a rough list of operations which was to be followed and then give a few free-hand sketches to the toolmaker to show him approximately how the tools were to be made, leaving many of the details to the man himself. When this man needed a pattern he went to the pattern maker and told him what he wanted, leaving the proportioning of the pattern to him. Then after the casting had been made the toolmaker "whittled" it out until a makeshift jig was evolved, which served its purpose in the production of so-called interchangeable parts.

The tool engineer of the present day must be up to date in the manufacturing field; must have a broad knowledge of machine tools; must understand the theory and practice of cutting tools, speeds, feeds and kindred subjects and should have practical shop training of such a nature that he *knows* from his own experience just how a given machine is handled and what the requirements are for tools to be used on it. If he does not have this knowledge he will not be able to do the work required of him in the most efficient manner.

Listing of Operations

In up-to-date tool engineering the first step in the process is the listing of the various operations necessary to machine each component part of the mechanism which is to be manufactured. In this listing of operations each step in the manufacture is considered carefully from various viewpoints, such as: Economy in handling; machine tools most suitable; tooling equipment available; production required; accuracy required; jigs and fixtures necessary; gages necessary, etc. In many cases, also, work may require heat treatment, local hardening, grinding after hardening, welding, riveting to some other unit, polishing, bluing or nickelplating. All of these matters must be considered in the listing of the operations. Hence it is evident that the tool engineer must not only be familiar with the processes of machining, hardening, gaging and grinding, but he must also understand the construction of the mechanism as a whole in order that he may decide on the necessity for machining this or that surface so that it will bear a distinct relation to some other hole or surface in order that the entire unit will function properly.

Points To Be Considered

Let us assume that the blueprint of a certain part is turned over to the tool engineer, with instructions that the part drawing has been approved and is ready for tooling. The following points must then be taken into consideration in listing the operations:

1. *Production Required*—This is an important consideration, which affects the method of handling to a considerable extent. If a comparatively small number of pieces is to be manufactured the tools must be simple and cheap in order to keep the tool cost as low as possible. If a large number of pieces is to be manufactured multiple fixtures and rapid clamping devices would be called for, in order to produce the work as rapidly as possible. In the latter case the cost of tools would be distributed over such a great number of pieces that the unit cost for tools would not be excessive.

2. *Material of Which the Work Is Made*—It may be a casting, a forging or stamping, or it may be made from bar or flat stock. If a casting, it may need to be pickled, sandblasted and snagged on a rough grinding wheel before machining. If it is a thin or irregular casting it should first be inspected both for quality and to see whether it has warped out of shape so that it cannot be machined to proper dimensions. If a forging it may require heat treatment before or during machining or it may be hardened and afterward ground so that necessary allowances must be made during the machining to provide sufficient stock for grinding. If made from round stock it may be

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found best to machine it from the bar on a screw machine, or perhaps its length and general shape may make handling it more profitable on a manufacturing lathe after cutting it into lengths on a cold saw or a cutting-off machine. It is evident from the foregoing that the material of which the part is made is an important factor in the machining.

3. *Surfaces to Be Machined*—In considering the various holes to be drilled, bored or reamed and the various surfaces to be machined, it is important first to decide whether the various holes can be drilled in one jig, or several jigs will be required; next, whether several milled surfaces can be machined in one setting or it will be more economical to make several operations. It is also necessary to decide whether any other operations that may be necessary can be handled to best advantage in combination, or by several operations. It is not good practice to drill small holes and large ones in the same jig, unless drilling machines can be so arranged as to obtain correct spindle speeds for the different sizes of drills required. In special cases it may be found profitable to do something of this kind in order to avoid a resetting of the work and the cost of an extra jig.

4. *Accuracy Required*—In any mechanism there are certain fundamental principles affecting the successful operation of the device. In order that it may function properly as a unit the various components which make it up as a whole must fit each other within certain limits of accuracy. These limits are usually specified on the drawings of each part and the tool engineer must keep them in mind when listing the operations as well as when designing the limit gages used in the production of the parts.

The accuracy with which various machine tools will work must be taken into consideration and if their accuracy is not sufficient to produce the results required a final fitting or grinding operation may be necessary. So it is apparent that the accuracy required is a factor of importance in listing operations.

5. *Selection of Working Points*—In order to obtain the best results in production it is advisable to select working points which can be used for location in all of the operations on the work. It is difficult to give a hard and fast rule for determining which points are the best to work from, due to the fact that different cases require different treatment and various pieces of work are of such widely different design that no fixed rule can be given to apply to all instances. A very good thought in connection with the establishment of locating points is first to obtain a flat surface and next machine two or more holes perpendicular thereto if the nature of the piece will permit it. In a case of this kind it is possible to work from the finished surface for all the subsequent operations, locating by means of pins in the drilled or reamed holes, and in this manner making certain that correct relations are kept for all the operations with the points established as working points. Sometimes it may be necessary to vary this procedure on account of the shape of the work, but the matter of establishing the working points must always be considered very early in the listing of operations. A very good example which shows the establishment of working points is shown in Fig. 1, in which the flange *A* is first milled to give a surface to work from and in the next operation the flange holes *B* are drilled and two holes *C* reamed to give the other locations so that the work can be carried through its various operations by using these points from which to locate.

6. *Provision for Chucking*—In the handling of work on the turret lathe it is frequently necessary to provide means for clamping or holding the work during the first operation. There are many cases where the shape of the work is such that it can be held in a chuck without difficulty, but in other instances it may be found necessary to provide the work with lugs in order to hold it properly. A case of this kind will be noted in the hub, illustrated in Fig. 2. In this case it was decided to machine the surfaces marked *f* in the same setting, and obviously it would be difficult to hold by means of the tapered portion *A*. By the addition

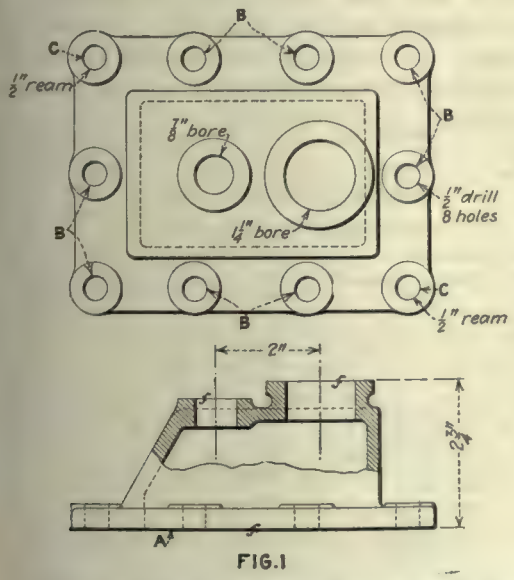


FIG. 1

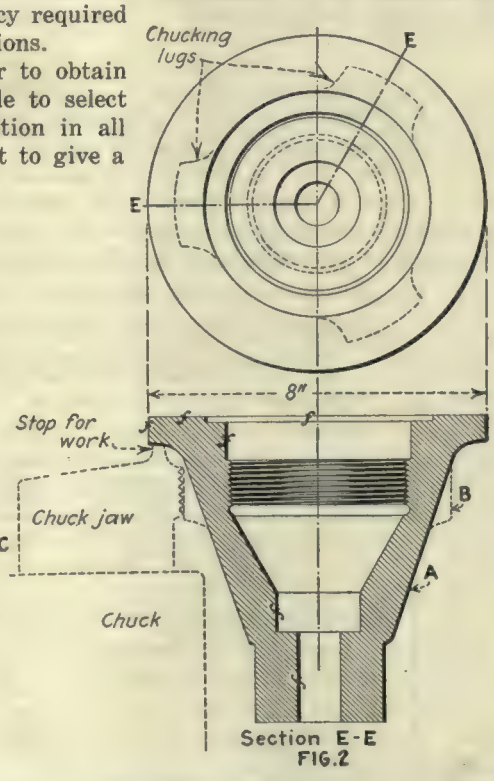


FIG. 2

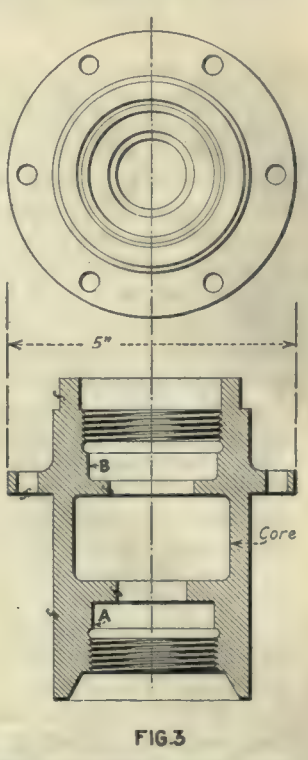


FIG. 3

FIG. 1. EXAMPLE SHOWING THE ESTABLISHMENT OF WORKING SURFACES TO BE USED IN LOCATING THE WORK DURING MACHINING. FIG. 2. ADDITION OF CHUCKING LUGS TO CASTING TO ASSIST IN MACHINING. FIG. 3. CONCENTRICITY BETWEEN SEATS *A* AND *B* VERY ESSENTIAL

of three lugs *B* the work can be readily held by the chuck jaws *C*, as indicated in the illustration. When lugs of this kind are added to a casting they may be removed by a subsequent operation or they may be left as they are, provided they do not interfere with the appearance or utility of the finished product.

7. *Concentricity of Cylindrical Surfaces*—In the listing of operations the importance of concentricity of the cylindrical surfaces which must be in alignment should be carefully considered, as any variation from the truth will cause the mechanism when completed to cramp and not run smoothly. It is advisable wherever possible to machine concentric cylindrical surfaces in the same setting, but as this is not always practical, particular attention must be paid to the method of holding, when several operations are used, in order that the work may be true when completed. A very good example of a piece of work of this character is shown in Fig. 3. In this case the bearing seats *A* and *B* must be concentric to each other, and yet it is apparent that the two surfaces cannot be machined in the same setting of the work. For this reason the greatest care must be exercised in designing the tool so that the first bearing seat *B* will be used as a location from which to produce the second bearing seat *A*. Many other examples could be given of work of this character, but the instance given is a representative one which will serve to illustrate the points involved.

8. *Machines Required and Available*—In the selection of machines for the work in process it is necessary that the tool engineer should be familiar with the various types of machine tools must suited to the work. In the case of listing operations for an old plant having a considerable assortment of machine tools from which to choose the tool engineer must have a list of these machines together with necessary data on their capacities and their working ranges. It must always be borne in mind, however, that the selection of a machine for high production should not be dependent entirely upon the machine tools which are in stock, and it may be more profitable to purchase new equipment rather than to use old equipment which is out of date and does not give maximum efficiency.

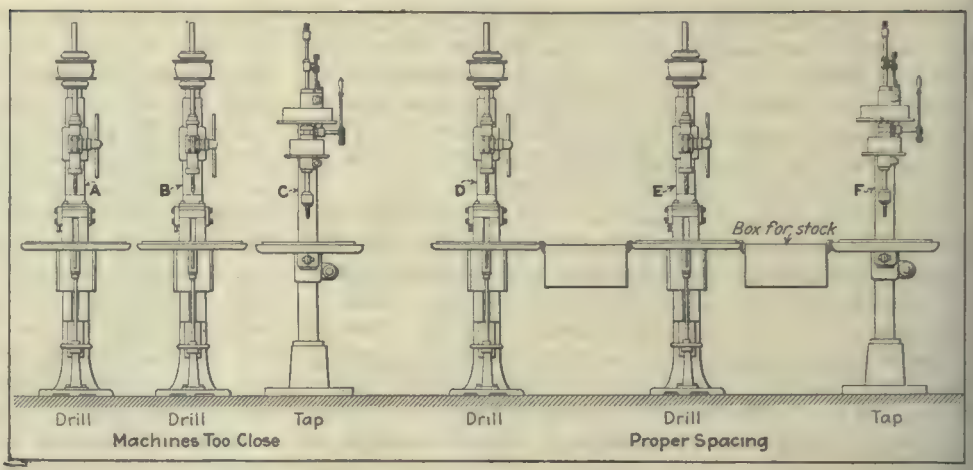


FIG. 4. IMPROPER AND PROPER SPACING OF MACHINES

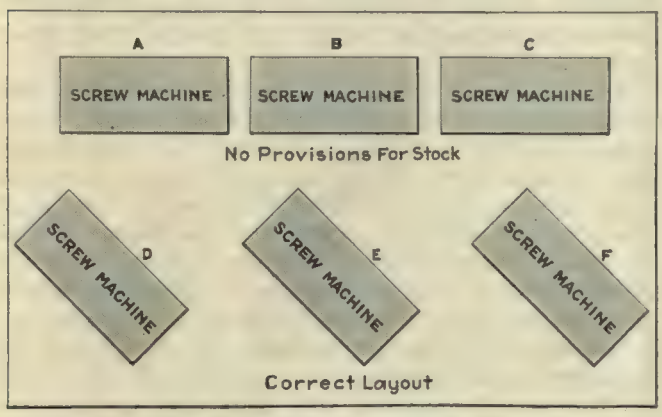


FIG. 5. IMPROPER AND PROPER SPACING OF SCREW MACHINES

Buy Tools as Needed

It is obvious that when listing operations for a new plant the machine tools can be selected as they are needed and can be bought as the occasion demands. In cases of this kind the tool engineer must be open-minded and must make his selection after having looked into the possibilities of the newer types of machines or the market.

Plant Layout

In handling production work the layout of the plant has an important bearing on the speed with which the work can be routed through the factory. In the case of a new factory it is evident that a plant layout must be made which will show the position of all machine tools suitably placed, so that there will be room for the piling up of raw material and the finished prod-

ALBERT A. DOWD ENGINEERING CO.
TOOL AND OPERATION SHEET

PIECE No. A13139 — **1 1**
NAME Segment Yoke
CUSTOMER BLANK REGISTER CO.
No. PIECES PER UNIT One
ADDRESS New York
MATERIAL Bronze Casting

Oper. No.	Description of Operation and Method of Holding Work	Type of Mach.	Tools, Gages and Fixtures	Tool Number	Dowd Order No.	Hr. Prod.	No. Mach. Reqd.
1	Drill and ream large holes, face and turn hub on large end, cut off chucking stem, allowing stock for profiling.	Screw mach.	Collet jaws, tool block, facing tools, cut-off tool, drills (std.)	9191 9192 9193 9194	1416 1417 1418 1419	60	1
2	Profile small end to length and one side of small arm.	Profiler	Profiling fixture, Profile cutter (std.)	9195	1420	60	1
3	Profile other side of small arm...	Profiler	Profiling fixture..... Profile cutter (std.)	9196	1421	100	1
4	Drill and ream hole in arm.....	Drill press	Drill jig..... Drill (std.)	9197	1422	75	1
5	Cut teeth.....	Gear cutter	Special arbor..... Hob (std.)	9198	1423	60	1
6	Mill inside bosses.....	Plain miller	Milling fixture..... Cutter (std.)	9199	1424	75	1

FIG. 7. REVISED ROUTING FOR THE PIECE SHOWN IN FIG. 6

uct. The plant engineer who understands his business takes all these matters into consideration.

Some of the points which come up in the placing of machines are illustrated in Fig. 4. In this case the drilling machines shown at *A* and *B* and the tapping machine shown at *C* have been placed so close together that it would be difficult to take care of the work both before and after machining. A much better arrangement is shown at *D*, *E* and *F* in the lower part of the illustration. It will be noted that the machines are more widely separated so that boxes can be placed between them for collecting the material as fast as it has been drilled or tapped. These boxes can be so made that they will hang on the edge of the drill-press table, or they can be resting on the floor. They can be readily removed and replaced if desired.

Another example of the placing of machines is given in Fig. 5. The upper view at *A*, *B* and *C* shows an arrangement of screw machines which is very bad because it does not make suitable allowance either for the stock in the machines or for the piling of the stock on the floor alongside of the machines. Referring to the lower portion of the illustration *D*, *E* and *F* show a much better arrangement, with plenty of room for finished and unfinished stock.

Tool Equipment Required

When the tool engineer has decided on his sequence of operations it will then be necessary for him to decide what tools will be used in the production and also what gages will be necessary to hold the work within the required limits of accuracy. It is customary for the engineer to talk over each piece of work in a conference with his chief draftsman and possibly some others who are intimately connected with the production work in the shop. At this conference it is decided just what varieties of tools would be best for the various operations, and in all probability rough sketches are made to indicate in a general way the kinds of tools needed.

At this conference it would be decided whether single or multiple fixtures would be advisable, and the machine tools to be used would be decided upon. As the shop superintendent is likely to be one of the men in the conference he would undoubtedly have certain preferences in regard to the tools to use for certain operations. After a decision has been reached as to just how each piece is to be handled the list of operations should be typed and turned over to the chief draftsman, who can then start on the design of the necessary tools.

Effect of Design on the Cost of Machining

It frequently happens that in working out the tools for the various operations it is found that the shape of the work makes it difficult to machine, and in many cases it may be found advisable to modify or change the shape of the work slightly in order to assist in the handling and cheapen the cost of manufacture.

A very excellent example of such a condition is shown in Fig. 6, which shows a small bronze casting correctly designed so far as its part function is concerned. When the design of tools was started it was found to be a very difficult proposition to obtain tools that would give good results. The original routing of operations was as follows: (1) Straddle-mill inside bosses and one end; (2) straddle-mill small arm; (3) drill and ream $\frac{33}{64}$-in. hole through both ends and $\frac{1}{4}$-in. hole to size; (4) turn $\frac{3}{4}$-in. end; (5) cut teeth; (6) ream $\frac{11}{32}$-in. hole.

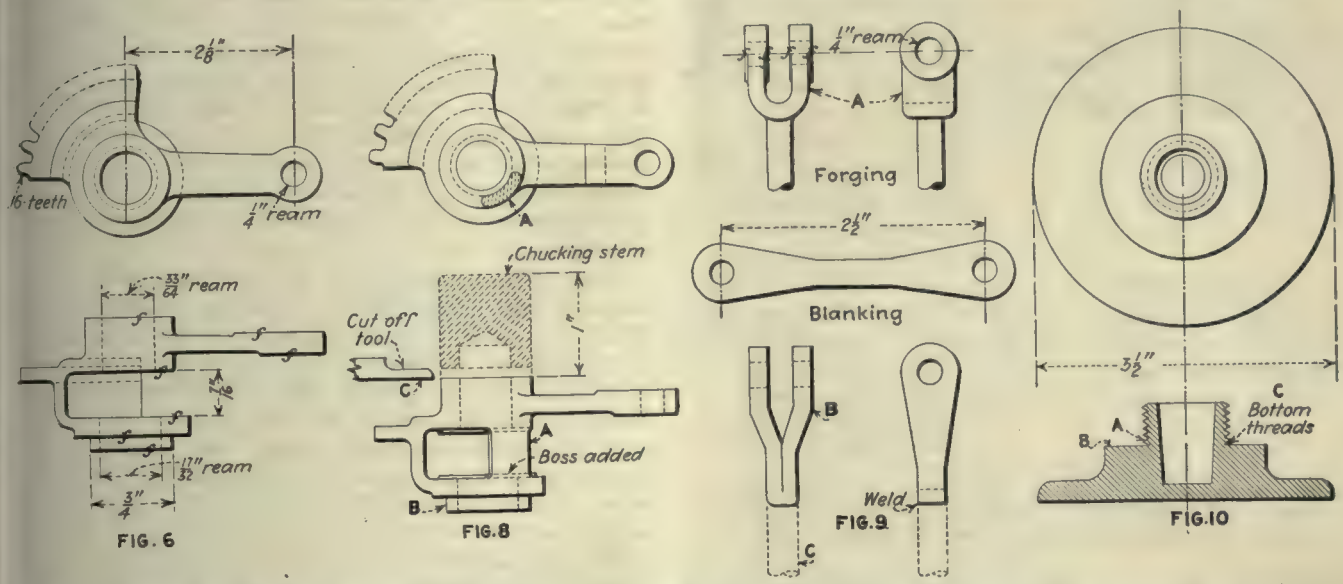


FIG. 6. PIECE OF WORK, THE SHAPE OF WHICH MAKES IT HARD TO MACHINE. FIG. 8. SHOWING CHUCKING STEM AND TIE-PIECE. FIG. 9. ORIGINAL AND REVISED DESIGN OF A YOKE. THE REVISED DESIGN RESULTED IN A SAVING IN MANUFACTURE. FIG. 10. A DIFFICULT PIECE OF THREADED WORK, WHICH WAS CHANGED TO ASSIST IN PRODUCTION

The first operation was difficult to hold, due to the two diameters that were to be located in V-blocks. The variation in the casting would throw out the work, causing the subsequent operations to be out of line.

The second operation was to be held in the same manner, using the milled slot for location, and the small arm required a clamp which was very weak, due to the thickness of the portion it was to clamp.

The third operation could not be finished in such a way as to be certain that the holes would be in the correct relation to the milled faces. An operation of this kind is also very difficult to line up to assure a hole which will be true with the milled surfaces.

The fourth operation required a special arbor with an undercut in order to allow the tool to face the end.

The fifth operation used a special hob which finished

the outside diameter of the teeth as well as cut them.

The sixth operation was very hard to get in line with the small hole and the clamping was very difficult.

As the tools had been planned it was noted that considerable improvement could be made if the operations were revised, and after careful study the routing was changed as shown in Fig. 7.

For the first operation a chucking stem was provided for the work, as shown in Fig. 8, so that by gripping the work in the chuck it was possible to drill, bore and ream the holes through the hub and to face and turn the end at *B* without any great difficulty, and then before the work was taken out of the chuck the chucking stem was cut off with the parting tool *C*, leaving the work clean and accurate and at the same time providing an excellent location for subsequent operations. It will be noted that a "tie-piece" *A* was cast in the

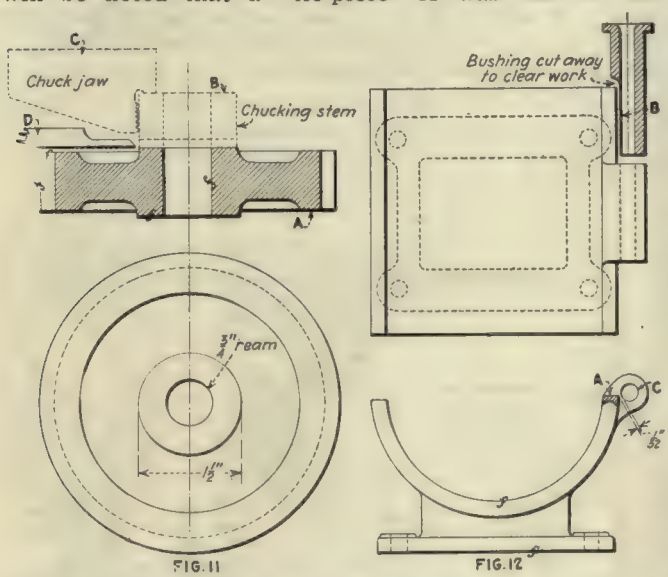


FIG. 11 FIG. 12

FIG. 11. CHUCKING STEM PROVIDED FOR MACHINING GEAR BLANK. FIG. 12. INSUFFICIENT CLEARANCE ALLOWED FOR DRILL BUSHING

work in order to prevent too much distortion and at the same time hold it together during the first machining operation. It is rather hard to appreciate the delicacy of this piece without seeing it but its construction and lightness made it extremely difficult to machine without distortion.

The second operation was the profiling of the small end of hub to the correct length and surfacing one side of the arm. This work was done on a profiling machine, using a set block for the variation in the height of the cuts. The hole in the hub was used to locate from, making it certain that the work when finished would be absolutely true with the hole.

The third operation, which was that of profiling the other side of the small arm, was very simple and the fixture was arranged in such a way as to use the center hole from which to locate. A suitable set block was provided.

The fourth operation was that of drilling and reaming the hole in the arm. By using the center hole to locate from and the finished surface of the arm to "bank" on it was very easy to design a jig for this operation which gave excellent results.

The sixth operation was that of milling the inside bosses and cutting out the tie piece. The work was located on studs in vise jaws. These jaws were provided with stop pins which prevented the jaws from crushing or distorting the work while the milling operation was taking place. It was found that the work did not spring over 0.0005 in. when the tie piece was cut out.

A great deal of thought was put on this particular piece as it was an extremely delicate one and difficult to machine. With the operations as originally laid out the tools would have been very costly and there would have been great difficulty in holding the work within the required accuracy. As the operations were finally revised the tools were simple and comparatively cheap and the work was held to a close degree of accuracy without difficulty.

Another Example

A very excellent example of a change in design which resulted in a great saving in manufacture is shown in Fig. 9. This might be considered an exceptional example, in comparing the cost of the production of piece *A* as shown above and *B* as shown below. The work is a yoke connection which was originally made from a forging bulldozed from a machine steel rod. The finished piece was about 50 in. long. As originally made, the machining necessary to complete the unit was as follows: (1) Straddle-mill bosses; (2) drill and ream holes. Both the drilling and milling operations were very awkward, due to the length of the piece. This method was followed for some time until it was thought by tool engineers that considerable improvement could be made.

After some consideration the unit was made in two pieces as shown at *B* and *C*. The yoke end was blanked in one operation on a punch press with the holes pierced to the finished diameter. The work was then formed as shown, thus completing the yoke. The next operation consisted of welding the yoke to a rod of machine steel cut to the required length. This operation was rapidly done at a smaller cost, and the only remaining work needed to finish the piece was to dress off the welded section.

The comparative labor costs of the two methods of manufacture showed a saving of 30 per cent in actual labor in the latter method. Taking the cost into consideration the new method does away with the milling cutters, drills and reamers, while the cost of punch-press dies just about offsets the forging dies originally used, so far as upkeep is concerned.

Threaded Work

Very often when designing a piece of work which is to be threaded the designer does not take into consideration the cutting of the thread. In manufacturing work the majority of threads is cut by means of dies and in order to have the dies work properly they should have a *lead* of at least two threads. That is to say, the first two threads should be chamfered to allow the die to run on to the work. Now it is evident that after two threads in the die are cut away like this it would be impossible for it to cut a full thread up to a shoulder. For this reason it is customary to show a relief of some sort in the thread if necessary to cut it close to a shoulder.

A very good example of a difficult piece of threaded work is shown at *A* in Fig. 10. This was an aluminum casting, the drawing of which called for a full thread directly up to the shoulder *B*. It was a production job and it was found to be practically impossible to cut the thread right up to the shoulder as shown. A con-

ession was finally made by the customer to permit he thread to stop one thread away from the shoulder nd a groove was made at the point *C* to allow the ie to run out. A little forethought on the part of he designer would have shown him the difficulty of utting the thread up to the shoulder as shown and he hould have made suitable provision on his drawing to ake care of this matter.

Chucking Stem on a Gear Blank

In making up spur gear blanks such as that shown t *A* in Fig. 11 it may be necessary to make several ettings of the work in order to machine it properly. f, however, a chucking stem is added as shown at *B* n the illustration the work can be held by means of he chucking stem in the chuck jaws *C* in such a way hat all of the machining can be done in one operation. fter the piece has been completely machined the part- ng tool *D* can be run in to cut off the blank as indi- ated in the illustration. An arrangement of this kind s very common and the same idea can be applied to any other cases of similar work.

Drilled Holes Close to a Shoulder

When drilled holes are called for in a piece of work is not only necessary to provide clearance for the rill but also, if the work is to be produced in quanti- ies, sufficient clearance should be provided for the drill ushing. An example of this kind is shown in Fig. 12, n which it will be noted that the hinge hole *C* is very lose to the shoulder *B*. The drawing was marked grind to suit" at point *A*. Evidently the intention was o grind away the casting slightly in order to allow learance enough for the drill. As a matter of fact, hen the jig was built the bushing was cut away as hown at *B*, but even when this was done the variation n the casting was so great that a proper location for ne hole could not be obtained.

The obvious remedy for a design of this kind is to ut away the interfering shoulder far enough so that here will be plenty of clearance for the bushing. Cases f this kind are more or less frequent in general anufacture and it is often necessary to make slight anges in the design in order to drill the work cor- ectly.

The Selection of Apprentices—Discussion

By an Apprentice

Commenting on A. F. Forbes' article in the *American achinist*, page 455, "The Selection of Apprentices":

Nearly every shop requires the applicant to pass an xamination. He must also have been graduated from grammar school or have the equivalent in education.

Colleges do not pay their students anything, but the udents do not produce anything that the colleges can ell, while an apprentice's work is either sold or used y the company employing him.

Nearly all shops that have a school connected with eir training department require the apprentice to do certain amount of school work at home.

In conclusion, if the shops followed the colleges' ad and did not pay the apprentices any wages, many pable boys, unable to go to college for financial rea- ns, would also be unable to obtain a good training serving an apprenticeship. It is not the wages paid the apprentice that affect "the quality of the finished product" but the training that he receives during his apprenticeship. This training should be as intensive and varied as possible.

Nickel and Nickel Alloys*

The larger part of the world's production of nickel comes from the famous pyrrhotite-chalcopyrite ores of the Sudbury district in Canada. These ores are at present smelted and refined by three processes, the larger tonnage being smelted in Canada and refined both there and in the United States by the Orford process. A natural alloy, monel metal, is produced from the same ores by roasting and reducing the copper-nickel matte shipped to New Jersey from the Canadian smelters.

Form and Use

Nickel is produced in the United States in several commercial forms. The greater tonnage is produced in the form of 50- or 25-lb. ingots, or pigs, which are used in the manufacture of nickel-bearing alloy steels. Nickel shot and electrolytic nickel cathodes are produced for the use of the manufacturers of non-ferrous nickel alloys, nickel-silver and cupro-nickel. Malleable nickel—sheet, strip, rod, wire—is produced for stampings, fittings, resistance and pyrometer wire, spark-plug points, and kitchen utensils. Nickel castings are produced for the chemical industries for use against corrosive solutions. Nickel is generally useful by reason of its anti-corrosive properties.

Monel metal is produced in the usual commercial forms, i.e., castings, rods, sheet, wire, and is principally valuable because of its resistance to corrosion, its high strength at higher temperatures and its resistance to the erosive action of superheated steam (use in turbines and steam valves).

Alloys of Nickel

Besides the nickel, or nickel-chromium alloy steels containing from 1 to 3.5 per cent nickel and largely used for automobile and ordnance construction, there is a large number of other nickel-bearing alloys having very interesting and commercially useful properties.

Nickel-silver, containing from 52 to 80 per cent of copper, 10 to 35 per cent of zinc, and 5 to 30 per cent of nickel, is used in sheet form for the base metal for silver-plated household ware and other stampings and fittings, in the wire form for resistance wire, and in the cast form for automobile hubs, etc.

Cupro-nickel, containing about 15 per cent of nickel, balance copper, is used for the manufacture of small-arms bullet jackets.

Constantan, containing about 45 per cent nickel, balance copper, is used largely for resistance and pyrometer wire.

Ferro-nickel, or 25 to 35 per cent nickel-steel, is used as resistance wire and as invar, having a low coefficient of thermal expansion.

Nichrome, and similar alloys, containing from 60 to 80 per cent of nickel together with chromium and iron, is used for resistance wire and as a heat or temperature resisting alloy.

Manganese-nickel alloys, containing from 2 to 4 per cent of manganese and the balance nickel, are used largely for the manufacture of gasoline-engine ignition points, or spark plugs.

*Abstract of Circular of the Bureau of Standards, No. 100.

Cost Accounting for the Machine Tool Builder

Report of Scovell, Wellington & Co. to the National Machine Tool Builders' Association

DURING January five regional conferences of the National Machine Tool Builders' Association were held at Chicago, Cincinnati, Cleveland, Worcester and New York, for the purpose of discussing cost-accounting systems and practice in the machine-tool industry. These meetings were conducted under the direction of C. H. Scovell, senior partner of Scovell, Wellington & Co., with the assistance of H. G. Crockett, another partner of the firm and in charge of cost accounting and industrial engineering at Scovell, Wellington & Co.'s New York office.

As a result of these conferences and of the returns from questionnaires sent out by Mr. Scovell, a report the substance of which follows, was prepared and presented to the meeting of the association held in Cleveland during the last week in February.

There is no doubt that good cost accounting for the machine-tool industry requires the operation of what is known as a job-order cost system, that is, a system which shall show the cost of the jobs which are issued to the shop—material, direct labor and a proper amount of overhead or burden. According to the information collected from the questionnaires, a large majority of the machine-tool builders are already handling material and labor in a reasonably satisfactory way, so that any discussion of better or more uniform methods of accounting in the industry will be concerned almost entirely with the development, distribution and application of overhead or burden.

Burden Distribution

The chart, Fig. 1, shows in graphic form the approved plan of collecting costs, particularly in respect to burden. A study of the chart will show that the aim is to allocate to each department or operating center of the business all the charges which belong there, and which should therefore be absorbed in the normal work done in that department or operating center.

One feature of this burden distribution which may be new to some of the members is the plan for adding some of the burden on to material as it goes into work-in-process. This idea is indicated on the chart by the lines which run from rectangles 37 and 38 to rectangle 43, and a somewhat similar charge on the cost of finished stock, storage and shipping is indicated by the line running from rectangle 39 to Selling Expense, rectangle 56. It should be clearly understood that this is a burden charge *on material used.* There is no suggestion of increasing the value of the unused inventories. Furthermore only one calculation is required for all the material used on the job during the month; so that although it is a desirable refinement in accounting, it adds nothing to amount to anything in the way of additional clerical work.

After a thorough consideration of the matter, the Executive Committee of the National Machine Tool Builders' Association decided unanimously to recommend to the industry that interest on investment b included in calculating the cost of manufacture. With out this accounting device the overhead or burden o different departments, or of different machine tool will not be correctly stated, particularly in that larg and costly tools will otherwise have an insufficier burden rate, as there will be nothing to measure th cost of tying up capital in such equipment in compariso with light and relatively inexpensive machines. Ther is everything to gain and nothing to lose by carryin interest on investment as a factor in the fixed charge rectangles 20 to 29 inclusive, and taking it up as credit, under miscellaneous income, rectangle 54.

As to details of this practice, it should be explaine that interest will be reckoned on *all* the assets employe in manufacture—land, buildings, equipment, and inven tories. The immediate effect is to increase the burde of that work which is done with large and costl machines, in comparison with that work which is don with a smaller capital investment. As the product wi include this element of cost, the stated value of th inventory of finished and partly finished work will b to that extent, increased; but a reserve for the amoun of interest included may, if desired, be deducted fro the inventory assets in stating the balance sheet a the end of the year. There is some additional incentiv to do this if there is an increase in the actual volum of such inventory during the year.

It should be further noted that only by chargin interest on investment can the cost accounting in plant that are wholly or in part rented be made uniform with plants that are wholly owned. What is more im portant in this industry, it is only when interest o investment is reckoned on the assets that are utilized i the business that correct costs can be figured on pa terns made in the company's pattern shop in compariso with patterns bought outside, or castings produced i the company's own foundry in comparison with cast ings purchased from others. Considerations like thi are important in a plan for uniform cost accounting

A similar situation arises in respect to an auxiliar department like a power house. When members bu power they necessarily get into their costs all suc fixed charges on the capital used, and certainly no on would think of making a comparison between the cos of power purchased and the cost of power generate on the premises without reckoning into the latter th fixed charges of every kind on the capital required, a well as the current operating expenses.

Finally there is a marked disposition to reckon int costs interest on borrowed money, or interest on bonde debt; and whereas charges of this kind are incorrec in principle, and most objectionable in practice, the do reflect a sentiment which is well-nigh universa in the business world that *the use of capital is a cos* which should be recognized before anything like a prof is calculated for the business.

All of the overhead or burden of an operating department is represented by the long vertical bar, rectangle K, in the middle of the chart. This total, as the chart shows, is made up of: (a) Land and Buildings Factor, rectangle 30, distributed to the several departments on the basis of the area occupied by each; (b) Equipment Factor, rectangle 32, apportioned according to the value of the equipment used in the several departments; (c) Steam and (d) Power costs, rectangles 33 and 34, distributed pro rata to the steam and power consumption; (e) General Burden, rectangle

A correct burden rate in any department will be determined by dividing the overhead or burden of the department by the normal number of operating units, that is, the normal man-hour or machine-hour capacity of the department or production center.

Great care should be taken to see that the calculation of a burden rate is made on the basis of operating units that can be realized with ordinary good management, if a shop has a steady volume of business, but not considering a night shift or overtime. It is not easy to say just what percentage of the theoretical hours

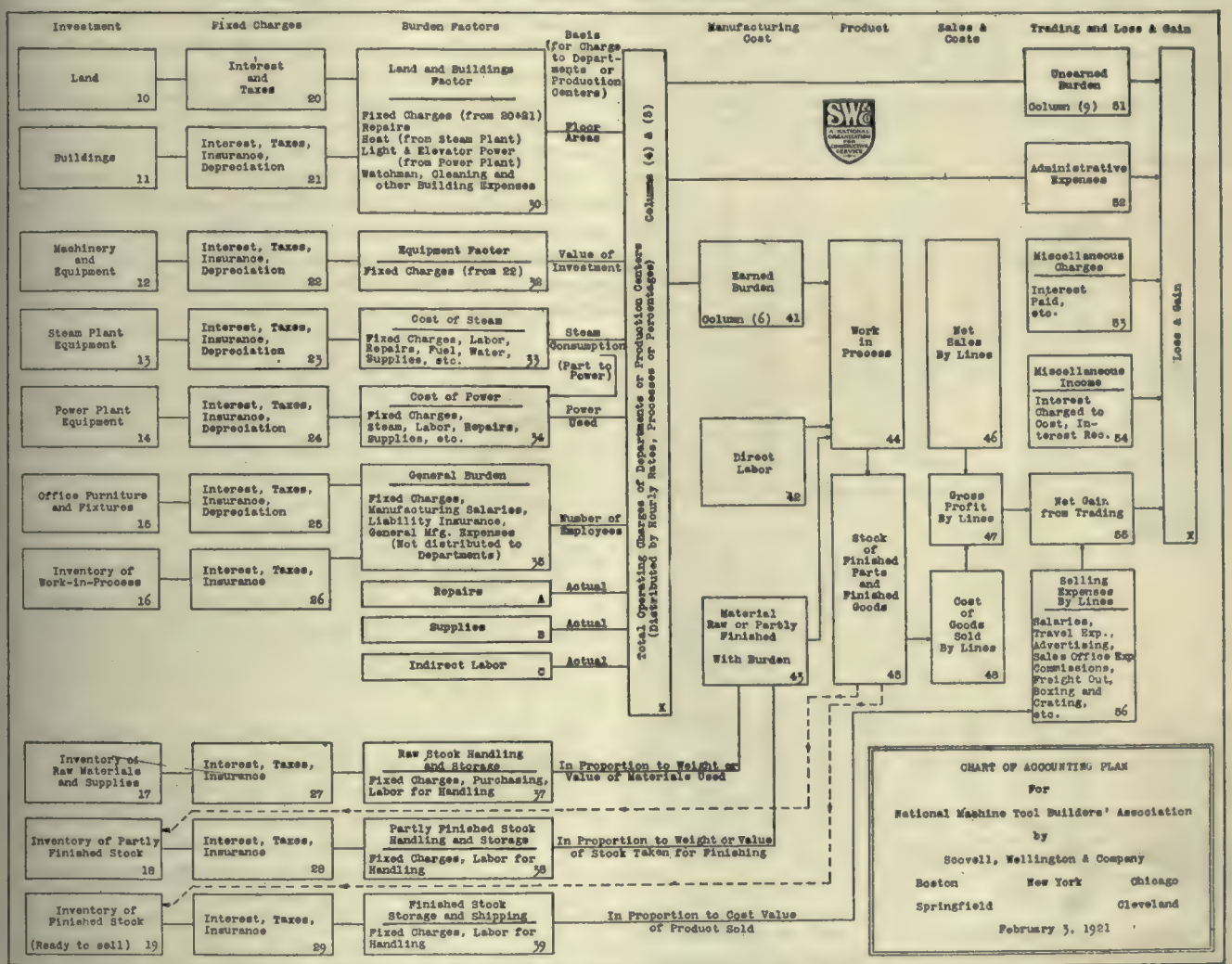


FIG. 1. CHART OF ACCOUNTING PLAN

35, distributed in proportion to the number of employees; and finally (f) Repairs, Supplies and Indirect Labor, rectangles A, B and C, charged to the several departments as actually incurred.

The idea of *distributing* or *apportioning* burden to "departments" or "production centers" is applicable particularly to the larger shops. For the small shop the idea is to develop or recognize *all* the burden that exists, and make plans to have it added to the cost of production as nearly as possible in accordance with the facts in that shop. In a very small shop, particularly if it is making only one product, there would be no serious inaccuracy in having one rate for the whole shop, or possibly two or three rates; but if there are varied working conditions, or if there is a great variety of product, distinctions must be made to get accurate costs.

should be taken as the standard for the purpose of setting burden rates, but allowance should be made for those shut-downs of a department (or a particular tool), repairs, absent workmen, etc., which occur under normal conditions. At this point in the calculation no allowance should be made for shut-downs resulting from lack of orders.

All of the work done in the shop should uniformly carry the normal rate of burden, not more when the shop is partly idle, and not less when it is unusually busy. This arrangement gives costs which are comparable at all times, and which vary only in proportion to operating efficiency. This idea of a normal rate of burden is fundamental to good cost accounting, and is particularly important in an industry subject to such ups and downs of production as the manufacture of machine tools.

According to this plan, when the shop is busy all of this burden will be "earned," as indicated by rectangle 41, and thus be carried into work-in-process, rectangle 44. When the shop is operating on part time, a corresponding portion of the burden will be unearned or unabsorbed, and will therefore go directly to loss and gain, as indicated by rectangle 51.

What Kind of Rate to Use

A rate-per-cent-on-wage-cost as a method of distributing burden is acceptable only when the wages of all the operatives are very uniform, and when the facilities at their disposal are likewise uniform. As these conditions are rarely present in a machine shop, the rate-per-cent-on-wage-cost is not a satisfactory method of disturbing burden in this particular industry.

The use of a man-hour rate removes the inequalities which arise by reason of varying earnings on the part of the operatives, and recognizes the fact that burden corresponds much more nearly to the number of people employed in the shop than it does to the wages which they earn.

Under some conditions the man-hour rate will be a satisfactory method of distributing shop burden, but generally the facilities with which the men work will vary so greatly that thoroughly accurate costs cannot be secured without the use of a machine-hour rate, which will be greater or less for different machines: (a) According to their size, and therefore the space they occupy; (b) according to their value, and therefore the fixed charges which they should carry (interest, taxes, insurance and depreciation), and (c) according to the power which they use, and therefore the amount of power cost which should be included in the burden rate.

TABLE I. STATEMENT OF UNEARNED BURDEN AND VARIANCES
MONTH OF ————

Department A

Burden Items	Standard Hours [41] (1)	Actual Hours [41] (2)	Idle Hours [51] (3=2−1)	Estimated Burden [K] (4)	Actual Burden [K] (5)	Earned Burden [41] (6)	Burden Variance [51] (7=4−5)	Unearned Burden [51] (8=4−6)	Net Unearned Burden and Variance [51] (9=5−6 or 7+8)
Fixed charges	....	....	....	$000	$000	....	$000	....	....
Indirect labor	Burden Rate=col.			000	000	....	000	....	....
Supplies	(4) div. by col. (1)			000	000	....	000	....	....
Repairs	....	....	....	000	000	....	000	....	....
Power	....	....	....	000	000	....	000	....	....
Compensation ins.	....	....	....	000	000	*	000	‡	
Misc. charges	....	....	....	000	000	....	000	....	[51]
Genl. mfg. burden	....	....	....	000	000	....	000	....	....
Total	$000	$000	$000	$000	$000	$000	$000	$000	$000

Summary for Entire Shop

Centers	Standard Hours (1)	Actual Hours (2)	Idle Hours (3=2−1)	Estimated Burden (4)	Actual Burden (5)	Earned Burden (6)	Burden Variance (7=4−5)	Unearned Burden (8=4−6)	Net Unearned Burden and Variance (9=5−6 or 7+8)
Department A	$000	$000	$000	$000	$000	$000	$000	$000	$000
Department B	000	000	000	000	000	000	000	000	000
Department C	000	000	000	000	000	000	000	000	000
Department D	000	000	000	000	000	000	000	000	000
Department E	000	000	000	000	000	000	000	000	000
Etc., etc.	000	000	000	000	000	000	000	000	000
Total	$000	$000	$000	$000	$000	$000	$000	$000	$000

* Column (6) = Column (2) multiplied by the rate.
‡ Column (8) = Column (3) multiplied by the rate.
Figures in [ ] refer to rectangles on the Chart, Fig. 1.

To understand the method of fixing a burden rate and the plan of reckoning earned and unearned burden, reference should also be made to Table I. On this statement the first three columns are hours, and the remaining six columns are dollars and cents. The top half of the table is intended to represent the facts for an accounting period for one department or production center, and the lower half of the table is intended to be a summary of all of the departments or production centers into which the shop may be divided.

The rate on which burden is charged to work-in-process in a particular department, rectangle 41, is calculated by dividing the anticipated burden of the department, column 4, Table I, by the standard operating hours, column 1.

The actual experience of the department as to burden will be set up in column 5, and the difference between the estimated and the actual appears in column 7.

The burden earned by the department or production center is the number of hours operated, column 2, multiplied by the rate; and the difference between the standard burden, column 4, and the "earned" burden, column 6, or rectangle 41, will be the "unearned" burden, column 8.

Variances

It should be clearly understood that column 7 may be a gain or loss, according to the experience of the accounting period (a gain if the actual burden is less than the estimated, or a loss if the actual burden is more than the estimated); and in a somewhat similar way that column 8 may be a gain or loss (a gain if the hours operated, column 2, exceed the standard hours, column 1, and a loss if the hours operated, column 2, are less than the standard hours, column 1). The net result of the gain or loss in column 7 and the gain or loss in column 8 is expressed as a net figure in column 9. Column 9 is also the difference between column 5 and column 6, and column 9 coincides with rectangle 51 on the chart.

The comparison of actual hours with standard hours may be made a very important factor in securing economical administration. For many years past, shops with the strongest management have had daily operation reports, summarized at frequent and regular intervals, accounting for all idle time of their machines. Some of this idleness will be recognized as inevitable; but in order to fix the standard hours, a record of this kind needs to be kept, and in order to reduce to a minimum the loss resulting from idleness, this record needs to have consistent executive attention. If this is done the management frequently gets an important reflection of the efficiency of the various departments in advancing a job from one operation to the next, not to mention the efficiency of the purchasing agent, storekeeper, employment department or planning department who may have to do with material being on hand in the first place, of men being on hand and at the right time to take care of it. This is a very good example of the kind of analysis which, if correctly made and correctly used, puts money into the pocket of the management.

Monthly Statement

The relation between the cost-accounting plan (indicated by the chart, and further illustrated as to its operation in a particular department by the statement, Table I) and the accounting or general bookkeeping of the company is indicated by Table II, "Statement of

Trading and Loss and Gain." The first item of Table II, in the outside column, corresponds with rectangle 46, the second item, "Cost of Goods Sold," corresponds with rectangle 48, and the "Gross Gain" immediately below corresponds with rectangle 47.

This section of Table II is of great importance to all manufacturers, for the margin of gross gain must be secured before there is any hope of net profits and dividends. It is specially important to a machine-tool builder who is making two or more lines of product, for he should see clearly the margin of gross profit on each line separately. The remainder of Table II does not lend itself to an easy subdivision by lines, although part of the following section, "Adjustment of Normal Costs," might be segregated in some cases.

The second section of Table II, "Adjustment of Normal Costs," is made up of Burden Variance, column 7, Table I, and "Unearned Burden," column 8. These items combined coincide with rectangle 51. "Unused Space and Equipment" differs from unearned burden only as it reflects such a condition as one would find in a new plant where considerable working areas have been provided for future use, but not put into immediate operation, and possibly where machinery has been installed, but not yet put into operation.

Of the two remaining items in this section, the "Gain from Sale of Scrap, By-products, etc." requires no explanation, and the first item, "Inventory Adjustments," is intended to provide for that kind of revaluation which was required in all manufacturing plants at the end of 1920, and which, if entered at this point on the loss and gain statement, provides a correct statement of gross profits free from the complications which would be introduced if all the variations of material value were carried into the cost of goods sold.

The following three sections of Table II coincide with the chart: Selling Expenses with rectangle 56, Administrative Expenses with rectangle 52, Net Gain from Trading with rectangle 55; the three credits in the financial group with rectangle 54, and the debits in the finanacial group with rectangle 53. The last item on Table II, "Net Gain for the Accounting Period," coincides with rectangle X, in the upper right-hand corner of the chart.

Less Detail for a Small Business

In considering the Loss and Gain Statement, Table II, it should be understood that the outside column in each case is the minimum of detail in statements of that kind which is considered appropriate for any business, however small; and that each of the items in the outside column must appear separately, provided of course that the company has such items to deal with.

The amount of detail which may be used by a large organization is suggested by the inside columns, and a large business might require even more detail than is indicated here, or might, under certain conditions, get along without some of the items which appear on the statement.

Separate Kinds of Business

Some of the members are engaged in other kinds of business in addition to the manufacture of machine tools, in which case the idea of a separate statement of gross profits applied to different lines (of machine tools) should be extended to apply with even greater emphasis to the different kinds of product manufactured.

Distinctions of this kind will be recognized and agreed to as soon as they are stated, and the same idea applies to the operation of a foundry or to a pattern shop if either one is run in connection with a machine shop, for many machine-tool manufacturers get along without either of these departments. If a foundry is operated, the castings should be charged to the machine shop at a fair commercial price, so that the executives may know whether they are making or losing on the foundry, and so that the cost of the machine tools may not appear to be greater or less on that account.

Spoiled Work

When spoiled work was brought up for discussion at the regional conferences, there was a considerable division of opinion as to how it should be treated. In general the two plans for spoiled work are: (1) To let it all stand as part of the cost of the job which is being done, and to let the good pieces absorb all this cost; or (2) to subtract all the (a) material, (b) labor, and (c) burden cost on the spoiled pieces from the cost of the job, and charge this total, less any salvage value of scrap material, as a factor of overhead or burden.

The first plan would properly be followed in an industry like drop forging or custom stamping, where the successive pieces are individual and might have such peculiarities of design as would make more spoiled work in some cases than in others, for certainly it would be fair to treat in that way any spoiled work which was a peculiarity of the pattern. In an industry where spoiled work is not a factor of design in any

TABLE II.

A. B. C. COMPANY

PRO-FORMA STATEMENT OF TRADING AND LOSS AND GAIN

			For the Month of ——19——	
Regular sales	[46]		$000.00	
Less returns and allowances			000.00	
			$000.00	
Less sales discounts		$000.00		
Outward freight		000.00	000.00	
Net sales			000.00	[46]
Cost of goods sold (normal basis)	[48]		000.00	[48]
Gross gain (normal basis)			000.00	[47]
Adjustment of normal costs:				
Inventory adjustments			000.00	
Burden variance—column (7)	[51]		000.00	
Unearned burden—column (8)			000.00	
Unused space and equipment			000.00	
Gain from sale of scrap, by-products, etc			000.00	000.00
Gross gain (adjusted)				000.00
Selling and merchandising expenses (56)				
Advertising			000.00	
Salesmen's salaries and commissions			000.00	
Traveling expense			000.00	
Sales offices salaries			000.00	
Sales offices expenses			000.00	
Finished stock handling and storage			000.00	
Demonstrating			000.00	
Collection expense			000.00	
Reserved for credit losses			000.00	000.00 [56]
Administrative expenses	[52]			
Officers' salaries			000.00	
General office salaries			000.00	
General office expenses			000.00	
General accounting			000.00	
Engineering and designing			000.00	
Industrial relations	[35]		000.00	
Legal			000.00	
State taxes			000.00	000.00 [52]
Net gain from trading				000.00 [55]
Financial				
Interest charged to cost Interest earned Income from investment	[54]		000.00 000.00 000.00	
			000.00	
Interest expense (deduct)	[53]		000.00	000.00
Net gain for month, before income taxes, carried to balance sheet				$000.00 [X

way, but merely reflects careless workmanship or other errors in the shop, and is, therefore, about as likely to occur on one piece as another, it is better to adopt the second plan and set up the net cost of spoiled work as a burden factor where it occurs.

In either case, the importance of spoiled work should be recognized, and spoiled work reports should be required showing all the particulars, including among other things the exact point at which the damage was done, if that can be determined, whatever details the management wants in the way of administration or discipline, and of course the cost of the spoilage.

The objection to letting the good pieces, however few they may be, take up all the cost of the work done on the job, is that when this is done the factor of spoiled work is introduced into cost comparisons, so that if a part is made three or four times during the year, the comparison which is naturally desirable as to material, labor, and burden cost on the part is to a considerable extent disturbed, and may be entirely destroyed, if the spoiled work factor is not eliminated.

TABLE III. RECOMMENDED DEPRECIATION RATES

Concrete buildings	2½%
Brick buildings (mill construction)	4%
Wooden buildings	6%
Machine tools	10%
Transmission (line shafting, hangers, pulleys)	15%
Electric motors	10%
Overhead traveling cranes	10%
All other boiler house, power house, electrical, plumbing, heating, lighting and ventilating equipment	10%
Motor trucks: Heavy	20%
Light	30%
Passenger cars	30%
Office furniture	15%
Office mechanical equipment	25%
Shop furniture, such as racks, bins, benches and trucks	25%

Drawings, Patterns, Jigs and Fixtures

During the discussion of the accounting practice to be recommended for the industry, both at the regional meetings and with the Executive Committee before and after, great emphasis was laid on the accounting for drawings, patterns, and jigs and fixtures; and we understand that the Executive Committee is unanimous in recommending (a) that everything in the nature of repairs to restore worn or damaged pieces should in all cases be charged as an expense, (b) that the cost of new drawings, patterns, jigs and fixtures, not replacement, should be carefully separated from all other costs, and (c) that these outlays should preferably be immediately charged as an expense in the year in which they occur; but under no circumstances should the expense be spread over a longer period than three years. The idea is to recognize these items unqualifiedly as an expense, and if they are not charged out currently as they occur, they should be considered like other deferred charges to operating.

As drawings, patterns, jigs and fixtures are all necessarily identified with lines of product, the cost of producing them handled as indicated in the preceding paragraph might very well be charged by lines.

Supplies, Small Tools, Etc.

Considering miscellaneous shop expenses, it was thought desirable to emphasize the fact that such items as oil, waste, emery cloth, sandpaper, emery wheels, paint brushes, oil cans, brooms, casehardening compound, hardening pots, hacksaws, small drills, etc., should be treated as supplies and charged to expense as issued.

Perishable tools, including hammers, wrenches, screwdrivers, chisels, reamers, larger drills, taps and dies, hobs, milling cutters, counterbores, slitting saws, cut-off saws (both hand and circular), broaches, and tools with a cutting point, etc. came in for a good deal of discussion. The best practice seems to be to charge these items to expense as issued, exactly like supplies; but many companies carry an asset for items of this kind intended to represent in a conservative way the investment which they have in such articles, and this asset should never be increased, except possibly in connection with a marked expansion of the business. Plans of inventorying perishable tools at regular intervals on a very conservative basis, or any systematic plan of depreciation at a high rate (50 per cent was suggested) are acceptable, provided anybody feels that the plan of writing off the cost of these items as issued makes the charge to operating too uneven.

Belting and Gages

Belting was discussed at the same time with perishable tools, and it is recommended that charges for belting be handled on a plan in all respects similar to that recommended for perishable tools. Even where belting is given a steady care it should not be expected to have a life of more than four or five years; and if treated as an asset and subject to depreciation, a rate of 25 per cent is recommended.

More permanent tools such as micrometers, calipers, test plugs, gages, boring bars, vises, milling-machine arbors, electric drills, pneumatic hammers, etc. may perhaps deserve a different treatment, but if set up as an asset should be depreciated so as to be written off over a period not to exceed three years.

Regarding supplies, perishable tools and permanent tools, it should be understood that these are to be set up as an asset when purchased, carried as an asset so long as they remain in the storeroom, but charged out to expense or otherwise when issued. This practice operates to distribute the cost of these items to correspond with the way they are put into use, and under most conditions will make a satisfactorily even spread of this item of expense.

Repairs

Before considering the depreciation of other assets used in the machine-tool industry, it should be understood that repairs of every kind are to be charged to expense as incurred. In this connection it may be well to note that whenever men are engaged on repair work, whether regular machinists diverted to repairs instead of production work, or men from the regular repair crew, the charge for the repair work they do should include not only the wage rate of the men concerned but also an overhead or burden rate on a man-hour basis. Only when repairs are calculated at full cost in this way do the repair charges of the respective departments and production centers appear correctly; and as repairs are frequently an important factor in fixing a burden rate, it is highly desirable that they be stated correctly.

This idea of a full and correct statement of repairs is also important as applied to the costs of separate departments like a foundry or pattern shop, which may exist in connection with some machine-tool plants, but be entirely absent from others. It is also important in connection with an auxiliary department, like the boiler house or the power house, where repairs are likely to be heavy; or a storeroom, hospital or some other department which correct accounting requires should have

its charges separately and fully stated, that the total may be distributed correctly over the departments served.

Depreciation and Obsolescence

Proceeding from this general statement regarding repairs to a consideration of depreciation, the next point to consider is that depreciation rates may and should take into account obsolescence; that is, a charge in addition to wear and tear, in the expectation that the asset may not continue to serve its intended purpose until it is worn out, but (a) that it may be outgrown by the size of the business, or (b) by the need for moving to another location, or may be (c) superseded by a design that is more economical and efficient, so that the business cannot afford to continue to use the original assets.

With this explanatory statement in regard to repairs and the basis for calculating depreciation, the minimum rates recommended by the Executive Committee are

TABLE IV. ESTIMATE SHEET

Material	Weight	Price	Value	—Burden *— Rate	Amount	Total	
Steel	000	00c.	$000	%	$000	$000	1
Castings	000	00	000	%	000	000	2
Forgings	000	00	000	%	000	000	3
Parts	000	00	000	%	000	000	4
Sundry	000	00	000	%	000	000	5
Total material and material burden			$		$	$	6
Labor	**Hours**	**Wage**	**Value**	**—Burden— Rate**	**Amount**	**Total**	
By operations	000	00c.	$000	00c.	$000	$000	7
	000	00	000	00	000	000	8
	000	00	000	00	000	000	9
	000	00	000	00	000	000	10
	000	00	000	00	000	000	11
	000	00	000	00	000	000	12
Total labor and shop burden			$000		$000	$000	13
Total manufacturing cost (normal basis) (line 6 + line 13)						$000	‡14
Selling and merchandising (rectangle 56)						000	15
Administrative expenses (rectangle 52)						000	16
Adjustment of normal cost (see Table II)						000	17
Profit and Federal taxes						000	18
Selling price						$000	19

* Rectangles 37, 38, 39. ‡ Rectangle 48.

as shown in Table III. These rates are to be calculated upon the first cost of the asset, and set up annually in Reserve for Depreciation account. It is recognized that in the present deflation movement, assets may suffer marked declined value through price recession. Such a revaluation would have to be taken care of in a special way.

Estimate Sheet

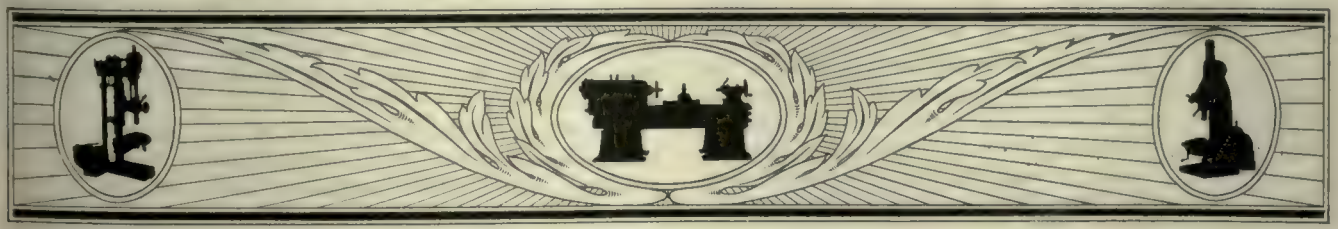
At the regional conferences another matter of large importance was brought up for discussion; namely, what are the factors that need to be considered in fixing a selling price. Obviously the first consideration is to know the manufacturing cost of what is sold, but then the question arises what kinds of charges must be added to cost to make a fair selling price. The Estimate Sheet, Table IV, was prepared as a guide to correct reasoning on this subject.

This estimate sheet from line 1 to line 13 inclusive indicates the general form in which the manufacturing cost of any machine product must be estimated, and also the form in which the cost should finally be collected for the benefit of an executive or sales department. In the case of a simple product, one sheet like this, indicating the material required in its manufacture and the operations necessary to transform it from raw material to finished product, will be sufficient, but in a complicated product like a typical machine tool, there will, of necessity, be several sheets of this general type, one for each of the many sub-assemblies which have to be brought together before the final assembly work on the product can be done.

The "Total Manufacturing Cost (Normal Basis)," line 14, is equivalent to rectangle 48 on the chart. Selling and Administrative Expenses are represented by rectangles 52 and 56. Beyond that are two items that must be taken into consideration (please note the exact wording) in fixing a fair selling price. No one can possibly collect all his Federal Income Taxes from his customers, but every business man realizes that so long as taxes are assessed on the present basis, he must endeavor to get a margin of profit from sales that will pay the tax and leave a reasonable sum for dividends to his stockholders.

The Adjustment of Normal Costs, line 17, is an item that brings us squarely back to cost accounting, and the chart, for if only normal burden is charged into costs, as represented by rectangle 41, there will be at times a considerable amount of unearned burden, rectangle 51, and in the long run, this feature of the business, so far as it is reasonably associated with good management, should be reflected in the selling price, and must be included, if the manufacturer is to continue in business. It is like the idleness of a seasonal business that must be covered during the months the business runs, only that the machine-tool industry has long stretches of activity and then a slump that may continue for months.

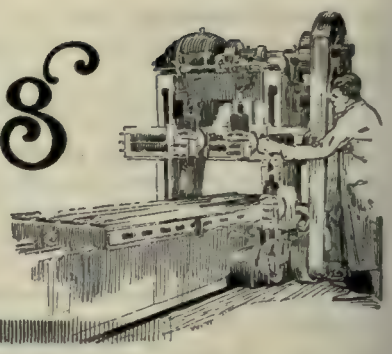
There will always be plenty of room for discretion and judgment about all the items in Table IV below line 14. Of course, Selling and Administrative Expenses, lines 15 and 16, will be more definite than the others, but if records are carefully kept in the form illustrated by Table I, each manufacturer will in time have data available for making an accurate judgment about the influence of unearned burden in his sales policy. Along with these considerations there will always be the pressure of immediate competition, which may be met or ignored as the manufacturer thinks he may best undertake to do. The fundamental idea is that whatever he does should be done with a full realization of all the facts that he can gather to guide his judgment.





Metal Cutting Tools.

By A.L.DeLeeuw



IX. Consideration of Face-Mills Continued—Securing Blades—Rake and Clearance—Backing Off Problems

TRUE face-mills which are fastened to the nose of the spindle, are for that reason of considerable size. As a consequence they are usually made with inserted blades on account of the high material cost if they were made solid. There are many methods in use of fastening the face-mill to the spindle. Not so many years ago spindles of milling machines were provided with a single thread screw, and the face-mill was placed on the spindle in the same manner in which a faceplate is put on the spindle of a lathe. When milling machines began to be used for heavy work it was found that it was practically impossible to remove the mill from the spindle after taking heavy cuts, and one of the first improvements along this line was to provide the spindle nose with a multiple thread of steep lead. Later on various milling machine makers introduced the plain spindle noses, driving the mill by means of a heavy cross key, centering it on a projecting cylindrical part of the spindle, squaring it up against a flange, and holding it in position by means of screws. This construction is shown in Fig. 142.

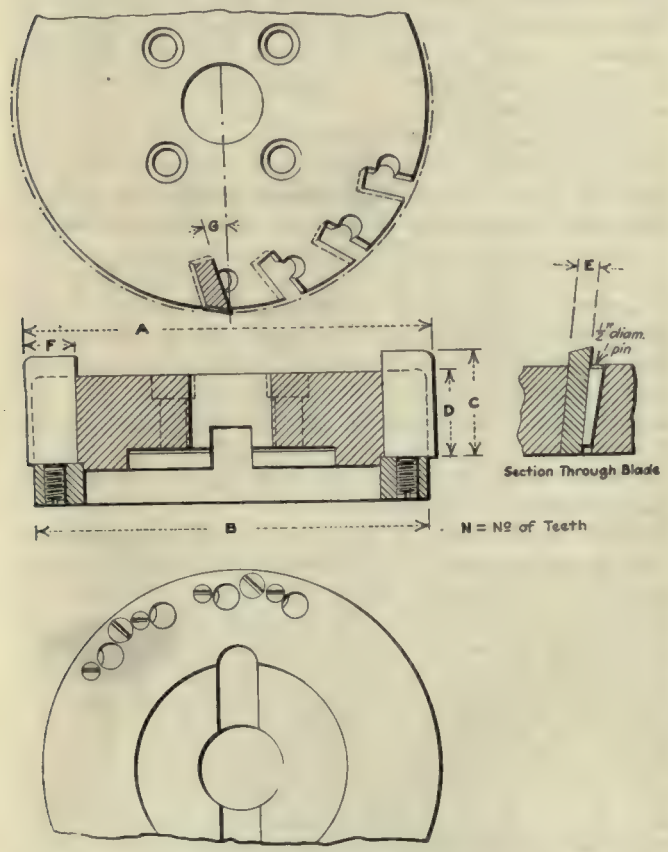


FIG. 142. FACE-MILL DESIGNED FOR DRIVE FROM PLAIN SPINDLE NOSE

Very large face-mills, such as are used on the heavier type of floor boring machines, horizontal and vertical planer type milling machines, and on rotary planers, are often fastened directly to the driving gear. This is the best way of driving a large face-mill, as it avoids vibration and chatter, caused by the torsion in the spindle. However, this method cannot very well be used on most of the existing milling machines. In an effort to make face-mills interchangeable for various sizes and makes of milling machines, one well-known company brought out a system of fastening the face-mill to the spindle, an idea deserving attention on the ground that it is a real attempt at interchangeability. This interchangeability, however, should not be obtained at the expense of rigidity and accuracy. The method referred to consisted of using an adapter which was fastened to the spindle nose and which was made in the form of a truncated cone. The taper was necessarily short. The advantages of this system were that anybody could make such a truncated cone to fit the nose of his particular milling machine, after which a cutter could be used on any size or make of machine provided with such an adapter. The disadvantage was that a short taper will not properly locate the cutter, and the chances were more than even that the face of the cutter would not be at right angles to the axis of the spindle. There would seem to be no good reason why present milling machine makers should not come together and adopt a common form of spindle nose, which would make all face-mills interchangeable so long as they are running in the same direction.

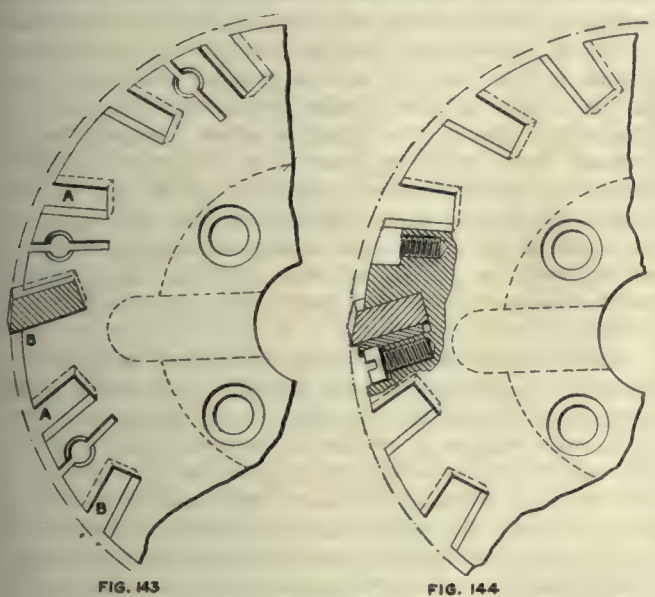
There are many ways in existence of fastening the blades into the body of the cutter. Most methods are good, but some are not. It used to be quite common to have a saw-slot between two blades and to open up this saw-slot by means of a screw, as shown in Fig. 143. This method is not to be recommended. In the illustration blade *A*, which receives its pressure in the direction of the arrow, bears against solid metal, whereas blade *B* bears against metal which can spring away on account of the saw-slot.

Another method is shown in Fig. 144, where a wedge is driven in front of every blade and held in position by a screw. Still another method is the one shown in Fig. 142, where straight pins, beveled off on one side, are driven into holes which are drilled at an angle with the

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blade, which causes them to act in the same way as taper pins. In still other cases, the blades are held in position by means of clamps, which method is illustrated in Fig. 145. All these methods depend on friction to hold the blades in position. The method of using clamps is a good one, as far as the holding of the blades is concerned, though not better than the others. But it has the disadvantage that the cutter becomes unsafe. An operator will naturally be careful not to put his hands or sleeves in the neighborhood of the cutting blades, but he is apt to overlook the fact that it is just as dangerous for him to bring them close to the overhanging clamps or bolts. Furthermore, these clamps can never hold the blade close to the bottom of the body, so that there is a greater part of the blade unsupported than where the wedge or taper pin method is employed.

All of these methods have one common disadvantage. The writer found by experimentation that, when taking medium-heavy cuts, some of the blades will move back.



FIGS. 143 AND 144. TWO METHODS OF HOLDING BLADES IN FACE-MILLS

It is true that this amount of movement is, in most cases, very small. Yet it is sufficient to put additional burden on those blades which have not moved. It was often found, when taking heavy cuts, that the height of the work would vary in the course of time. The work would be higher after several cuts had been taken, and the variation in height was found to be much greater than the possible wear of the blades. All the blades had moved back. For this reason a construction as shown in Fig. 142 is recommended. In this cutter a backing ring is provided. Screws projecting through the backing ring support the individual blades. These screws do not need to be very heavy, for it is not so much the direct end pressure which moves the blades back, as it is the vibration caused by the cut. These backing screws also serve to push the blade through when repeated grindings have caused the projection of the blade beyond the body to be too short. When the length of the backing screw no longer permits the pushing out of the blades, they can be screwed back and spacers placed between the screw and the blade. In the construction of Fig. 142, where the tapered pin is shown for fastening, it is necessary to knock this pin back whenever the blades must be set out, and for this reason a hole is provided in the backing ring, allowing a drift to be used for knocking out the pin. It will be noticed that the heavy end of the pin is at the bottom of the cutter; this is done so that any tendency of the blade to

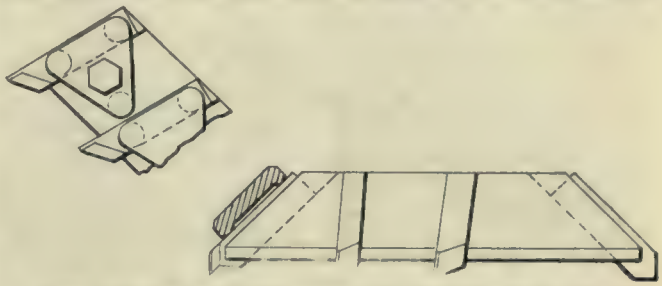
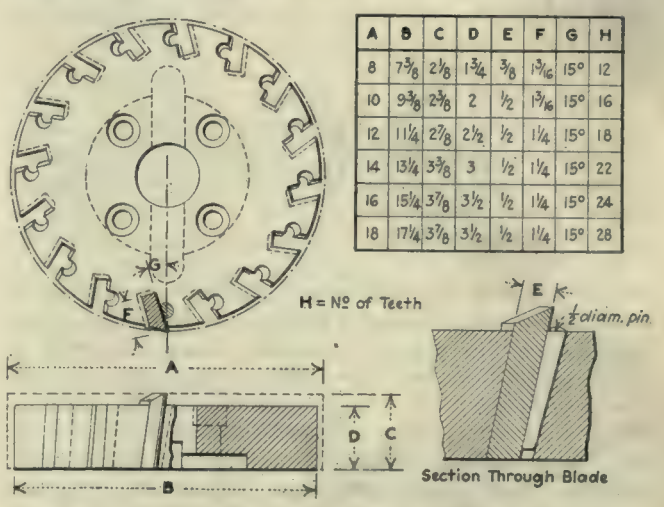


FIG. 145. CLAMP METHOD OF HOLDING BLADES

move upward will be counteracted by the tendency of the pin to go with the blade.

The blades are set in the body somewhat like the teeth of a spiral milling cutter, that is, the slots in which the blades are fastened are not milled parallel with the axis, but as shown in Fig. 142. Not so many years ago, this was the only angle of the blades. It was thought at that time that this provided rake for the cutter. We know now that this setting of the blades will provide rake if the cutter were used as a boring tool, but not when it is used as a face-mill. In order to provide true rake, the grooves in which the blades are fastened are not milled toward the center of the cutter but at an angle with the radial line. This angle may vary but it is usually made 15 deg. when steel is to be milled, 10 for cast iron, and from 5 deg. down to nothing for aluminum. Where a cutter must be used for both cast iron and steel, it will be well to use the lesser angle—10 degrees. If such a cutter must occasionally be used for aluminum it is a small matter to grind a narrow edge of the cutter blade to the desired degree of rake. It should be remembered that it is not at all necessary to have the entire surface of the blade at the desired rake angle, but only a very narrow edge; $\frac{1}{32}$ in. would be sufficient. The angle of clearance is also a variable amount. A 5-deg. angle is all that is required for steel, whereas 8 or 9 deg. is better for cast iron. A compromise angle which will serve both cast iron and steel would be 7 degrees.

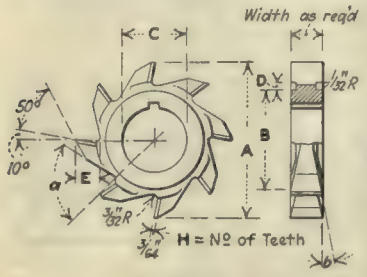
Fig. 142 also shows the manner in which the bottom of the blade of a face-mill should be ground. It was mentioned before how uncalled-for it is to grind the entire bottom of the tooth at right-angles to the axis, and how, on the other hand, bad finish is produced by grinding this bottom to a slight angle. And it is shown



A	B	C	D	E	F	G	H
8	7 3/8	2 1/8	1 3/4	3/8	1 3/16	15°	12
10	9 3/8	2 3/8	2	1/2	1 3/16	15°	16
12	11 1/4	2 7/8	2 1/2	1/2	1 1/4	15°	18
14	13 1/4	3 3/8	3	1/2	1 1/4	15°	22
16	15 1/4	3 7/8	3 1/2	1/2	1 1/4	15°	24
18	17 1/4	3 7/8	3 1/2	1/2	1 1/4	15°	28

FIG. 146. DIMENSIONS OF A FEW SIZES OF FACE-MILLS

how the best way to grind these cutters is to have a narrow land not exceeding $\frac{1}{16}$ in. in length, ground at right-angles to the axis, to have the corner bevelled, and



A	B	C	D	E	a	b	H
2½	1½	1	⅛	13/32	65°	7°	8
2½	1½	1	⅛	13/32	65°	12°	8
3	1⅞	1¼	5/32	7/16	55°	7°	10
3	1⅞	1¼	5/32	7/16	55°	12°	10
3½	1⅞	1¼	¼	½	55°	7°	10
3½	1⅞	1¼	¼	½	55°	12°	10
4	2¼	1½	¼	17/32	55°	12°	12
5	2¼	1½	9/16	⅝	55°	12°	12
6	2¼	1½	⅞	11/16	55°	12°	14

FIG. 147. DIMENSIONS OF SIDE-MILLS

to have all the remainder of the tooth relieved to an angle of about 3 to 5 degrees.

Fig. 146 gives a tabulation of the dimensions of a few sizes of face-mills.

Side-Mills

A side-mill is essentially a combination of a plain-mill and a face-mill. For this reason side-mills should have all the constructive features of a good plain milling cutter and a good face-mill. As a rule, side-mills are made so that they will cut with the circumference and

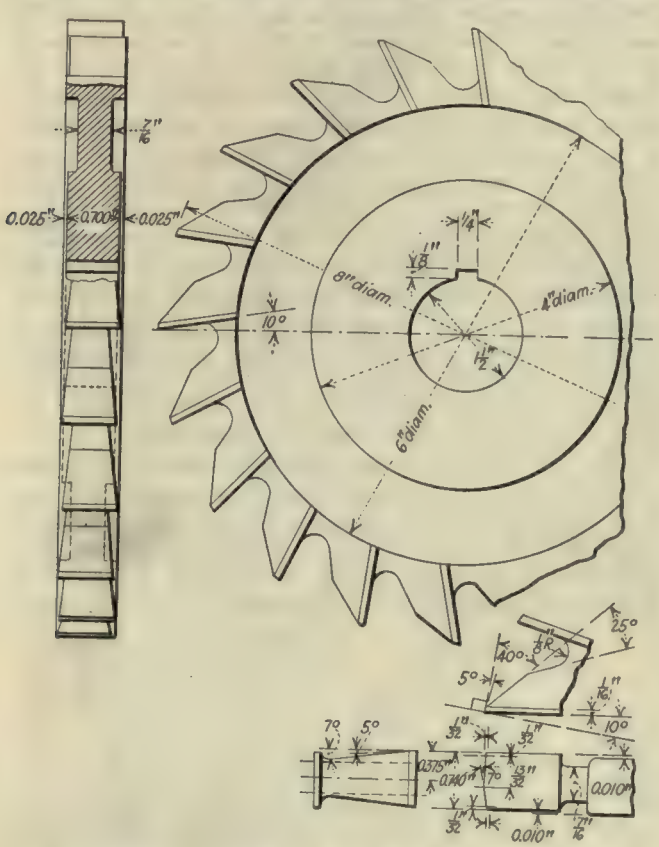


FIG. 148. MODERN TYPE OF RELIEVED SLOTTING CUTTER

with either end. In other words, side-mills, as commonly made, are a combination of right-hand face-mill, a left-hand face-mill and a plain milling cutter. In order to make a good plain mill the teeth should be cut spirally. However, if we do so, we will push the chips toward one side of the cutter and if we should use such a cutter for making slots, there is great danger of crowding the chip between the slot and one side of the cutter. For this reason it is better to make the teeth without spiral—at least for general utility cutters. Where a side-mill is of considerable width and where it cuts a shallow groove, the cutter might be made as a spiral cutter. Where cutters are used indiscriminately for a great variety of jobs, the commercial cutter which is made without a spiral will best serve the purpose. But where we have a manufacturing proposition, where a cutter is used for one operation only, it would be well to look carefully into this matter and decide whether the side-mill should be made with or without spiral.

Side-mills, just as face-mills, should not have the entire length of the side tooth ground at right-angles to the axis. This broad surface does no good if a shallow groove is cut, and does positive harm in a deep cut. Fig. 147 shows a tabulation of the dimensions of a few side-mills.

The matter of the broad side of the end teeth dragging against the finished metal becomes of special importance when very deep slots must be milled. To overcome this dragging, and at the same time to overcome the sticking of the chip in the cut, slotting cutters are often made as shown in Fig. 148. It will be noticed that only two-thirds of the length of the circumferential teeth is ground parallel to the axis, the other one-third being relieved at an angle of about 3 to 5 degrees. This is done alternately, so that if the first tooth cuts on the right, the second tooth will cut on the left, etc. In addition, every other tooth is ground away at the end about 0.010 in. Such a cutter will cut much freer, produce better results, and last longer than the ordinary side-mill.

Where side-mills must produce a slot of given width it becomes necessary to make the mill in two parts which are made interlocking and which can be spread apart by spacers between so as to furnish the proper width of cut. No matter how carefully the two halves are spaced, it will be found necessary to take a trial cut in order to be certain as to the width of slot produced. Though the two halves of the cutter assembled may have the exact width required, when the cutter is assembled on the arbor a slight bending of the arbor caused by the tightening up of the nut may throw the cutter at an angle which is very apt to produce a slot 0.001 or 0.002 in. greater in width than the width of the cutter.

Form-Mills

Any milling cutter of which the body is not a cylinder, cone, or truncated cone, is called a form-mill. Form-mills are used to give some peculiar form or cross section to a piece of work. A well-known example of a form-mill is the gear cutter. In the use of various standard metal-cutting tools we depend on the tool itself only for its ability to remove metal, and we depend on the arrangement of the machine or on the skill of the operator or on both to bring the work to the desired size and shape. For instance, we use the peculiarities of the lathe to make a round piece of work; the peculiarities of the planer to make a flat piece of work. If we want a bevel at a certain angle we depend on the peculiarities of the machine which permits certain slides being set at that angle, and on the skill of the operator to set the slide correctly. When we have to make sections with irregular or complicated outlines we can no longer depend on the peculiarities of any of the standard machines. If we should have to shape a piece of work to a cross section as shown in Fig. 149, we would have to depend entirely on the skill of the operator to plane the piece to the desired shape. Such an operation would

be very difficult and, of course, very slow. If we had only one, or even a few, of such pieces to make, we would have to use the planer and depend on the skill of the operator to have the tool point follow the outline which must first be scratched off on the end of the piece.

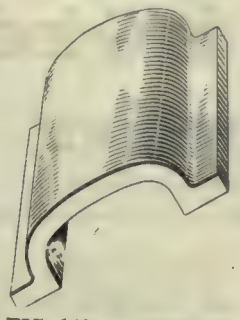


FIG. 149. A TYPICAL FORM-MILL JOB

The form-mill permits us to get away from this slow method of making complicated sections. The cross section of the mill is made to conform to the desired outline of the work. Using such a mill in a milling machine will produce the complicated section rapidly, correctly, and without depending on the skill of the operator. Form-mills, then, are of the greatest economical importance in the machine shop, especially where parts are produced in quantities. Notwithstanding all this, form-mills are not liked in the shop. This is due to the fact that they are apt to give trouble if not properly ground and that they are slow-working as compared to the best design of spiral mills.

If a form-mill were made in the same manner in which ordinary spiral mills, or plain mills, are made, we would first turn up a body which has the desired cross section, we would then mill slots so as to form teeth, and we would finally grind these teeth with the necessary angles. It is this latter operation which is not possible with a form-mill. "Not possible" is perhaps not the correct expression, because there are machines in existence which permit of the grinding of teeth of a form-mill by following a templet of the same outline. However, this method of grinding is not the same in its details as the method of grinding ordinary spiral mills and is quite a lengthy operation. It is, of course, of the greatest importance that the form-mill should retain its shape after every resharpening. If, for instance, we use a disk gear cutter and the shape of the teeth should be changed ever so little after resharpening, we would be cutting gears with improper form of teeth. For that matter, wherever we have to make pieces that should be interchangeable, it is of the greatest importance that the shape of the form-mill which produces the piece shall not change. This requirement of the form-mill is met by the mode of its construction.

(To be continued in next week's issue.)

The Cost of the Metric System to the Machinist

By C. C. Stutz

The machinist in this country is generally a highly skilled mechanic. As a rule, to which there are few exceptions, he owns a toolchest filled in many cases with a most elaborate collection of various tools suitable to his trade. Of prime importance among these are the graduated devices he uses for measuring, such as scales of different sizes, inside and outside micrometers, depth-gages, test-indicators, screw-pitch gages, wire gages, caliper gages, etc., etc. On his ability and skill to properly use these tools, depends his earning capacity.

How would the machinist be affected if the bills (H. R. 15,420 and S. 4,675) now before the committees of both the House and the Senate should become the law?

Section 5 of these identical bills provides:

"That from and after four years from the date of passage and approval of this Act no person shall manufacture or make for himself for use, or purchase for use, or convert to use, in any of the transactions detailed in section 4, any weight or measure or weighing or measuring device designed, constructed, marked, or graduated to determine, indicate, or deliver weights or measures in any other system than the metric system of weights and measures."

It will be readily admitted that the tools the machinist owns cannot be regraduated to the metric system. Being compelled by the provisions of the bills to work only to the metric system, he is obliged to buy new measuring tools.

This expense can be judged by the list given herewith, which in the majority of cases will be much larger:

1 two foot rule	$0.50
1 steel rule, 2 in. long	0.40
1 steel rule, 6 in. long	0.80
1 steel rule, 12 in. long	1.50
1 key-seat rule, 4 in. long	3.00
1 micrometer depth gage	8.50
1 screw pitch gage	1.25
1 center gage	0.50
1 wire gage	3.00
1 one-inch micrometer caliper	8.50
Total	$27.95

Such tools as the following are omitted, although they are very frequently found in the machinist's outfit:

Dial test indicator	$24.00
Standard screw thread-tool gage	3.00
29-deg. screw thread-tool gage	3.30
Twist-drill gage	2.75
Inside micrometer caliper	15.00
2-in. micrometer caliper	12.50
Steel rule 24 in. long	3.00
Total	$63.55

We thus see that the cost involved in this change will run for the individual from $28 up to over $90. Many of these machinists are classified as "toolmakers." Their toolchests contain a much larger assortment of measuring tools, the average cost of which can be placed at $150 and over. The National Association of Machinists, affiliated with the American Federation of Labor, alone has a membership of about 400,000. The cost to this body of men would be represented (at a low estimate) by $28 \times 400{,}000 = \$11{,}200{,}000$.

But all machinists are not members of the A. F. L. A very conservative estimate places their number at at least 1,000,000. Taking this figure as a basis, the cost of changing from one system to the other would therefore involve approximately $28,000,000, an outlay which must be borne by the individuals.

But while this cost is a great burden and will undoubtedly be resented, a far greater burden is laid on the machinists by the metric legislator. By compelling the workman to use unfamiliar and unhandy tools, by insisting that he think in a strange language alien to his experience he is deprived of value, of his capital, the possession of which enables him to command his price in the labor market and so make his living for himself and his family. The metric promoters claim it a simple matter to acquire the knowledge of their system. But this is not the case, because the mere measuring in millimeters instead of inches is not one-half of one per cent of the knowledge required by a machinist to properly use this system.

With his inability to rapidly conform himself to conditions arbitrarily imposed upon him his value will decrease, he will suffer and so will his employer. The cost of the tools he must replace is therefore the smallest part of his burden and becomes insignificant by comparison. Thus a sequence of events is put in motion which will react on the country as a whole.



The Use of Special Fixtures in Grinding Operations

By Ellsworth Sheldon
ASSOCIATE EDITOR AMERICAN MACHINIST

Cylindrical Work Ground on Dead Centers—Special Holding Devices for Grinding Chuck Shells—Magnetic Chucks Provided with Holding Strips and Aligning Bars

THERE are few minor annoyances more exasperating to the careful, conscientious toolmaker than a "wabbly" drill chuck.

When he is endeavoring, with a No. 60 drill, or smaller, to spot a center that is indicated only by an infinitesimal prick-punch mark, and yet is depended upon to locate a drill-hole within a very few thousandths of an inch of a certain point or line upon the work; to have the drill, upon being set in motion, assume a fuzzy appearance at its outer end and look to be three or four times bigger than it really is, generally causes him to use language that should be no part of the vocabulary of a self-respecting toolmaker.

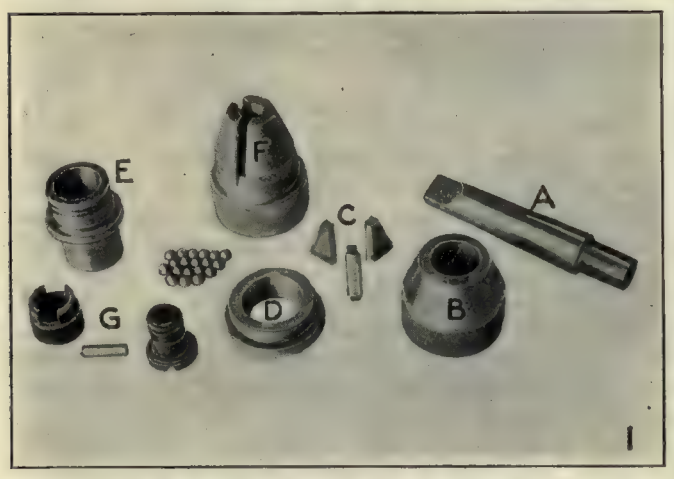


FIG. 1. PARTS THAT MAKE UP THE MORROW CHUCK

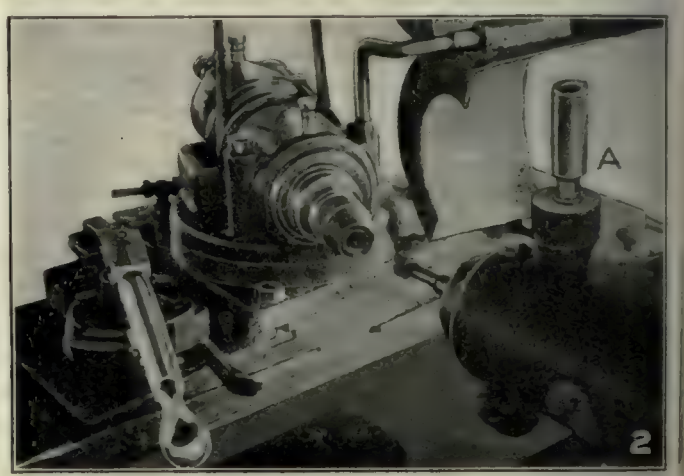


FIG. 2. GRINDING THE TAPER ON INTERIOR OF SHELL

And yet many drill chucks do that way. This is not because the manufacturer makes them so; for all makers of these tools pride themselves upon producing a "true-running" chuck, and a drill held by any new chuck in a true-running spindle revolving at high speed will look like a rigid and stationary piece of wire.

Drill Chucks Are Often Abused

Drill chucks are, however, subjected to more abuse per square inch than almost any other tool. There is always the fellow who wants to punch a hole through without waiting for the drill to cut out the metal, and who, with spanner and hammer or any old chunk of iron that comes handy, will "sock up" the chuck until its parts are distorted, and another wabbly chuck is added to the equipment.

There are two commonly applied methods by which a drill chuck may be made to hold a drill in true axial alignment with its own center line and with the center-line of the spindle in which it is used. Both are corrective and are not necessarily a part of any manufacturing process.

One is to hold in the spindle of a grinding machine a round piece of steel small enough to be within the capacity of the chuck that is to be corrected, and grinding it true; after which, and without removing the round piece from the machine, the chuck is gripped onto it in the same manner as a drill would be held, and the taper hole in the body of the chuck is ground true by means of an internal grinding fixture.

The other method is to hold the chuck by its own taper shank in the spindle of the grinding machine, open the jaws to nearly their full capacity and grind the "bite" of the jaws with the internal wheel. Either of these methods will correct a faulty chuck but neither is properly a manufacturing operation. Drill chucks should be, and are, made to run true in the first place and do not need to be corrected until after the "bulldozer" has "put them on the blink."

The E. Horton & Son Co. of Windsor Locks, Conn., makers of the "Morrow" drill-chuck, machine the chuck parts nearly to size, harden them, and then finish them by grinding; by which method the chuck will, when assembled, run true without any corrective operation. This would be the toolmaker's method of making a single chuck; but under ordinary circumstances such tactics, applied to the manufacture of a device that must be produced in hundreds or thousands, would render its cost prohibitive. It is only by the use of special fixtures, designed for and used upon grinding machines exactly as similar fixtures have long been applied to

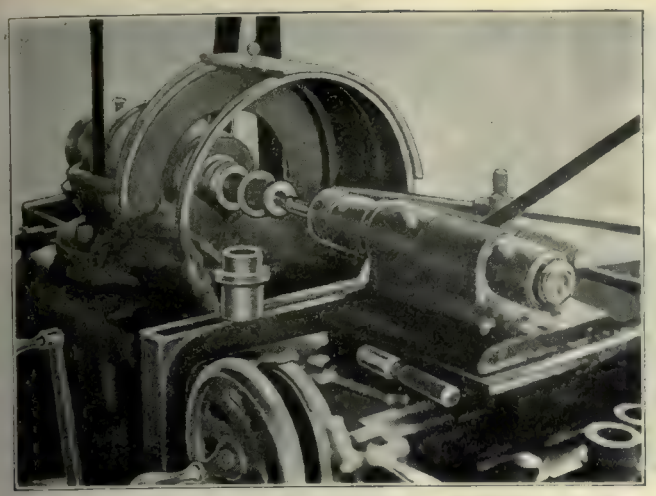


FIG. 3. GRINDING THE TAPER HOLE FOR THE SHANK

operations upon unhardened material, that results may be obtained at a reasonable cost.

The Morrow drill-chuck is too well-known to warrant an extended description of its construction and manufacture, therefore the scope of this article is confined practically to those parts which are hardened directly after they come from the turret-lathe or other manufacturing machine and upon which the finishing operations are performed by grinding.



FIG. 4. HAND BROACHING DEVICE

The separate parts of a Morrow chuck are shown in Fig. 1; the parts finished by grinding being the shank *A*, the shell *B*, the jaws *C*, the thrust collar *D*, and the inner part of the chuck body *E*. (The chuck body is made in two parts instead of one because of the feature, peculiar to the Morrow chuck, known as the "releaser.") The outer part of the chuck body, shown at *F*, is not ground; being the only unhardened part of the chuck. The parts of the releasing device, shown at *G*, are hardened but no machining operations follow the hardening.

The grinding of the shank is, of course, done upon centers and involves the use of no unusual devices.

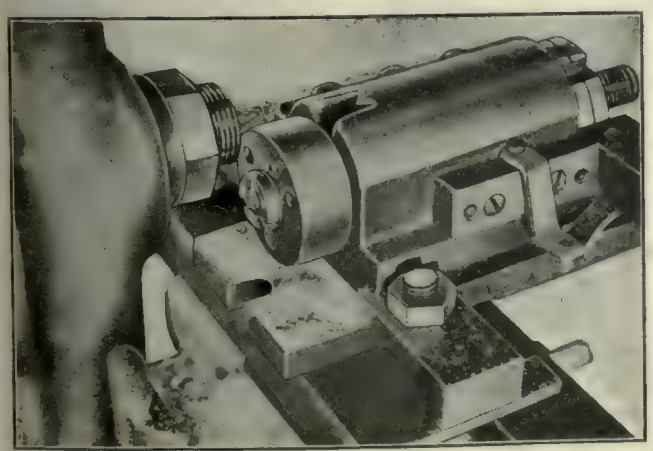


FIG. 5. FIXTURE FOR SLOTTING THE "RELEASER"

It would be difficult indeed to conceive of any device that would be better adapted to the accurate and rapid grinding of parts, the nature of which lends itself to this method of holding, than a pair of dead centers and a driving plate so arranged as to traverse the work back and forth before the grinding wheel while revolving it through the medium of a loosely connected dog. No inaccuracy that may be inherent in the machine can thus be transmitted to the work.

The shell *B* is produced originally upon Gridley Automatics. From these machines the parts come practically finished as to shape, but not to size. The knurling is put on, but the internal thread that holds the part to the chuck body is the subject of two later operations.

The first of the threading operations is performed in an engine lathe where the shell is held by means of a special draw-in chuck of which the spring collet is removable and holds the work by expanding inside the tapered part of the shell; drawing the shell to a seat correspondingly tapered to fit its outer contour. The thread is cut to gage (but not to finish size) by a single-point tool in the usual manner.

The reason for keeping this thread to a definite size, even though it is practically but a roughing cut, is apparent when it is seen that it becomes the locating point for the next operation—finish-boring the inner tapered surface. For this operation it is screwed to a shank mounted in the spindle of an engine lathe and a cut run over this surface by means of an internal boring tool. This operation naturally leaves a true-running shell, but all interior dimensions are still below finish size for the piece is yet to be hardened. In packing the shell for carbonizing, the threaded portion is first filled with fireclay so that it will receive no carbon from the carbonizing material. Thus, in the subsequent hardening, the thread is as soft as it was originally. After the hardening operation the thread is brought to finish size by tapping.

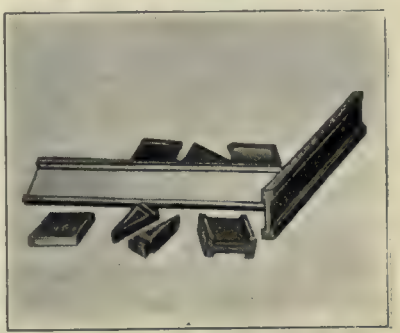


FIG. 6. JAWS, BEFORE AND AFTER CUTTING UP

A Van Norman grinding machine is used for the final operation which is the grinding of the interior cone. As this is the surface that determines the position of the jaws it is one of the two factors (provided the jaws themselves are all alike) upon which the truth of the chuck depends.

In the spindle of the grinding machine is a threaded shank (the counterpart of the one used in the lathe to hold the shell for boring, except that it is to finish size) that is in effect a dummy chuck. When the shell is screwed upon this shank it is in exactly the same position relative to the other parts that it will occupy, when, as a part of a finished chuck, it is used in lathe or drill press. The grinding upon this part is very carefully done and each piece is tested with the taper plug gage shown at *A*. Not only must each piece show a full bearing upon the plug, but the fit must be good enough so that, though the included angle of the taper is nearly 60 deg., the shell will support its own weight by adhesion when held in a vertical position.



FIG. 7. HOLDING THE JAWS FOR GRINDING

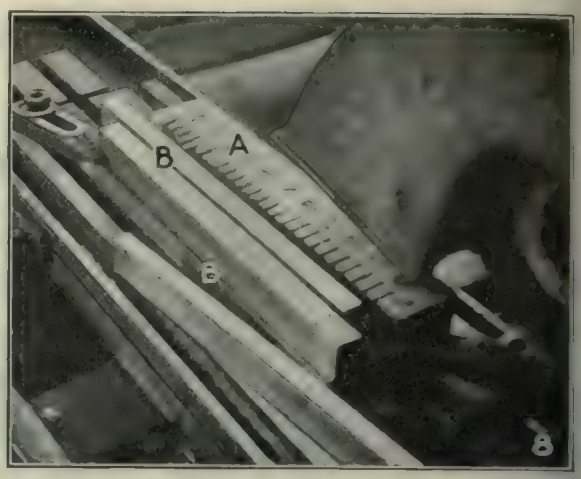


FIG. 8. FIXTURE TO HOLD JAWS FOR GRINDING END

The part *E*, Fig. 1, is finished practically all over by grinding. The hole in one end is the tapered socket by which the chuck is held to the shank, and in the other end is the thread that holds the releasing device in place. This thread is protected in the carbonizing process so that it remains soft when the rest of the piece is hardened; and the thread upon being retapped to size becomes the locating point for the succeeding operation, shown in Fig. 3.

In this operation the tapered hole for receiving the shank is ground to size. Following this the parts are held by a shank fitting the tapered hole while they are ground over the entire outer surface, including the shoulders, one of which acts as the ball race in the ball bearing that sustains the thrust of the jaws in closing the chuck on a drill.

Skill Required in Grinding the Collar

The grinding of the threaded collar *D*, Fig. 1, is a job that requires careful attention in order to produce the pieces at a rate that may consistently be called a manufacturing operation, and still keep within the required limits of accuracy. The sizing of the whole while the piece is located by the threaded portion is easy, but the facing of the shoulder and of the end of the piece, though accomplished by ordinary methods, is one that requires skill and attention, for the reason that the distance between them must be maintained within very close limits so as to allow the collar to come to a bearing upon the ring of balls at the same time that the shoulder seats upon the body of the chuck.

If this distance is too long it would result in a looseness that, though not affecting the accuracy of the chuck, would convey the impression of faulty workmanship; while if the distance is too short the chuck would bind and it would be impossible to operate it.

The releasing device *G*, Fig. 1, has no machining operations after hardening except the finish broaching of the three radial slots which hold and operate the chuck jaws and which are left as soft as may be in the hardening.

The device shown in Fig. 4 is used to do the broaching. It is held in a bench vise and all the movements are performed by hand. This device is very simple; does the work perfectly; and is probably much faster than any entirely mechanical movement would be. The slots have been milled to size in the indexing fixture shown in Fig. 5 before the piece is hardened; therefore the broach has merely to clean them out and make certain the jaws will slide freely therein without shake.

Forming the Jaws

The stock for the chuck jaws is first milled out to a section not unlike an I-beam but with the web very deep and thick in proportion to the flanges. It is flat bar stock, carbon steel, just large enough to finish all over and is cut up in strips about 6 in. long.

The channels are milled on each side of these short pieces in two operations. The edges are then rounded to conform to the curvature of the interior of the shell

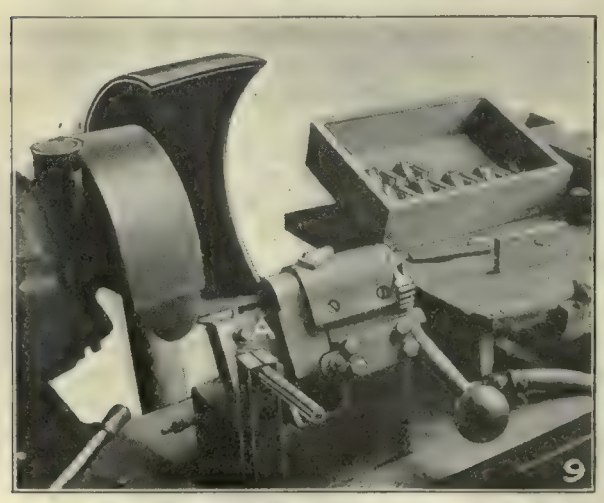


FIG. 9. SPECIAL DEVICE FOR GRINDING "BITE" OF JAW

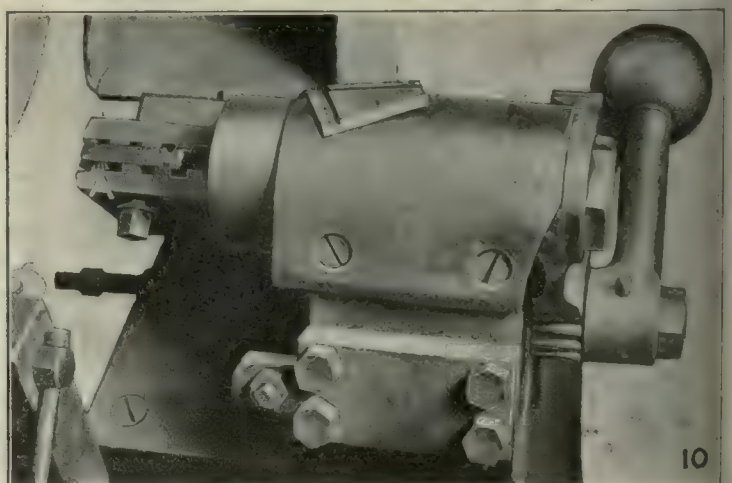


FIG. 10. THE HOLDER REVERSED

in two further operations, following which the formed pieces are sawed into six or more sections, according to the size of the jaws to be made, by a gang of saws.

This latter cut is not made at right angles to the piece, but at an angle to complement the angle formed by the taper of the inside of the shell, so that the resultant pieces are rhomboid in shape. Each of these pieces is then cut in two at an angle and each jaw thus formed is grooved on both sides parallel to the widest end to fit the groove in the corresponding part of the chuck. The transformation is shown in Fig. 6. None of these cuts, except the depth of the grooves, is to finish size.

The jaws, after hardening, are ground on the sides and under the shoulder formed by the channelling cutter, by placing them in a row upon a special holding strip on a magnetic chuck. The rounded surface of the tapered part of the jaws abuts against the aligning bar or gage which forms a part of the chuck. This aligning bar, being in magnetic contact with the body of the chuck, forms one pole of the magnet while the steel parallel upon which the jaws rest, in turn rests upon the central polepieces of the chuck, thus forming, through the jaws, a complete magnetic circuit that holds the latter very firmly.

In milling the channel in the steel bars that afterward are made into jaws, the forming cutter is so made as to cut a relief immediately under the shoulder, so that in the grinding operation shown in Fig. 7 it is practicable to grind the side of the jaw and the inner face of the shoulder at the same setting. The wheel is run over the work, reducing its thickness, until the side of the grinding wheel touches the shoulder, at which point further movement of the cross-slide of the machine is prevented by a stop.

Reversing the position of the jaws on the parallel the grinding is repeated upon the other side; thickness of the work being determined by gage and the relative position of the shoulder fixed by the stop on the cross-slide. Grinding this shoulder serves only to bring the two sides parallel and in correct position relative to each other. As this shoulder becomes the locating point for the succeeding operation it is not necessary for two loadings, or even for two jaws to come exactly alike in this respect.

The wide ends of the jaws are next ground in the fixture shown in Fig. 8, where they are held by slipping them into the comb-shaped steel plate *A* that forms the top of the fixture and wedging them in place by the taper wedges *B*.

From this operation they go to the cylindrical grinding machine where they are held, six at a time, by a special fixture and ground upon the curved outer edge, which, as stated in reference to the shell, becomes one of the important factors in securing a true-running chuck.

The final operation upon the jaws is the grinding of the "bite"; the edge that is in actual contact with the drill when the chuck is in service. The device used is a small special machine with an electrically driven wheel, shown in Figs. 9 and 10.

The holding fixture has two positions, reached by throwing the weighted lever to the limit of its movement in either direction.

The jaws are held, one at a time, in the vise *A*, where they are located by the ridge, or shoulder, along the curved edge and by a stop which limits the distance to which they can be inserted. The wheel head has two movements; one lengthwise and one crosswise of the work, besides vertical adjustment. The vise or clamp pivots about a center that is in the same axial line as the edge of the jaw to be ground so that it is necessary only to traverse the wheel over the work, reverse the position of the weighted lever and bring the wheel forward again to grind both bevels upon the gripping edge of the jaw.

A Question in Factory Management—Discussion

By A. W. Forbes

L. L. Thwing has an interesting article on page 422 of the *American Machinist*, in which he states that the technical graduates are not advancing to the higher positions in technical lines to the extent that he feels they should, and he raises the question of why, but does not attempt to answer it.

My experience with technical students may furnish some evidence, but my experience is too limited to be taken as more than a base for some suggestions. It is confined to students of one of the leading technical schools of the country, requiring full high school course before admission, and giving a four-years' course to the degree of B. S., five years to M.E.., E.E., and the others.

I have tried members of all four classes, and they all do good work in snagging castings and in the operation of simple machines where skill is not required, but for work that requires technical judgment, such as the design of special tools or the operation of a difficult machine, I have found the freshmen distinctly and consistently superior. They seem to have a better ability to apply their intellect to the specific problem in view.

In the first place the entering class is a select body containing the best mechanical brains in the country, so that the excellent work done by many of the freshmen is not surprising. But why can I not get equal results with the upper classmen? One reason that I have thought of is that possibly they study so much at school that it places the mind in a condition that makes further thought repulsive, in the same way that physical exhaustion makes a person want to rest. But it is not a daily phenomenon, for the freshmen engaged in the middle of the year appear about the same as those engaged at the beginning. If it is a matter of exhaustion, it takes a year or so to show results.

On the other hand it may not be exhaustion at all. It may be that the ideas of the older students have advanced to such a point that they look down on the problems that I am able to give, and, therefore, do not give them the thought that is necessary. If such is the case we should not expect them to advance beyond the job of straightening steel plates as mentioned by Mr. Thwing. They cannot expect advancement until they have shown themselves to have enough intelligence to handle a simple job well. They may know that they have this intelligence, but their foreman is not likely to see it unless it shows in their work.

One of the professors told me that he thought the trouble was that the upper classmen have more to do at school, but from what I have seen of the students, I do not think that this is in any way responsible for the results.

Possibly someone may have other explanations or may have had different experiences with technical graduates.



The Foreman and His Job

Suggestions for live foremen who wish to go up the ladder, and for firms who want better shop executives

By Fred H. Colvin
Editor, American Machinist

ONE of the real problems of the foreman is to pick the right men for the different jobs. This does not refer so much to the hiring of men as to giving each man the job he can handle to the best advantage both to himself and to the firm. The human qualities must be carefully considered in making these selections.

It is usually found for example, that a man of nervous temperament is not happy either turning or grinding crankshafts. The motion of the various cranks as they fly through the air is disconcerting to many and they are not only uncomfortable but apt to be inefficient from fear or timidity. The same man will do much better on comparatively plain work such as cam shafts, lay shafts for transmissions, spindles for machine tools and similar work.

Some men do better on heavy work and others on light work—and this is not by any means connected with the size of the individual. Some large men make excellent inspectors on small, delicate work, while others belong on a huge boring mill or planer. The same is true of small sized men and medium sized men. There is no grading them by size though much can be done by making a study of character as expressed by the face and head and by actions.

A Dollar Man and a 40-Cent Job

Another very important point is to guard against putting a fine workman on coarse heavy work which can be done by a cheaper man. The cost of the work as well as the effect on the man must be considered in all such cases.

But in plain language—"Do not put a dollar an hour man on a 40-cent an hour job."

This is not always easy to guard against, however, as experience shows. Nor is it always easy to prevent putting men at work where they are not the most efficient. For circumstances will arise when work must be gotten out and the men available must be used. Then too it is frequently necessary to keep an organization together during a slack period, even though we know the work will cost more than usual. It is for reasons like these that hard and fast rules are not practicable for all cases. We must try to follow the best course under the different conditions which arrive.

Keep an Eye on Costs

It is when the job to be done contains both coarse and fine work that we are most apt to find expensive men on the wrong work. This is taken care of in some cases by dividing the work, even in small shops, so that the rough work is done before it comes to the high-priced man. In the case of some tool work it is now quite common to have the tool roughed out by lower priced men, and the finer work done by the skilled men. In some shops during the war, much of the preparatory work was done by women, and in some few cases these women became expert and finished the tools themselves.

Perhaps the best guide as to whether the right men are being used or not is to watch the cost of the tools or the machines being made. It is also well to remember that men do the best when the work is congenial. Some men like punch-press die work, others gages and still others tap and die work. Precision work appeals to some while the regular run of repair work, with its ever varying problems, makes life worth while for many. Cost, the natural aptitude of the worker, the keeping of work going through the shops, preventing disorganization, all must be considered in distributing work and this is one of the best tests of a really good foreman.

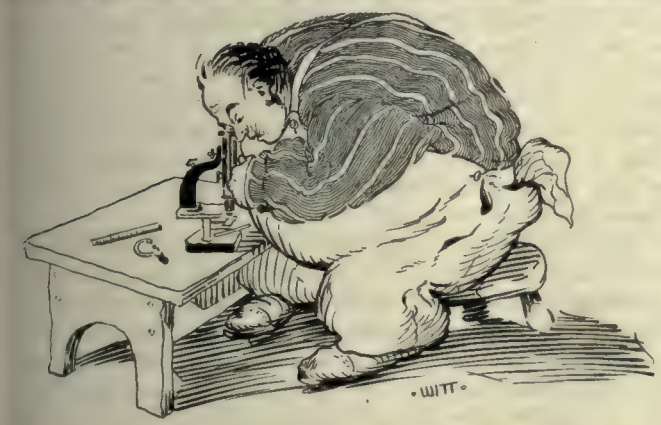
One of the greatest helps a foreman can have is a

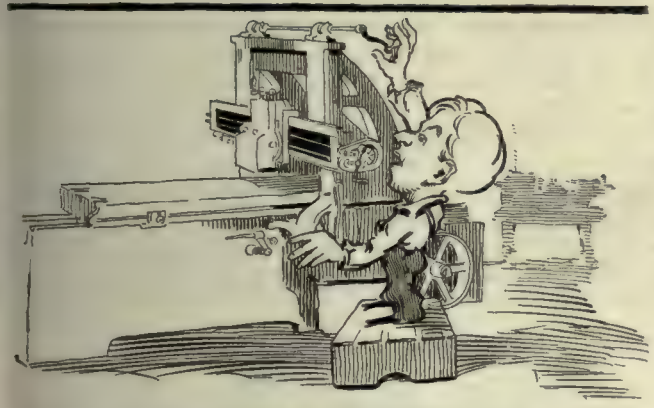


MUCH CAN BE DONE BY MAKING A STUDY OF CHARACTER AS EXPRESSED BY THE FACE AND HEAD

schedule of the work as it should go through his departments. If this is not part of the shop system, it is a good plan to fix up a little schedule of your own. Knowing when the different jobs are to leave your department, and knowing how long the work should take, tells you when it must be started. And right here is a good place to practice "safety first" on delivery schedules. Always allow a margin over the usual time required for machines will go out of commission, tools will break and men are bound to be absent, sometimes unavoidably. It isn't always a ball game that keeps them away either.

Once in awhile you can make up lost time by getting all your men working with you to the limit. Once in awhile overtime helps out on a rush job. But avoid it whenever possible as it is of doubtful value in the long run. When the men know you are delayed by things you could not help, they will usually duck in and help





YOU CAN'T GAGE A MAN'S JOB BY HIS SIZE

you out of a hole gladly. But if it happens too often, they know it is bad management somewhere and the enthusiasm wears off.

Automobile Etymology

By Edwin Tarrisse

With reference to the use of foreign words by American manufacturers to describe American-made products, it may be pointed out that automobile terms are almost all imported from France, and that some of these have homely meanings in the French that are quite unlike the rather aristocratic sound they have in our ears. We talk of the tonneau, of the limousine, of the garage, of the chassis, of the chauffeur, but it is unlikely that any of us ever stop to inquire where these words come from and the reason for the present application.

A tonneau in French is a vat or tub. That is surely a fine name to apply to that part of the automobile in which the passengers loll at their ease! What is a limousine? It is cruel to be obliged to state that a limousine is a rough goatskin such as is worn by the peasants of the countryside near Limoges.

The driver of a motor car is a cut above the driver of other vehicles. We do not even call him a driver. Let us again consult the dictionary. Here he is: "Chauffeur, a fireman, a robber."

Good Work in the U. S. Bureau of Standards

The work that is being done by the U. S. Bureau of Standards is brought to our attention at intervals.

A short time ago the Interstate Commerce Commission submitted a portion of a broken locomotive crank pin which was the cause of a wreck on one of the Eastern railroads. It was requested that an examination of the pin be made to ascertain the probable cause of failure. A summary of the Bureau's report to the commission shows: "(1) that the material is satisfactory in that it meets the required specifications; (2) that the fracture was of the fatigue type and originated on the outside surface of the pin, presumably being localized by some surface defect; and (3) that the mechanical properties of the material may be very materially improved by further heat-treatment so that the ability to withstand failure of this type should be very considerably increased. In view of the uncertainty which exists concerning the service conditions which serve to localize a break, it cannot be claimed that failure would not ultimately occur regardless of the structural condition and mechanical properties."

Recent experiments at the Bureau of Standards have gone far toward determining the causes of airplane disasters which, according to the pilots' reports, were caused by engine trouble. Subsequent examination of the engine would fail to disclose the trouble with the result that the pilot would be blamed. The Bureau of Standards investigations have disclosed the fact that an airplane motor, while traveling at a high altitude, is the victim of a snow-storm. The snow-storm, however, is not visible to the pilot, as it is in the intake manifold.

It is stated in the report that to form snow, two conditions must be met: (a) moisture must be present and (b) the temperature must be low enough to freeze this moisture. Indirectly, both of these conditions may be satisfied by the vaporization of fuel in the inlet system. During tests in the carburetor test plant of the Bureau, the snow itself has been observed through a glass section of the induction system. By reducing the air to a condition of rareness approximating that of the upper altitudes, measurements showed the rate of air flow to have decreased as would have been the case had the drop in power been occasioned by closing the throttle. At this point the trouble developed. By then preheating the air as it entered the engine, the trouble disappeared. Tests showed that the chief danger from this source is not that it causes a decrease in power, but that it results in fluctuations of power which can neither be predicted nor controlled by the pilot. These fluctuations are produced when fragments of snow are dislodged and result in changes of speed similar to those produced by suddenly opening the throttle. Moreover, if such trouble is instrumental in causing disaster to the plane, the snow will all melt before the engine can be torn down for examination, leaving nothing to substantiate the pilot's report of engine trouble.

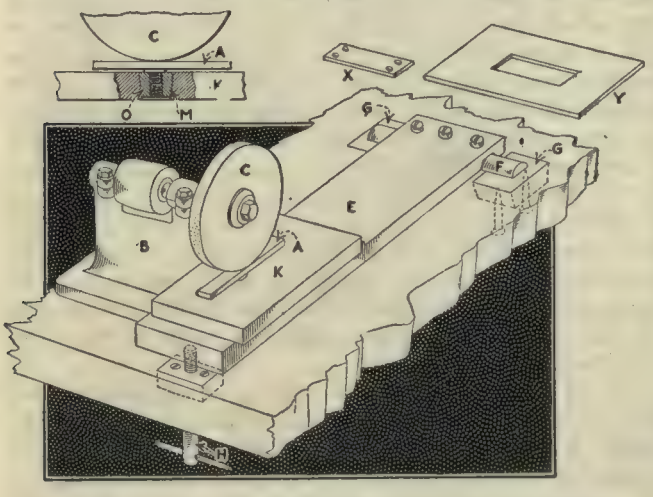
Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

A Home-Made Surface Grinding Machine

By John T. Slocomb

About thirty years ago I was struggling along trying to make a success in a little shop where the equipment and the bank account both were far from what most people would consider satisfactory. One of our problems was to surface-grind, accurately, several hundred hardened steel bases as shown at *A*. These pieces each



AN EFFICIENT HOME-MADE SURFACE GRINDER

had a threaded stem in the center on one side and the opposite side had to be ground true and at right angles to the thread. My associate said, "Send them outside to be done," but there were objections to this—the condition of our bank account and our own lack of work. I suggested the make-shift grinding machine, as illustrated, and I remember that Jim remarked that "It would not be worth the powder to blow it to blazes." The device was made and Jim finally admitted that it was "worth enough powder to blow it a long ways anyway," for he used it himself for quite a number of years and grew to consider it as a part of our regular equipment. In after years a new and up-to-date surface grinding machine with magnetic chuck and all the fixings was set to work on this job, but the quality and the time were not improved, and considering the extra cost, the old method had something in its favor.

Referring to the drawing—*B* shows our all-around grinding-wheel stand bolted to the work bench in the usual way. *C* is the grinding wheel set out on the spindle by a wooden collar. An adjustable tilting cast-iron plate is shown at *E*, the back end of which swings on the trunnion *F*. This trunnion is fastened in the V in plate *E* by three screws and has a bearing in two babbit blocks that are molded in mortices cut in the top of the work bench as shown at *G-G*. This tilting plate is supported on the front end by the adjusting screw *H* and this screw works in a nut that is morticed and screwed to the bench as shown. The top surface of the tilting plate is planed and scraped to a good surface for the upper or work plate *K* to slide on and the surface of the work plate is also planed and scraped. A taper hole *M* is bored through this plate, true with its planed surface. The bushing *O* is made to fit this taper hole and is threaded inside to take the threaded stem of the work, the piece being screwed down to a shoulder on the top of this bushing. The taper of the bushing is such that it will cling to the seat, though not so hard but that it can be turned to align the work with the slide. The work is moved back and forth under the grinding wheel, by hand, and the feed to the cut is made by the screw *H* under the bench.

This device was used for a considerable variety of work within its range. In grinding little hardened steel plates as shown at *X*, where they were too thin to be handled by the hand directly, a hole of similar shape though a trifle larger, was made in the piece of sheet iron, as shown at *Y*. The work was held on the table by this plate, into which the pieces fitted loosely. With this device any piece that has one flat side is easily ground on the opposite side to great accuracy. Work that has sprung or warped in hardening is made to lie flat in grinding the first side, by putting little drops of soft solder on some of the low places and then filing them off flat.

For a real nice job of parallel grinding, this method is hard to beat. It might be thought that the connection through the wooden work bench would be too weak and springy, but it seemed to be a help in keeping down vibration. Sometimes we used a heavy weight attached to the tilting plate and suspended under the bench.

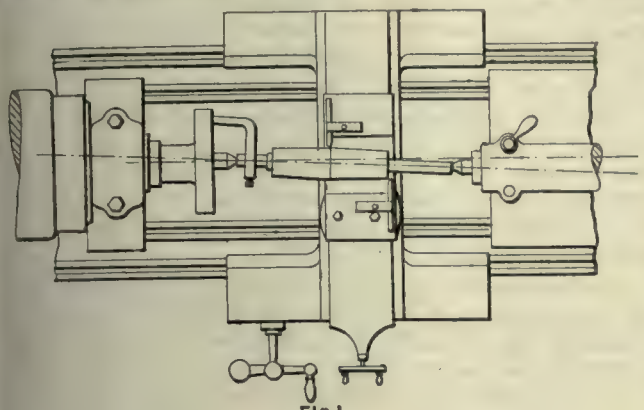
Speeding Up on the Lathe

By R. H. Kasper

Having a number of cast-iron double-cones to turn in the lathe, it was found that the set-up shown in Fig. 1 reduced the time by more than half. The tailstock is set over in the usual manner, but instead of turning off one taper and then reversing the arbor to turn the other taper, two tools are provided, turning both tapers at the same time. Fig. 2 shows the set-up as seen from the tailstock end, in a line parallel with the axis of the arbor. The toolpost is removed from the cross-slide, and a cast-iron bracket is used in its place. A tool is carried on each ear of the bracket, the tool on the back of the bracket being inverted. The back of the bracket is made higher than the front so that the tool will be held with its cutting edge in line with the center of the work. The support for the back of the bracket is gibbed to the dovetail of the cross-slide, so that it cannot lift up under the force of the cut.

The tool at the front starts the cut from the small end of the work, while the other tool starts from the center and runs to the other small end. The distance between

the cutting edges of the tools, measured parallel with the cross-slide, is equal to the largest diameter of the work. The tools should be set so that they both begin the cut at practically the same time. Otherwise a step



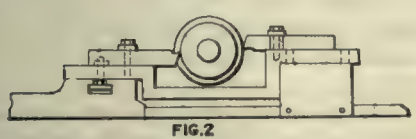


FIG. 1. PLAN OF SET-UP FOR TURNING A DOUBLE CONE
FIG. 2. END VIEW, SHOWING ARRANGEMENT OF TOOLS

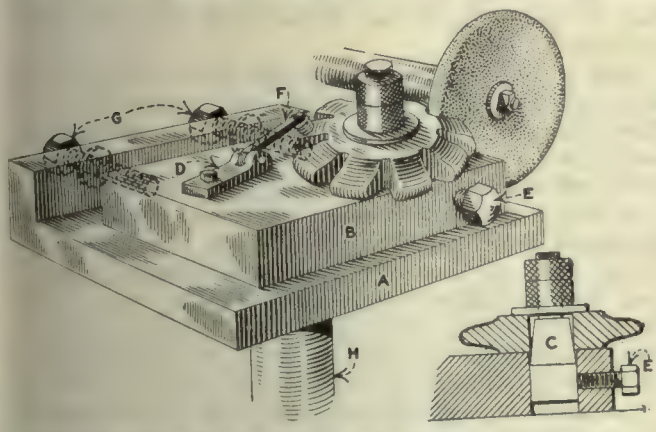
may be cut on one side when the second tool starts to cut. The work is held against a flange on the arbor, making it unnecessary to adjust the cut for each piece. Should more than one cut be required, it would be advisable to provide screws for adjusting the tools.

By having two tools in operation at the same time, the cutting time required for each piece is reduced by one-half, in addition to which there is no time lost in reversing the arbor.

Form Cutter Grinding Attachment

BY HARRY MOORE

The sketch shows a device made to enable form cutters to be ground correctly on an ordinary grinding machine. Part *A*, fitted with shank *H*, fits into the hand rest holder, which is supplied with the machine. Part *B* made of cast iron, is drilled at the front to take



DETAILS OF FORM CUTTER GRINDING ATTACHMENT

the plug *C* and tapped for a screw at the back to hold the indexing piece *D*. Part *C* is made of tool steel, hardened, and has a tapered end, to take the different sizes of cutters without the use of bushings. The cutter is held to the taper by means of a washer, nut and locknut, and the proper adjustment is easily obtained. A capscrew *E* holds *C* in place when set.

The indexing finger is made of two parts consisting of *D* and *F* so part *F* can be swung out of the way when indexing the cutter. In operation *A* is placed into the hand rest holder in line with the wheel horizontally, the final adjustment for grinding the cutter on the center line is made with the screws *G*, the indexing finger is set into position, and the usual procedure followed.

Ammeter Base Slotting Punch and Die

BY CHARLES H. WILLEY

We recently made a change in the design of an ammeter base, which necessitated the cutting of two slots in the rim of the base at 180 deg.. These slots were to be flush with the inside back of the base, as indicated in Fig. 1. It was this requirement that made the design of the die unusual and perhaps it will be of interest to some of your readers.

The diameter of the base inside the rim was $1\frac{3}{4}$ in. and the stroke of the punch press was short enough to

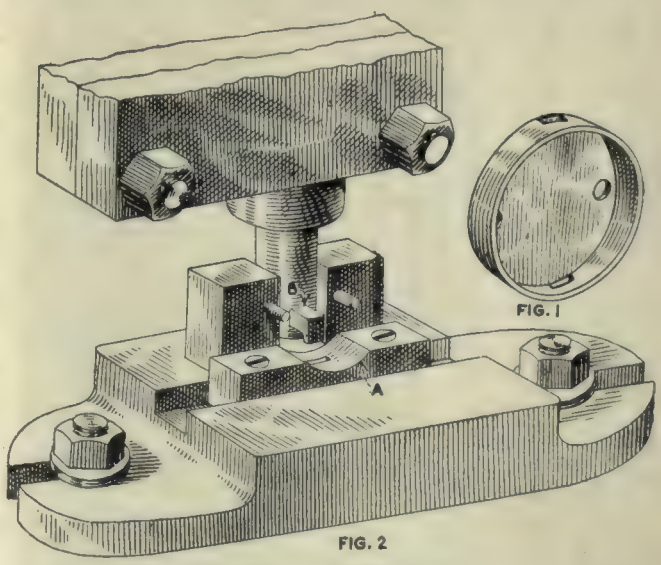


FIG. 1. AMMETER BASE
FIG. 2. PUNCH AND DIE FOR SLOTTING AMMETER BASE

permit the punch being used on the inside of the rim of the base.

The sketch, Fig. 2, shows the construction of the punch and die. The face of the die *A* was made the same radius as that of the outside diameter of the base. The punch *B* was made offset and its dimensions were $\frac{1}{8}$ x $\frac{3}{8}$ in. to cut the slot, and $\frac{3}{8}$ in. thick. Locations for punching the slots were obtained by pins which entered the two holes in the base that were previously punched. The material punched was soft iron, 0.026 in. thick.

How Do You Determine Your Mold Weights?

BY J. B. CONWAY

The quality and quantity of castings obtained from a mold, once it is closed, depend to some extent upon the manner in which the mold has been weighted. It is the practice in some foundries to use the same weights on all flasks regardless of the actual weight required, the object being to reduce foundry equipment to a minimum. This practice perhaps will apply nicely where the character of the work does not vary a great deal. But where there is a wide difference, although the same

size flask may be employed, it quite often developes that the weights used are too heavy. The result is that the copes are crushed, in some instances sufficiently to cause the core to cut through, thereby shutting off the molten metal and producing a spoiled casting.

The more modern foundries are eqiupped with various sizes of weights, but more often than not, the size is a

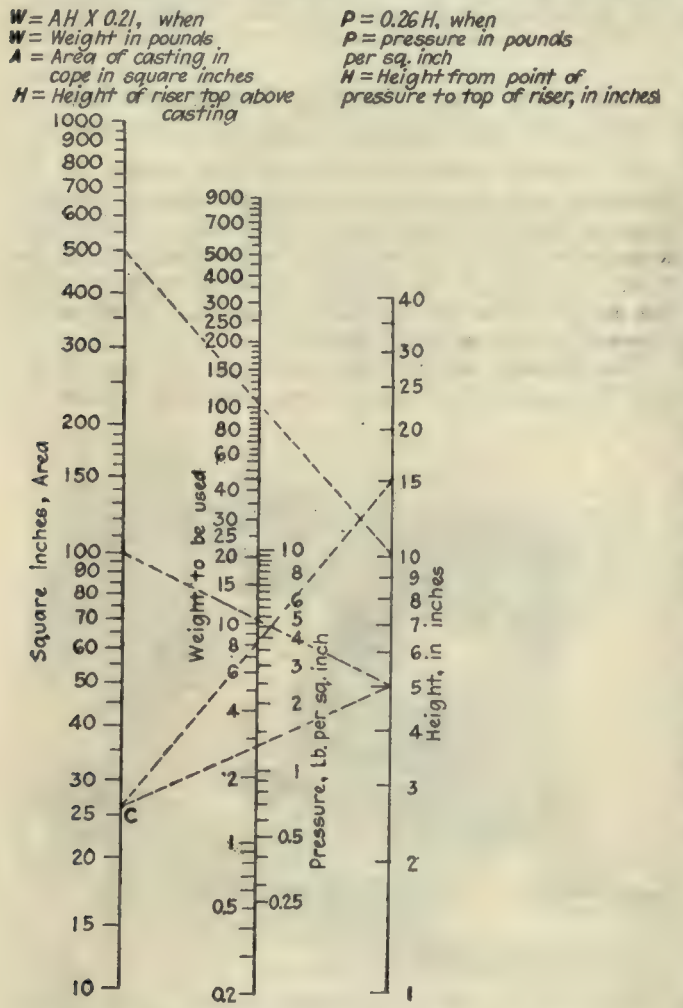


CHART FOR DETERMINING THE WEIGHT *W* REQUIRED ON A COPE TO RESIST THE PRESSURE OF THE MOLTEN METAL, AND THE PRESSURE *P* EXERTED UPON THE MOLD

matter of "guesstimating," or of previous experience. Again, the variation in sizes available is limited by the expense account for the foundry. Not only does the practice of using the same weight for all jobs produce results as above mentioned, but weights are employed that are too heavy, at least heavier than required, and the molder is forced to shoulder an extra burden. For, in placing the weight and again in removing it after pouring, a load is handled which might otherwise be reduced, a reduction which would decrease the amount of fatigue and permit the molder to handle more actual production.

For illustration, let us assume that a certain job was weighted with a weight of 100 lb. and that actually one weighing 75 lb. is sufficient to hold the cope. Now, if the output of the job was, say, 100 flasks per day, it is evident that the excess load carried by the molder would be 100 × (100 — 75) = 2,500 lb. In other words, he is handling that amount per day which is causing him unnecessary fatigue and might better be turned into productive work.

The accompanying chart is designed to enable one to quickly and closely determine the weight best suited for a certain class of molding. It is based upon a formula given in "The Founder's Manual," by Payne. For finding the weight required on a cope, $W = AH \times 0.21$, when W = the weight; A = area of casting in cope, in square inches; and H = height of riser top above casting in inches.

There is, naturally, a pressure exerted in the mold when it is filled with molten metal; and to determine this pressure the following formula is used: $P = H \times 0.26$, when P = pressure in pounds per square inch and H = height from the point of pressure to the top of the riser in inches.

To illustrate the use of the chart, let us assume that the cope area of a mold is 100 sq.in., and that the height of the riser top above the casting is 5 in. To determine the weight required, connect 100 on the left-hand scale with 5-in. on the right-hand scale and on the left of the middle scale read the weight, a trifle over 10 lb. Again, assume that the cope area is 500 sq.in. and the height 10 in.; connecting the scales as before, we find 100 lb.

Now, to find the pressure in pounds per square inch, let us assume that the height from the point of pressure to the top of the riser is 5 in. Then connecting 5 in. with "C" on the left-hand scale, read 1.30 lb. on the right side of the middle scale. Again, if the height is 15 in., the pressure is seen to be 3.9 pounds.

It is doubtful whether the smaller values for the weights should be used and they have been given so that a choice could be made and also a comparison with values for different areas. The larger sizes have been given also to serve as a comparative measure. It is believed, however, that the chart will be found useful where a varied line of work demands that several sizes of weights be kept on hand.

An Extemporaneous Snagging Grinder

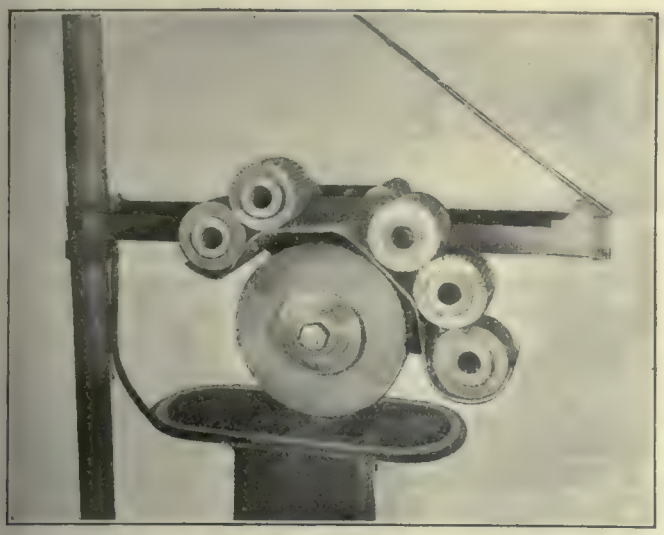
BY MILTON WRIGHT

The iron casting shown in the illustration is a pedestal for the Forbes & Myers electrically driven tool grinder. It is necessary that the top be reasonably smooth and flat, and bringing it to this condition with chisel and file was a tedious operation, while planing it required a big planer and was a time-consuming job.

One of the boys rigged up the device here shown, and smoothed off the pedestals very acceptably in a few minutes. The business part of the device is a bench grinder made by the same firm, the rest being odds and ends of material picked up at random.

A bolt 1¼ in. in diameter and about 3 ft. long is supported in a vertical position by two brackets lagged to the wall. A piece of pipe of suitable size is slipped over the bolt before the second bracket is secured, the lower end of the pipe resting upon one of two nuts that are run a short distance on to the threaded end of the bolt (which is at the bottom), the nuts serving to adjust the arm up and down. A short piece of channel beam is welded (autogeneously) to the pipe near the lower end, to project at a right angle and a ⅝-in. rod is welded by the same means to the top of the pipe and to the end of the channel to support the outer end of the latter.

The whole device therefore resembles a small jib crane, with the grinder, suspended bottom side up from



IMPROVISED GRINDING RIG FOR SMOOTHING OFF THE TOPS OF SMALL PEDESTALS

four wheels, so placed as to run on the upturned edges of the channel, representing the trolley.

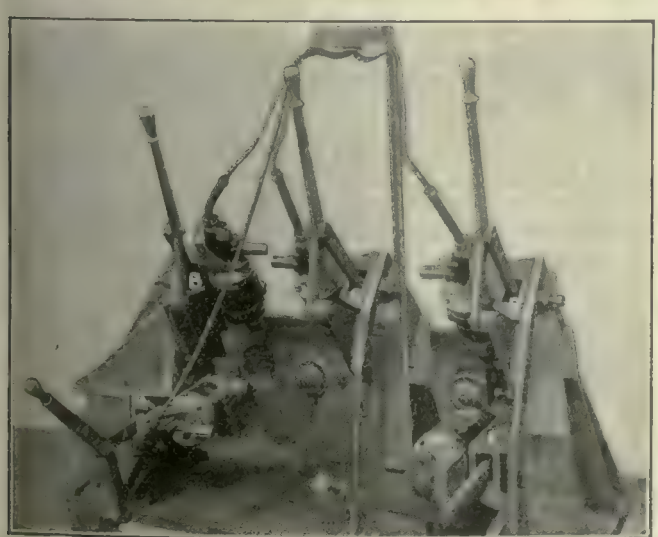
A short metal spark guard, quickly bent up from a piece of scrap, serves as a shelf to hold various pieces of junk to weigh down the grinding wheel as it passes over the work.

A flexible cord, attaching the motor to a convenient lamp socket, completes the apparatus, and one boy can grind off tops of the pedestals by pushing the grinder back and forth along the channel, almost as fast as another boy can take away the ground castings and bring up others.

Utilizing Electric Drills

SPECIAL CORRESPONDENCE

The illustration shows a unique method of utilizing electric drills on special work in a way which proved to be much more economical than to build a special machine. As can be seen, the device consists of a suitable framework built up from cast-iron pieces and having five sides, *A*, *B*, *C*, *D* and *E*, each carrying a portable electric drill of standard make. These drills are connected by flexible cable with a junction box overhead. Each drill can be moved independently by the levers shown and the holes drilled at desired angles without difficulty. This machine drills the holes in the main bearings of the Lexington motor at the Connersville, Ind., plant.

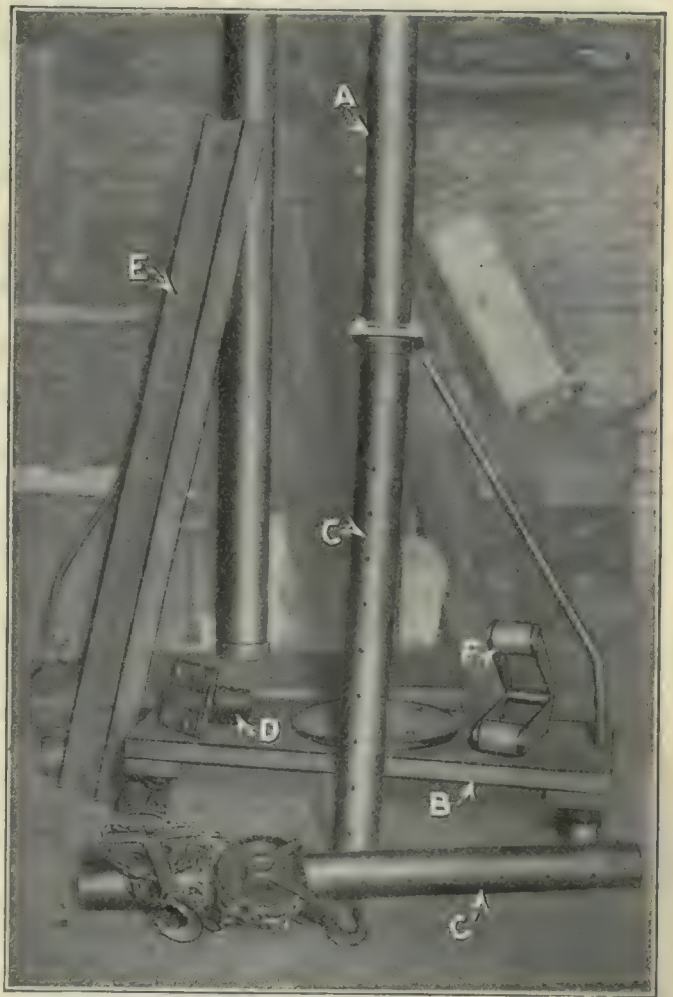


SPECIAL DRILLING MACHINE FOR CRANKSHAFT BEARINGS

A Home-made Portable Crane

BY JOHN VINCENT

The portable crane shown in the illustration is in use in the shop of the Printers Machine Works, Chicago, Ill., for handling heavy printing press cylinders. It consists of two pipe standards *A* fitted in cast-iron bases on the platform *B*, and which are mounted on heavy rollers so that they may be easily trundled about the



A HOME-MADE PORTABLE CRANE

shop. The extension pipes *C* are used to raise the height of the standards when the cylinders must be lifted over high frames, adjustments being obtained by inserting a rod through the drilled holes which are spaced at 4-in. intervals. When using either the permanent standards or the extensions, the cap-piece *D* is slipped into the top for holding the I-beam *E* that extends across the two posts. The cap-piece has lugs on both sides that bolt down over the flanges of the I-beam, preventing it from slipping.

A longer I-beam than the one shown is commonly employed for spanning large presses. The hoist trolley *F* has rollers that run on the top face of the beam, the body of the trolley being underneath so that a block and tackle may be attached to it, thus allowing the load to be hoisted and swung into place.

IN THIS ISSUE

AS PROMISED in the advance notice of coming features in last week's issue we are beginning this week an unusually valuable series of articles on jig and fixture design by Albert A. Dowd and Frank W. Curtis. The authors have called their series "Tool Engineering" and its importance to progressive tool designers, toolmakers and foremen can hardly be overstated. The series will probably run through the rest of this year at least and perhaps for the first part of 1922.

As might be expected, the first article is more or less introductory in nature and takes up the functions of up to date tool engineering and the best method of attacking the tool problem as it is presented to the tool engineer. Some of the other points considered this week are the tool equipment required, the effect of design on the cost of machining, and the layout of the plant. A glance at the illustrations in this article will give you an idea of the care that has been taken to bring out the points made by the authors in the clearest possible manner.

The leading article is by the editor of our European edition and describes the methods in use in a modern English locomotive shop. Mr. Chubb has included a number of sample forms as used to control the manufacturing processes as well as photographs of some of the novel machining jobs. Especial interest should attach to this article as it brings out the progress made by a big munition plant in returning to peace time production, particularly as the product is one which the company had had no experience in building before the war.

An article beginning on page 726, has been titled "Cost Accounting for the Machine Tool Builders." It contains the greater part of the report made by Scovell, Wellington & Co. to the National Machine Tool Builders' Association at the recent Cleveland meeting. While it was prepared primarily for the members of this association the methods developed apply with equal force to almost any manufacturing plant, and for that reason we have felt justified in giving so much space to it. The report is a thoroughly practical one and goes into details sufficiently to make them clear even to the shop manager who has had little experience in bookkeeping methods. The chart of the plan and the tables giving forms for statements of unearned burden, trading and loss and gain and the estimate sheet are worth careful study. And everyone will be interested in the table of recommended depreciation rates for shop buildings, tools and equipment.

On page 753 we have Fred A. Geier's address at the same meeting of the National Machine Tool Builders' Association. Mr. Geier took up the matter of financing a machine-tool building company from the standpoint of a fair return on the investment and of taking wise precautions for lean years.

Page 732 is the first of several we have assigned to the beginning of Part IX of Mr. DeLeeuw's series on metal cutting tools. Part IX is a continuation of the consideration of face mills and takes up good and bad methods of securing the plates to the body of the mill, and also various methods of driving the mill itself. Mr. DeLeeuw then goes on to a brief discussion of side mills and begins his treatment of form mills. This installment will be continued in the next issue.

Another article of particular value to the men in the shop is one by Ellsworth Sheldon on the use of special fixtures in grinding operations. It begins on page 736 and goes into the grinding practice in the shops of the E. Horton & Son., where "Morrow" drill chucks are made.

Following Sheldon's article is another of Fred Colvin's talks on the "Foreman and His Job." This time he warns against the wastefulness of putting "A Dollar-an-Hour Man on a 40-Cent-an-Hour Job." He uses this as a base on which to build his admonitions to the foreman to save money by picking the right man for the right job.

Over on page 755 we are printing in full the speech made by Secretary of Commerce Herbert C. Hoover before the Engineers Club of Philadelphia, at a dinner given by them in his honor a week or two ago. In this speech Mr. Hoover took up the matter of re-organization of government departments and brought out plainly the need for it and the way in which it might be accomplished. We have given some space to an editorial on the opposite page endorsing Mr. Hoover's statements and urging the co-operation of public spirited citizens in supporting the McCormick bill.

Coming Features

As this issue opens with an account of the transformation of an English munition plant to peace-time production it seems only fair to include in next week's issue a story of the changing of a big French airplane factory to a shipbuilding plant. The author, Charles E. Carpenter, has called his article "A French Hog Island," and his account of the strides made by French industry is a cheering one.

A rather noteworthy article on the design of traveling cranes with regard to safe operation will also appear in the next issue. Written by an expert in this particular field of designing, it brings out clearly the trend of modern crane practice.

Another of Fred Colvin's Rolls-Royce articles has been scheduled for the first issue in May. It takes up cylinder machining practice in the Springfield plant.

The situation in Germany is so acute at the present time that we are glad to say that our Berlin correspondent has made arrangements to send double the amount of material that he has been giving us lately. His letters will appear frequently.

EDITORIALS

"More Business in Government"

PRESIDENT HARDING'S repeated statement that he favors "Less Government in Business and More Business in Government" has met with the widespread approval of business men and engineers. Our sad experience with government ownership of railroads, for which we are still paying heavily, has cured most people of any idea that much good can come from government operation of our transportation facilities. There are some few who are still agitating the taking over of the railroads and their operation by government officials, but it seems likely that the majority of these people are moved by decidedly selfish considerations. However, it is fairly safe to assume that this part at least of the President's slogan will be put through.

When it comes to "More Business in Government" the problem is not quite so simple. Attempts have been made almost since the establishment of our government to improve it and make its functions more direct. Many able brains have been applied to the task and some of the plans proposed have had much merit. But those plans all failed through lack of support.

The reorganization plan embodied in the McCormick Bill, which will be pushed in the special session of Congress, now sitting, is largely the result of the careful analysis of government departments made by the United States Bureau of Efficiency. With few exceptions the changes proposed are approved by the member of the Cabinet who is probably the best judge, Herbert C. Hoover. In his speech before the Engineers' Club of Philadelphia, which we print in full on another page, he gives some of the reasons why the reorganization is necessary and points out the necessity of the enthusiastic backing of public opinion to force the legislation through.

Mr. Hoover has had valuable experience to show the power of enlightened and organized public interest to carry out big projects such as his relief drives. His plea for public support of reorganization legislation is made with a full understanding of the situation and merits the hearty response of all of us.

It will be well, therefore, to familiarize yourself with the McCormick Bill and to write your senator and representative telling them where you stand.

The Three "M's" of Success

THESE are times that are the real test of management. When demand is abnormal and price not a controlling factor, almost anyone can run a business. But the days of real, stiff competition are on us once more and only the well-managed plants in the different industries will survive.

The three greatest factors toward success are machine equipment, methods and men, and it's a toss-up as to which comes first. All three are vitally necessary. Good men can frequently do better with poor equipment than poor men with the best of tools and appliances. But no half-way measures will suffice now. Only the best of all three will serve to make any business a real success.

Now is the time, before the real competition begins, to lay plans and get ready for the battle of trade. Study your machine equipment and scrap all that cannot compete with the best that your keenest competitor can buy. The firm that will not invest in the best machinery cannot hope to stay in the game.

Study your methods. Eliminate the waste and lost motion that grew up when the only object was big production. Hire a real engineer to do it for you if necessary. But get one who is not full of fancy frills. Plain horse sense is the best qualification he can have. Beware of the man with a system which uses a host of clerks and tons of paper to tell you next week what you should have known last month.

And don't forget the men—the human problem is after all the biggest—and getting larger every day. Neither new equipment nor methods will get results unless you have co-operation in the shop. No sort of an armed truce gets very far in securing a big output. Reduced production costs depend on the men as much as on machines.

These three factors are the legs of the stool on which success must sit. No one of them can be weak if success is to be secure.

Taking Outside Work to Keep Busy

THE shop manager who enlarged his plant to meet war demands is now looking for some way of utilizing the excess capacity to advantage. It is well, however, to make haste slowly lest he jump from the frying pan into the fire.

Some years ago a contract shop which was struggling to make a place for itself, took a contract for lathes and managed to make a little profit on the job. Years passed and in the meantime they had given up contract work to devote their time to building a special product. A slack period came and they again took a contract for the same lathes at double the former price. But instead of a profit they lost money on the contract.

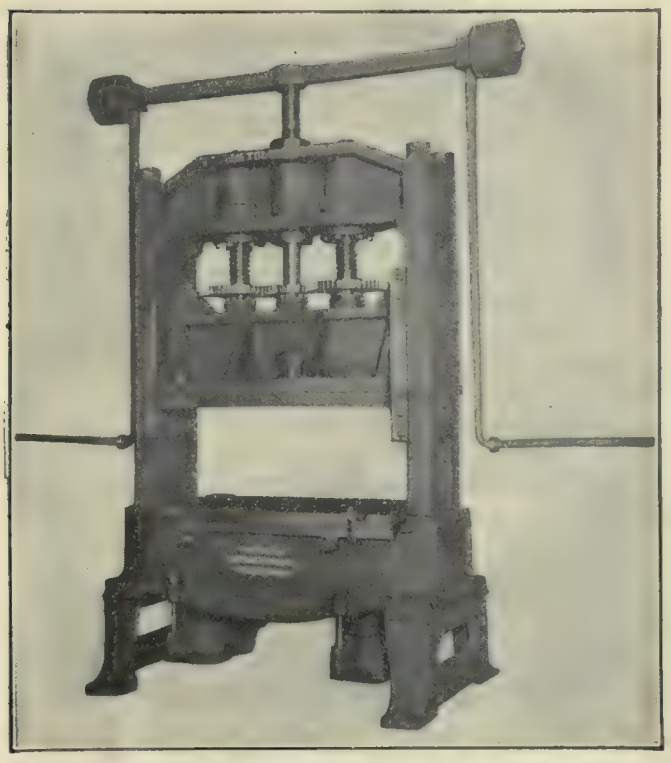
In the first instance their men were accustomed to any kind of work which came along. While manufacturing their one product they had specialized. New men had come in with little or no all-around training and they could not adapt themselves to new work at a profitable production rate.

There are two lessons here. One, that we have lost some of our adaptability for new work by over-specialization. The other, that we should recognize this when attempting to get into any other line of work as a means of tiding over the present situation. Keep busy if possible—but be sure there is a chance at least to break even.

Shop Equipment News

Toledo Double-Screw Press

The Toledo Machine and Tool Co., Toledo, Ohio, has developed the large double-screw press shown in the accompanying illustration. The press is made with



TOLEDO DOUBLE-SCREW PRESS

sufficient capacity and area of bed to try out dies such as used for blanking, forming, drawing and stamping sheet metal, and which are too large for the ordinary single-screw press.

As can be noted, the frame is of the four-piece, tie-rod construction, which is said to be popular for presses subjected to heavy stresses. The press is fitted with two screws 4 in. in diameter. The bed is arranged with a powerful spring-pressure drawing attachment, which can be used when trying out combination and deep-forming dies.

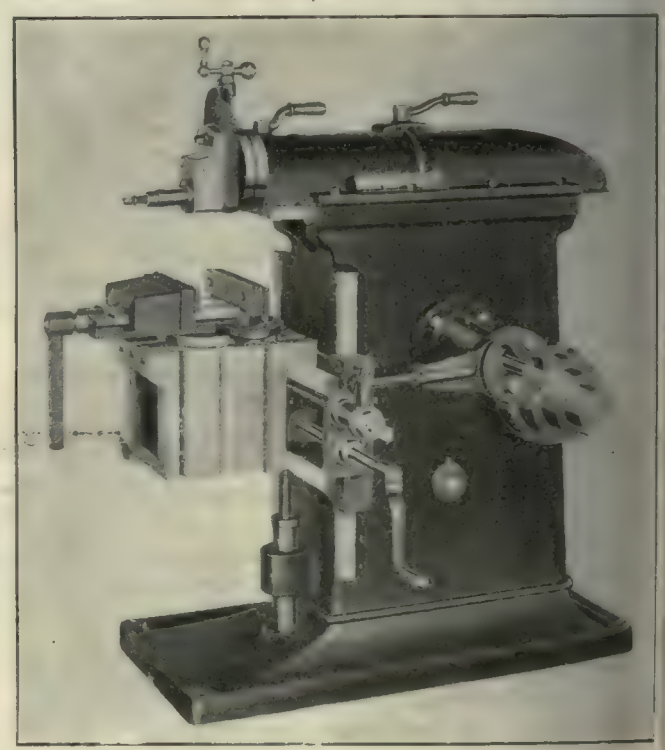
Some of the principal dimensions are as follows: Weight, about 14,000 lb. Area of bed, 30 x 54 in. Opening in bed, 20 x 48 in. Area of slide, 24 x 49 in. Height on top of bed; slide down, 14½ in.; slide up, 32½ in. Thickness of bolster plate, 2½ in.

Whipp 12-In. Crank Shaper

A 12-in. single-geared, crank shaper with a maximum stroke of 14 in. is built by the Whipp Machine Tool Co., Sidney, Ohio. The machine, shown in the illustration, is of the type described on page 1165, Vol. 52, of the *American Machinist*. It is belt-driven, and the cone-pulley is provided with three bronze bearings, one being located on each side of the bull-gear pinion to prevent the pinion from springing away from the bull-gear during a heavy cut. The third bearing is placed to insure the shaft alignment under a heavy belt pull, and to avoid the necessity of an out-board support.

The column is internally ribbed. The ram guides are extended, to give a long bearing. The cross-rail guides have a wide spread, and serve both to firmly guide the cross-rail and to stiffen the column. Adjustable gibs are provided. The nut for the telescoping elevating screw is carried in a lug extending from the face of the main column casting, to insure more perfect alignment. The base is surrounded by a rib, so as to collect oil dripping from the machine.

The ram is of box-type construction, and is fitted in square ways. It is driven by a long rocker arm. The length of stroke may be changed by an adjusting shaft through the center of and extending beyond the end of the bull-gear shaft. The adjustment may be made while the machine is running. The swivel-head is graduated, and is held in place by an eccentric lock. The down-feed screw has a graduated collar. The feed mechanism to the saddle is simple and can be adjusted while the machine is running. The vise has a graduated base, is fitted with tool-steel jaws and its screw acts in tension.



WHIPP 12-IN. CRANK SHAPER

Specifications: Maximum stroke of ram, 14 in. Travel of table; horizontal, 18 in.; vertical, 14 in. Maximum distance table to ram, 16 in. Feed to head, 6 in. Table size, width, 9 in.; length, 13½ in.; depth, 12 in. Key-seating capacity, 2½ in. diameter shaft. Cross-feed per stroke, 0.010 to 0.083 in. Ratio of gearing, 7 to 1. Countershaft pulleys, 8 x 2½ in., speed, 210 r.p.m. Shipping weight; domestic, 1,350 lb.; boxed, 1,450 lb.

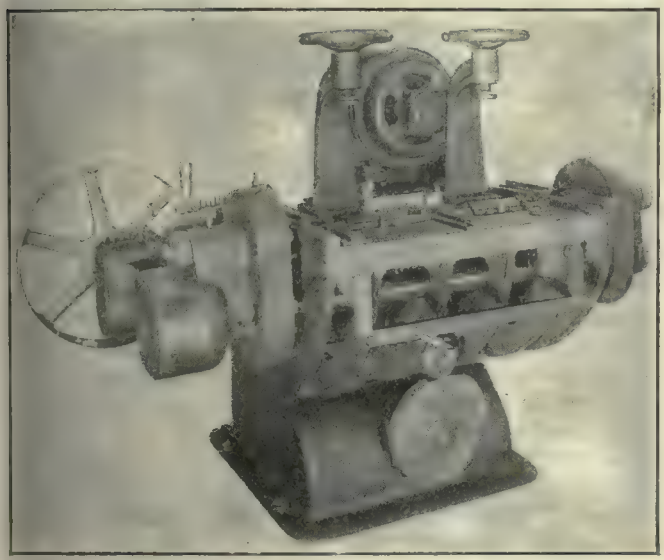
Newton Model C-70 Straddle-Milling Machine

The accompanying illustration shows a specialized type of machine for facing, with caps removed, the bearings for crankshafts of automotive engines, and at the same time milling the oil slinger grooves. The machine is made by the Newton Machine Tool Works, Inc., 23d

and Vine Sts., Philadelphia, Pa. The spindle carrying the cutters does not change position, but the feed motion is obtained by vertical movement of the table, the loading and unloading being done at the top of the stroke when the table is in line with the conveyor system. The table is raised and lowered by a cam providing slow feed and a quick return.

The table is provided with hardened steel jig plates and with locating pins, which can be raised and lowered by means of the lever on the front of the machine, so that there is no obstruction to the free entrance and removal of the casting. Clamping is done from above by means of two screws provided with handwheels.

The cutter mandrel is driven from both ends and supported between cutters by bearings, so that it cannot spring or buckle. Spacing collars to give a variation of 0.002 in. are provided to hold the proper dimensions between the cutters. The machine illustrated has eight cutters, to suit the casting being machined. All three bearings are machined on both sides, an additional cut-



NEWTON MODEL C-70 STRADDLE-MILLING MACHINE

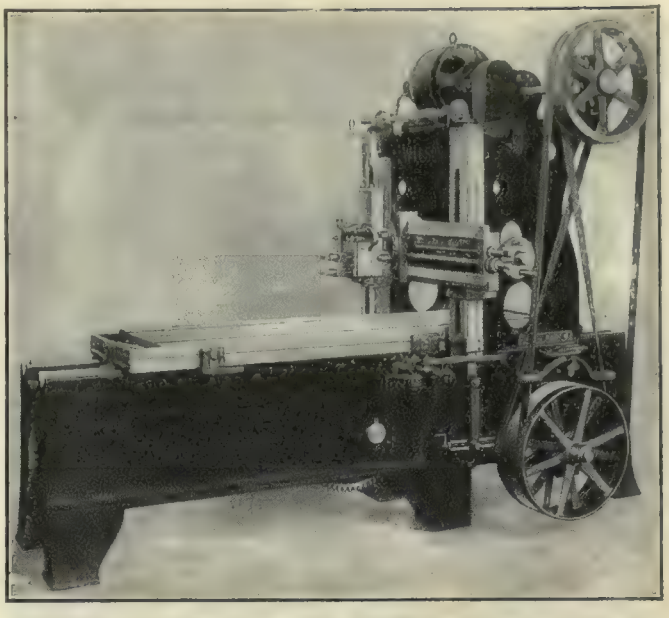
ter is provided for the oil-slinger groove and a small cutter for finishing the bore of this groove.

The production obtained from the machine is twenty-five pieces per hour. A larger machine of the same general construction is used for the same operation, except with the caps in place on the bearings. Provision is made so that the rate of feed or the time of a cycle of one operation may be increased or decreased, according to whether the machine is used for cast iron or aluminum.

Changes in Wilson Planers

The Morley Machinery Corporation, 215 North Water St., Rochester, N. Y., has recently made some changes in the design of its line of Wilson planers. The illustration shows the type of motor drive now fitted to the planers, the motor being mounted on top of the uprights and the usual double-belt arrangement being used. The pad for mounting the motor has been added to all sizes of the machine, even though the drive be from a countershaft, so that the motor drive can be easily fitted when desired.

Various changes have been made in the details of the machine, the following points being among them. The ends of the bed have been squared and the cross-sections



WILSON PLANER MADE BY THE MORLEY MACHINERY CORPORATION

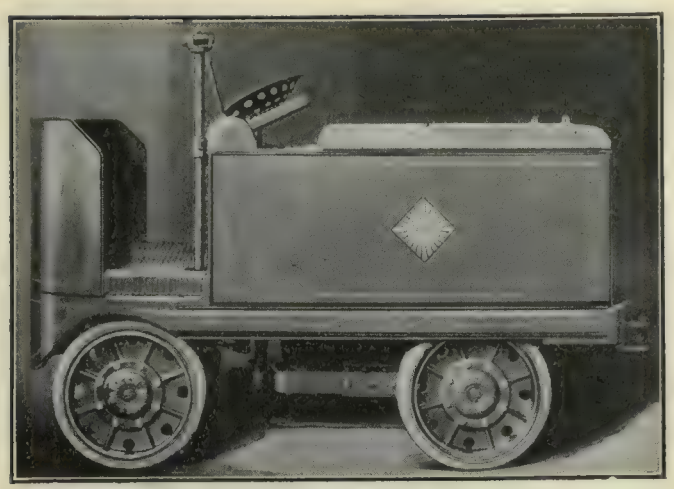
strengthened, while additional support has been placed under the uprights. The width of the bearing surface on the crossrail has been increased, and all the racks are made of steel instead of cast iron.

Elwell-Parker Type-TM Electric Industrial Tractor

The Elwell-Parker Electric Co., Cleveland, Ohio, has recently placed on the market the four-wheeled industrial tractor shown in the illustration. The tractor was designed especially to meet the requirements of iron and steel plants, the motive power being supplied by storage batteries.

The drive from the motor is through a worm reduction to a full-floating axle, the power being delivered to 20 x 5-in. drive wheels having 7-in. double-row radial and thrust bearings. The rear of the tractor frame is supported over the drive axle on springs which work in lubricated boxes. The forward, or third point of suspension is on a ball held in a bracket. The front axle supports the frame on springs, and oil is supplied to the axle pads and axle guides. The frame consists of four heavy channels to which the front and rear bumpers are hot-riveted, the channels being tied together by cross braces and plates. At the front is a heavy, ribbed bumper flush with a high dash of ⅜-in. plate, which protects the operator. The rear bumper has a swiveling spring draw-bar coupler.

The truck is steered by a hinged adjustable lever located in front of the operator, and the steering mechanism is placed behind the front axle to give clearance and protection for its parts. The tractor has three speeds in each direction. The spring seat it attached to a hinged plate which operates a safety switch or circuit breaker, When the operator sits down, his weight closes the circuit breaker if the controller handle is in neutral; otherwise the circuit breaker will not close. When the operator dismounts, the circuit breaker opens and the brake is applied automatically. The controller is beneath the seat. There are but seven controller fingers. The brake can be operated regardless of the power application. No fuse is used for the heavy-duty motors.



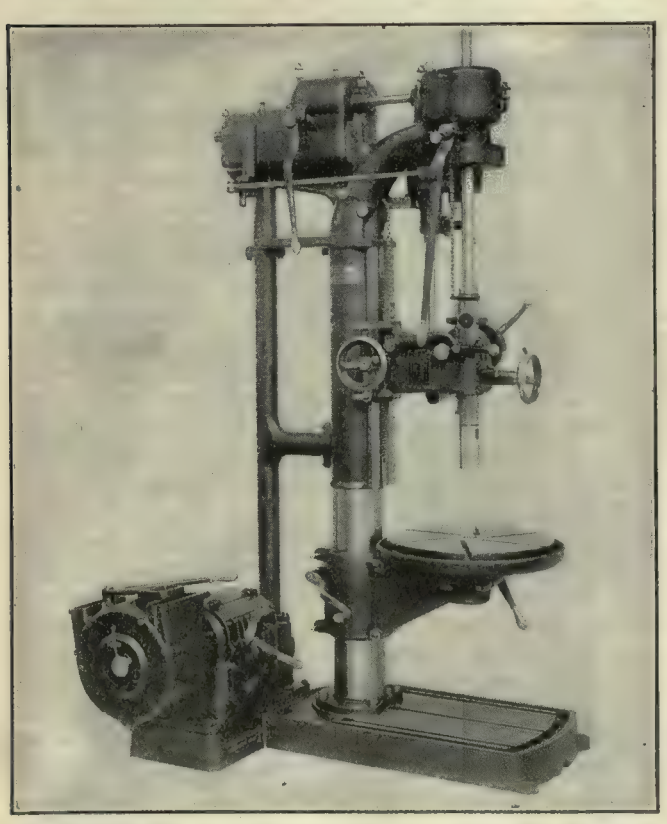
ELWELL-PARKER TYPE-TM ELECTRIC INDUSTRIAL TRACTOR

The tractor is 87 in. long, 41 in. wide and 45 in. high, and it has a turning radius of 78 in. Its normal drawbar pull is 500 lb., with a 42-cell A-8 Edison or a 24-cell, 21-plate Ironclad battery. The weight is 4,650 lb., most of it being placed over the driving wheels.

Fosdick 21-Inch Heavy-Duty Upright Drilling Machine

The Fosdick Machine Tool Co., Cincinnati, Ohio, has added a 21-in. size to its line of heavy-duty drilling and tapping machines of the type previously described on page 485, Vol. 51, of the *American Machinist*.

The machine is said to be heavily made, in order to produce accurate work. It is ordinarily driven by a constant-speed belt to tight and loose pulleys on the speed box. A range of spindle speeds from 49 to 550 r.p.m. is thus obtained, being suitable for driving all sizes of drills above $\frac{3}{16}$ in. in diameter and boring tools up to 5 in. in diameter. There are five geared feeds, ranging from 0.004 to 0.028 in. per revolution of the spindle.



FOSDICK 21-IN. HEAVY-DUTY UPRIGHT DRILLING MACHINE

Specifications: Drills to center of 21-in. circle. Base to spindle, maximum, 49½ in. Working surface on base, 19 x 20 in. Table diameter, 17 in. Table to spindle, maximum, 33 in. Spindle taper, No. 4 Morse. Spindle traverse, 11 in. Sliding head traverse, 22 in. Column diameter, 7 in. Net weight, 2,100 lb.

The machine is equipped with a tapping attachment controlled by a lever on the spindle head for starting, stopping or reversing the spindle. An automatic trip and depth gage may be set to stop the feed at any desired depth. This action is accomplished without disengaging the feed worm, which permits continuation of the handwheel feed after the power feed has been tripped. The spindle quick-return is of the expanding-ring friction type, and also operates without disengaging the feed worm. It serves as a hand lever for sensitive drilling, for rapid movement of the spindle, and for engaging or disengaging the power and hand feeds.

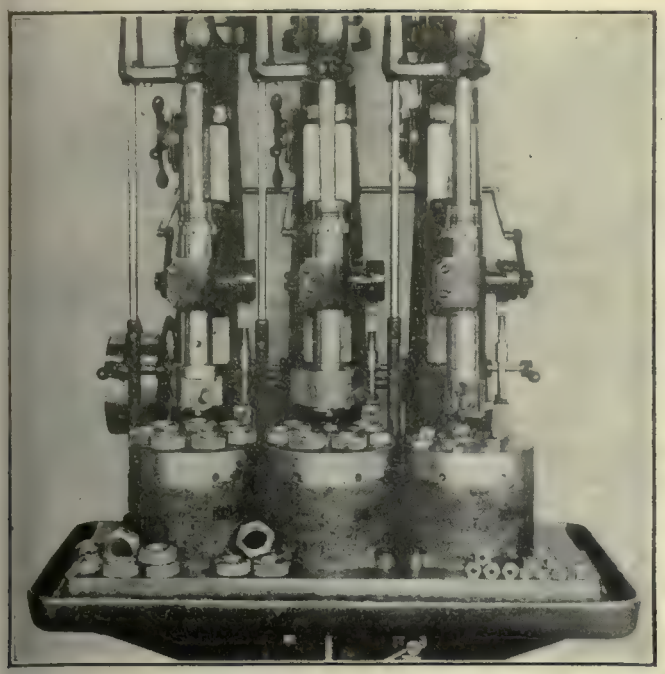
The machine may be driven by a constant-speed motor geared or belted to the speed box or by a 3-to-1 variable-speed motor, which eliminates the speed box. All styles of drive are interchangeable. These machines can also be furnished as gang drilling machines, having from two to six spindles and various types of tables, bases and drives.

Edlund Automatic Nut-Facing Fixture

The illustration shows an automatic nut-facing fixture fitted to a three-spindle No. 2B drilling machine made by the Edlund Machinery Co., Inc., Cortland, N. Y. The machine is intended for facing the top surface and bevel on cast-brass hexagon valve-packing nuts ranging from 1 to 2¼ in. across the flats. The work has been previously faced on the bottom, tapped and bored. The machine is belted to run at the regular spindle speeds of 510, 816 and 1,273 r.p.m. The spindles have hardened steel and bronze thrust bearings at the lower end to take the cutting thrust, and ball thrust bearings at the upper end to carry the weight when running idle.

Each automatic fixture consists of a revolving work table, operated from a camshaft located at the rear of the fixture, and driven by worm gearing. The worm is driven by the vertical shaft shown at the left of each spindle, taking its power from the lower step of the front cone pulley. The drive for the fixture is therefore governed by the spindle operating with it, and any tendency to slow up or stop the spindle affects the speed of the fixture. Three cams are mounted on the camshaft, one cam operating a pawl for indexing the work table, another operating a slide for unlocking the work table, and the last operating the feed for the spindle through the vertical rack at the right of each tool. The tool is moved by the arm to quickly approach the cut, fed to the desired depth and revolved several times without feed to give a smooth finish to the work. Helical springs lift the tools after finishing the cut.

A safety device makes the indexing of the table impossible, unless the spindle returns to the end of its stroke. Each work table has seven spaces into which are fitted the work-holding plugs. These plugs have guide holes which engage with pilots on the tools when the cut is being taken. Adjustment is provided for different lengths of tools and work plugs. Each fixture is thoroughly protected from chips, and lubrication is

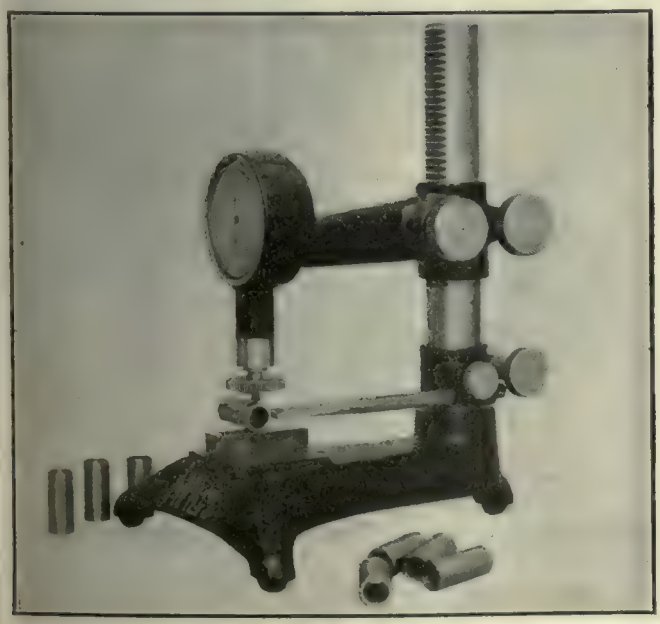


AUTOMATIC NUT-FACING ATTACHMENTS ON EDLUND NO. 2B DRILLING MACHINE

provided for. Chips are removed by a blast. The operator has simply to load and unload the fixtures, which may be done while indexing or while the cut is being made. All three fixtures can be used for one size of work, or a different size can be handled on each.

Ames Dial Comparator

The B. C. Ames Co., Waltham, Mass., has added to its line of dial gages the comparator shown in the illustration. The device is intended for use in the shop on production, as well as in the inspection department. All parts are protected from dust, and all bearing surfaces are hardened and ground. The gage is adapted to use on bushings, pins, shafts, plates and on most work ordinarily checked by micrometers. The personal element does not enter into the operation, as the gaging pressure is controlled by a spring. The dial is $1\frac{7}{8}$ in.



AMES DIAL COMPARATOR

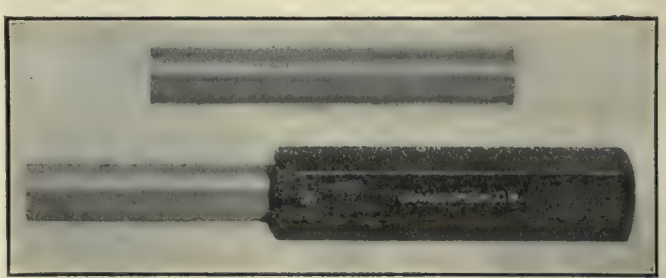
in diameter. A movement of 0.0005 in. at the measuring point appears as $\frac{1}{8}$ in. on the dial, thereby enabling readings of 0.00025 in. to be easily made.

The arm supporting the dial is raised or lowered by means of a knurled nut, so that the point makes the proper contact with the work. The arm can then be clamped in position. The hand of the gage can be brought to zero by turning the knurled screw above the measuring point. The point has a travel of $\frac{1}{4}$ in., so that although the gage be set to a 0.500 in. standard, it will measure from 0.500 to 0.750 in. The gage is useful on shafts or bushings having more than one diameter, as, provided that the difference in size is not too great, both diameters can be measured at one setting.

A stop is furnished for positioning round work. The device is furnished with two hardened and ground anvils, one $\frac{1}{2}$ x 2 in. and the other 2 x 2 in. and scored. Special anvils can be made to fit the groove milled in the base of the gage. The gage stands $10\frac{1}{2}$ in. high, weighs 10 lb. and is finished in black japan.

Van Keuren Plug Gage

A line of plug gages has recently been placed on the market by the Van Keuren Co., 361 Cambridge St., Allston, Boston, Mass. The simplicity of the construction is shown by the illustration. A plain, lapped cylinder constitutes the usable part of the gage. It is inserted for about one-third of its length in a hexagon handle, being cemented in position by means of shellac.



VAN KEUREN PRECISION PLUG GAGE

So firm is the bond of the shellac, it is said, that even when the plug is gripped in a vise, the action of a wrench on the handle only turns the plug in the jaws of the vise.

An important feature is that the plug is reversible. When one end of it is worn, the handle may be heated in a flame to a temperature about that of boiling water, so that the plug can be removed and its position reversed. Thus, the useful life of the gage is doubled.

The plug of the gage is made by a special process of manufacture, which is said to result in a cylindrical surface of fine finish and great accuracy, in regard to both roundness, straightness and size. Standard sizes of the gage, up to $\frac{1}{2}$ in. diameter, are made in the type shown. A different type of handle is used for larger sizes.

Cutler-Hammer Pressure-Operated Switch

A pressure regulator of the diaphragm type has recently been developed by the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., the device being more simple and compact than the other diaphragm-type regulators made by the same concern. The device, as shown in the illustration, is arranged for easy mounting. Its overall dimensions are 6 x $6\frac{1}{2}$ x 8 in. It is used

with motor-driven pumps or compressors controlled by a mainline magnet switch or some other suitable automatic starting device. It has two poles, which construction enables it to be used also for connecting small a.c. and d.c. motors directly to the line.



CUTLER-HAMMER PRESSURE-OPERATED SWTICH

The air, water, or other fluid under pressure is conducted into a chamber in the base of the regulator, and the pressure acts against a rubber diaphragm and compresses a spring, the normal compression of which can be changed by means of an adjusting nut to allow of operating the switch at various pressures. When the switch is closed and the pump or compressor operating, the pressure builds up, the adjusting spring being compressed to the point where the switch snaps open and stops the motor. When the pressure has fallen to a predetermined point, the switch closes with a quick action, and the pump or compressor again operates to build up the pressure.

The make-and-break action of the switch is cam operated, and is said to be very quick. The difference between the opening and closing pressure is about 20 lb. The entire mechanism of the regulator is inclosed in a cast-iron case arranged for the entrance of conduit. Terminals and fingers are exposed by taking off the cover of the case, which necessitates the removal of only three screws. The regulator is made for 60 lb. maximum pressure.

American Vertical Spot-Welding Machine

A series of spot-welding machines is the first to be announced of a complete line of spot- and butt-welding machines made by the American Electric Fusion Corporation, 1906 N. Halsted St., Chicago, Ill. A phantom view of the vertical welding machine is shown in the illustration. The machine is built in four sizes and designated as Type VW, the nominal throat depths of the different sizes being 12, 24, 36 and 48 in., but in each case the actual throat depth exceeds the nominal by about 8 inches.

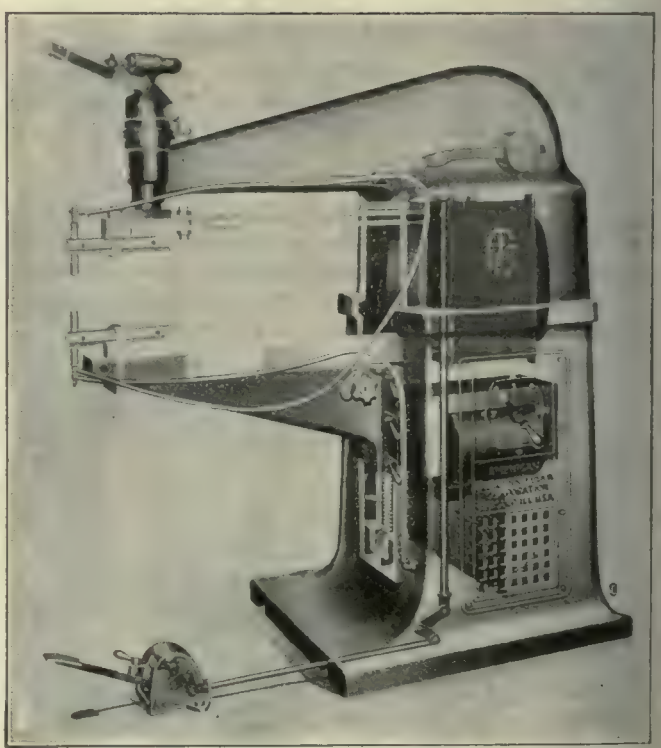
The column is of box-form and incloses all high-voltage parts of the electrical mechanism, including the switches, thus insuring the safety of the workman from accidental contact with any of the high voltage connections.

The lower horn support is a box-form grey-iron casting that slides on finished I-section ways bolted to the front of the column. It is raised and lowered by means of a rack and pinion drive, controlled through a pawl and ratchet, and driven by a special hand wrench that fits on a quill on the right-hand side.

The lower horn is a copper bar of large cross-section, resting on the top face of the supporting casting, from which it is electrically insulated. The insulation used for this purpose is a molded channel of a bakelite composition, this same insulating material being used throughout the machine. The inner end of the copper horn lies between two heavy vertical copper bus-bars, from which it draws the welding current. The horn is a sliding fit between the buses and may be raised or lowered with the horn support to accommodate the different work. A single hand-operated screw is used to exert the necessary clamping pressure on the buses.

The upper arm is cast on the column. It covers the upper portion of the transformer and the counterweight mechanism for balancing the upper head. The upper head is so constructed that it may be completely turned around, so that it may be worked from all sides of the machine. The head is balanced by a counterweight, so that the only effort exerted for the welding operation is that required to bring the points together with the necessary welding pressure. The treadle for controlling the movement of the upper points is built as a separate unit, placed in front of the machine, to which it transmits its movement by means of a sliding rod.

The welding points are copper die-castings, and are stated to have 98 per cent electrical conductivity. In order to avoid trouble that has been experienced with holding bolts made of other materials, monel metal has been adopted for the bolts used to bind together the parts of the welding points. The regulator for controlling the current to adjust it for different thicknesses of metal is placed on one side of the column. Current adjustments can be made for welding from



AMERICAN VERTICAL SPOT-WELDING MACHINE

the thinnest gages of metal up to two pieces $\frac{1}{8}$ in. thick. Full directions for welding are furnished on an etched metal panel which is attached to the side of the column.

The total height of the machine is 76 in.; the floor space, 28 x 52 in. for a 12-in. throat, and the net weight is 1,950 lb.

The Principles of Sound Financing for the Machine-Tool Industry

Machine Tool Industry Vital to World Progress—Need for Adequate Return on Capital—Small Returns and Large Fixed Assets Characteristic

BY FRED A. GEIER
President, Cincinnati Milling Machine Co.

THE machine-tool industry can well be considered a basic industry. Machine tools enter into the production of all mechanical devices that have brought about the great improvement in living conditions today. Machine-tool manufacture certainly has contributed greatly to lowering costs of transportation, cheapening the automobile, printing press, agricultural machinery, and innumerable other mechanical devices that enter so intimately into the needs of present day civilization. The importance of this industry need therefore no longer be discussed. It follows that it should be so conducted that it may continue in an ever-increasing measure to serve the progress of civilization.

This business, like any other business that is to live, must produce for the capital invested in it sufficient returns to command at all times the new capital on which it is dependent for its life and growth. Many machine-tool builders I fear, have not given sufficient thought to the question of whether their respective businesses would stand the test that capital makes when it seeks investment. The machine-tool business has been entered by too many of us because of its interesting phases, and we have not given sufficient thought to its financial needs to make certain that the business would have all the financial strength necessary to insure its fullest development over a long period and at the same time give adequate reward to the capital invested.

Again, the financial returns must be such as to enable us to compete with all other industries for engineers, designers, salesmen, managers, and the labor that the various functions of our business require. There must be sufficient financial returns not simply to manufacture our product, but there must be enough of a margin to allow ample funds for research, investigation and development, if we are fully to discharge our obligations as leaders of an industry as basic as the machine-tool industries.

I want to present to you a few statements of what financiers consider some of the fundamental requirements of sound investments.

The attractiveness of an investment to the general public depends somewhat upon the character of the business in which it is proposed to invest, but to the underwriting banker it depends more upon the history and present character of the management, together with an unquestioned standing in its particular field of industry, which cannot obviously be one without a good future ahead of it. Fashions change with respect to the character of popular investments, as is evidenced by the present demand for notes and bonds, whereas until three or four months ago, the market dealt almost exclusively with preferred stock issues.

With reference to the fundamental details which insure ready marketability of industrial securities, they might well be specified as follows: A protection of net tangible assets —in the case of bonds to at least 150 per cent of their face value; preferred stock, 200 per cent; a protection of net quick assets of not less than 100 per cent of the face value of bonds and notes and 125 per cent in the case of preferred stock; a regular earning power over a period of years—in the case of bonds a minimum of two and a half times the interest requirements, and for preferred stock at least three times the dividend requirements; provision for the establishment of a sinking fund for the retirement of bonds or preferred stock, which, if not paid, permits control of the company to revert to the bond or preferred stockholders.

On the subject of stability and amount of profit earned, another financier said:

From the investment standpoint it is not only the amount of profit, but the stability of earnings which is important. If an industrial is to bear fixed charges in interest on bonds, it should always earn such charges with a large factor of safety, even in the poorest business year. This is also true of preferred stock. Common stock is intended to bear the risks of the business and care should be exercised not to overload an industrial with preferred dividend and bond interest charges. How large the factor of safety should be depends on a variety of circumstances and no precise rule can be given.

I would now like to call your attention to some tables. Let us consider the case of a machine-tool manufacturing company owning its own buildings, spending a reasonable amount of money for new designs, tools and fixtures, and properly charging into current costs all the elements that the Scovell-Wellington report indicates are proper. I believe investigation would prove that the sales of such a company over a period of years will not average greater than the company's invested capital required to carry on the business. Therefore we will assume sales equal to capital invested. Table I gives the yield on invested capital for percentages of profit on net sales ranging from 5 to 50 per cent. The deduction of federal taxes diminishes the percentage of return on invested capital resulting in a range of 4½ to 32 per cent.

Continuing with the case of the same company, you

TABLE I

Percentage of Net Sales					Yield on Invested Capital	
Profit	Federal Taxes	Net	7 Per Cent Preferred	Common	Total	Common and Surplus
5	.5	4.5	2.33	2.17	4.5	3.25
10	1.31	8.69	2.33	6.36	8.69	9.54
15	2.71	12.29	2.33	9.96	12.29	14.94
20	4.11	15.89	2.33	13.56	15.89	20.34
25	6.41	18.59	2.33	16.26	18.59	24.39
30	8.71	21.29	2.33	18.96	21.29	28.44
35	11.01	23.99	2.33	21.66	23.99	32.49
40	13.31	26.69	2.33	24.36	26.69	36.54
45	15.61	29.39	2.33	27.06	29.39	40.59
50	17.91	32.09	2.33	29.76	32.09	44.64

YIELD ON INVESTED CAPITAL AS AFFECTED BY EXISTING FEDERAL TAXES, BASED ON NET SALES EQUAL TO INVESTED CAPITAL

TABLE II

Capital Stock Preferred 7 Per Cent	Capital Stock Common	Net Earnings	Preferred Dividends	Common Cash Dividends	Accumulated Surplus	Total Invested Capital	Net Yield on Invested Capital	Net Yield on Common Stock	Net Yield on Common Stock and Surplus
500,000	1,000,000	278,850	35,000	100,000	.....	1,500,000	18.59	27.8	24.4
500,000	1,000,000	305,591	35,000	100,000	143,850	1,643,850	18.59	30.6	23.6
500,000	1,000,000	.....	35,000	100,000	314,441	1,814,441	.....	.....	.....
500,000	1,000,000	312,236	35,000	100,000	179,591	1,679,591	18.59	31.2	23.3
500,000	1,000,000	345,184	35,000	100,000	356,827	1,856,827	18.59	34.5	22.8
500,000	1,000,000	384,257	35,000	100,000	567,010	2,067,010	18.59	38.4	22.3
500,000	1,000,000	430,594	35,000	100,000	816,267	2,316,267	18.59	43	21.8
500,000	1,000,000	.....	35,000	100,000	1,111,861	2,611,861	.....	.....	.....
500,000	1,000,000	460,448	35,000	100,000	976,861	2,476,861	18.59	46	21.5
500,000	1,000,000	520,949	35,000	100,000	1,302,309	2,802,309	18.59	52	21.1
5,000,000	10,000,000	3,038,109	135,000	1,000,000	5,769,017	20,769,017	14.6	29.4	18.4

Average net yield on invested capital 14.6 Average net yield on common stock 29.4 Average net yield on common and surplus 18.4

YIELD ON INVESTED CAPITAL AS AFFECTED BY PARTIAL REINVESTMENT OF EARNINGS TO PROVIDE FOR NORMAL GROWTH. BASED ON NET SALES EQUAL TO NET INVESTED CAPITAL

will note in Table II that I have started out with a capitalization of one million dollars of common stock and five hundred thousand dollars of preferred stock, listing the preferred stock at 7 per cent, which, I think, is very conservative. I have assumed sales the first year of $1,500,000, increasing the sales each year to the same extent that the invested capital is increased from year to year. I have assumed further, that the concern will earn on its sales a net profit of 25 per cent before allowing for federal taxes. You will note further from the table, that I have indicated that every fifth year there is a depression or a year in which no profit is earned. Therefore you have only four years of earnings on sales to take care of five year's returns on capital invested. You will note further, that I have deducted from the gross earnings of each year, based on the present tax law, what you may fairly consider as the tax to be paid the Federal Government. While the tax law may be modified, it is fair to assume that for the next ten years at least business will be required to pay the Government an amount equal to present taxes.

You will further note in this table that I have simply allowed $100,000 per annum to be paid to the common stockholders, which represents a 10 per cent dividend on the $1,000,000 of common stock outstanding.

I have further assumed that the business will require, over a period of years to take care of its normal growth, an average increase in invested capital about equal to its increase in sales. Of course, there must be an annual allowance of $35,000 for payment of dividends on the preferred stock. At the end of ten years we have taken out of the business simply 10 per cent for the common stock, and find ourselves with a total invested capital of $2,800,000. The final result of operation for the period shows that we have earned on invested capital an average book profit of only 14.6 per cent. We have, of course, earned an increasing percentage of book profit on the common stock, but it has not been available to the common stockholders.

In the final analysis the only real test of any business is how much you can pay in cash to the common stockholder year in and year out.

The last column, you will note, shows a diminishing return on the invested capital from year to year. Starting with 24.4 per cent, we finally get down to 21 per cent, or, allowing for two unprofitable years in ten, an average return of 18.4 per cent.

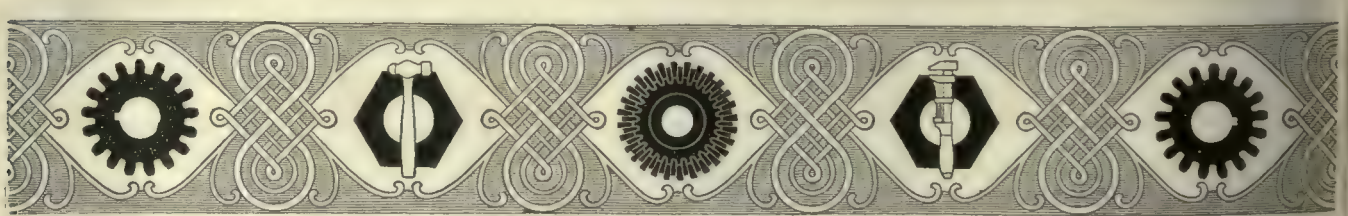
I believe I am safe in saying, that the net profits of the machine-tool business as a whole do not begin to be as much as 25 per cent on sales. At the time of framing the Underwood Tariff Bill you may recall that the committee secured from seventy machine-tool concerns their net earnings on total invested capital for the ten year period preceding 1913. The figures show an earning of only 9.5 per cent on invested capital. I am quite certain that if the committee could have gone over the books of these companies and have taken out of their assets the items that should properly have been charged into current costs, the net earnings on invested capital would have been nearer to 5 per cent than 9.5 per cent.

Another very important matter to be considered is, the question of the realizable value of invested assets in the machine-tool industry. Table II shows a return merely of 10 per cent on the original common stock capital. In addition, of course, you have an increase in your invested capital. The value of this amount, however, is problematical. There is no certainty that you can realize in cash the full value of invested capital as shown by your books.

In conclusion let me emphasize again, that capital will seek investment in those industries soundly and safely conducted, which yield it the largest returns over a long period of time. It prefers that type of business in which the capital required most nearly approaches liquid form. Unfortunately, in the machine-tool business, a very large percentage of the capital is invested in so-called "fixed" assets, with more or less questionable realizable values.

We are engaged in an industry that is basic and vital to every other industry. There rests upon us a serious obligation to see to it that our industry is so conducted that it will have the life and energy to continue to improve the productive capacity of our machines. To attain this we must see to it that we have sufficient financial returns not only to make this possible, but also to attract to the industry at all times sufficient capital for carrying on its business.

[Note: This was one of the principal addresses at the February meeting of the National Machine Tool Builders' Association at Cleveland. The one by E. J. Kearney, presented at the same session, was published in our issue of April 14.—EDITOR.]



The Need for Governmental Reorganization*

Public Opinion Must Back Joint Congressional Committee—Enlarged Activities of Certain Departments Burdensome—Adequate Budget System Should Be Erected

BY HERBERT C. HOOVER
Secretary of Commerce

THERE is one problem of the new administration that has received the attention and thought of the organized engineers of America for many years past. This is the problem of the reorganization of the federal government. The inadequacy, the wastefulness, and the inefficiency of our federal organization was evident enough under pre-war conditions. These inadequacies, these inefficiencies, these wastes were exhibited to the country during the war at the cost of millions.

Congress has placed the problem in the hands of a very able Congressional Joint Committee. But if this Joint Committee succeeds in securing the imminently necessary results it will only be by full insistent support of it by public opinion. Many attempts have been made at reorganization before but all of them have gone to the same crematory—the interminable differences in opinion among the executive and legislative officials over details.

To any student of federal organization one sweeping and fundamental necessity stands out above all others, and that is that the administrative units of the government must be regrouped so as to give each of the great departments more nearly a single purpose. The hodgepodge of aims in certain administrative branches is scarcely believable when we consider our national pride and skill in organization. Such functions as public domain, public works, assistance to veterans, public health functions, aids to navigation, to industry, to trade, purchasing of major supplies, are each and every one scattered over from four to eight departments, most of which are devoted to some other major purpose.

Economies can be accomplished from a public point of view by an elimination of the overlap in these different units of administration through unification into groups of similar purpose. The real economy to the nation, does not lie here, however great this may be, but it lies in their more effective functioning in their daily relation to the public. The extra cost imposed upon business in general in the determination of the relation of any particular business to the different functions of the government, with the unnecessarily duplicating interferences and demands, is a real charge on national wealth, probably as great in some directions as the actual costs of the administrations themselves.

Of equal importance with economy is it to secure effective concentration of government effort into service to the community. No constructive vision or policies can be built around a national service directed by from two to ten Cabinet members, more especially when this particular purpose is a side issue to all of them. No better example of this exists than the deplorable handling of our relations to our veterans.

There are other reasons that render reorganization imperative. The changed economic situation of the world demands that the functions of the government in aid to commerce and industry be given more concentration and wider scope.

The enlarged activities of the government as a result of the war greatly affect certain departments. The Treasury today as the fiscal office of the government must handle an annual budget of $5,000,000,000 as compared with $1,000,000,000 pre-war. Activities of the Army have increased from a budget of $200,000,000 to $400,000,000; activities of the Navy have increased from a budget of $125,000,000 to $425,000,000. Thus the burden and responsibilities for the major purposes of these departments have been enormously increased. I believe it is the concensus of opinion of the gentlemen conducting these departments that in the interests of efficiency they should not be called to responsibility for the administration of at least some of the matters not pertinent to their major functions which clutter their departments.

We have also some confusion between executive, advisory, and semi-judicial functions. One of the tendencies of government both local and national during the last twenty years has been to add executive functions to commissions and boards created primarily for advisory or regulatory purposes. It requires no argument with our business public that the executive functions can not rise to high efficiency in the hands of government boards where from the very nature of things each member has a separate responsibility to the public and is primarily engaged in a semi-judicial function.

Furthermore, during the last few years there has been a great growth of independent agencies in the government reporting directly to the President until his office is overburdened almost beyond the point of endurance. The original and sound conception was that the executive functions should be reported up to the President directly through his Cabinet officials. Not only do these outside functions today overburden the President but they render co-ordination with executive departments extremely difficult. It is neither possible nor advisable to place all these outside organizations into the departments, but much could be done to mitigate the situation.

One of the great steps in federal reorganization is the erection of a budget system, with its necessary reorganization of the congressional committees. There can be no doubt as to the early accomplishment of this great reform, but it will not serve its real purpose until the departments have been reorganized so that they represent a common purpose. Without this Congress will never have before it budgets showing the expenditure of the government in its relation to any particular function.

I have daily evidence in the Department of Commerce of all these forces. The question of governmental aids to navigation is not by any means one of the principal functions of our government, but it must be a sore trial to the hardy mariner. He must obtain his domestic charts from the Department of Commerce, his for-

*From an address delivered before the engineers of Philadelphia, April 16.

eign charts from the Navy Department, and his nautical almanac from the Naval Observatory—and he will in some circumstances get sailing directions from the Army. In a fog he may get radio signals from both the Navy and Commerce, and listen to foghorns and look for lights and buoys provided him by Commerce; if he sinks his life is saved by the Treasury. He will anchor at the direction of the Army, who rely upon the Treasury to enforce their will. His boilers and lifeboats are inspected by the Department of Commerce; his crew is certificated by one bureau in Commerce, signed off in the presence of another, and inspected at sailing by the Treasury, and on arrival by the Department of Labor.

It is possible to relate the same sort of story in our governmental relations to industry to our domestic and foreign commerce.

The moral of all this is that economy could be made by placing most of these functions under one head, not only economy to the government but to the mariner. Congress would know what it spends in aid to navigation and the government could develop definite policies in giving proper assistance, and lastly could remove from the hardy mariner's mind his well founded contempt for the government as a business organization.

The economic changes in the world, growing out of the war, and their reflex upon our trade and industry make it vital if we are to maintain our standards of living against increasing ferocity of competition that we shall concentrate and enlarge our national effort in the aid, protection, stimulation and perfection of our industrial and commercial life. There can be no real Department of Commerce or commercial policies to these broad purposes so long as the instrumentalities of the government bearing on these questions lie in half a dozen departments.

We want no paternalism in government. We do need in government aids to business in a collective sense. In a department we do not want to either engage in business or to regulate business. We need a department that can give prompt and accurate diagnosis from both a foreign and domestic point of view of economic events; of economic tendencies; of economic ills; that can promptly and accurately survey economic opportunity, economic discrimination and opposition; that can give scientific advice and assistance and stability to industry in furnishing it with prompt and accurate data upon production, supplies and consumption; that can co-operate with it in finding standards and simplifications; that can by broad study promote national conservation in industry and the elimination of waste; that can study and ventilate the commercial side of our power possibilities; that can study and advise national policies in development of rail, water, and overseas transportation; that, in fact, covers, so far as government functions can cover, the broad commercial problems of trade, industry, and transportation. This can be accomplished more by co-ordination of existing governmental facilities than by increased expenditures.

The Leipsic Engineering Fair

Fair a Failure From the Sales Point of View—Better Workmanship on Machine Tools Evident—Many Copies of American Tools But No New Designs

BY OUR BERLIN CORRESPONDENT

THE Leipsic Fair is an institution of many hundred years' standing, almost as old as Leipsic itself, but never in its history, even in Germany's most prosperous times, has it assumed such proportions as now. The fair is a different thing from what it used to be. From a passing event, which took place once a year for a few days, it has become a national institution. Organized propaganda is working for it all the year round. It seems to have made the whole town of Leipsic, and its entire population, subservient. Large sums are raised for its maintenance. It receives a subsidy of 5,000,000 marks per year from the state treasury. The newspapers of the country give it every assistance by way of extensive publicity. The fair has seized all available buildings of the city for its purposes, and its organizers are at present planning the erection of an enormous exhibition building, ten stories high and with several acres of floor space, which when finished will be the largest building in Europe.

The fair at Leipsic has always been a very successful marketing place for goods of a certain kind. Other towns, evidently grudging Leipsic its success, have taken up the idea and are instituting fairs of their own. Such towns are numerous, but only the Frankfurt Fair has so far reached a degree of a certain importance. The success of the old Leipsic Fair was due to the mutually recognized convenience of bringing together buyers and sellers every year to exhibit samples and transact business right on the spot. Such transactions were very extensive; the method was quick, inexpensive and to the point. The scope of the fair was, however, limited. Mostly commodities of everyday use were represented. The idea suggested itself that the usefulness of this institution could be extended to all marketable articles. This notion spread far into the different branches of industry. It found strong favor with the manufacturers of engineering products, foremost among them the German machine tool builders, and this gave rise to the idea of adding to the Leipsic Fair an engineering fair.

Salesmanship has suffered during the war. Advertising and traveling have become very expensive, and the latter is handicapped by many restrictions. The Leipsic Fair appeared to be an excellent sales opportunity. This may have been the cause of the wide support the idea gained among manufacturers, who never before dreamed of taking their goods to a fair.

The Engineering Fair at Leipsic has now been held three times, in March and August 1920, and again in March of this year. It is particularly ill-favored by circumstances. In March last year it coincided with the counter-revolutionary coup which was followed by a universal strike. August 1920 was marked by extreme business dullness. This year's fair had hardly been opened when the London conference dispersed and the sanctions, with their far-reaching effects upon trade, came into force. The actual business transacted at the Leipsic Fair has this time, as on the two previous

occasions, been practically nil. Visitors coming from all parts of Germany, and even from abroad, have attended in considerable numbers. Almost all German factories of any importance have sent representatives to view the exhibits. Many inquiries have been received, but only a few exhibitors, mostly those manufacturing small, inexpensive specialties, have booked orders. It is not quite clear how much of this restraint has to be ascribed to the present-day troubles, or to the general reserve prevailing.

From such experience, and other indications, it must be assumed that the idea of using institutions like the Leipsic Fair for the marketing of enginering products is impracticable. Such products cannot be marketed like articles of everyday use. Exhibitors seem, however, quite satisfied with the advertising they get. Whether this satisfaction will be of any duration is, however, doubtful. To see novelties has been and always will be the chief attraction of such fairs.

The Engineering Fair comprises almost all branches of the engineering industry. The building, electricity, and machine building industries are represented by a considerable number of firms. The largest exhibit is that of the German Association of Machine Tool Builders, which comprises almost all machine tool builders of note. It occupies an extensive stone building left over from the exhibition of 1913, which will be remembered by the American mechanical engineers who took part in the A. S. M. E.'s trip to Germany in that year. Many of the machines are under belt, and power is provided to drive them so that they can be viewed in actual operation. Some 200 machine tool manufacturers show their products. A number of leading firms who exhibited last year stayed away this time. The general impression received from the tools exhibited is that the manufacturers have directed their efforts in the main towards workmanship, the samples exhibited showing excellent finish. Of new designs, however, there is little to be seen. A number of manufacturers have brought out new makes, but as most of them bear close resemblance to well-known American types they do not deserve to be spoken of as new designs.

The Acme automatic is represented in several variations. The Gridley automatic was exhibited by one only of the several firms which have adopted it. This firm is building it in three sizes. Their 2¾-in. size is now selling at 100,000 marks. One firm is showing several new automatics, and is taking a good deal of credit for their design, which by right belongs to Brown & Sharpe. The La Pointe broaching machine is seen in one stall, very scrupulously copied from the American original. The same may be said of the Little Giant key seater.

A well-known firm of lathe manufacturers is exhibiting a bevel-gear cutting machine, working on the Gleason principle. This machine has several patented features, and is one of the few instances of a designer not contenting himself with merely copying the work of others. The same firm is also building the Lo-Swing lathe. Otherwise the lathe manufacturers show nothing new. One of the best lathes to be seen is a high-speed lathe made by Gebrüder Böhringer of Göppingen, at present probably the foremost lathe manufacturers in Germany. This lathe is started, stopped, and reversed by lever motion from the apron.

On this lathe a demonstration was made during the Leipsic Fair with stellite which created some stir. Several record cuts were taken which have not been seen in Germany before, and which none of the known steels are capable of. Stellite is not on sale in Germany, but several firms procure it from dealers in neutral countries, paying as much as 1,000 marks per kg. The same firm is showing a planer equipped with quick power traverse, and elevation of the toolslide on the saddle. Another feature of this planer is a new device for change of feed. The feed is adjusted by a stud gliding in the circular slit of a dial. Another interesting planer is exhibited by Billeter & Kluntz. It is operated by magnetic clutches, one for the cut and two for the reverse. One of the latter is for slow, the other for quick reverse. The first is thrown in at the beginning of the reverse stroke and is automatically released by the other after the platen has travelled a few inches. Again at the end of the reverse stroke the motion is slackened down by the first coupling. This produces excellent cushioning and smooth running.

Very little has been shown in the matter of gear-cutting machinery, the chief makers not having been represented. A well-known Chemnitz firm exhibited a copy of the Fellows gear-shaper. This is equipped with positive drive and gear-box. The same firm showed a machine for rounding the edges of the gear-flanks, working automatically. The range of the machine is gears up to 16 in. in diameter, and 10-in. pitch.

The exhibit of grinding machines is extensive, but rather bare of new features. It is astonishing to see how many firms have during the last few years taken up the building of grinding machines, especially cylindrical grinders. During the war the supply of the latter type was entirely insufficient, and this no doubt has been a strong inducement. Most of the new makes have adopted the Norton principle. Of the Landis type grinding machine only one representative could be noticed. Still larger is the increase in the makes of surface-grinding machines. Mayer & Schmidt of Offenbach are showing a large surface-grinder, with a range of 2 m. in length and 600 mm. in width. This machine is distinguished by an intermittent feed motion. Between cuts the feed advances in one jerk, traversing up to 2 in. at one time.

The milling machines to be seen show all the well-known designs. Only a few new makes of keyseat milling machines appeared on the scene. One of the latter, exhibited by a Munich firm, shows very accurate work. It has a patented device for the motion of the table, of which it is claimed that it imparts an almost uniform motion in both directions, resulting in high accuracy of the cut. Grooves are cut on the machine, with a range of from 2 to 16 mm. One of the best types of tools seen at the Fair is a backing-off lathe, made by Schüttof & Bässler of Chemnitz. This machine contains nothing essentially new, and deserves mention only as the best representative of its class in Germany.

Considerable space was occupied by the manufacturers of small tools. These exhibits were bare of novelties which could in any way be called noteworthy.

The general impression received from the show is that since the war the German machine tool and small tool manufacturers have made considerable progress towards improving the quality of their products. The slipshod way of manufacturing which had become almost universal during the war has carefully and successfully been stamped out. The pre-war standard undoubtedly has been reached, and in several instances even surpassed. The improvements of design—such as there are—are keeping well within the range of known and approved features.



NEWS SECTION

Hoover Resigns as President of Engineering Council

Herbert Hoover has resigned as president of American Engineering Council of the Federated American Engineering Societies. Mr. Hoover's resignation was submitted and accepted as the closing action of the sessions of the council, held April 16 at the Engineers' Club of Philadelphia.

Mr. Hoover gave as his reasons the fact that American Engineering Council by its constitution was necessarily engaged in furthering national activities which involve legislation, and that he, as a member of the executive branch of the government, could not consistently direct such activity as an officer of American Engineering Council.

The council, in a resolution of regret at Mr. Hoover's retirement, voted its appreciation of Mr. Hoover's leadership during the organization period of the council and his initiation of policies and effort.

The meeting of the council was one of the most important yet held and progress was noted in every direction. The sessions were opened by Calvert Townley as presiding officer. Later Mr. Hoover took the chair and presided over the greater part of the deliberations.

One of the most important matters before the council was the report of the Committee on Elimination of Waste in Industry, of which J. Parke Channing is chairman and L. W. Wallace, executive secretary of the council, vice-chairman. The committee has been conducting an assay of waste in principal industries for more than three months, under the direction of Mr. Wallace. The work has been conducted from the temporary headquarters in New York. The first reports of the assay will be ready in June.

Shop managers will find in the report a method of measuring the relative standing of their organizations and will find positive suggestions as to improved methods. The questionnaire has fundamental value, because of the pertinent leading questions it asked concerning means of production and the other aspects of management.

The finding will indicate the major factors which contribute to waste and their relative weight. It will suggest those long-time programs such as standardization and stabilization which are larger than the action any one group can take for itself.

It will also indicate how each form of waste has been reduced or eliminated in certain industries, citing the specific instances.

E. E. Hunt, who has been on Mr. Hoover's staff, and who has been identified with the Elimination of Waste in Industry Committee since its formation, has been retained to direct the work of that committee until its completion. He will be largely responsible for collating and editing the report.

The report of Executive Secretary Wallace gave the results of a special study of the Employment Service made by Mark M. Jones. Plans for broadening the scope of the service were recommended and adopted. In submitting the report of the Patents Committee, headed by Edwin J. Prindle, Mr. Wallace noted the favorable attitude of members of Congress toward pending patent legislation sponsored by the council. Every effort will be made to bring about necessary Patent Office reforms at the present session of Congress.

Three new member societies have joined the Federation since the last meeting. They are the Boston Society of Civil Engineers and the Engineering societies of Milwaukee and Duluth.

The next meeting of the council will be held in St. Louis on June 3. This meeting will probably be the most important yet held by the society. It will synchronize with the report on the waste assay and will mark another progressive stage in the work of organization. For the intervening period Mr. Wallace and his associates have mapped out a vigorous campaign of constructive effort.

Atlantic City Meeting of National Machine Tool Builders' Association Cancelled

It has been announced by Ernest F. DuBrul, general manager of the National Machine Tool Builders' Association, that the spring convention which was scheduled for Atlantic City, May 19 and 20, has been cancelled. There will be no spring meeting of the association this year.

American Engineers To Present Fritz Medal in London This Summer

To express the obligation which the world owes to the engineers of Great Britain for the part they played in winning the war, the organized engineers of America will send a mission to London this summer. This mission, consisting of nationally known engineers and representing the so-called founder societies, will make the award of the John Fritz Medal to Sir Robert Hadfield at the opening meeting of the British Institution of Civil Engineers on June 29.

The inability of Sir Robert to come to the United States to receive the medal moved the trustees of the board to make the ceremony of presentation in England the occasion for an international expression of appreciation by the engineers of the United States to the engineers of Great Britain.

The Delegation

The deputation to England will consist of a representative of each of the four Founder Societies represented on the John Fritz Medal Board of Award as follows: Charles T. Main, of Boston, the American Society of Civil Engineers; Colonel Arthur S. Dwight, of New York, the American Institute of Mining and Metallurgical Engineers; Ambrose Swasey, of Cleveland, the John Fritz Medal Board of Award and the American Society of Mechanical Engineers; Dr. F. B. Jewett, of New York, the American Institute of Electrical Engineers. Dr. Ira N. Hollis, president of Worcester Polytechnic Institute and past president of the American Society of Mechanical Engineers, will accompany the deputation and bear the message from the American engineers.

The John Fritz Medal is a gold medal presented for achievement in applied science as a memorial to the engineer whose name it bears.

The medal was established by the professional associates and friends of John Fritz, of Bethlehem, Pa., on August 21, 1902.

The medal has been won in previous years by such men as Edison, Bell, Noble, Westinghouse and Douglas.

Business Conditions as the Big Banks of the Country See Them

Business and Impaired Capital—National Bank of Commerce, New York, on Money and Markets

Banking credit cannot be substituted for reduced capital and credit lines must be commensurate with present assets. Business must now recognize that it cannot operate on borrowed money to the same extent as before capital was impaired. It is unsound to attempt to maintain the former high aggregate of credit lines after a year of heavy losses. Easier credit conditions and cheaper rates would not alter this fact. Not to recognize it would result in the substitution of capital loans for current borrowings with serious effect upon the general banking situation.

Fortunately, some of the very factors which have combined to make credit liquidation desirable also make an adequate volume of business possible on a smaller credit base. It will take less money to do business on a lower price level, even though further increases in production and sales, as measured by physical volume, may take place. Elimination of the speculative element from business and the trend towards conservatism should bring about more rapid turnover. For a time also it may well be that even when measured by physical volume, the total of business will be smaller and with sharper competition goods will be better made and replacement requirements appreciably lessened.

Deposits and Loans

The steady and substantial reduction of bank deposits during the last year without corresponding reduction in loans has been and remains an important factor in any survey of the banking position. Deposits of member banks in New York City, for which group of banks most complete data are available, reached maximum in the latter part of May, 1920, between which date and the end of March, 1921, they have declined 776 millions. Loans and discounts, on the other hand, did not reach their maximum until October, and have declined steadily since that time. These opposite movements reflected the closer use of balances and in part the tightening of credit, which naturally contracted deposits as borrowing facilities were curtailed.

There has consequently been a substantial reduction in the margin by which deposits have exceeded loans. In May, 1920, deposits, then at their maximum, exceeded loans by 650 millions. By October, when loans were at their maximum, the margin had dropped to 226 millions. At the beginning of February, 1921, the margin had been further reduced to 100 millions or less than one-sixth of the differential in the preceding May. Recently, however, deposits have recovered somewhat while loans have continued to decline, in consequence of which on April 8 (the latest date available) deposits exceeded loans by 270 millions.

The process of deflation, so apparent in business for the year past, has, it will be observed, been also at work in the banking system. The figures for New York indicate the country-wide trend, and are an evidence of the strain which liquidation has imposed on the country's banking facilities. The recent moderate improvement in the ratio of deposits to loans cannot be taken as a definite change in the tendency. It is not improbable that as liquidation proceeds, with lower values, both deposits and loans will decline still further.

Money Rates

The rate on money requirements for commercial purposes has shown little change during the period March 16 to April 15. Commercial paper has ruled at 7½ per cent for prime names. Really first class paper, however, judged by former standards, has been scarce. Evidence of improvement in the current position of business houses with increased confidence in the soundness of values, would undoubtedly make for a broader and easier market than now exists.

The flow of gold in this center has continued without interruption during the period under review and has been an important influence in raising the reserve ratio of the combined Federal reserve banks from 50.9 per cent on March 11 to 53.5 per cent on April 8.

Railroads

The abrogation of the so-called "National Agreements" is the first important step toward the remedying of an almost intolerable situation. Negotiations must yet be had between individual lines and their employees, but the enunciation by a Government agency of the broad principles of honesty in work and fair treatment both ways as a basis for these negotiations is certainly the most favorable development we have had since emergency legislation separated railway employees from other labor in general.

First National Bank of Boston Sees End of "Buyers' Strike"—Iron and Steel Trade Decreased

The buying power of the country does not seem to be waning, but on the contrary retail trade is excellent. The so-called "buyers' strike," at least so far as women are concerned, seems to have passed. Retail sales in dollars since January 1 have been about equal to those of 1920, while reports indicate that sales in units of goods are measurably greater than a year ago. This steady consumption has begun to have its inevitable effect on New England's principal industries, and greater activity, albeit at scant profits, is distinctly noticeable. Woolen mills have experienced a good volume of heavy-weight sales and have pretty much sold out their capacity to mid-August. There is a slightly broader demand throughout the cotton goods field, although the market is very spotty, some goods being in very active demand, while others are almost entirely neglected. In hides, leather and shoes there has been a distinct improvement, the oversupply of hides having been reduced and retail buying very encouraging.

The production of iron and steel decreased steadily during the past month, as new business booked by manufacturers failed to keep pace with the completion of old orders. Steel production has dropped to about 30 per cent of capacity. Pig iron output has decreased to an annual rate of about 16,000,000 tons, as against a capacity of nearly 48,000,000 tons annually. During March fifty-two blast furnaces were blown out, leaving only 103 in blast March 31. In relation to present capacity this number represents the smallest percentage ever in commission. The price situation has shown little change. The United States Steel Corporation has announced a substantial reduction from the quotations adhered to since March, 1919. An independent interest recently announced an advance in steel products of $2 per ton. The bookings of the leading interest, however, have suffered somewhat, to the benefit of the independents, due to the lower prices of the latter. Some of the larger independent mills booked 25 per cent more business in March than in February. A little better buying by the automobile trade has accompanied the reports of a revival in that industry. For the most part, however, automobile builders have been specifying material already on order, or they have been requesting shipments of material which previously they had asked should be held up. Municipalities have been buying cast-iron pipe somewhat more freely. The city of Detroit has been inquiring for 20,000 tons of pipe. Structural business has expanded moderately with the coming of lower prices. Seasonal buying of barbed wire and wire fencing for the farm trade has been fair. Railroad buying has been conspicuously small. Export business has remained light.

Spring Meeting of the American Society of Mechanical Engineers

The 1921 spring meeting of the American Society of Mechanical Engineers is to be held in Chicago, May 23 to 26, at the Congress Hotel.

Well developed programs will be presented by the professional divisions of the society devoted to Forest Products, Fuels, Machine Shop, Management, Material Handling, Power, Railroad, and a specially important session will be devoted to Training for Industries. The Chicago committee, jointly with the Western Society of Engineers, is preparing a session on "Chicago as the Rail-Water Gateway."

Visits to a great number of points of engineering interest in Chicago will be arranged. Special attention is being given to the correlation of plant visits with the technical sessions.

En route to the meeting, the society, jointly with the Society of Automotive Engineers, will stop at McCook Field on Saturday, May 21, for an inspection of the facilities of the field.

On May 27 and 28, the Friday and Saturday following the meeting, a joint excursion with the Army Ordnance Association will proceed to Rock Island Arsenal, where the Ordnance Division will present papers and enjoy an inspection of the plant. Saturday will be devoted to a handicap golf tournament on the Rock Island links.

Institute of Metals to Meet at Birmingham

The autumn meeting of the Institute of Metals (British) will be held on Sept. 21 to 23 at Birmingham, England. An attractive program has been arranged by the Birmingham section of the society which includes visits to the university and plants in the neighborhood.

Electric Heating Show in June at Edison Showrooms

An Electric Heating Exhibit is to be held in the showrooms of The New York Edison Co., Irving Place and 15th St., New York City, from June 6 to 11, inclusive.

This will be the first time that such a show has been held and practically all of the electrical appliances for industrial heating which have been perfected during the past five or ten years will be exhibited. Forty-one manufacturers have accepted the Edison company's invitation to take part and at least one hundred different applications of electric heat will be shown. Cartridge units, tubular heaters, soldering irons, capping tools and branding irons, apparatus for candy makers and for use in show factories, printing plants and other industries will be exhibited and demonstrated. No charge will be made for admission and the show will be open from nine o'clock in the morning to five in the afternoon.

L. G. French, Editor and Engineer, Dies at New York

Lester Gray French, for thirteen years editor and assistant secretary of the American Society of Mechanical Engineers, and manager of the journal *Mechanical Engineering*, died on April 18 at the French Hospital in the City of New York from septic poisoning following an operation.

Mr. French was born in Keene, N. H.,



LESTER GRAY FRENCH

in April, 1869. He received his technical education at the Massachusetts Institute of Technology, from which he was graduated in 1891 with the degree of S. B. He served the year 1891-92 with the Cranston Printing Press Co. as draftsman, and then became connected with the International Correspondence Schools, Scranton, Pa., as instructor in mechanical engineering. Leaving this institution in 1895 he went to Providence, R. I., where he entered the employment of the Builders Iron Foundry as assistant to the superintendent. In 1897 he became editor in chief of *Machinery*, continuing in this position until 1906, when he resigned to take up the publication of technical books, among them being one of the earliest treatises on the steam turbine, of which he was the author. In 1908 he was made editor of the publications of the American Society of Mechanical Engineers, which organization he faithfully and ably served to the date of his death. With a rare combination of enterprise, vision and dependability Mr. French developed the publications of the A. S. M. E. to a very high standard.

Mr. French had been a member of the American Society of Mechanical Engineers since 1899.

Only those who knew Lester French intimately could appreciate his many fine qualities, for he was naturally of a shy and retiring disposition. His many friends will long cherish memories of his kindliness, his willingness and desire to be of service, and his thoughtfulness of others, as well as his marked ability in handling the many difficult problems which arise in such a high position which he attained.

Krupps Produce a Non-Corroding Steel

After years of experiments the Krupp laboratories have succeeded in producing a steel alloy, which is claimed to be non-corrosive. It contains over 70 per cent of iron, its other components being chromium, and in a lesser degree, nickel. The alloy is made in three different varieties. The first resembles silver in chemical qualities, but has inferior mechanical qualities. It is recommended for medical instruments, turbine blades, valves, and the like. It is said to be immune against water, and nitric acid, but not against sulphuric and muriatic acid. It is marketed at a price of 75 M per Kg. A second variety offers non-corrosiveness in a lesser degree, but is more ductile and malleable. As regards immunity against the chemical action of water, it is claimed to be superior to all existing steel alloys. A third brand, still more compromising between non-corrosiveness and mechanical qualities, is made for being used in cutlery manufacture, and the like. It is claimed to equal the non-corrosive chromium-steel recently put on the market in England.

Link-Belt Co. Buys Steel Works

The Link-Belt Co., Chicago and Philadelphia, has purchased the plant of the Dodge Steel Co., located at Tacony, Pa., said to be the only plant in Philadelphia, or vicinity, making electric steel castings. The plant comprises about five acres of property and has a capacity of 150 tons per month. The Link-Belt Co., aims to use only about one-third of the capacity of the plant for its own uses and the remainder to supply the needs of local manufacturing establishments for steel castings.

The steel company will be operated as a separate corporation under the name of the Dodge Steel Co., the officers being Charles Piez, president, and Staunton B. Peck, vice-president of Link-Belt Co., president and vice president, respectively, and Chester S. Roberts, secretary, treasurer and manager.

Old Cornwall Plant to Be Dismantled

The Bethlehem Steel Co., has ordered the razing of the twin Bird Coleman blast furnaces at Cornwall, Pa.

For more than a half century the twin Bird Coleman furnaces were prominently identified with the iron industry in the Lebanon Valley. Situated on the edge of the Cornwall iron ore mines the furnaces for a quarter century were operated by the Freeman estate of which the late William Coleman Freeman, of Cornwall, was the head. Later they were leased to the Lackawanna Iron and Steel Co. and two years ago became the property of the Bethlehem Co. at the time of its purchase of the majority interest in the Cornwall mines, the Cornwall Railroad and the Lebanon plant of the American Iron and Steel Manufacturing Co.

Washington Notes

By Paul Wooton
Washington Correspondent

No effort will be made on the part of Representative Vestal, Chairman of the Committee on Coinage, Weights and Measures of the House of Representatives, to defer further a comprehensive hearing on legislation looking to the adoption of the metric system as the ingle standard of weights and measures in the United States. At the last session of Congress, Mr. Vestal accepted the suggestion of those opposing the compulsory adoption of the metric system and declined to call up any metric bill on the ground that it would have interfered with production at a time when it was necessary for the manufacturers of the country to concentrate or that problem. The industrial situation now has changed to the point where he sees no objection to the discussion of this subject. No date for the hearing has been set and it may not begin for several months. It is Mr. Vestal's thought, however, that this session of Congress offers a good opportunity to make a comprehensive record of current opinion on this much controverted matter.

Metric system legislation is expected to be one of the major topics of discussion at the annual conference on weights and measures which will be held at the Bureau of Standards, May 23 to 26. Matters concerning the handling of liquid-measuring pumps are expected to come in for important discussion. Another major topic is weight standards for bread.

Means will be discussed at the meeting for a more ready method of preventing short weights on cars shipped in interstate commerce. This is aimed particularly at coal and other commodities shipped in bulk. Standardization of goods in package form also is to be discussed.

National Screw Thread Commission Plans

Further work to be undertaken by the National Screw Thread Commission was outlined at a meeting April 18. It was decided to report on the standardization of taps, dies, and tap drill sizes. This work is to be handled by a subcommittee which consists of Col. E. C. Peck, R. E. Flanders and Earl Buckingham. The matter of standardizing bolt heads, screw heads and nuts is to be handled by the following subcommittee: F. O. Wells, E. H. Ehrman and Commander L. M. McNair. The matter of standardizing sizes of bar stock for producing cut and rolled threads is to be taken up by a subcommittee consisting of Commander J. S. Evans, E. H. Ehrman and Major J. A. Johnson. The standardization of instrument threads and threads cut on brass tubing is to be taken up by Commander L. M. McNair, F. O. Wells and S. W. Stratton. The standardization of acme, square, buttress and other special threads is to be considered by Major J. O. Johnson, R. E. Flanders and J. S. Evans.

A subcommittee consisting of Colonel E. C. Peck, R. E. Flanders and E. H. Ehrman was designated to go over the recent report of the commission with the idea of adding explanatory notes intended to be helpful to designers and users. It is believed that more specific statements can be made as to the use of various classes of fit. For example, machine screws ordinarily will be manufactured in the medium fit class, subdivision A. There ordinarily would be no occasion for manufacturing machine screws either in the loose fit class or in the close-fit class. Similarly, the close-fit tolerance will not ordinarily be applied to coarse-thread series, nor the loose fit tolerance to the fine-thread series.

Tariff Rates on Various Metals and Ores

The storm center in the preparation of the metal schedule for the new tariff bill is about the crude ores of the metals used as alloys in the making of steel. During the war the United States was forced to curtail to the greatest extent possible its imports of manganese, tungsten, chrome and other ores. This gave rise to a considerable expansion in the working of domestic deposits. These industries are making a determined fight for a duty high enough to enable them to compete with the imported ores. Since the American producers are not in a position to furnish more than a small percentage of the country's needs the proposal is being resisted strongly. Manganese, chrome, antimony, cobalt, nickel and molybdenum and tungsten ores have been on the free list. Sentiment in the committee is divided, with the chances favoring the removal of these ores, with one or two possible exceptions, from that list, but it is regarded as a safe prediction that any duty that may be prescribed for these imports will be much lower than the amount being asked by domestic producers.

The present duty on high-speed and tungsten-bearing steels is 15 per cent. A rate of duty has been asked on these steels which would be equivalent to 50 per cent ad valorem. This is being opposed by users of steel on the ground that American manufacturers do not require any such rate of duty to compete with the English manufacturers, who are the principal competitors. It is claimed that manufacturing costs in England are no lower than they are in the United States, while the English manufacturers have higher expenses in the distribution of their products in this country. It is argued that the present rate of 15 per cent ad valorem should be allowed to remain on this class of steel.

The users of high-speed steel object to the placing of the duty on tungsten ore. It is their position that it is a basic raw material which can not be mined economically in the United States. The proposed rate of duty of $10 per unit is one and one-half times the price of the selling product before the war. Such a duty will benefit a few individual mine owners, it is claimed, and those importers who have large stocks of ore on hand. It is said that no revenue can be expected for several years if this duty is levied on tungsten ores, as it would preclude further imports. It would greatly enhance the value of stocks held in this country.

National Metal Trades Association in Convention

The twenty-third annual convention of the National Metal Trades Association was held at the Hotel Astor, New York, April 20 and 21, with a large representation of its membership in attendance. In addition to the usual reports by Albert E. Newton, president; Frank C. Caldwell, treasurer; John D. Hibbard, commissioner, and Homer D. Sayre, secretary, there were papers and addresses as follows:

"Industrial Education," by Harold C. Smith; "Economic Conditions in Europe and How They Affect Us," by William S. Kies; "Quit Deceiving Yourself," by A. T. Simonds, "Time Industrial Problems," by M. W. Alexander; "Labor Unions in Times of War," by Hon. Chas. L. Underhill; "Mistakes of Interchurch Steel Report," by Rev. E. Victor Bigelow.

Under the general heading of "Practical Methods of Industrial Training," Philip C. Molter, superintendent, department of training, gave his annual report. This was followed by addresses on "Our Experience with Training," by George A. Seyler, works manager of the Lunkenheimer Co.; "Modernized Apprenticeships," by J. E. Goss, supervisor of apprentices, Brown & Sharpe Manufacturing Co.; and "Recent Developments in Training Instructor Foremen and Plant Leaders," by D. J. MacDonald, professor of vocational education in the University of Cincinnati.

No change was made in the four leading officers of the association. A. E. Newton, George O. Rockwood, W. W. Coleman and F. C. Caldwell were re-elected president, first and second vice-presidents and treasurer, respectively. The councilors elected for two years are L. J. Chandler, A. C. Gilbert, G. W. Mixter, Paul C. DeWolf, Paul T. Norton and M. B. McLauthlin. E. J. Miller was elected to fill the unexpired term of D. W. Wright, deceased.

In addition to these, Justus H. Schwacke of William Sellers & Co. was made an honorary member of the council. Extracts from some of the papers will be published in a later issue.

Using Window Display to Sell Machine Tools

The Mine and Smelter Supply Co. of 42 Broadway, New York, N. Y., with branches in Denver, Salt Lake City and El Paso, has recently tried the method of window display for selling machine tools. The method followed is to display a single tool, such as a lathe, with suitable background. We are advised that the experiment proved successful beyond expectations. Displays were made at the Denver and Salt Lake City branches.

Business Items

The Universal Crane Co. announces the removal of its plant from Cleveland, Ohio, to the new factory at Elyria, Ohio, construction of which has just been completed. The company has greatly increased its capacity and production is now under way in the new plant. The move from Cleveland was made by motor truck so as to eliminate delay and loss in production.

The Connersville Foundry Corporation, a subsidiary of the United States Automotive Corporation of Connersville, Ind., is completing an extensive addition to its large plant. It has also installed heat treating equipment, demanded by the requirements of the Ansted Engineering Co., which produces the recently announced Ansted engine for the exclusive use of the Lexington Motor Co. All of these plants are subsidiaries of the United States Automotive Corporation.

The Armstrong Manufacturing Co., Waterloo, Iowa, has cut the price of its gasoline engines, well-drilling machines, pumps, tools and parts, approximately 20 per cent, according to J. E. Armstrong, general manager. Some tools have been cut to the extent of 30 per cent.

H. B. Lichty, president and general manager of the Construction Machinery Co., Waterloo, Iowa, has announced a cut of 15 per cent in the prices of all the manufactured products of that company. The company manufactures cement mixers, hoists, trench pumps and trench fillers and other like products in the machinery line. Mr. Lichty states that this is an arbitrary reduction unaccompanied by any corresponding reduction in the cost of manufacture, but that though there has not been this corresponding reduction in labor and raw materials such a reduction ought to be taken by the manufacturer as a loss in the readjustment of prices.

Directors recently elected by the Valley Mold and Iron Corporation, of Sharpsville, Pa., are: John Sherwin and J. R. Kraus, of Cleveland; George H. Boyd, J. E. Perry and Hugh J. Garvey, of Sheron; Henry Lockhart, Jr., and E. H. Tinker, of New York.

The Curtis & Marble Machine Co., at Worcester, Mass., has taken over the patterns, drawings, etc., used in the manufacture of Woonsocket cloth trimming or inspecting machines used by cotton mills, and also Woonsocket double rotary cloth press used for woolen and worsted mills. The company will not build new presses of this type, but will furnish brass and copper jackets for the various styles of Woonsocket presses and also any other parts from which patterns are available.

The Commercial Drop Forge Co. has opened its new plant at Warren, Pa. This plant is equipped with the latest machinery and forging equipment. Officers of the company are W. T. Davidson, president; F. B. Bielaski, vice-president; L. C. Jamieson, secretary and treasurer.

The Page-Lewis Arms Co., of Chicopee, Mass., has recently been incorporated to manufacture firearms, etc. The plant will be located in Chicopee and the capital stock is listed at $400,000. The officers of the company are: President, Irving H. Page; treasurer, Charles H. Leonard. The board of directors consists of Irving H. Page, Charles H. Leonard, and George S. Lewis, all of Chicopee Falls, Mass.

At the annual meeting held last week directors of the Reading Iron Co., Reading, Pa., were elected as follows: L. E. Thomas, J. M. Callen, S. R. Seyfert, Jefferson Snyder and Randolph Stauffer. The board later met and elected the following: President, L. E. Thomas; vice-president, J. M. Callen; secretary, George W. Delany; treasurer, H. N. Yost; assistant treasurer, R. J. Wenger.

Organization of the Community Steel Corporation, Buffalo, N. Y., has been effected. The new company will engage in the designing and fabricating of commodities from rolled materials. Officers are: President, Frank Herzog; vice-president, Charles A. Faessler, and secretary-treasurer, Milford R. Burgwardt.

After negotiations that have been under way for some time it was announced last week that a new organization had been formed to take over the business of the Vaughn Foundry Co. at Norwich, Conn. Papers were filed for a change of name from the Vaughn Foundry Co. to the Vaughn Foundry Corporation and for increase of capital stock to $80,000, with 2,000 shares of common stock, $10 par, and 600 shares of preferred stock, $100 par. The Vaughn Foundry Corporation has for president Archibald A. McDiarmid, for secretary and treasurer W. Russell Baird. The directors include Charles A. Saxton, Frank E. Palmer and Calvin H. Fisbie. The Vaughn Foundry Co. was founded in 1854 by the late Alfred H. Vaughn and has been engaged in making gray iron castings. It has been widely known throughout eastern Connecticut and has always done a prosperous business.

Directors of the Youngstown Foundry and Machine Co., Youngstown, Ohio, at the dividend meeting held recently declared a quarterly dividend of two per cent. The company paid four per cent per quarter for the last periods.

The financial condition of the company is good, but owing to the present conditions, the reduction in the dividend at this time is made. The company has an authorized capital of $250,000, all of which is common stock.

Roundhouse and machine shops of the Maine Central Railroad at Calais, Me., were destroyed by fire of undetermined origin. Four locomotives were burned.

Personals

W. R. Noxon has been appointed sales manager for the Alexander Milburn Co., Baltimore, Md. His experience in the oxyacetylene line is very extended. He served as sales manager for the Davis-Bournonville Co., at New York and as district manager at Chicago, Ill.

W. B. Joyner has joined the Buffalo office of the Simmons Machine Co., of Albany, N. Y.

C. Whitney Crosby is now connected with the Automatic Signal Co., of St. Paul, Minn., as production engineer. He is also engaged in a consulting capacity with the Motor Efficiency Co. and the Mutual Automobile Association, Inc., which are under the same management as the Signal company.

John W. Mowrey has recently been appointed general manager of the Worcester Pressed Steel Co., of Worcester, Mass. Mr. Mowrey was formerly with the Chester Shipbuilding Co., of Chester, Pa.

Joel A. Thayer has become New England manager of the Acme Road Machinery Co., of Frankfort, N. Y., with offices at 141 Milk St., Boston, Mass. Mr. Thayer succeeds the late W. T. Becker, who died recently, and who was in charge of the office for a number of years. Mr. Thayer was formerly superintendent of streets of the City of Taunton, Mass.

Ray W. Light, of Westmont, Johnstown, Pa., who recently resigned as superintendent of the bessemer department of the Cambria Steel Co., was tendered a dinner by the Cambria Country Club prior to his leaving to accept a position as superintendent of the Inland Steel Co.'s plant at Midland, Pa. Clyde Denlinger, of Westmont, superintendent of the open hearth department of the Cambria Steel Co., has been named to succeed Mr. Light. The two positions will hereafter be combined.

W. S. Hutchinson, district manager for the Sullivan Machinery Co., with headquarters at Birmingham, Ala., has resigned his position to become general sales manager for Watt & Co., at Pineville, Ky. He is succeeded by Mr. Small, who comes to Birmingham from Salt Lake City.

James McKenny, formerly superintendent of the National works of the Wickwire-Spencer Steel Corporation at Worcester, Mass., has resigned as production manager of the Republic Rubber Co., of Youngstown, Ohio.

Victor T. Goggin, late New England sales manager of Fred T. Ley & Co., Inc., of Springfield, Boston and New York, has severed his connection with that concern to associate himself as contracting engineer with Dwight P. Robinson & Co., Inc., of New York, Chicago, Dallas, Youngstown, Los Angeles and Montreal.

H. GILBERT HART has been elected president of the reorganized Hart & Crouse Foundry Co., Utica, N. Y. Merwin K. Hart is general manager. This company, which manufactures heating apparatus, is running full time.

WILLIAM S. SEAMAN, JR, has been appointed sales manager of the Frontier Manufacturing Co., North Tonawanda, N. Y., which company markets a line of cutting and lubricating oil. Mr. Seaman was formerly an executive with the American Locomotive Works, Baldwin Locomotive Works, and recently with the Union Petroleum Co., of Philadelphia, Pa.

FRANK C. WHITNEY, for eleven years with the Davis-Bournonville Co., Jersey City, N. J., has resigned. He was sales manager during the years 1914-1920.

ROBERT R. KEITH, formerly of the Moline Plow Co., in charge of the Universal Tractor Works, has been made superintendent of tractor works of the International Harvester Co. at Chicago.

SAMUEL JACOBSON, president of the Jacobson Supply Co., of Cleveland, Ohio, has been elected a director of the International Steel Tube Co., Cleveland, Ohio.

ARTHUR SCHROEDER, for twenty years New York representative of La Belle Iron Works, of Steubenville, Ohio, and dean of the company's sales force, retired, effective March 1, but is remaining with the company for a while in an advisory capacity. He became identified with the iron and steel industry in 1886 when he was made Eastern sales agent of the Standard Iron Co., Bridgeport, Ohio. Prior to that, beginning in 1876, he had been with Manning, Maxwell & Moore and later with Lovejoy & Co. When the Standard company was merged with the Aetna Iron and Steel Co., in 1912, Mr. Schroeder continued as Eastern representative. The Aetna-Standard organization in 1899 was absorbed by the Moore companies, which later were merged with the other companies in forming the United States Steel Corporation. Shortly after the organization of the steel corporation Mr. Schroeder joined the sales force of La Belle Iron Works.

JOHN R. COMSTOCK, assistant superintendent of blast furnaces at the Steelton, Pa., plant of the Bethlehem Steel Co., has been appointed assistant general manager of the Detroit, Ohio, Valley furnaces of the Hanna Furnace Co., Cleveland, Ohio.

The next industrial census of the United States, soon to be issued in Washington, will show more than 300,000 manufacturing establishments with an average employment of 25 persons. It will show 98 per cent employing 250 persons or less, and less than one-fifth of 1 per cent employing more than 1,000.

Obituary

AUGUST D. COOK, president of A. D. Cook, Inc., Lawrenceburg, Ind., died on March 28. Mr. Cook was the founder of the company which bore his name, and was a prominent figure in the machine trade in the West.

LOUIS C. BLANCKE, president of the L. C. Blancke Co., New York, N. Y., died at his home on April 5. Mr. Blancke was prominent in the machine-tool trade, specializing in the manufacture of twist drills.

CHARLES W. SCHWARTZ, JR., president of Proctor & Schwartz, Inc., machinery manufacturers, died at his home in Germantown, Pa., on April 6. He was well known in the metal trades, being chairman of the directorate of the Smith & Furbush Machine Co.

JACOB L. ENGLEHART, a native of Cleveland, Ohio, died at his home in Canada recently. He was formerly proprietor of the London Oil Refining Co., and later manager of the Imperial Oil Co. For the past fifteen years he was chairman of the Temiskaming & Hudson Bay Ry.

Trade Catalogs

Horizontal Boring Machines. Universal Boring Machine Co., Hudson, Mass. A 6 x 9-in. booklet of instruction on the proper way to unpack, assemble and use the various models of "Universal" boring machines.

Safety Starting Switch. Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Circular describing the C-H enclosed switch used for starting polyphase squirrel cage motors. Specifications and detailed drawings are included.

"Germ Process." Henry Wells Oil Co., London, S. W., England. "The Germ Process in a Nutshell" is the full title of this booklet which covers this new phase of oil production.

Eyetect. Strauss & Buegeleisen, Brooklyn, N. Y. Twenty-four 6 x 9-in. pages, describing a full line of sun glasses, goggles, eye-shades, shields and other forms of eye-protectors.

Pyrometers. Thwing Instrument Co., Philadelphia, Pa. Bulletin No. 10 describing the latest types of indicating and recording thermo-electric pyrometers which are particularly adapted for heat-treating.

Universal Cranes. The Universal Crane Co., Cleveland, Ohio. Bulletin No. 11, eight pages of illustrated and descriptive data about several types of cranes. Specifications and detailed drawings are included.

Lubrication. The Texas Co., 17 Battery Place, New York City. March issue of a technical publication devoted to the selection and use of lubricants.

Ball Bearings. The Chicago Pulley and Shafting Co., Chicago, Ill. A four-page circular describing the line of power transmitting appliances and ball bearing specialties.

Die-Forming Machines. The Anderson Die Machine Co., Bridgeport, Conn. Bulletin No. 10, describing the line of Anderson die forming machines and super-helical cutters.

Saws. E. C. Atkins & Co., Indianapolis, Ind. A supplement to Catalog No. 18, giving the full list of revised prices on mill saws and specialties.

Friction Clutches. George W. Pyott Co., North Ave. and Noble St., Chicago, Ill. Bulletin C-21, 6 x 9 in. Describing a full line of power clutches, couplings, friction wedges, drop hangers, gearing, shafting and other power transmission machinery.

Safety Products. American La France Fire Engine Co., Inc., Elmira, N. Y. A new circular covering a comprehensive line of safety appliances and first aid equipment.

Bulletin No. 1. National Rivers and Harbors Congress, 824 Colorado Bldg., Washington, D. C. A sixteen-page bulletin giving some valuable information on matters concerning governmental appropriations for rivers and harbors. A table covering such expenditures from 1896 to 1920, some information on the Panama Canal and like data are included. A copy of the bulletin will be sent to anyone from the above address.

Garage and Shop Equipment. Manley Manufacturing Co., York, Pa. Bulletin No. 50, a comprehensive 8 x 10-in. catalog describing presses for garage and shop work, cranes, engine stands, portable work benches and all-steel legs.

National Selling Aids. National Tube Co., Pittsburgh, Pa. A forty-three page catalog, 8½ x 11 in., showing numerous selling aids for those who handle national pipe and tube products.

Woodworking Machinery. Wayne Machinery Co., Fort Wayne, Ind. "A Trip Through the Plant" of this company, showing the various departments, shop layout of machines and equipment and shipping facilities.

Drawing Instruments. "Made in America," by C. F. Pease Co., Chicago, Ill., is the title of a new eight-page 6 x 9-in. booklet known as Catalog D-21. The booklet illustrates and describes complete sets of Pease "Chicago Made" drawing instruments in genuine morocco leather pocket-style cases, as well as four styles of bow instruments which may be purchased separately.

Delivery Sheet and Price Guarantee. The Burke Machine Tool Co., Conneaut, Ohio. A single page list of the products of the Burke company, giving the quantity of each machine in stock and the date of delivery possible. A notice is included which guarantees the prices of Burke machines for six months.

Forthcoming Meetings

The National Foreign Trade Council will hold its eighth annual convention in Cleveland, Ohio, on May 4, 5, 6 and 7. J. G. Hammond, care of the Council, 409 Park Bldg., Cleveland, is secretary.

The seventh annual convention of the American Association of Engineers will be held at Buffalo, N. Y., on May 9, 10 and 11, with headquarters at the Lafayette Hotel.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The spring meeting of the National Association of Manufacturers will be held in New York, May 16, 17 and 18 at the Waldorf-Astoria Hotel. The headquarters of the association is at 30 Church St., New York City.

The Taylor Society will hold its Spring Meeting at the Hotel Statler, Cleveland, Ohio, May 19 to 21.

The spring meeting of the American Society of Mechanical Engineers will be held at the Congress Hotel, Chicago, May 23-26. Calvin W. Rice, Engineering Societies Bldg., 29 West 39th St., New York, is secretary.

The Society of Automotive Engineers, 29 West 39th St., New York announces that its summer meeting will be held at West Baden, Ind., on May 24 to 28 inclusive.

The American Railway Master Mechanics Association will hold its Spring Meeting at the Drake Hotel, Chicago, Ill., on June 15 and 16.

The 1921 annual meeting of the American Society for Testing Materials will be held at Asbury Park, N. J., on June 20 to 24, with headquarters at the New Monterey Hotel. C. L. Warwick, Engineers Club, Philadelphia, Pa., is secretary.

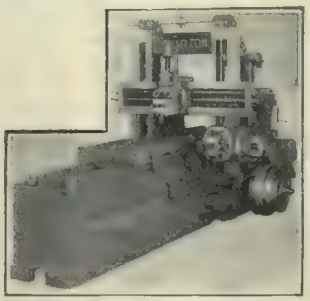
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Planer, Toolroom, No. 10-A

George Gorton Machine Co., Racine, Wis.

"American Machinist," Feb. 17, 1921



The machine is made in two sizes, 24x24 in. and 30x30 in. A side head is used, and either one or two heads can be supplied on the crossrail. The bed has a closed top, except at the center where the driving gears are located. The table is of box section, being closed on the bottom, with openings in the sides for the removal of chips. The machine can be controlled from either side of the machine. The principal specifications are as follows: Width of table, 22 in. for 24-in. machine, 28 in. for 30-in. machine; distance between housings, 25 or 31 in.; height under crossrail, 25 or 31 in.; length of finished surface of table, 6 ft.; proportion of bed to table length, 1⅛ to 1; height of table top from floor, 33¼ in. length of down feed of crossrail, 10 in.; motor recommended, 7½ hp. 1,200 r.p.m.

Indexing Fixture, Hand-Milling Machine, for Squares and Hexagons

M. B. Hill, 10 Eden St., Worcester, Mass.

"American Machinist," Feb. 17, 1921

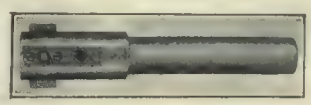


The device is intended for use on a hand-milling machine for cutting squares and hexagons on the heads of screws and bolts or on the ends of round stock of any kind. Interchangeable spring collets are provided for holding screws or any size of round stock up to ⅞ in. in diameter, the work being gripped by the partial rotation of the hardened and ground shell-chuck operated by the upper handle. Four holes in the periphery of the chuck are threaded to fit the handle, which may thus be placed in a position that will be most convenient to operate after the fixture is set up. It is stated that the device is not intended to compete with more elaborate and automatic devices for accomplishing the same purpose, but that for the small job shop it is a very convenient and inexpensive tool.

Boring Bar, Adjustable

Murchey Machine and Tool Co., 951 Porter St., Detroit, Mich.

"American Machinist," Feb. 17, 1921

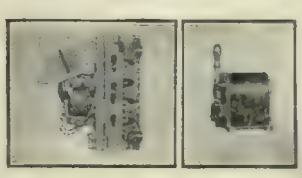


The tool can be furnished with any size or shape of shank required. It is made in sizes to bore holes from 1½ to 9 in. in diameter. The position of the cutters can be adjusted by means of a micrometer screw, which is turned by means of a wrench inserted in the hollow head of the screw. It is claimed that the adjusting device provides a positive adjustment either in or out for the cutters, each division of the graduated circle representing a change of 0.001 in. in the diameter of the bored hole. After the adjustment is made, the cutters are locked in place by means of another screw. A facing attachment can be supplied.

Controller, Magnet, Two-Unit, Magnetic-Switch

Ohio Electric and Controller Co., 5900 Maurice Ave., Cleveland, Ohio

"American Machinist," Feb. 17, 1921



The controller is intended for use with electromagnets, such as employed for crane service. The device consists of two units, the magnetic switch being shown at the left and the operator's master switch at the right. The controller is stated to be small in size, and yet capable of continuous operation and of protecting the magnet from heavy inductive current loads. The resistance wire in the magnetic-switch box is enameled and set in clips mounted in a case back of the slate of the switch. The resistance wire may be inspected by opening the box, which is hinged at the bottom, it being unnecessary to disturb any wiring. The operator's master switch is compact and has three positions of the operating lever, forward for turning the current in the magnet, center for shutting it off, and reverse for dropping the load quickly.

Tool and Holder, Threading, Spring

M. B. Hill, 10 Eden St., Worcester, Mass.

"American Machinist," March 3, 1921

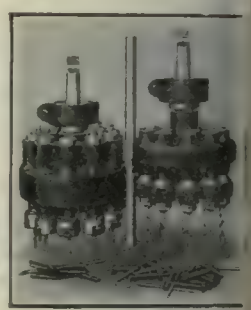


The threading tool and holder may be used either as a spring or as a rigid tool. The shank is pack-hardened. The cutting blades are interchangeable. An adjusting screw passes vertically through the shank behind the blade, the back of the latter being hobbed to match the thread of the screw, so that vertical adjustment is obtained by loosening the clamping bolt and turning the adjusting screw. A tapered bolt, which can be drawn up by a knurled thumbnut, fits a correspondingly tapered hole that passes transversely through the shank; and to convert the device from a spring to a rigid tool requires only that the thumbnut be tightened.

Heads, Combination of Drilling and Tapping

John H. Dorman & Son, 5148-52 Hudson Blvd., West, West New York, N. J.

"American Machinist," Feb. 17, 1921



The device is intended for the drilling and tapping of an automobile bevel gear, being used upon a vertical-turret type of drilling machine, such as the Turner. The drilling head is first brought into use, and then the turret of the machine is rotated so as to bring the tapping head over the work. The heads are of the type previously made by the concern. The rod between the heads is intended to be secured at its top to the center of the turret and at its bottom to the table. The housing of each head is provided with a bearing, so that the heads slide upon and are guided vertically by the rod. When the turret is indexed the rod serves to properly position the heads.

Reamer, Piston, F-J

Foster-Johnson Reamer Co., Elkhart, Ind.

"American Machinist," Feb. 17, 1921



The reamer is intended particularly for use in garages and repair shops for line reaming piston-pin holes. It is first inserted in the hole, and then the blades are "expanded" by means of the knurled screw head at the end, until the cutting edges just touch the walls of the hole. After the blades are pushed out an additional 0.001 in. the hole is reamed through. The expanding and reaming operations are repeated until the hole is up to the desired size. The size of the hole can be read on the micrometer graduations on the head of the screw. The blades vary from 3 to 4¾ in. in length.

Drilling Head, Multiple-Spindle, Fixed-Center

John H. Dorman & Son, 5148-52 Hudson Blvd., West, West New York, N. J.

"American Machinist," Feb. 17, 1921



The device is of the multiple-spindle, fixed-center type, being adapted to drilling holes grouped closely together. It should be noticed that straight-shank drills are used, being held in the spindles by means of setscrews. On account of the closeness of the holes adjustable chucks to hold the drills cannot be employed. The bottom plate of the machine is cast iron. The housing is made of aluminum. The main spindle has a large gear on its lower end, four wide-face pinions being driven from it. The pinions drive the gears on the drill spindles, it being necessary to lap the gears over each other because of the closeness of their centers. The speed ratio is about 3 to 1.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

N. J., Passaic—The Falstom Co., manufacturers of sheet metal specialties—plate bending roll, capacity ⅜ in., angle iron roll, capacity 2 in. x 2 in. x ¼ in., 2 shears, capacity ⅝ in. plate, Lennox Serpentine.

Pa., Wilkes-Barre — The Vulcan Iron Wks., 730 South Main St.—1 gear hobbing machine to cut gears up to 36 in. diameter.

Fla., Jacksonville — The Aetna Iron & Steel Co., P. O., Box No. 1151, J. M. Burrell, Secy. and Treas.—hand pipe benders to bend 2 in. pipe to a 6 in. radius.

Ga., Atlanta—Austin Bros., Greenwood Av. and Southern Ry., E. C. Knodel, Jr., Mgr.—cranes, punches, shears and power riveters.

Tenn., Nashville—The State Bd. of Administration—$35,000 worth of equipment for workshops of the State School for the Blind.

Va., Richmond—The Commonwealth Sales Co., 1813 West Broad St. (auto repairers), —small lathe, steam shovel, metal garage scraper and road machinery.

Va., Richmond—Ross & Carle, 1606 West Main St. (auto repairers)—1 radial drill 42 in. swing and 1 cylinder grinder.

W. Va., Logan — The Guyan Machine Wks., B. Schell, Mgr.—lathes, shapers, milling machines, hydraulic presses, radial drills, plate shears, bending rolls, power hammers, planers and bolt machines.

Ill., Chicago—D. Gayton, 4419 Lexington Ave.—combination notching and cutting machines and punch press.

Mich., Detroit—C. F. Duer, 1957 Magnolia Ave.—repair equipment for automobile shop, also coil testing machine, torches and equipment, etc.

Mich., Detroit—L. H. Voss, 4763 Sheridan Ave.—combination vise and vulcanizing equipment for auto repair shop.

Mich., Howell—The Howell Washing Machine Co.—one 8 ft. brake and one post boring machine.

O., Columbus—The Solar Metal Products Co., 470 Starr St.—1 double crank single geared press, weight about 9,000 to 10,000 lb., similar in construction to Toledo No. 91 D., Bliss No. 134, or consolidated No. 164 A.

O., Mansfield — The Columbia Tire & Rubber Co., N. S. Sutherland, Purch. Agt. —lathes, drill presses and other tools.

O., Norwalk—The Norwalk Drilling Tool Co.—general equipment.

O., Sebring—The Sebring Machine Co.—lathe.

Wis., Ft. Atkinson—The Bull Milking Machine Co., North Main St., J. W. Meyer, Purch. Agt.—24 in. shaper and medium size engine lathe.

Wis., Hortonville—Otts Bros. Garage—repair shop machinery.

Wis., Jefferson—F. Schulz, 100 C St.—power machinery for garage.

Wis., Madison—A. O. White, 313 West Johnson St., (garage)—repair shop equipment including lathe.

Wis., Ripon — The Fargo Co., A. M. Harger and H. L. Fargo, organizers—machinery for the manufacture of metal ash receptacles.

Minn., Duluth—The Liberty Mfg. Co., c/o Duluth Commercial Club, C. P. Smith, Pres. —lathes and tools for the manufacture of automobile chains.

Mo., Springfield — The Ampco Metal Products Co., 302 Woodruff Bldg., W. C. King, Secy.-Treas.—rolls, benders, crimpers, shears, formers, dies, jigs and special machinery.

Okla., Okmulgee — The Rebold Knock Down Tank Co., J. H. Rebold, Purch. Agt.—
Power press or brake—15 ft. 6 in. between housings.
Power shears—12 ft. between housings to shear No. 10 ga. iron.
Set rolls to roll No. 10 soft iron to radius of 8 ft.-10 ft. between housings.
Electric welding equipment.
Presto-lite equipment.
Circular shears for No. 10 iron.
All of above machinery to be electrically driven, 220 volt, 3 phase, 60 cycle a.c.

Que., Montreal—The Canadian Fairbanks Morse Co., 84-98 St. Antone St.—one 72 in. lathe with short bed, for turning locomotive wheels (new).

Machinery Wanted

N. J., Camden—Cooper Hospital, 6th and Stevens Sts.—laundry machinery.

N. J., Mt. Holly — The Bd. of Freeholders, Burlington Co., laundry machinery for the Insane building at New Lisbon, N. J.

Pa., Philadelphia—The Freihofer Baking Co., Land Title Bldg.—$235,000 worth of machinery for its proposed bakery at Camden, N. J.

Pa., Philadelphia — H. F. Grow, 1306 North 3d St. — machinery and equipment for forge shop.

Ala., Bay Minette — The Bay Minette Mfg. Co. Inc.—O. H. Ertzinger, Pres. and Mgr.—short log saw-mill and two-color printing machines.

Ala., Felix—The Felix Lumber Co., J. Suttle, Proprietor—planning mill machinery, etc.

Tenn., Martin—E. E. Gooch Mfg. Co., E. E. Gooch, Pres. and Mgr.—mixing machines and packing machines, etc.

Va., Danville — The Piedmont Tobacco Co., E. L. Dodson, Pres. and Mgr.—Complete equipment for tobacco plant.

Va., Stuart — J. D. Blackard Stave & Cooperage Co., W. G. Blackhard, Mgr.—boring machines for boring holes in posts, also lathes for turning old fashioned posts and rounds.

W. Va., Cameron—The Cameron Mining & Developing Co., G. E. Myers, Pres. and Mgr. — hoisting equipment, shaft mining machinery, etc.

W. Va., New Martinsville—The Universal Concrete Products Co. Inc., H. Eschenbrenner, Secy-Treas.—electric or hand crane, 30 ft. span, 3 to 5 ton capacity, 2 or 3 ton electric hoist for use on crane in case hand crane is used, and a 5 ton stiff leg derrick about 30 ft. mast, 50 ft. boom.

Wis., Chippewa Falls — The Chippewa Falls Woolen Mills, 901 Prairie St.—machinery for making woolen goods.

Wis., Herbster—The Clover Co-operative Creamery Co., O. E. Kaupp, Secy.—power driven creamery machinery.

Wis., Madison—Frank Bros., 607 University Ave.—ice making and refrigeration machinery.

Wis., Manitowoc — The Cereal Products Co., c/o F. Miller, Secy., 6th and Washington Aves—machinery, feed mills, etc.

Wis., Milwaukee—J. H. Ehlert, 799 42d St.—special wooden box making machinery.

Wis., Ripon—C. D. Storck—machinery for proposed ice cream factory.

Wis., Two Rivers—The Wisconsin Textile Mfg. Co., c/o G. C. Kirst, Pres.— textile machinery.

Col., Denver—The Western Alfalfa Milling Co., Denham Bldg.—$6,000 worth of equipment for its proposed plant at Douglas, Wyo.

Mo., Medill—The Producers Cold Storage Co.—complete machinery for refrigerating plant.

Okla., Pawhuska—The Echo Planing Mill —molder.

Ont., Kitchener—The Dumarts Ltd., Breithaupt St.—refrigerating equipment.

Ont., Leamington—The Diamond Tobacco Co., new equipment for handling tobacco and manufacturing cigars, etc.

Ont., Toronto—The Nukol Fuel Co. Ltd., 88 Bay St., A. Heffermen, Jackson Bldg., Ottawa, Mgr.—briquetting machine.

Cal., Los Angeles—The Pacific Oil Co., 636 Pacific Electric Bldg. — hand power gang punch, cornice brake.

Ont., Bowanville — C. Rehden & Son — electrical equipment for proposed foundry.

Que., Maisoneuve — The L'air Liquid Society, 1 Earnest St., manufacturers of acetylene, etc.—additional equipment.

Metal Working

NEW ENGLAND STATES

Conn., Georgetown — Gilbert & Barker Mfg. Co., Railroad Sq., manufacturer of wire, has awarded the contract for the construction of a 1 story, 40 x 85 ft. galvanizing building and a 1 story, 50 x 100 ft. annealing plant. Estimated cost, $100,000.

Conn., New Haven — R. Villanno, 100 Portsea St., has had plans prepared or the construction of a 1 story, 45 x 60 ft. addition to his garage. Estimated cost, $10,000. Private plans

Conn., Norwalk—J. Donaldson, 32 Washington St., will soon award the contract for the construction of a 1 story, 50 x 136 ft. service station on West Ave. Estimated cost, $25,000. Noted April 7.

THE WEEKLY PRICE GUIDE

This Week's Market

The market remains quiet. The only change in New York was for steel pipe, the discounts for which are 52 per cent for ¾-in. butt weld, 54 per cent for 1@3-in. butt, 49 per cent for 3½@6-in. butt, 37 per cent for ¾-in. galvanized lap weld, 40 per cent for 1@3-in., and 35 per cent for 3½@6-in. Malleable fittings now sell at list.

There has been a slight adjustment of prices of black sheets. Cleveland reports a sharp reduction on linseed oil. Spot linseed oil is also off in Chicago, although wholesale trading in futures is on an upward tendency.

Chicago reports a 5 per cent decrease on steel pipe. As regards tinplate, the reduction in mill price caused no cut at warehouses, for the reason that existing prices anticipated the decrease.

The metals market is dull. Copper remains the same, tin advanced 2c. per lb., while zinc declined 10c. per 100 lb.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$29.50
Northern Basic	27.52
Southern Ohio No. 2	28.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	35.26
BIRMINGHAM	
No. 2 Foundry	25.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75 sil	26.25@28 50
Virginia No. 2	*28.00
Basic	†26.25
Grey Forge	*27.00
CHICAGO	
No. 2 Foundry local	26.00
No. 2 Foundry, Southern, sil 2.25@2.75	32.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26.96
Basic	26.86
Bessemer	27.00

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.23	$3.33	$3.09	$3.23
Soft steel bars	3.13	3.23	2.99	3.13
Soft steel bar shapes	3.13	3.23	3.48	3.13
Soft steel bands	4.18	4.28	6.25	
Tank plates	3.23	3.33	3.78	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	4.25	3.85	4.13
No. 12	3.15	4.30	3.90	4.18
No. 14	3.20	4.35	3.95	4.23
No. 16	3.30	4.45	4.05	4.33
Black				
Nos. 17 and 21	3.75	4.95	4.60	5.20
Nos. 22 and 24	3.85	5.00	4.65	5.25
No. 25 and 26	3.90	5.05	4.70	5.30
No. 28	4.00	5.15	4.80	5.40
Galvanized				
No. 10 and 11	4.00	5.30	4.70	5.70
No. 12 to 14	4.10	5.40	4.80	5.80
Nos. 17 and 21	4.40	5.70	5.10	6.10
Nos. 22 and 24	4.55	5.85	5.25	6.25
No. 26	4.70	6.00	5.40	6.30
No. 28	5.00	6.25	5.70	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$4.73	$4.63	$4.25
Flats, squares and hexagons, per 100 lb	5.23	4.63	4.75

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	65%
Cleveland	50%
Chicago	50%

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	41
Electrolytic	43
Monel Metal	
Shot and blocks	35
Ingots	38
Sheet bars	40
Hot rolled rods (base)	42
Cold rolled rods (base)	56
Hot rolled sheets (base)	55
Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 3/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.50	8.00	8.25
Spring steel (light)	8.00	7.00	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.28
Hoop steel	4.38	3.69	3.83
Cold rolled strip steel	8.50	8.25	7.90
Floor plates	5.50	3.09@3.40	5.78

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Steel Inches	Black	Galvanized	Iron Inches	Black	Galvanized
⅜ to 3	57½%	44%	¼	15½–16½%	+10½–11½%
			⅜	19½–20½%	1½– 2½%
			½ to 1¼	24½–25½%	8½– 9½%

LAP WELD

2	50½%	38%	2	20½–21%	6½– 7%
2½ to 6	53½%	41%	2½ to 6	22½–23%	9½–10%
7 to 12	50½%	37%	7 to 12	19½–20%	6½– 7%
13 to 14	41%				
15	38½%				

BUTT WELD, EXTRA STRONG PLAIN ENDS

¼ to 1¼	55½%	43%	⅜ to 1¼	24½–25½%	9½–10½%
2 to 3	56½%	44%			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	48½%	37%	2	21½–22½%	8½– 9%
2½ to 4	51½%	40%	2½ to 4	23½–24%	11½–12%
4½ to 6	50½%	39%	4½ to 6	22½–23%	10½–11%
7 to 8	46½%	33%	7 to 8	14½–15%	2½– 3%
9 to 12	41½%	28%	9 to 12	9½–10%	+2 –2½%

Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
¼ to 3 in. steel butt welded	52@54%	37@40%	42½%	33½%	62½%	44%
3½ to 6 in. steel lap welded	49%	35%	44½%	29½%	58½%	41%

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13.62½
Tin in 5-ton lots	31.75
Lead	4.62½
Zinc	5.60
ST. LOUIS	
Lead	4.22½
Zinc	5.00

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.00	21.50	23.50
Copper wire (carload lots)	15.00	17.50	20.00
Brass sheets	17.25	24.00	24.50
Brass pipe	21.00	22.00	20.75
Solder (half and half) (case lots)	18.00	20.50	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	15.25
Cleveland	19.00
Chicago	18.75

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill + less 8% for carload lots..... 11.50

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	13.70	14.30
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.25
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	$9.75
Copper, heavy, and wire	9.00	9.50	8.50
Copper, light, and bottoms	8.00	9.00	8.00
Lead, heavy	3.25	3.50	3.50
Lead, tea	2.00	2.50	3.00
Brass, heavy	6.00	7.00	9.00
Brass, light	4.50	4.50	4.50
No. 1 yellow brass turnings	5.00	5.50	5.00
Zinc	3.00	3.00	3.00

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.1@28.2	25.50@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.00
Chicago	20.50
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	40.00	35.00
Commercial	30.00	15.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$1.00	1.60
Hot pressed hexagon	List	1.00	1.60
Cold punches hexagon	List	1.00	1.60
Cold punched square	List	1.00	1.60

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	50%
Cleveland	70%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50-10%	60%	50%
1¼ and 1½ in. by 3 in. up to 12 in	50%	50%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $3.50 Chicago..... $4.00
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $4.00 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅜ by 6 in. and smaller	40%	50%	40%
Larger and longer up to 1 in. by 30 in.	40%	40%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	50%	50%	45%
Tinned	45%	50%	30%

Structural, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.85 Cleveland...$5.00 Chicago....$4.88 Pittsburgh..$3.90
Boiler, same sizes:
New York...$4.95 Cleveland...$5.10 Chicago....$4.98 Pittsburgh..$4.00

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	25.50
Brass	21.00	24.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼-2 in., inclusive in rounds, and ¼-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 prices from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$8.50 per 100 lb.; New York price is 8c.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	10.00@13.00	13.00	14.25
Colored mixed	7.00@11.50	10.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$4.00@$5.00
Prompt foundry	5.00@ 6.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.67	$0.66	$0.68
5-gal. cans	.70*	0.81	0.93

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

Mass., Cambridge—G. Prendle, c/o Tuck & Gilman, Archts. and Engrs., 34 School St., Boston, will build a 2 story, 150 x 282 ft. garage on University Rd. Estimated cost, $200,000.

Mass., Cambridge—(Boston P. O.) The Pub. Wks. Dept. will soon award the contract for the construction of a garage on Hampshire St. Estimated cost, $40,000. E. B. McGirr, 6 Beacon St., Boston, Archt.

Mass., Charlestown—(Boston P. O.) M. D. Cressey & Co., 7 Mercantile St., Boston, plans to build a 1 story, 40 x 80 ft. garage on Rutherford Ave., here. Estimated cost, $25,000. H. A. Goodspeed, 67 Milk St., Boston, Archt.

Mass., Dartmouth — J. Simpson, Bridge St., has awarded the contract for the construction of a 1 story, 40 x 85 ft. garage, etc. Estimated cost, $10,000.

Mass., Salem — The Spencer Regulator Co., 5 Front St., has awarded the contract for the construction of a 1 story, 50 x 80 ft. factory on Liberty St., for the manufacture of draft regulators. Estimated cost, $40,000.

Mass., Springfield — Genden Bros., 28 Morgan St., has awarded the contract for the construction of a 1 story, 50 x 100 ft. garage. Estimated cost, $25,000. Noted April 14.

Mass., Taunton — The Weir Stove Co. will build a 1½ story, 75 x 80 ft. addition to its foundry on 4th St. Estimated cost, $25,000.

Mass. Worcester—I. Katz, 927 Main St., will build a 1 story garage and auto sales station on Main St. Estimated cost, $30,000.

MIDDLE ATLANTIC STATES

Md., Baltimore — The Acme Garage & Auto Co., 912 Lovegrove Alley, is having plans prepared for the construction of a 2 or 3 story garage on Biddle St. and Fallsway. Estimated cost, $150,000. O. E. Adams, Calvert Bldg., Archt.

N. J., Florence—The Florence Pipe Fdry. & Machine Co. has awarded the contract for the construction of a 50 x 100 ft. pattern shop. Estimated cost, $100,000. Noted Jan. 13.

N. J., Trenton — The DeLaval Steam Turbine Co., North Clinton St., along the tracks of the Pennsylvania R.R., has awarded the contract for the construction of a 3 story, 60 x 220 ft. machine shop. Estimated cost, $150,000.

N. Y., Buffalo—The Buffalo Forge Co., 490 Bway., will reconstruct its 163 x 196 ft. fan and forge shop. Estimated cost, $60,000.

N. Y., New York—(Boro of Bronx) J. Reitano, c/o C. Shaefer, Archt. and Engr., 394 East 150th St., will build a 1 story, 25 x 135 ft. garage on the Southern Blvd. Estimated cost, $55,000.

Pa., Philadelphia — The Federal Container Co., 25th and Locust Sts., has awarded the contract for the construction of a 2 story, 82 x 302 ft. factory, on 56th and Paschall Sts. Estimated cost, $150,000.

Pa., Philadelphia — H. F. Grow, 1306 North 3d St., will build a 1 story, 100 x 140 ft. machine and forge shop, on Melvale and Ontario Sts. Estimated cost, $5,500.

SOUTHERN STATES

W. Va., Logan — The Guyan Machine Wks. will build a 2 story, 60 x 100 ft. machine shop. B. Shell, Mgr.

MIDDLE WEST STATES

Mich., Battle Creek—The Amer. Stamping Co., Burchard St., has awarded the contract for the construction of a 1 and 2 story, 100 x 150 ft. office and factory, for the manufacture of hollowware. Estimated cost, $125,000. Noted Jan. 27.

O., Cleveland — A. J. Alej, 2626 Cedar Ave., will soon award the contract for the construction of a 1 story, 47 x 128 ft. garage at 2826 Cedar Ave. Estimated cost, $40,000. Private plans.

O., Cleveland—The Denison Sq. Garage Co. has awarded the contract for the construction of a 1 story, 49 x 121 ft. garage on West 25th St. Estimated cost, $40,000.

O., Cleveland—The Northampton Realty Co., c/o I. Feigenbaum, 704 Ullmer Bldg., has awarded the contract for the construction of a 2 story, 80 x 175 ft. garage at 3142 Prospect Ave. Estimated cost, $100,000.

O., West Park—T. H. Grussey Co., 16807 Lorain Ave., has awarded the contract for the construction of a 1 story, 50 x 100 ft. garage. Estimated cost, $40,000.

Wis., Appleton—A. Brandt Co., 987 College Ave., has awarded the contract for the construction of a 2 story, 80 x 158 ft. garage and repair shop. Estimated cost, $45,000. Noted March 17.

Wis., Hortonville—Otts Bros. Garage has awarded the contract for the construction of a 3 story, 92 x 150 ft. garage, repair shop and show room, on Main St. Estimated cost, $75,000.

Wis., Jefferson—F. Schulz, 100 C St., has awarded the contract for the construction of a 2 story, 65 x 85 ft. garage, repair shop and show room, on Milwaukee St. Estimated cost, $80,000.

Wis., Milwaukee—J. Luff, 864 16th St., has awarded the contract for the construction of a 1 story, 60 x 100 ft. garage on 11th St. Estimated cost, $40,000.

Wis., Milwaukee — The Rosenberg Elevator Co., 174 Reed St., is having plans prepared for the construction of a 1 story, 100 x 200 ft. factory on Richards St. Estimated cost, $60,000.

Wis., Okauchee—W. Schrandenwach will receive bids about May 2 for the construction of a 2 story, 80 x 150 ft. garage, repair shop and show room. Estimated cost, $75,000. A. Kuenzi, Watertown, Wis., Archt.

STATES WEST OF THE MISSISSIPPI

Kan., Emporia—The Maouse Bros. are having plans prepared for the construction of a 2 story, 50 x 130 ft. garage at 726-30 Commercial St. W. F. Marx, Emporia, Archt.

Minn., Duluth — The Liberty Mfg. Co., c/o Duluth Commercial Club, plans to build a 2 story, 100 x 250 ft. factory and a 1 story, 65 x 80 ft. drop forge plant, on West 4th St., for the manufacture of automobile chains. Estimated cost, $150,000. C. P. Smith, Pres.

Minn., Minneapolis — The United States Postoffice Dept., c/o E. A. Purdy, Postmaster, 205 Post Office Bldg., will open bids May 10 for the construction of a 1 story, 110 x 130 ft. garage. Estimated cost, $65,000.

Okla., Ardmore — The G. Harris Buick Co., 108 North Washington St., plans to build a 2 story, 50 x 140 ft. garage and show room, etc., on West Main St. Estimated cost, $70,000.

CANADA

Ont., Bowanville—C. Rehden & Son are preparing plans for the construction of a 1 story foundry. Estimated cost, $60,000.

General Manufacturing

NEW ENGLAND STATES

Conn., New Haven—The Connecticut Sash & Door Co., Co., 451 Grand Ave., will build a 2 story 55 x 102 ft. addition to its mill on Grand Ave. Estimated cost, $15,000.

Me., Brunswick — Lockwood, Greene & Co., Archts. and Engrs., 60 Federal St., Boston, Mass., will soon award the contract for the construction of a 1 story, 90 x 100 ft. picker house, for the Cabot Mfg. Co., here. Estimated cost, $40,000.

Me., Lewiston — The Lincoln Worsted Co., 97 Exch. St., Portland will build a 2 story, 40 x 180 ft. worsted mill, 1 story, 30 x 41 ft. dye house and a 1 story, 40 x 60 ft. finishing building, here. Estimated cost, $100,000.

Me., Lincoln—The Lincoln Worsted Co., 97 Exch. St., Portland, will build 2 story, 40 x 180 ft., 1 story, 40 x 60 ft. and a 1 story, 30 x 40 ft. mill building, here. Estimated cost, $100,000. Noted March 31.

Mass., Lawrence—D. Carinc, 288 Lawrence St., has awarded the contract for the construction of a 1 story, 60 x 90 ft. factory, at 50 Bway., for the manufacture of auto bodies. Estimated cost, $25,000.

Mass., Worcester — The Grocers Bread Co., 306 Main St., will soon award the contract for the construction of a 2 story, 63 x 102 ft. bakery on Main St. Estimated cost, $50,000. G. H. Fanning, 221 Essex St., Lawrence, Archt.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Crane Ice Cream & Baking Co., Spruce St., Philadelphia, Pa., is having plans prepared for the construction of an ice cream plant, on Greenmount Ave. near Preston St., here. K. W. Schantz, 768 Potomac Ave., Buffalo, N. Y., Engr.

N. J., Asyla—(Grenlock P. O.) The Bd. of Freeholders of Camden County (Camden), will open bids May 10 for the construction of additions to the almshouse, infirmary, bakery and refrigeration plants at the Insane Asylum, here. Estimated cost, $40,000. T. Stephen, Camden, Archt.

N. J., Camden — The Cooper Hospital, 6th and Stevens Sts., plans to rebuild its 1 story, 30 x 30 ft. laundry which was recently destroyed by fire. Estimated cost, $25,000. Morris & Erskine, Philadelphia, Pa., Archts.

N. J., Camden—The Freihofer Baking Co., Land Title Bldg., Philadelphia, Pa., plans to build a bread baking plant on 5th and Berkely Sts., here. Plans include a blacksmith shop, etc. Estimated cost, $650,000.

N. J., New Lisbon — The Bd. of Freeholders, Burlington Co. (Mt. Holly), is having plans prepared for the construction of a 1 story laundry building at the Insane building here. Estimated cost, $15,000. J. J. Logan, Mt. Holly, Engr.

Pa., Philadelphia—The General Baking Co., 43 East 17th St., New York City, plans to build a 3 story bakery on Kensington and Airdale Aves., here. Ballinger Co., 329 South Broad St., Archts.

MIDDLE WEST STATES

Ill., Long Point—The Bd. Educ. plans to build a 2 story community high school to include a manual training department, etc. Estimated cost, $75,000.

Ill., Mineral—The Bd. Educ. has awarded the contract for the construction of a 2 story consolidated high school, to include a manual training department. Estimated cost, $75,000. E. E. Atherton, Pres.

Ill., Peoria—The Bd. Educ. is having plans prepared for the construction of a 2 story rear addition to the manual training high school, to include a forge and sheet metal shop, etc. Estimated cost, $225,000. E. J. Klein, 331 Main St., Archt.

Ill., Peoria—The United Paperboard Co., 2800 North Adams St., is having plans prepared for the construction of a 1 story, 150 x 160 ft. factory. Estimated cost, $200,000. E. C. Foster, Secy. Private plans.

Wis., Herbster—The Clover Co-operative Creamery & Dairy Products Co., c/o O. E. Kaupp, Secy., plans to build a 2 story, 60 x 190 ft. dairy on Main St. Estimated cost, $50,000.

Wis., Milwaukee—A. Gumz & Co., 125 Muskego Ave., is having plans prepared for the construction of a 3 story, 47 x 95 ft. addition to its packing plant. Estimated cost. $45,000. Lesser & Schutte, 68 Wisconsin St., Archts.

Wis., Milwaukee—The Wells Bldg. Co., 120 Wisconsin St., has awarded the contract for the reconstruction of a 5 story factory on Bway., which was destroyed by fire. Estimated cost, $45,000. Ellworth & Thayer, 336 Bway., manufacturers of gloves and sheepskin lined coats, Lessee. Noted March 24.

Wis., Park Falls—The Flambeau Paper Co. is having plans prepared for the construction of a 2 and 4 story, 160 x 250 ft. pulp mill, etc. on Main St. Estimated cost, $250,000. G. Waldo, Mgr. G. F. Hardy, 309 Bway., New York City, Engr.

STATES WEST OF THE MISSISSIPPI

Mo., St. Louis—The C. P. Curran Printing Co., 102 South 8th St., will soon award the contract for the construction of a 2 story, 110 x 115 ft. printing plant on 7th and Gratiot Sts. Estimated cost, $100,000. P. J. Bradshaw, International Life Bldg., Archt.

CANADA

B. C., Vancouver—L. S. Beardsley, Archt. and Engr., 116 West 39th St., New York City, will open bids about May 2 for the construction of a bakery, for Shelley Bros., 601 10th St. Noted Feb. 17.

Que., Montreal — The Imperial Knitting Mills, 200 Waha Roche St., plans to rebuild its 3 story plant which was recently destroyed by fire. Estimated cost, $40,000.

American Machinist

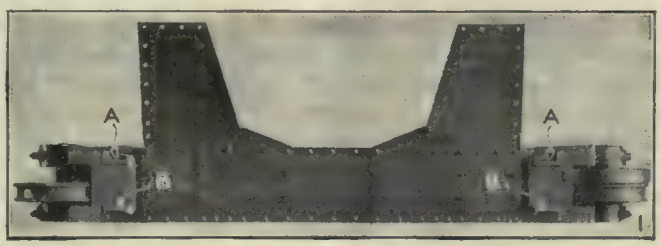
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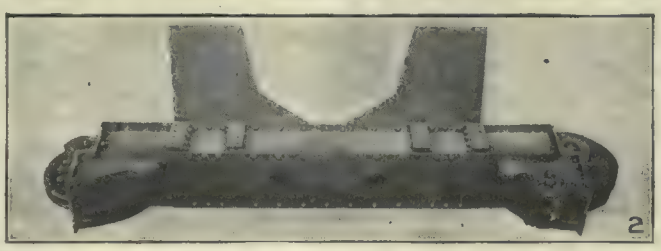
Designing Traveling Cranes with Regard for Safe Operation

Structural Safety to Sustain Loads—Safety Appliances—Locking Switches to Prevent Operation by Unauthorized Persons—Transfer Cranes—Monorail Hoists

By NICOLAAS PRAKKEN
Assistant Manager of Crane Sales, Pawling & Harnischfeger Co.

THE several compensation boards in session on accidents, the factory inspectors working under instructions of their respective industrial commissions and the safety engineers employed by private corporations, have all wielded considerable influence toward having laws enacted, requiring that all machinery used for manufacturing purposes must be suitably protected so that workmen can avoid accidents when working on or about such machines in the regular discharge of their duties. Although no class of machinery has been exempt, the electric overhead traveling crane and the various types of hoisting units have not received safety study until late years, mainly because the crane was working overhead in the charge of the operator and consequently the chance for accident to workmen below was minimized. Such safeguarding features as were formerly provided were incorporated in the design by the manufacturer. Several of the manufacturers of electric overhead traveling cranes have considered the facility of making repairs and getting about on the crane as part considerations of their design.





FIGS. 1 AND 2. TYPICAL END TRUCKS

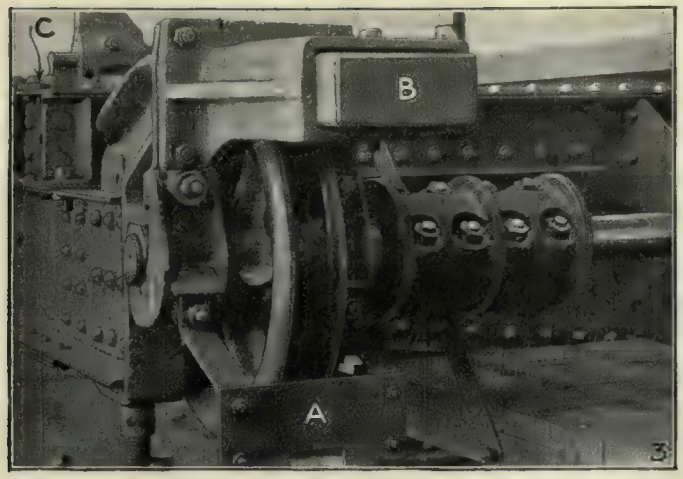
Electric overhead traveling cranes in some form or other are used extensively in nearly all industries where heavy materials must be handled. Such cranes are either operated from a cage attached to the end of the bridge, to the center of the bridge in the case of long spans, or to the trolley, as service demands. Some cranes can be operated from the floor by pendant cords where the service demanded does not require an operator in constant attendance. Many cranes of the floor operated type are in use today in foundries, machine shops, or wherever hoisting service is required. They are usually handled by the operators of the machine tools.

Considerable demand has also been found for the cage controlled monorail hoist and the floor controlled monorail hoist, for the various services outlined above. A cage or floor controlled monorail hoist can be used in connection with transfer cranes which span from runway to runway the same as the standard crane, with the added flexibility that the monorail hoist can run onto the transfer crane in the yard, pick up its burden at any point under the transfer crane runway, lock the transfer crane at the spur connection, and then travel over its I-beam runway and switches, through doors, and onto another transfer crane and deliver the materials to be worked upon. For the same working space in the clear, more headroom is required for the combination of the cage-controlled monorail hoist and transfer crane than for the standard overhead electric traveling crane. The gantry crane is likewise a utility and can be considered better by itself.

In the use of these various types of hoisting units, the mechanical and electrical maintenance is of prime importance and many safety features are now furnished as required by law; many additional safety features are added by request of the purchaser and in many instances the manufacturer provides safety features where neither the law nor the purchaser has requested them. The use of these safety features will be considered with respect to design, construction, and mechanical and electrical maintenance.

The standard overhead electric traveling crane is usually considered as being composed of three units, bridge, trolley and cage. The bridge can be divided into end trucks, girders, bridge machinery and wiring, and each of these divisions will be subdivided in the discussion. The trolley can be divided into trolley sides, girts, gears, pinions, gear cases, limit switches, sheaves, blocks, load and magnetic brakes. The cage is the position from which the crane is controlled and operated, and headroom is the main essential as it usually projects below the top of the crane runway rail anywhere from 6 ft. 6 in. for an inside crane to 10 ft. 4 in. for an outside crane.

The end trucks are that portion of the bridge to which the girders are attached and which contain the bearings and the wheels upon which the crane runs



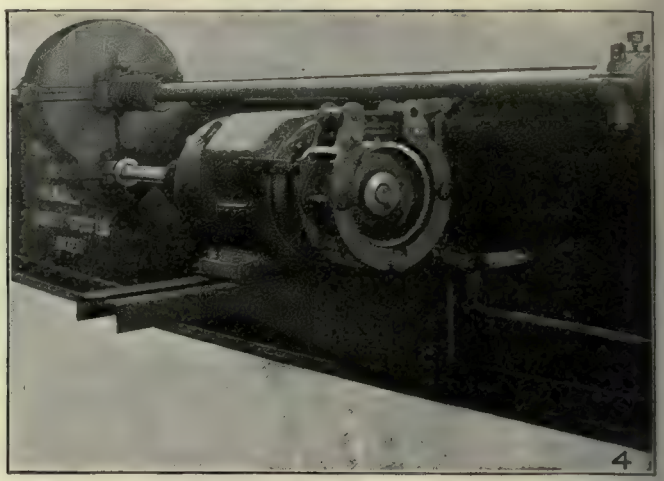


FIG. 3. LUGS AND KEEPER PLATES. FIG. 4. TYPICAL BRIDGE MOTOR WITH FOOT-BRAKE ATTACHMENT

back and forth on the runway. A typical end truck is shown in Figs. 1 and 2. The cast steel M.C.B. housings are first machined and then riveted between the truck channels with top and bottom cover plates. The gusset plates shown hold the girders securely to the end trucks. The M.C.B. bearing seats are then milled in pairs so that both end trucks will be the same length. On the bottom of the M.C.B. bearing castings will be seen lugs at *A* and *B*, Fig. 1, which project down one or more inches below the top of the runway rails. The mission of these lugs is to hold the crane on the runway rail in the event of a wheel breaking. At *A*, Fig. 3, is shown the fender, which fits around the runway rail and functions to brush off a workman's hand should he happen to place it on the rail when working near the runway. Bumpers, as at *B*, should always be used when two or more cranes are on the same runway. They prevent the wheels from jamming together and breaking or distorting the flanges. The bearings can be kept in perfect alignment by placing shims between the M.C.B. journal and its seat, equal in thickness to the wear of the journal. The wear on the journals can be either increased or minimized by having an end truck of a sufficiently large wheel-load part. By wheel-load part is meant the number of pounds each wheel can safely carry. The M.C.B. type of end truck permits removal of the wheels with the minimum amount of effort. The wheels are keyed to the pins, which revolve in journals on both sides. By driving a wedge between truck end and rail the pressure on wheels is released and they can be rolled out after removing the oil boxes. In the pin truck the pin is held in place by keeper plates and the wheels revolve on the pins. No adjustment for alignment can be made in this type of end truck and considerable effort is required to remove the wheels, as they must be lifted up out of the trucks.

The Girders

The two standard forms of girders now in use are the I-beam and channel girders, and the box girders. For machine shop and foundry service I-beam and channel girder spans should not be over 45 ft. for 5-ton capacity, and not over 40 ft. for 10-ton capacity. When spans are longer, the universal box girder should be used. Box girders can be built in any reasonable span and they can be so proportioned that there will practically be no lateral vibration. Irrespective of the type, the girders should be notched or coped around the end trucks and not set on top. In case the girders are merely set on top and bolted to the end trucks, any loosening of the bolts will permit the end trucks to rock. This is not true of coped girders, as they have horizontal bearing angles securely riveted to them. The horizontal bearing angles rest on the end trucks and can be bolted securely to them. Vertical shear angles are likewise provided and match up with vertical angles on the end trucks. The bolting together of these vertical angles eliminates any possible chance of rocking of the end trucks. To make the girders and end trucks still more secure as one structural member, bottom gusset plates are provided under the end trucks, which securely tie the end trucks and girders together on the bottom, keeping the bridge structure square at all times and under all conditions of normal load and travel. Box girders properly constructed are provided with diaphragms at about 3-ft. intervals (depending upon depth of girder and length of span) to which the bridge motor bracket and squaring shaft supports can be fastened. The diaphragms are the inner structure or skeleton of the girder to which the web plates and top and bottom cover plates are riveted. Angles are then run where the web and cover plates join each other and the web and cover plates are securely riveted to these angles. Keeper plates are bolted at the ends of the girders as shown at *C* to keep the trolley rails from creeping.

Bridge Machinery

The bridge machinery is mounted usually on the cage-side girder and consists of the bridge motor with foot brake parts, bridge motor bracket, bridge motor gear case, pinion and gear, squaring shaft and squaring shaft supports, squaring shaft couplings, and foot walks.

A typical bridge motor with foot-brake attachment and motor bracket is shown in Fig. 4. The motor bracket is a structural member, bolted to the girder near the center of span. It is necessary that the girder be here provided with diaphragms as the motor mounted on the bracket is a cantilever beam and the web would buckle were it not reinforced.

The bridge motor gear-case should always be mounted at the center of span. The gear case is a three-part casting with ground joints so gears can run in oil, the middle section being bolted to the face of the web and through the diaphraghms. The bottom casting provides for the removal of the motor pinion and the top cover permits the removal of the motor gear. The motor gear is keyed to a short piece of shaft which revolves in bronze journals on both sides of the gear case. Coup-

lings are provided on each side to transmit the power through the squaring shafts to the gear reductions at the end trucks. By placing the gear case at the center of span the torsional deflection of the shafts on both sides is made more clearly equal, causing the crane to run square. Where the motor bracket is mounted on the girder near one of the end trucks there will be more torsional deflection in the long squaring shaft member and the result is the crane will run out of square. The couplings in common use are the compression and flange types. The compression type is used on moderate capacity cranes and the flange type on the higher capacities. Couplings should be placed at such intervals that the squaring shaft members can be easily handled.

The foot walk should come up against the girder. Foot walks, where heat conditions demand, are made of checkered floor plate, but under normal conditions wood plank suffices. The hand rail is fastened to a toe angle usually 6 in. in height. It provides a support for the workmen on the crane and the toe angle prevents tools and parts being kicked off on workmen working underneath. The foot walk meeting the girder likewise prevents tools and parts from falling to the floor beneath.

The bridge girder conductors can be either wires, bars, or angles. Wires are commonly used, although purchasers, where heat conditions demand them, express a marked preference for bars. The bridge collector wires are held at their ends by strain insulators and where spans of cranes exceed 50 ft. insulated supports should be provided every 30 ft. on which the wires may loosely lie. The bridge collector wires should be kept at least 2½ in. apart and separated at all times a minimum distance of 1½ in. from the surface wired over. In case bars or angles are used as bridge conductors they must be screwed or bolted to insulated supports at such intervals as the properties of the sections require.

The Trolley

A typical top-running trolley is shown in Fig. 5. The trolley sides are of box section and are provided with S.K.F. or S.C.B. journals, as in the case of the end trucks, and also with lugs to keep the trolley on the girder rails should a wheel break. Other sections of trolley sides are the I-beam sections but they are not as strong and reliable as the box section.

The girt *A* is a structural member that connects the two trolley sides by bolting. The equalizing sheave, when one is employed, is mounted in the girt, as is also one of the gear cases together with the first reduction. The second and third reductions are on opposite sides of the trolley.

All of the gear-case castings have ground edges so that the surfaces will meet and retain the oil. The trolley drive gear case is shown in Fig. 6 with the front cover removed showing the train of gears. The casting holding the gears is bolted onto the trolley side and with the cover bolted, on the gears are enclosed and run in a continuous bath of oil. Loose covers, as shown at *A*, should be provided on all gear cases for inspection of gears. The enclosing of gears is one of the greatest safety features on the crane and this practice has become universal.

A limit switch is almost as essential as a hoist motor. Its duty is to stop the upward travel of the load block and one of the latest type is shown in Fig. 7. This limit switch consists of two weights. The heavier weight *A* is provided with a loop *B* through which the hoist cable passes to the equalizing sheave and is suspended from a cable *C* fastened to the limit-switch sheave. The limit switch sheave has a weight attached but not so heavy as the suspended weight *A*. Attached to the limit switch sheave shaft is an arm with a keeper that holds the circuit closed to the magnet coil of the contactor. This magnet coil is connected across the line. The contactor is in the main line circuit and is provided with dynamic braking contacts when used in connection with a crane operated by direct current. The lower block is provided with a pan *D* as shown. When the lower block in its upward travel engages the weight it lifts weight *A* permitting the weighted sheave to open the circuit of the magnet coil, thereby opening the main-line motor circuit. As the bridge-motor magnetic brake is in series with both the series field and the motor armature, the magnetic brake coil is de-energized and the friction of the mechanical parts of the brake on the motor pulley brings the armature to rest, thereby arresting the upward travel of the load. The connections in this type of limit are such that with the reversing of the controller to lowering, the suspended weight will automatically reset the limit after the load block has lowered sufficiently to leave the weight suspended by its cable. With this type of switch the cable *C*, to which the weight is attached, can meet any swinging condition of the load block on account of the flexibility of the suspended cable.

A safety cage with doors open is shown in Fig. 8.

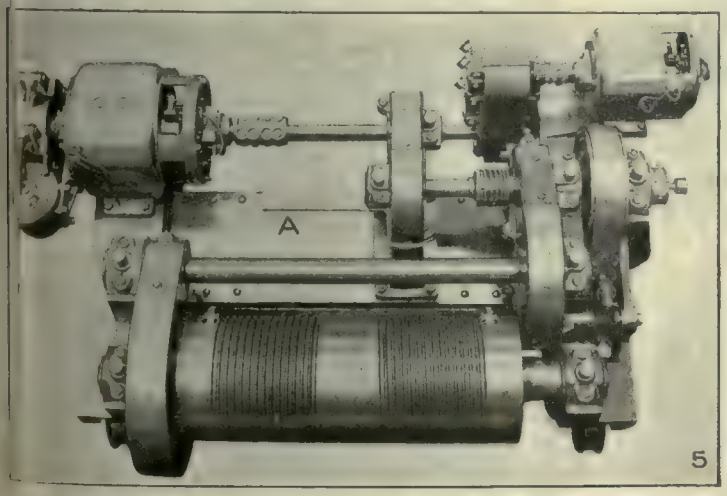


FIG. 5. TROLLEY SHOWING COVERED GEAR CASES

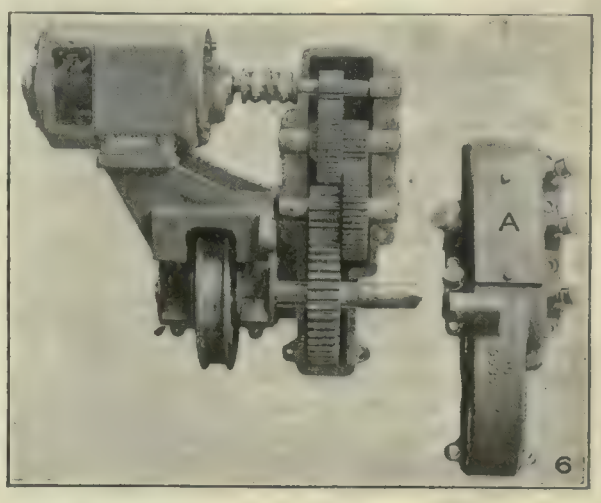


FIG. 6. TROLLEY GEAR-TRAIN AND CASE

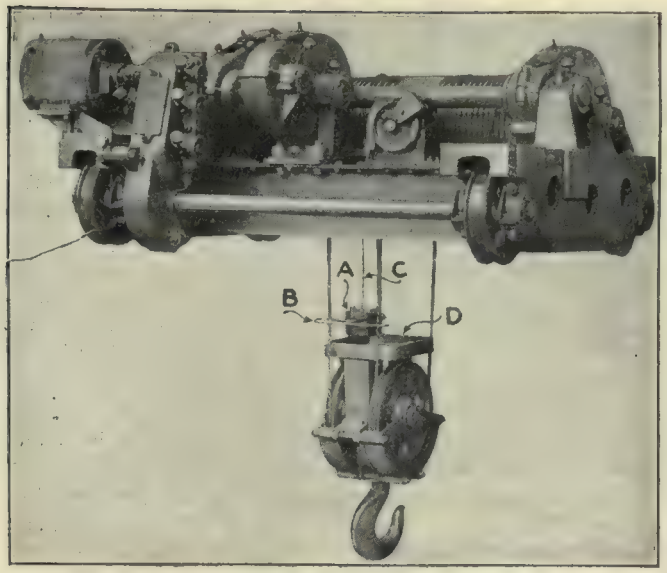


FIG. 7. LIMIT SWITCH FOR THE HOIST

This cage is of the front-lever-stand type. The levers are connected to the controllers by link motion. The controllers are located at rear of cage and enclosed. Doors are provided so workmen can have access to the controllers and for inspection of the switchboard equipment. By having the controllers and switchboard equipment enclosed in a cabinet it is next to impossible for workmen to come in accidental contact with live parts. If the operator wishes to open the switch all he has to do is to pull out the door handle when all the wiring on the crane will be de-energized. Spaces are provided for locks in the door handle. Usually three spaces are required, one for the operator and the other two spaces for workmen. Whenever the operator leaves his cage he should put his lock on this arm. This will prevent unauthorized persons from starting the crane. In case repairmen come onto the crane they likewise should place their locks in their respective spaces and not remove them until their work is finished. The operator's lock should be the last one to be taken off and on closing the switch the crane is ready for service.

This method of locking the main line switch open has advantages because it opens both sides of the line. In many plants plugs are used in one side of the line, operators and repairmen keeping the plugs in their pockets until repair work is completed. This practice is open to objection as there might be a ground on the line and the operator or repairmen could still be shocked.

Where the cage is attached to the trolley there will be main-line wires carrying full potential on the bridge girders and in such cases an additional main-line switch as mentioned above should be provided as near to the main collectors as possible. The front-lever stand is superior to having controllers mounted in front as the operator's vision is not obstructed. The direction in which the levers are thrown indicates the direction of movement.

In all cage controlled cranes having more than one motor, each conductor of each motor circuit should be individually protected by fuses, time limit current breakers, or overload relays controlling line contactors. The cage shown in Fig. 8 has fuses in each individual motor circuit and in the limit-switch contactor with its dynamic braking contacts. Jib cranes, pillar cranes, and floor controlled hoists having a combined motor horsepower of ten or less need not have individual motor protection.

In Fig. 9 is shown the resistance banks *A* mounted under the floor on a sub-floor. Trap doors are provided in the cage floor so these resistances, while isolated, can be made accessible.

The foot brake lever is back of the controller stand and is connected to the brake parts on bridge motor by links.

When cranes are controlled from the floor by pendant cords, the controllers should be of the spring-return type so they will return to the off position the instant the operator releases his hold on the controller ropes. The bridge motors should be provided with magnetic brakes also, so that in case the operator should stumble and fall when walking with his crane he could let go of his hold on the controller ropes and instantly the controllers would go to the off position, opening the motor circuit and the magnetic brake stopping the bridge motor.

The bridge speeds of floor controlled cranes should not be more than 200 ft. per minute.

Fig. 9 also shows a typical cage-controlled monorail hoist which runs on the lower flanges of an I-beam or on T-rails fastened to it. The hoist and cage parts are fastened to the trolleys by king bolts. Hoists of such type often run as high as 85 or 90 ft. above the ground level, consequently some provision must be made that the machines will not fall if a king bolt should fail. By observing the illustration, safety catches *B* and *C* that ride over the flange of the I-beam, will be seen. These safety catches are always kept clear of the I-beams when running on straight and curved tracks by a link motion attached to the trolleys. The safety catches are free to move laterally and should one or both king bolts fail the safety catches would engage the I-beam and prevent the hoist from falling to the ground.

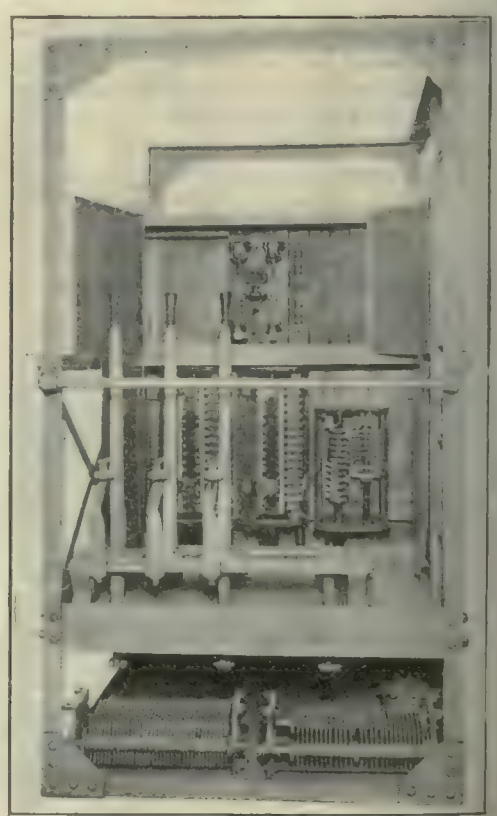


FIG. 8. SAFETY CAGE WITH DOORS OPEN





FIG. 9. CAGE CONTROLLED MONORAIL HOIST WITH SAFETY CATCHES OVER THE FLANGES OF THE I-BEAM. FIG 11. A TRANSFER CRANE ON WHICH A MONORAIL HOIST, EITHER CAGE OR FLOOR CONTROLLED, CAN RIDE

This safety catch is very effective and gives the maximum degree of protection at a minimum cost.

Main line switches should be provided in the cage of monorail hoists with spaces for locks the same as covered in cage-controlled cranes. The individual motor protection likewise applies as given in the section devoted to cranes.

Floor-controlled hoists are those operated by pendant cords, and their I-beam runways are usually near the floor. The maximum capacity of the floor-controlled type is usually not over 5 tons. The hoist speed is usually not over 20 ft. and the trolley speed seldom higher than 200 ft. per minute. The service is very intermittent and consequently the maintenance is not as high as on the cage-controlled type.

I-Beam Switches

In Fig. 10 is shown a two-way switch. The direction in which the switch is thrown is the path of travel for the materials the monorail hoist is carrying.

Switches of this type should be baffled so the hoists cannot run off open spur ends. Heavy steel lugs, as at *A*, engage the web of the I-beam, prevent the hoist from running off an open spur or the tongue, for when the switch tongue is thrown halfway there is not sufficient clearance between the I-beam to let the trolley pass through. As the switch is thrown clear over, the lug is fully engaged with the open spur and totally disengaged from the lined-up spur.

A system can contain as many switches as are necessary and a further flexibility is added by the use of the transfer crane.

The Transfer Crane

In Fig. 11 is shown a typical transfer crane installation. The end trucks, bridge motor and bridge motor gear case, and bridge machinery, are the same as that on the standard cage-controlled overhead electric traveling crane. It differs from the standard crane in that it carries an I-beam on which a monorail hoist, either cage or floor controlled, can ride. Transfer cranes when not locked to the spur runway must have ends baffled so the monorail hoist cannot run off the open ends. The baffles are a part of the mechanism that locks the transfer crane securely to the spurs. In the locking process the baffle on the spur as well as on the beam is raised, which permits the monorail hoist to leave the bridge. As the controller for the bridge motor of the transfer crane is installed in the cage of the monorail hoist, the operator is assured that his transfer crane will not be moved while he is delivering material to other parts of the plant. Upon his return he can unlock the crane which will drop his baffles on both the spur and the beam of the crane.

General

A very bad practice is prevalent among users of traveling cranes; namely, the tendency to overload them. This fact becomes more evident when it is realized that some 10-ton cranes offered for sale, weigh the same, span for span, as their competitor's 5-ton cranes. It is obvious that weight when properly placed is a measure

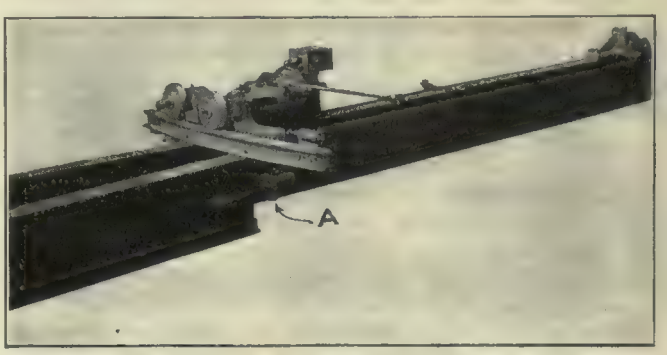


FIG. 10. A TWO-WAY SWITCH. STEEL LUGS PREVENT THE HOIST FROM RUNNING OFF AN OPEN SPUR

of strength and when equipped with motors the crane can be made to perform work in proportion. Therefore the 10-ton crane that weighs the same, span for span, as the 5-ton crane cannot be overloaded to the same extent. The safety features on a crane are essential to protect the operator and the reapirmen, and it is just as essential from a safety point of view, to buy a crane of a recognized weight that will insure a full measure of successful operation with maintenance costs at a minimum.

A French Hog Island

Growth of Industry During the War—Transformation to Peace-Time Production—Bleriot Shipbuilding Plant—Citroen Automobile Plant—France's Marketing Problem

By CHARLES EDGERTON CARPENTER

"WANTED: An able advertising manager, one especially experienced in international trade. Address: French Government, Paris."

This advertisement has not yet appeared in the Paris journals. That it has not is due altogether to the innate modesty of the French people, who still cling in large measure to the belief that to advertise is immodest. Heroic in war, industrious and thrifty in peace, honorable and considerate in both, France has yet to learn that while good deeds ultimately bring their just rewards, a little judicious advertising can be made to expedite them, particularly when trade is dull.



If the world were not so busy with its own affairs and could spare the time to investigate the needs of its neighbors, France might be able to dispense with the services of an advertising manager for a long time to come, relying upon her past reputation for quality and service to bring the patronage she needs. But the world has troubles of its own and, even if they are less pressing than those of France, they are nearer at home and therefore more insistent in their demands for adjustment.

What France needs from the world at large is neither money nor credit, but confidence and faith—confidence in her ability to recover from the devastating effects of the war, and faith in her ultimate ability to meet the obligations imposed upon her by the huge financial drain she has suffered. These desirable commodities of confidence and faith exist throughout the world in generous quantities. Only the wand of the advertising manager is needed to direct them to France, to help her in the vital work of reconstruction which her people have undertaken.

Statistics showing the growing recovery of French industries since the close of the war, particularly regarding exports, are published at frequent intervals by the Ministry of Finance of the French government. They indicate that the foreign trade of France is slowly but surely approaching a state in which the imports of food and raw materials, so necessary to France's industrial recovery, will be offset by the exports of the products of French farms and factories. If this steady growth can be maintained, the day will not be far distant when the unfavorable balance of trade which has weighed heavily against France since 1914, and has largely brought about the onerous depreciation in her currency, will be transferred to the credit side of the ledger.

It is unfortunate that the French statistics, while telling eloquently of the general progress made by France in her recovery from the devastation and demoralization of the war, cannot show the spirit of individual courage and energy that is being contributed by Frenchmen in all industries to the results generalized in the figures. If a few sidelights could be thrown on the brief reports of the Ministry of Finance, they would prove beyond doubt that the new spirit of enterprise born of France's necessities during the war has come to stay, and that it will prove no mean factor in establishing the industrial position of France among nations in the future. There is a great lack of knowledge throughout the world as to what has been accomplished in an industrial way in France since the signing of the armistice. Much has been published in the United States and elsewhere about the industries in the north which were carefully and systematically destroyed by the Germans, and the world in general is familiar with the huge task of reconstruction that has been courageously undertaken by the people of the devastated provinces. Little or nothing, however, has been published to show the magnitude of the industrial reconstruction that has been carried out in those parts of France which were untouched by the invaders, and yet the problems that have been met and overcome have been very close in magnitude to those of the north.

Growth of Industry During War

It must be remembered that before the war France was not a great industrial nation. Her metal-working industries were markedly inferior in importance and diversification to those of England and Germany. As a result, shortly after the beginning of the war France became acutely dependent upon other countries during the period required to equip herself for turning out the vast quantities of material and supplies needed by her armies. The country's needs called for and received a quick response from the latent spirit of enterprise of French manufacturers and metal-workers, and great industries for the manufacture of shells, gun parts and airplanes sprang up magically through the country from the war zone to the Mediterranean. So successfully did these industries meet the demands made upon them that, when our own armies came to France, it was found possible to furnish them a large amount of equipment out of the surplus capacity of French plants.

The armistice confronted these newly created industries with the problems of peace-time existence. Few

establishments, obliged by the ever-growing needs of the war to strain every nerve and muscle to meet the demands of increased production, had been able during the war to study and prepare for their industrial future. The coming of peace, therefore, found them faced with idle machinery, demoralized transportation, organizations highly trained in munitions making but untrained in commercial manufacturing, and with sources of supply thoroughly upset. Had these establishments existed before the war, it would have been a comparatively simple problem to transform them to their pre-war production, although even in this case four years of intensive war activities, coupled with the general industrial demoralization, would have placed serious obstacles in the path. Not all of them, however, particularly the large establishments, possessed the asset of pre-war training in the production of commercial articles; and for these plants the question of future existence carried acute significance.

Location of Plants Important

One of the post-war problems that bore heavily upon the owners of many munitions establishments was that of location. The needs of war are usually separated from economy by a wide margin, and a location that might prove to be suitable for a war factory might mean inefficiency and failure to a commercial enterprise. The war factories that grew like mushrooms throughout France were built with little regard to future convenience from the standpoint of economical production, the problem of future utilization being wholly secondary to the urgency of the moment.

The importance of location, in making plans for commercial manufacturing, became increasingly signficant to French manufacturers during the period immediately following the armistice, when the intricate transportation system, designed and built up almost exclusively to satisfy the needs of the military authorities, was handed back to its civilian executives. Rolling stock was found to be badly scattered and in urgent need of repairs, while the facilities for restoring it to workable condition were found to be totally inadequate in comparison with the amount of work to be done. This condition spelled disaster to manufacturing prospects dependent upon equipment and raw materials, unless, co-incidentally with the development of manufacturing programs and with the training of workmen, means for obtaining a supply of materials could be devised.

Motor Trucks Help Transportation

How efficiently and with what energy and resourcefulness French manufacturers, spurred on by the inspiration given them by the magnitude of their achievements during the war, met and overcame the transportation difficulties is a story in itself. When it became evident that the railways were powerless to cope with the country's needs, motor trucks appeared magically upon all the roads throughout France. Truck factories worked night and day and the thousands of trucks released by the armies were patched up and put into service to relieve the strain on the railroads. Regular truck services were inaugurated, not only between the large cities and towns, but also between France and Belgium. Truck builders, instead of testing their finished chassis on the roads adjacent to their plants, sent them to the ports for fuel and to the mills for steel.

Meanwhile, the stocks of gasoline accumulated during the war when the exchange rates were favorable to France began to show signs of depletion, and prices began to soar. The operation of trucks became a costly undertaking, but by this time the railways had been able to straighten out their kinks and traffic moved freely once more.

Building Ships in Paris

There are many examples in France of the successful utilization of war factories for peaceful purposes in apparent defiance of the economic law of location, but it is doubtful whether a more brilliant example can be found than the transformation of a vast airplane factory into a modern, twentieth-century shipyard—a miniature Hog Island—fifteen minutes ride by automobile from the Place de l'Opera, and a stone's throw from Paris' magnificent park, the Bois de Boulogne.

It is highly improbable that in the ordinary course of events a successful shipbuilder, in looking about for a site for a highly efficient yard in which to build ships in series, would select the city of Paris for his undertaking. With several hundred miles of seacoast, dotted profusely with deep-water ports that afford unusual facilities for shipyards to choose from, no Frenchman planning to build ocean-going ships in pre-war days would have given a serious thought to the city of Paris, 150 miles inland, as a possible location for his project.

When Louis Bleriot, the first to cross the English Channel in an airplane, thereby setting a new fashion in cross-channel travel and demolishing England's confidence in her feeling of splendid isolation, looked down from his plane upon the ships that dotted the channel, it is fairly certain that no premonition of his future career as a shipbuilder was revealed to him.

Bleriot Plane Factory

The spirit of enterprise, however, that carried Bleriot from France to England through the air had a stronger foundation than the mere desire for adventure. When the importance of the airplane in warfare had made itself apparent in the early days of the war and the call for planes became insistent and imperative, Bleriot threw himself heart and soul into the task of supplying the army's needs. He built and equipped a huge plant for the manufacture of planes, and to his efforts was due in no small measure the success of the French in the air. As fast as profits came to him he reinvested them in increased capacity for making planes, although he knew that the end of the war would sound the deathknell to the manufacture of airplanes for a long period of time.

The armistice had scarcely brought the wheels of industry in France to a full stop, when this indefatigable aviator-manufacturer began to cast about for a means to employ his modern plant and the thousands of workmen he had gathered together. Here the problem of location intervened. Situated in the middle of a great center of population with all the attendant drawbacks of transportation and fuel, with a factory designed for the manufacture of articles of great bulk but little weight, it became manifestly difficult to settle upon a suitable product to make. The structure of the buildings precluded the selection of heavy material, since no mechanical means of handling it had been provided for in their form of construction. On the other hand, the extensive use of wood and fabrics in the manufacture of planes pointed to the desirability of undertaking work in which similar materials formed the main foundation.

It was at this juncture that the crying need for ships for fishing purposes to replace those sunk by German submarines and to provide an increased source of food supply became acute. Bleriot decided to build ships and to build them as no one in France had dared build



FIG. 1. COMPLETED HULL OF WOODEN FISHING BOAT

them before; namely, wholesale. He secured the services of an experienced and active young shipbuilder from the coast, to whom he confided his ambitions, with the injunction to organize the plant without loss of time, to order the necessary equipment and to train the men in the proposed new method of operation. While this task was being drawn into shape Bleriot went out to solicit orders, which he obtained in the form of a contract from the French Government Merchant Marine for seventy ships at a cost of approximately three hundred thousand francs each.

Contract Secured in Spite of Objections

It must not be supposed that the securing by the aviator-shipbuilder of so handsome a contract from the Merchant Marine was not attended by numerous difficulties. It is characteristic of the man that the contract was forthcoming in a brief space of time, notwithstanding the violent objections to the project that were raised in seafaring circles. To the officials of the Merchant Marine the proposal of an aviator to build ocean-going trawlers of one hundred tons displacement in the heart of the city of Paris verged so closely on the ridiculous that for a time it was not taken seriously. When, however, it became clear that Bleriot's proposal was based upon a determination to carry out his plan, negotiations with him were begun. Whereupon, the seacoast shipbuilders, learning of the affair, raised loud cries of protest against so unheard-of a project. These objections, however, were as chaff in comparison with the material difficulties that beset the successful carrying out of the undertaking.

A Year of Perseverance

Almost the last available foot of lumber in France had been used to feed the armies of France, America and Britain. The construction of wooden ships on a vast quantity basis meant primarily an assured supply of suitable timber, while the trees needed to furnish it stood still uncut in the forests and the machinery to convert them into the necessary shapes had not been built. Furthermore, the demoralization of the transportation system was such as to throw the gloomiest doubt on the possibility of gathering together in a crowded metropolis, several hundred miles distant from the forests, enough material to realize so extensive a program. A year of uninterrupted perseverance solved the material difficulties, and within eighteen months from the date of the armistice the Bleriot shipyard on the banks of the Seine had set a new fashion in shipbuilding in France.

Type of Boat Built

In the eyes of Americans familiar with the prodigious efforts of Hog Island and other American yards during the war, the Bleriot yard is not a vast accomplishment, but as an example of the new spirit of industrial France it is significant and compelling. The ships, which are now being turned out at the rate of one per week, have an overall length of seventy-six feet, a beam of twenty-one feet and a draught of twelve feet. They have a displacement of one hundred tons and are driven by eighty-horsepower semi-Diesel engines of two or four cylinders. A completed hull is shown in Fig. 1. Built throughout of oak, only the keel strips, cross braces and bolts are of iron. The oak is exclusively of French growth, the logs being brought to the lumber yard at the plant, where highly developed modern machinery saws them to the proper shapes. The planks and beams are then steamed, to extract the sap, and dried, preparatory to the final operations.

The fashioning of the shapes is done by ordinary carpenters, little or no skilled shipyard labor being em-



FIG. 2. TEN HULLS IN THE COURSE OF CONSTRUCTION IN THE MAIN HALL

ployed, except for the assembling of the hulls. Accurate templets of the parts to be made are given to the carpenters, who are merely required to duplicate the dimensions and shapes of the templets, a comparatively simple operation. Each templet bears the number of the part, this being duplicated on the shape and insuring easy identification in the final task of bolting the shapes in place on the hull.

The Assembling Hall

The large assembling hall is one of the wonders of munitions-factory installations in France. It measures 283 x 233 ft. and the doorway is 133 ft. in width. A good idea of the building can be obtained from the headpiece of this article, showing the main launching doorway. The entire floor of the hall is laid with tiles that would be a credit to the bathrooms of a modern apartment house. There is sufficient accommodation in the hall for the simultaneous construction of ten hulls, as shown by Fig. 2, the keels being laid upon heavy greased ways placed upon the tiles in such manner that the completed hulls can be hauled by powerful winches to the doorway of the launching dock.

Not the least of the difficulties encountered in the organization of the building program was the lack of a suitable means of launching the completed hulls. The shipyard is located on a broad thoroughfare, known as the Quai du General Gallieni, and which skirts the river Seine. The permanent obstructing of the thoroughfare being forbidden, it became necessary to improvise mechanical means for lifting the hulls and lowering them into the water. A slight incline leads from the floor of the hall to the door. On this incline, rail carriers receive the finished hulls and transport them across the thoroughfare to the dock, where they are picked up in slings, as can be seen in Fig. 3, by a giant crane, which swings outward over the river and deposits them gently in the water. Here the masts are set, the engines installed and the ships prepared for the sea.

Conversion of the Citroen Plant

Another noteworthy example of the successful transformation of a great munitions factory into a modern manufacturing establishment is that of the great shell plant, in Paris, of Andre Citroen. The Citroen plant at the close of the war was producing daily fifty thousand shells and employing ten thousand hands. Situated almost at the base of the Eiffel Tower, in the heart of the city, this huge establishment attracted world-wide attention as one of the wonders of France at war. Scarcely a day passed that distinguished foreigners, crowned heads, statesmen and military representatives did not visit it to see the magnitude of France's industrial effort. It was one of the first of the great French munitions plants to utilize female labor on a large scale, more than half the employees being women. Women operated the huge forging presses that drew the shells from solid bars of steel, operated the lathes that turned the shells to size, inspected the finished work and packed it for shipment.

The armistice stopped the wheels of the Citroen plant, but not for long. In an incredibly brief space of time the machinery was rearranged, raw materials began to arrive, and in a few months the new Citroen automobile made its bow to the public. It, too, set a new fashion in France, a fashion born of the war. An intensive advertising campaign announced that the Citroen plant had adopted American practice and was prepared to accept orders for twenty thousand cars, all for delivery within a year. The public responded generously, orders poured in at the rate of several hundred a day. The price was low, the design attractive, but above all the product was French.

The appearance of the new car in ever-growing numbers in the cities and towns throughout France was the signal for caustic criticism by the skeptics who disapproved of the adoption of American methods in France. It was pointed out that quantity-built cars were all right for the Americans who were accustomed to things quickly and cheaply made, but that in France only the hand-finished product would suit the fastidious taste of motor-car buyers. The answer to the critics was the swelling stream of cars that flowed from the doors of the Citroen factory. Another munitions plant had successfully bridged the gap between war and peace.



FIG. 3. THE LAUNCHING CRANE LOWERING A HULL

Success Not Universal

From the striking examples of success that have attended the transformation of certain war-built establishments in France, it must not be inferred that progress in the reorganization of industries has been universally conspicuous.

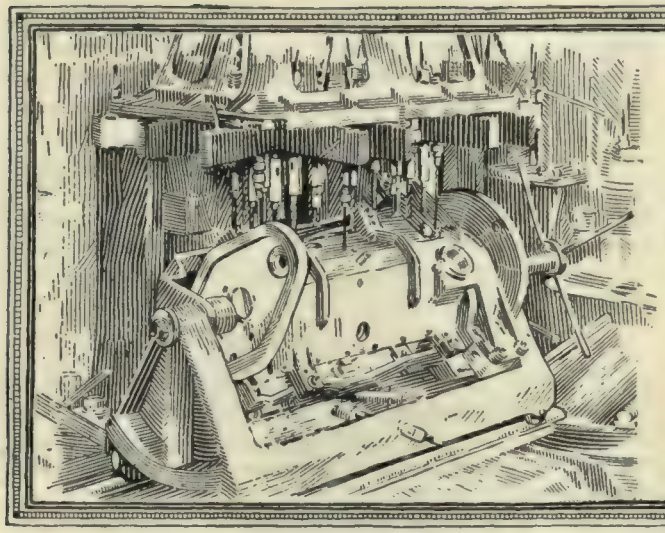
Ability to manufacture economically and efficiently, while important and necessary to success, is unavailing unless proportionate means of distribution are at hand. The problem of distribution during the war did not exist. A single customer, the Government, bought the output of French factories and placed it in the hands of the consumers, the armies. Salesmen were superfluous and sales departments existed only as receiving points for the Government's orders. The salesmen were the first to be called to the colors and the last to return. Many of them failed to return, and herein lay one of the most serious problems of reconstruction that French producers were called upon to solve.

In pre-war days, France was not a large exporter of metallurgical products. She possessed little or no commercial organization for the introduction of her manufactures into foreign countries. Her industries were comparatively small. Highly developed home selling organizations, as known in the United States, were rare. How, then, to market the output of mass-production methods was the question that faced the owners of factories which the war had lifted to the ranks of the big business undertakings.

France's Final Reconstruction Problem

This question has yet to be answered in France. In spite of the encouraging growth of the French export trade, it can truthfully be said that this growth is less the result of French selling initiative abroad than the desire of the outside world to buy certain French specialties. The war practically excluded from the markets of the world the silks, tapestries, linens, automobiles, wines and bronzes of France, and buyers who have hungered for them for years have been eager to replenish their stocks. The favorable rate of exchange prevailing since the summer of 1919 has been an added attraction to those countries whose currency is less inflated than the French, and orders from abroad have come unsolicited.

It cannot be expected, however, that this condition will continue indefinitely, for France as a producer of luxuries must ultimately give way to France as a producer of necessities. The return to France of the iron ore of Lorraine, the richest known deposits outside of the United States, entails marketing obligations on a world scale that will severely tax the capacity of the country to meet; and it remains to be seen how skillfully the manufacturers of France will solve this final reconstruction problem.



Tool Engineering

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Drill Jig Design—Value of Analysis—Location of Rough and Finished Work—Correct and Incorrect Location and Clamping

THERE are a number of elementary points which need to be considered in the design of drill jigs. The progressive designer considers these points almost unconsciously when he starts to design a jig. The beginner, however, and the man who has had only a small amount of experience in jig design must continually think of the things which he must look out for in his design. In taking up these various points they will be considered in elementary and graphical forms in order to make the *principles* clear and readily understandable. After the tool designer obtains a clear knowledge of the fundamentals which underlie the design of jigs and fixtures he will be able to analyze things for himself and he will know absolutely whether or not the principles on which he is working are correct.

Value of Analysis

Let us digress for a moment to take up the matter of analyzing a problem before attempting to solve it. Every piece of work which is to be tooled must be very carefully looked over before any tooling is started, in order that a clear understanding of its functions and the importance of the various surfaces may be understood. In analyzing the processes considerable thought must be given to the machine tools which are to be used in the manufacture. If the work has been laid out by the tool engineer, there will be a list of operations which the tool designer can consult so that he will know just what machine tools are to be used for each operation. A complete analysis of the tool problems connected with the work should embrace also the types of jigs and fixtures most suitable, and should consider the location of the fins, ribs or drafts, as well as any irregularities, in order that location points may be selected which will not be subject to variations caused by rough grinding, filing and clipping. It is always advisable for the tool designer to make such a thorough study of the piece of work which he is about to tool that he can carry it in his mind without having to question the relations of various portions to each other. After this analysis has been made he should be ready to start his first jig or fixture.

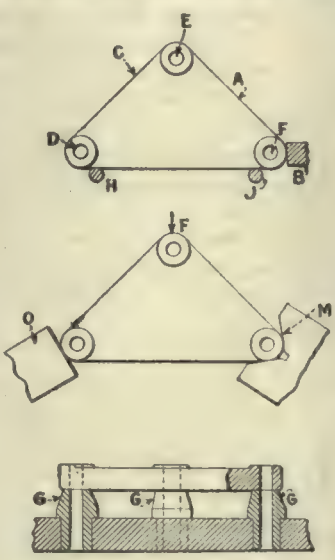
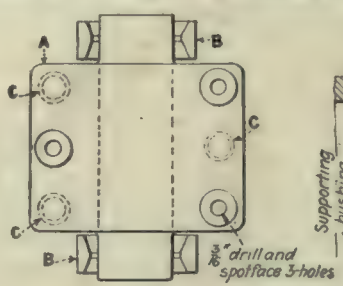


FIG. 13



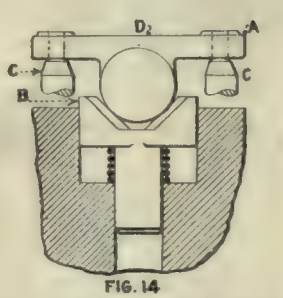


FIG. 14

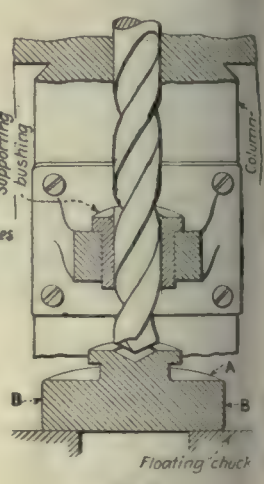


FIG. 15

FIG. 13. LOCATING ROUGH WORK. FIG. 14. LOCATING A PIECE OF ROUGH WORK HAVING A HUB CAST ON IT. FIG. 15. FORGING OF GEAR BLANK WITH HOLE COUNTERSUNK

When designing a jig the following points must always be considered: the method of locating the work so that it will be machined in a uniform manner; the clearance between the jig body and the work; suitable provision for clearance; chip clearance; accessibility in setting up and removing the work; distortion in clamping, etc. Various points in connection with these matters will be discussed in detail.

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In locating a piece of work in a jig when no other operation has been performed on it previously, the greatest care must be taken to select such points for locating that inequalities in the casting or forging will not cause the work to be thrown out of line in such a way that subsequent operations will not give accurate results. The work may be a rough casting or forging and while the forging may be smaller and more accurate than the casting there is always the matter of draft to be considered. It is advisable wherever possible for the tool designer to obtain a sample casting or forging from which to work. Not only does this make the tool problem more simple, but at the same time it enables him to note where irregularities are likely to be found on the work and to guard against putting a locating point so that it will come in contact with some irregular surface. In a forging, if it happens to be a complicated one, there may be an excessive quantity of metal on certain parts, on account of forging conditions. Unless the tool designer has a forging drawing, a "lead," or a rough forging, he may not be able to make sufficient allowance in his jig or fixture to take care of the excess metal mentioned.

A fundamental principle in tool design is, that a rough casting or forging must not be supported on more than three fixed points. Let us consider the work shown at *A* in Fig. 13, which is a rough casting of triangular shape to be drilled in the three corners where the bosses are located. Now in setting up this work in a jig we shall apply the principles mentioned above and use three points as a support. These three points will come directly under the three holes *D*, *E* and *F* and they may be made in the form of bushings as illustrated at *G* in the lower part of the figure. Now let us consider that we have located the work in one plane but we must also make sure of its location in the other direction. Probably the easiest way to locate it is by means of the pins *H* and *J* and by placing a square stud or block at *B*. In clamping the work, pressure can be applied at one point in the direction *C* as indicated by the arrow, so that this clamp will force the work over against the pins *H*, *J* and *B* and hold it there positively. The other method of locating the same piece is shown in the center of the illustration. In this case one corner of the work is located in a V-block *M* and the other corner comes against the angular block *O*. Pressure is applied at the point *F*. It is understood that the method of setting up on the three bushings is the same in either case.

Locating a Piece of Rough Work Having a Hub Cast On It

Referring to Fig. 14, another piece of work is shown which has a rough hub cast on it and extending beyond the flange of the work *A*. Now this piece is also a rough casting and in order to obtain a true relation between the hub and the rest of the casting it is necessary to use the hub in setting up the work. By referring to the upper figure it will be seen that we do not depart from the three point method of setting up on the pins indicated at *C*. At the same time however the necessity for considering the hub makes it advisable to provide a means for locating it on the spring V-blocks *B*. By applying pressure at *D* the work will seat itself on the three points *C* and will also locate in the spring V-blocks. In connection with the V-block mentioned it is well to note that these should be made with a so-called "knife-edge."

Very frequently rough forgings are made with the locations of drilled holes indicated by a countersunk spot. Fig. 15 shows a gear blank with the center hole countersunk in this manner. In cases of this kind it

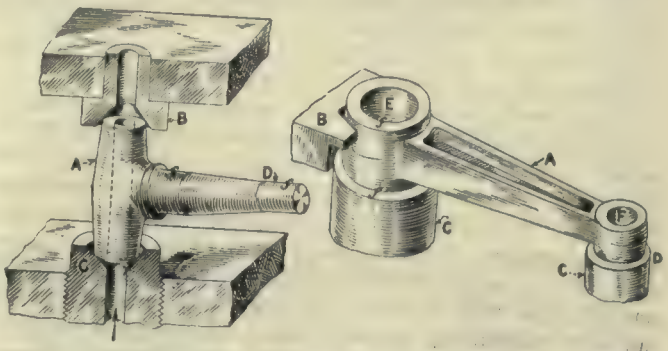
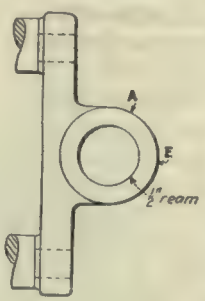


FIG. 16. INCORRECT METHOD OF LOCATING A FORGING FOR DRILLING. FIG. 17. LOCATION OF A CONNECTING-ROD FORGING

is common practice to set the work up and hold it by the outside *B* in a floating chuck. When this is done the chuck is placed on a drilling machine and the drill centers itself in the countersunk hole, thus making a jig unnecessary. It is sometimes found advisable where very much of this work is to be handled and when the drilled hole is long, to provide a supplementary bushing, supported on the column of the drilling machine in order to steady the drill and prevent it from "wabbling." The manner in which this is accomplished is clearly shown in the illustration.

Another condition sometimes found in machining a rough forging is indicated in Fig. 16. In this case steering knuckle *A* is the part in question and it is necessary to drill through the center of the long hub indicated. One end of the hub is located in the cup bushing *B* while the other end seats itself in the screw bushing *C*. Now this particular case is given as an example of a method which should not be used. In the first place a screw bushing is not very good practice because it is not sufficiently accurate and it is likely to become clogged with chips and in the second place the method shown is dependent for its accuracy on the regularity of the two ends which seat themselves in the bushing. If these ends are not uniform the work will not be true in the



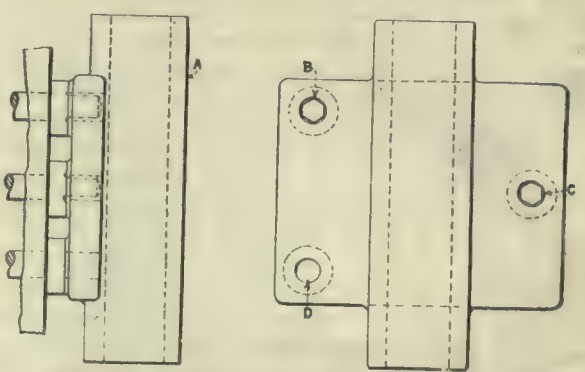


FIG. 18. LOCATION OF FINISHED WORK

bushing and as a consequence there will be a variation in the relation of the hole to the arm *D*, such that the latter may be out of line and will not clean up in the subsequent operation of turning the portions marked *f*. A much better way to locate a forging of this sort would be to locate it with a knife-edge V-block at each end of hub *A* so that when the hole is drilled it will be true with the hub and in correct relation to the portion *D*.

When work has been partly machined it is usually necessary to locate it for subsequent operations from some of the finished surfaces or holes. An example of this kind is shown in Fig. 17, in which the connecting rod *A* has been previously machined as indicated by the finished marks. As these surfaces have been previously finished and as it is necessary to drill the holes *E* and *F* so that they will be true with each other and with the surfaces machined, the work must be set up with this point in mind. By allowing it to rest on the bushings *CC* the relation desired can be readily obtained. It is however, necessary to obtain a location for the hole *E* and at the same time make sure that this location will not disturb the seat on the two bushings *CC*. This can be done by using a V-block as shown at *B* having a bearing which touches the hub above the parting line of the forging. When pressure is applied at *D* the effect will be to throw the hub over into the V-block and at the same time the angularity on the hub will tend to draw it down on to the bushing *C*. It is not usually considered good practice to drill and ream the hole *E* and the small hole *F* in the same operation and it is customary to locate the hole *F* from the previously machined hole *E* and to do the work in another jig.

Fig. 18 shows another method of locating finished work. It will be noted that this piece is the same as that shown in Fig. 14 and the operation to be done in this case is the drilling of the long hole in the hub *A*. The holes *B*, *C*, and *D* have been drilled and reamed in a previous operation. It will be remembered that we were careful to locate the work for the first drilling by means of the long hub and as a consequence we can now use the holes drilled in the previous operation for locating the piece when drilling the long hub. By setting the work up on pins at *B* and *C* we obtain our alignment and the stud *D* simply acts as a support. If there were to be other operations on this piece it would be advisable to use the holes *B* and *C* to locate from through all the subsequent operations.

Fig. 19 shows another example of a method of locating a piece of finished work of which the surface *f* has been machined in a previous operation. The work is shown at *A* and it is located on the finished surfaces indicated as it is necessary to keep the holes square with the finished surfaces. At the same time we wish to make certain that the holes are drilled in the right relation to the hubs *E* and *F*. Therefore we use a V-block *B*, slightly undercut at an angle of about 10 deg., in which to locate the hub *F*. The hub *E* will swing over against the block *C* which is also slightly undercut. Now when pressure is applied in an angular direction as indicated by the arrow at *D*, the work will not only seat itself on the finished surface but will be forced over into the V-block *B* and against the angular block *C* thus assuring a positive and accurate location.

There is a very important point which should always be considered in the location of holes in two adjacent pieces, when these holes pass through both pieces and are used as rivet or bolt holes to hold the two pieces together. An example of this kind is shown in Fig. 20. In this case the two disks *A* and *B* shown in the first part of the illustration, are held together by rivets passing through the holes *C* and *D*. It is evident then that these holes must be in alignment. Now let us assume that the work *B* is placed in the jig so that it is drilled from the side *E* and in the direction indicated by the arrow. After this is done it is evident that the drill may "run" a trifle so that the holes may take a slightly angular direction as indicated. Now if the upper pieces *A* were to be drilled from the side *F* and in the direction indicated by the arrow there is a possibility that these drilled holes might also run out a trifle. The result would be that when an attempt was made to assemble the two parts *A* and *B* they would be out of alignment and

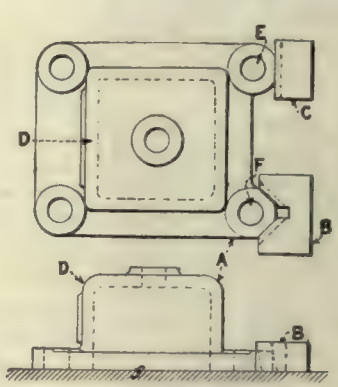


FIG. 19

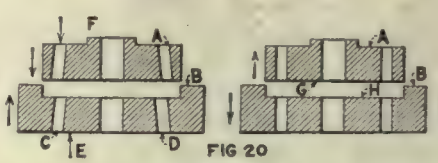


FIG 20

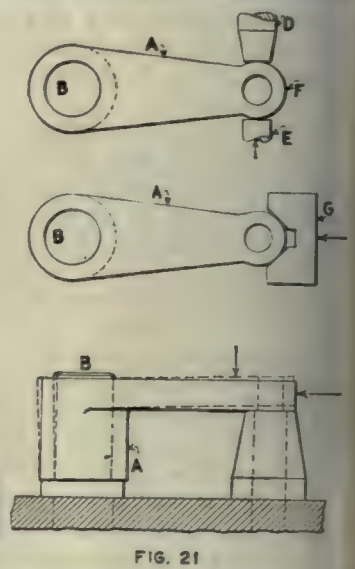


FIG. 21

FIG. 19. LOCATION OF A FINISHED CASTING. FIG. 20. CORRECT AND INCORRECT METHODS OF DRILLING HOLES IN ADJACENT PARTS. FIG. 21. CORRECT AND INCORRECT LOCATION AND CLAMPING

it would be impossible to put the rivets in place to hold the two parts together.

Assuming that both parts *A* and *B* as shown again in the other part of the illustration, are drilled in each case from the sides *G* and *H* which are adjacent to each other, then it is evident that at the points where the drill starts in each case the holes will coincide.

The matter of distortion must be considered when locating and clamping any piece of work. Several examples of this kind are shown in Fig. 21. Referring to the upper illustration the lever *A* is located on a stud *B* and is clamped at the end *F* by means of the clamp screw *E* which throws the work over against the stud *I*. Now it will be seen that when pressure is applied in the direction indicated by the arrow it cannot cause distortion or change of shape in any way. On the other hand, referring to the illustration below if the work *A* were to be located on a stud *B* with a sliding V-block *G* used as locater and clamper, it is evident that the pressure applied in the direction indicated by the arrow might very easily tend to distort the work as shown by the dotted lines in the lower portion of the illustration. These are points which are frequently neglected by the tool designer.

Railroad Shop Notes

Repairing Broken Cylinders by Electric Welding—Gaging Driving Box Brasses—Gage for Setting Half Cranks on Walschaert Valve Gears—Link Milling Attachment

By S. ASHTON HAND
Associate Editor, *American Machinist*

ONE of the interesting things to be seen in the railroad shop of today is the repairing of broken parts by electric welding. In a large railroad shop in the Pittsburgh district the writer recently saw some remarkable examples of welding broken cylinders. Cylinders are among the most costly parts to replace and shops will go to almost any length to repair and keep in service cylinders so badly damaged that before the days of electric welding would have been scrapped.





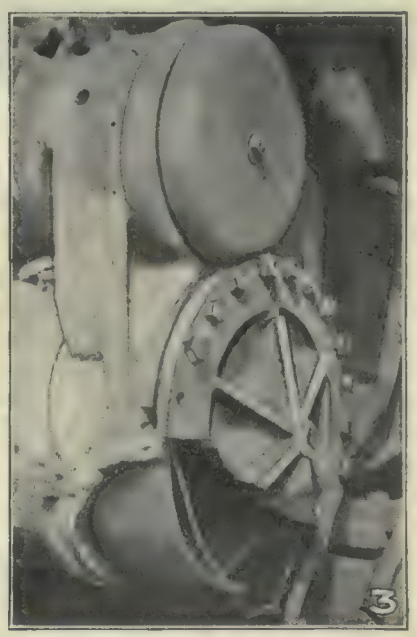
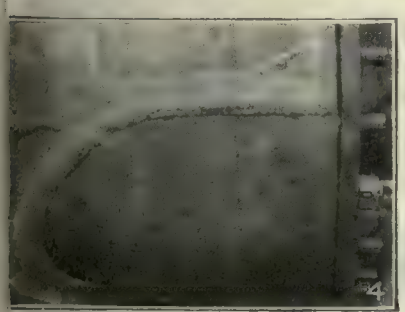


FIG. 1. CRACKED CYLINDER WITH V-GROOVE CHIPPED, DRILLED AND TAPPED FOR STUDS. FIG. 2. SAME CYLINDER WITH STUDS IN PLACE. FIG. 3. A BADLY BROKEN CYLINDER

Much ingenuity has been developed in the methods of making cylinder repairs as will be evidenced by an inspection of Figs. 1 to 6. In Fig. 1 the web between the cylinder and valve chamber has been cracked and the cylinder itself sustained some injury.

The crack has been closed as much as possible by clamps held by a heavy bolt through the cylinder. With the crack as a guide a V-shaped trough was chipped its entire length and the sides drilled and tapped for the insertion of studs. Fig. 2 shows the studs in place. The crack was welded by the electric process, using wire electrodes and the application was continued until the trough was entirely filled.

Fig. 3 illustrates a cylinder so badly broken that it would seem to be almost beyond repair. The part broken out was in several fragments and could not be used as a patch so a pattern was made from which a piece of the shape of the break was cast. The inside of the casting was machined to the same radius as that of the cylinder and the final fitting of the edges completed by chisel and file.





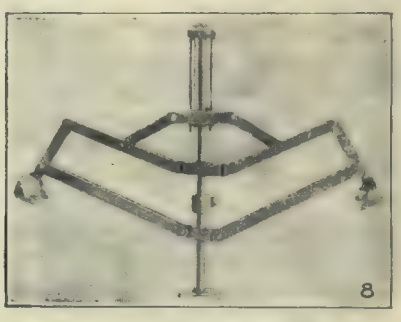


FIG. 4. A COMPLETED PATCH FIG. 6. AN UNUSUAL BREAK FIG. 8. THE INTERNAL GAGE

With the patch clamped in place a groove was chipped, drilled and studded as in the previous case and the welding completed in the usual manner. Fig. 4 shows a patch welded in a cylinder that had been broken nearly in the same way as the one shown in Fig. 3. Both of these cylinders are now doing good service.

Another bad break that was successfully repaired may be seen in Fig. 5.



FIG. 5. ANOTHER BAD BREAK



FIG. 10. THE EXTERNAL GAGE

A very unusual break is shown in Fig.6. Here one of the ribs dividing the exhaust ports is broken. There was no chance to fit a patch, so the edges of the break were studded and after being built up by welding, the whole valve seat was faced off and made as good as new.

Crown brasses must fit tightly in the driving boxes, and not being a complete circle the fit cannot be made by size of diameter alone, but, while the diameter must be right, the tightness of the fit depends on the horns *A* (Fig. 7) bearing against the recesses *B* in the driving box. It will be readily seen that a fit of this kind is not the easiest one to make unless special gages are at hand.

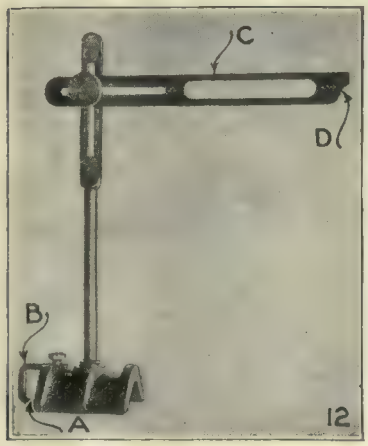
In machining the outside of the brass, the ends are first trued and it is then clamped on a mandrel between heavy washers and turned in a lathe. As the brass is slightly more than a half circle, calipers can be used for this part of the fit. To fit the horns *A* to the recesses *B* is another matter and to get the first measurement the gage shown in Fig. 8 is used in the manner illustrated in Fig. 9. This measurement is then transferred to the gage shown in Fig. 10 and the gage applied to the crown brass as illustrated in Fig. 11; here it is used as a template for scribing the horns, and after the horns are planed, as a gage to show if the planing has been properly done. The amount of metal left on the horns for making the fit a tight one is much greater than would be supposed—from 0.02 to 0.03 in. Before being pressed in place, the edges of the brass are bevelled so as to enter the box. If the fit is too tight, some of the metal will be sheared off the horns as the brass is forced in but that is not a matter of any moment as the main thing is to have the brass as tight a fit as possible.

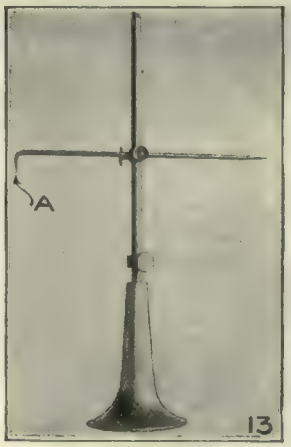
Some Other Gages

Fig. 12 shows a gage for locating the flanges on truck wheels in relation to the collar on the axle journal. The base, in the form of a V-block, is placed on the journal and against the collar where it is confined by bringing the end *A* of the adjustable hooked-piece *B* against the end of the axle. When the arm *C* is set in both height and extension in accordance with the dimensions of the wheel, the part *D* shows whether the flange has been properly located and also whether its contour is correct.

A gage for setting the half crank of the Walschaert valve gear is shown in Fig. 13. The base is held against the end of the driving axle and is centrally positioned by a spring plunger pin in the interior entering the countersink in the axle. With the pointer *A* set to the off-center distance called for by the design of the engine, the half crank can be swung around and the gage revolved until the center in the pin and the pointer *A* of the gage coincide, when the keyway can be located and marked.

Some things, such as wedges and shoes for driving boxes, are gotten out by manufacturing methods. Fig. 14 shows a planer with fixtures running the full length of the table and arranged for holding gangs of wedges and shoes while being planed. The screws in the





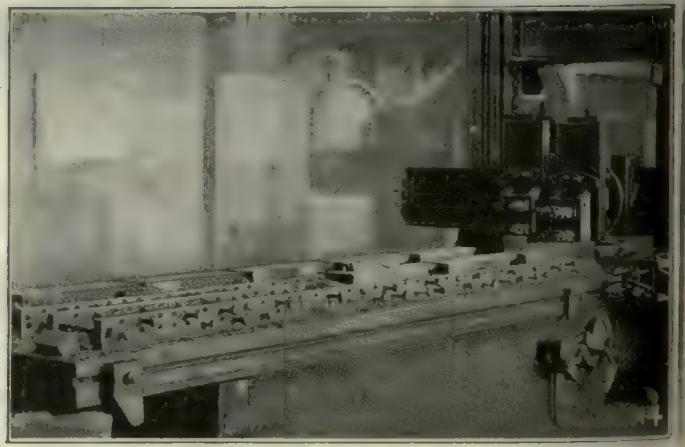


FIG. 12. FLANGE GAGE FOR TRUCK WHEEL. FIG. 13. GAGE FOR SETTING HALF CRANK ON WALSCHAERT VALVE MOTION. FIG. 14. PLANING SHOES AND WEDGES IN GANGS

upper part of the fixtures are for holding the work, while the ones below operate wedges for leveling and adjusting it for height. These wedges, together with the center block used in conjunction with them, are shown in Figs. 15*a* and 15*b*. In Fig. 15*a* they are shown in the relative position occupied by them when in the fixture, while in Fig. 15*b* they are shown on their sides with the wedges on top of the center block so as to bring to view the shape of the holes for the ends of the adjusting screws. The adjusting screws are ball-ended, the ball part fitting into the circular parts of the holes so that the screws will move the wedges either in or out according to the direction in which they are turned.

Eccentrics are bored on a vertical boring mill as shown in Fig. 16. The auxiliary table on which the eccentric is mounted has two pins which fit in blind holes in the under part of the eccentric and locate it for the boring operation. The two locating holes are laid out on the eccentric by a sheet-metal templet. It will be noticed that the clamping bolts are slotted in the upper ends and that taper keys are used for tightening the clamp on the eccentric.

Side rods are milled in gangs of four on a planer-

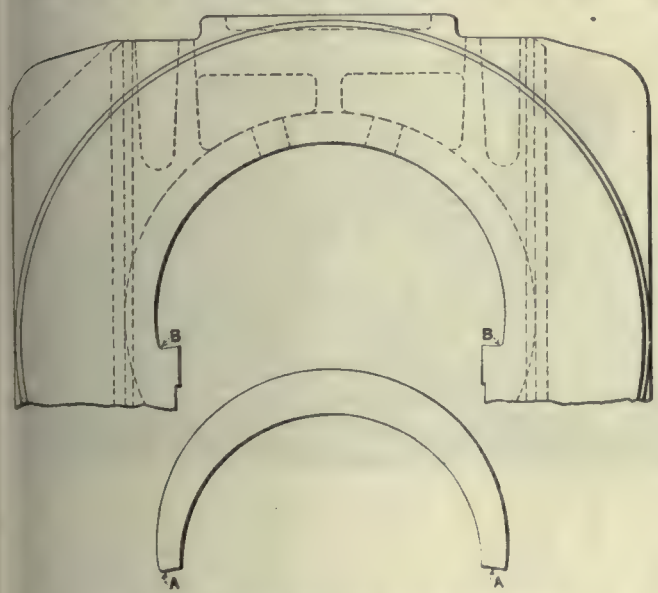


FIG. 7. DRIVING BOX AND CROWN BRASS

type milling machine and the ends are rounded in gangs of two on a vertical milling machine fitted with a revolving table. The latter operation is shown in Fig. 17. An inserted tooth milling cutter is used and it will be seen that the arbor is prevented from springing by being held at its lower end in the bearing at the end of the arm *A* which is rigidly supported by the column of the machine.

In some shops cylinder bushings or liners are first turned to fit the cylinder bores and the boring done after the liners have been shrunk in place. In the shop under consideration it is the practice to bore the liners to standard cylinder sizes and hold them in stock so that when needed, a liner can be fitted to any engine by turning the outside to fit the cylinder.

This method makes for quicker repairs as it takes less time to do the boring in a lathe or horizontal boring machine, than to set up a portable apparatus and bore the liner after it is in the cylinder, and besides half the machine work is done in advance because a rough liner would have to be both turned and bored after the engine was in the shop.

Fig. 18 shows a liner being bored in a lathe, a cradle

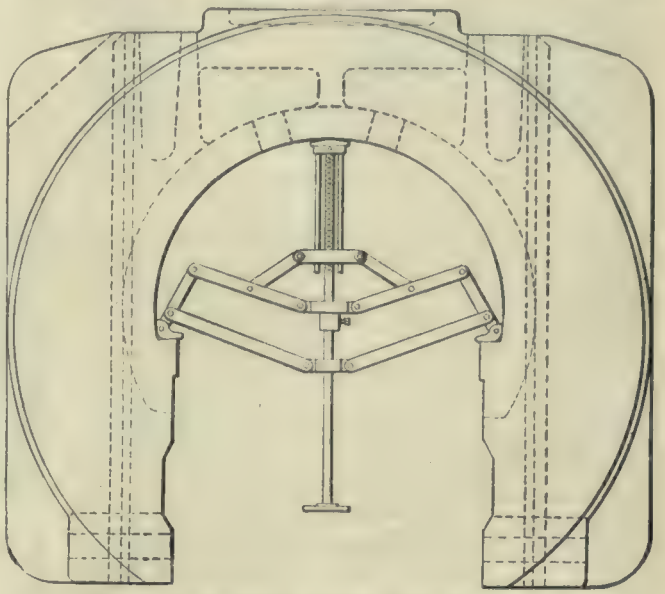


FIG. 9. INTERNAL GAGE IN DRIVING BOX

and clamps of flat bar-iron being used to hold it during the operation. For turning, the liners are held on mandrels provided with collars to fit the counterbored ends.

In shrinking in liners, the cylinders are heated by coke fires built in and around them. The allowance for the shrink fit is about $\frac{1}{64}$ inch.

The Old Reliable Slotting Machine

In spite of the advent of the miling machine, the old "slotter" still holds sway in the railroad shop, for on what other machine could the work on the rod strap, as shown in Fig. 19, be more conveniently done?

Links for valve motions are usually planed by the use of a radius bar pivoted at a distance from the work, determined by the radius of the link. Fig. 20 illustrates a home-made attachment to a vertical milling machine for milling links. Two tables, *A* and *B*, are mounted on the circular table of the milling machine. Table *A* is clamped in position while table *B* is pivoted to it and carries the link to be milled. The attachment at the left is built wholly of bar iron and carries a radius bar

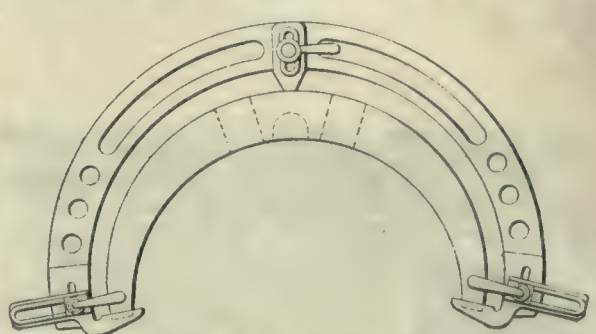
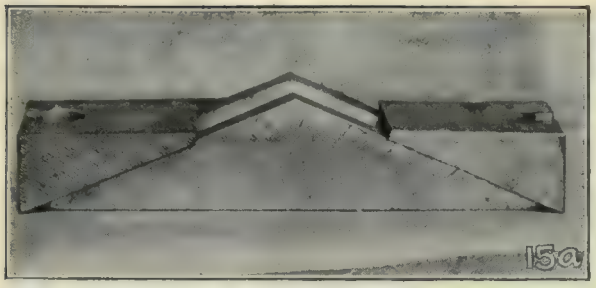
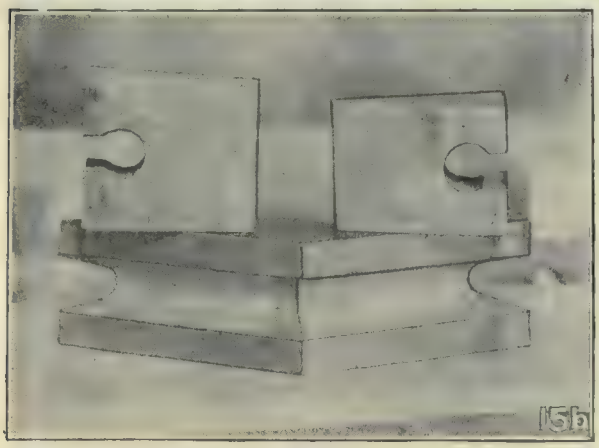
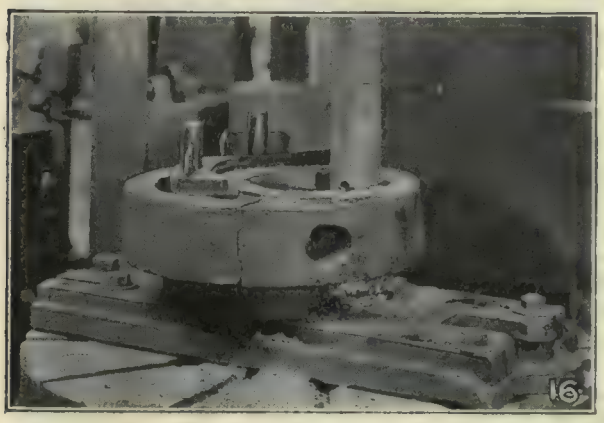


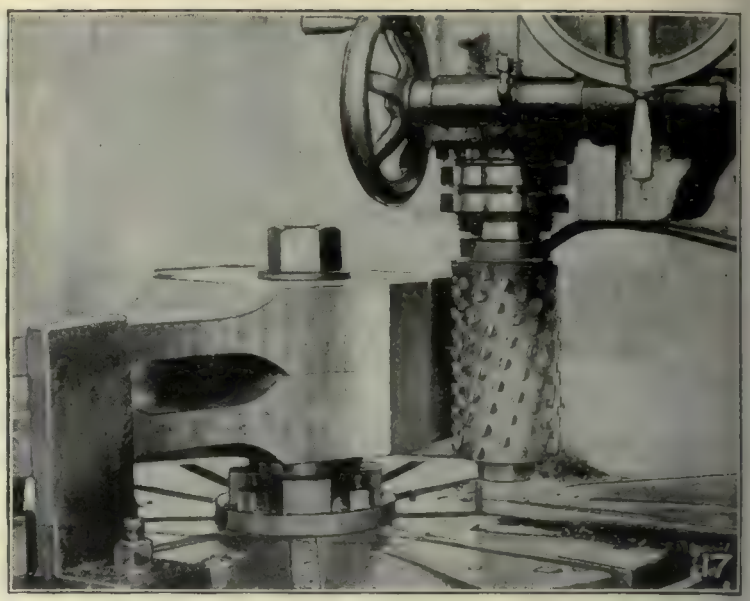
FIG. 11. THE EXTERNAL GAGE ON THE CROWN BRASS

C pivoted near one end and guided by the quadrant *D* by which it can be adjusted to varying angles. Table *B* is slidably connected to the under side of the radius bar by the extension *E*. It will be readily understood that with the radius bar set to the proper angle and the cross-feed of the machine in action, the link mounted











FIGS. 15a AND 15b. TAPER BLOCKS FOR LEVELING SHOES AND WEDGES. FIG. 16. BORING ECCENTRICS. FIG. 17. MILLING ENDS OF SIDE RODS. FIG. 18. BORING A CYLINDER LINER

on the pivoted table will be made to move in the path of an arc.

Cleaning boiler flues is one of the most disagreeable jobs in the shop and many are the devices that have been arranged for doing the work. One device is shown in Fig. 21. Here a sheet-metal tank has been sunk below the floor and provided with loose endless chains passing over sprockets at each side. The chains pass completely around the tank, the upper parts hanging down in the middle in "bights." The sprockets on one side of the tank are revolved by an electric motor, giving motion both to the chains and the sprockets on the opposite side. The flues are placed in the "bights" of the chains and enough water put into the tank to

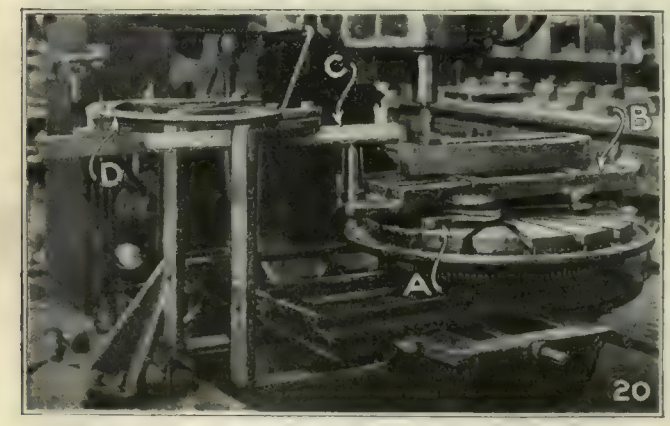


FIG. 20. A LINK MILLING ATTACHMENT

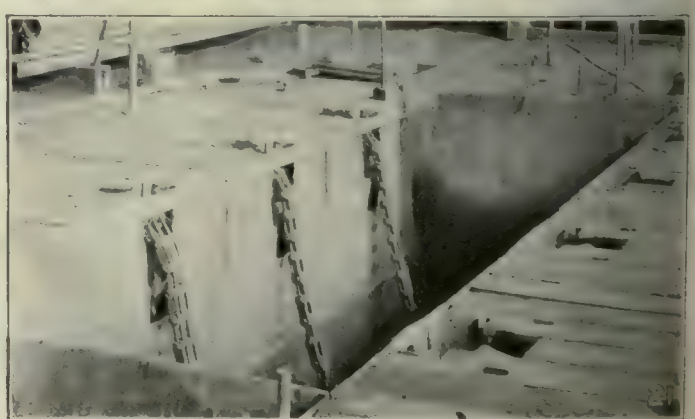


FIG. 21. TANK FOR CLEANING BOILER FLUES

cover them. When the motor is started the flues are tumbled one upon the other, loosening and washing off the scale. A set of flues can be completely cleaned in this device in about 7 hours.

The Apprentice School

A school for apprentices is held daily from 7 to 9 a.m. in a class room on the shop gallery. There are about seventy-five apprentices in the shop who attend school in

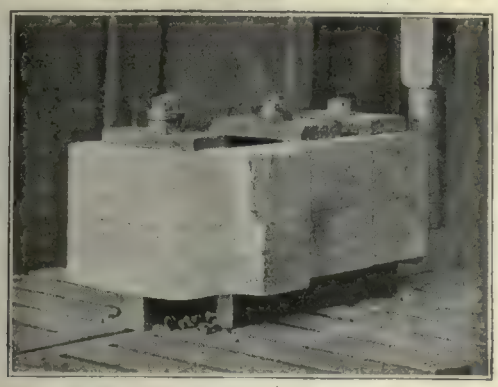


FIG. 19. MACHINING A ROD STRAP

classes of 25, giving each class two sessions per week. At one of the sessions the instruction is evenly divided between drawing and mathetmatics, while the following session is entirely devoted to mathematics. The writer was privileged to be present at one of the sessions and was very much impressed by the earnest endeavor of the boys and their strict attention to the instructor's directions.

What Is a First-Class Machinist?

By James Vose

Browsing among some back issues of the *American Machinist* brought up the irresistible impulse to make some comments on the good fare provided by a number of your contributors.

It appears to me that with regard to the query "What is a first-class machinist?", again referred to on page 858, Vol. 53, a quite broad-minded attitude will need to be adopted in order to get an approach to the real answer. Much depends on the manner and the circumstances under which men are employed. For instance, I have had men under me whom it was a pleasure to employ on lathe work. They were quick, deft and possessed of an innate aptness for keeping tools sharp and voluntarily finishing their jobs with those little nuances which intimate to the competent observer that the workman has a natural sense of the fitness of things. And yet they might be but sparsely endowed with initiative or desire to expand themselves beyond the kind of work they had, more or less fortuitously, become engaged in.

On the other hand I have equally satisfactorily handled men who would never quite reach the top notch as regards finish, but by their instinctive grasp on the requirements, and their versatility, could take hold of any job reasonably within their line and carry it through with a minimum of uncertainty to the management as to a satisfactory outcome. Also they could be depended on to make a good showing if placed under unusual circumstances without immediate guidance or instructions.

I have in mind at the moment one who could take charge of a works stores, run the boiler and engine, etc., cut a creditable figure on lathes and standard machine tools, benchwork, general outdoor millwrighting and erecting, and write to headquarters an intelligent and intelligible report as to the conditions to be met and progress on the job. He could also act as foreman if required. Such men, however, are not to be expected to do their best work if governed by cast-iron or petty regulations.

Another variant of such a man will, as a matter of course, tackle a full round of general and wheelwright blacksmithing, operate a lathe and general shop tools, do a certain range of sheet-metal work and work of rather rough steel construction and boilermaking character and carry out dismantling, re-erection, and comprehensive general repairs to a distinctly hefty building-contractors plant, often under discouraging out-of-doors conditions. But, quite likely, by many critics he would not be considered a "good machinist."

Again, where regular quantity or mass production is in evidence, men who are not conspicuously bright, who only are fairly good workmen in a rather narrow sphere but are cheerful, willing and consistently regular in attendance might gladly be conceded by some harassed foremen or superintendents to be what are called "good machinists."

Touching on the remarks on "Efficient Pattern Making" on page 858, Vol. 53, an experience of mine may shed some light on how the provision of outlets for good points may cancel, or make unnecessary consideration of bad points. Being shown over the works by the superintendent of a widely known engineering shop in Rugby, a wood carving machine was pointed out to me in the patternmaking shop. It was explained that a similar machine had been seen doing good work in a cabinet making works and, it was thought, it could hardly fail to be useful in a large pattern shop. However, one of the men, who, by reason of his good hand craftsmanship and capacity for "efficient pattern making" on the improvisation lines outlined on page 858, carried considerable influence in the shop, had a perverted kink in his makeup which impelled him to belittle the possibilities of wood-working machinery. His attitude led to the carving machine being comparatively ignored.

Congenial Work and Its Results

One young fellow, who had nothing like the same measure of patternmaking and foundry work lore as the first mentioned man, was noticed by the superintendent to have a sneaking regard for not only the carving machine but for any other woodworking or allied machinery. The upshot was that the re-actionary man was assigned to a regular post in the foundry on a congenial job assisting the molders in the setting of intricate cores and co-operating with the foundry generally in the way of simplifying methods of molding and, in general, making the most economical and versatile use of existing and new patterns. Meanwhile, the man who liked machinery felt free to indulge his bent and used the carving machine freely, bringing out unsuspected good uses of it, and gradually so changed the shop's attitude that it became a quite accepted and appreciated item in the equipment. Now, to my mind, each of these two patternmakers might fairly be classed as an efficient craftsman, but to those for the look out only for bad points, each of them might fail to qualify for places in that category.

Programs of Apprenticeship and Special Training In Representative Corporations

By J. V. L. Morris



XII—The Packard Motor Car Co., Detroit, Mich.

Apprentices Trained in School and Shop—Technical Graduates Given Comprehensive Course — Truck Salesmen Instructed by Lecture Course

THE most significant educational work of the Packard Motor Car Co. is its apprentice training, in which 122 young men are enrolled. There are in addition, however, some excellent advanced training courses for technical graduates in which twenty-one men are enrolled, and in the truck department there is a salesman's school through which about twenty are continually passing, the length of the course being three weeks.

All of the 122 apprentices are in the machinists' trade, except seven patternmakers and six electricians. All, however, take the same supplementary course of about four and one-half hours per week of mathematics and mechanical drawing. A class of apprentices is shown at drawing work in Fig. 53. All students are also required to attend the city night school, when it is in session. The course is three years in length and during the third year the best students are selected for transfer to the toolmaker's shop and for tool designing. The number, of course, depends on the demands of those departments. The trial period is for only two weeks.



FIG. 53. APPRENTICES IN DRAWING CLASS

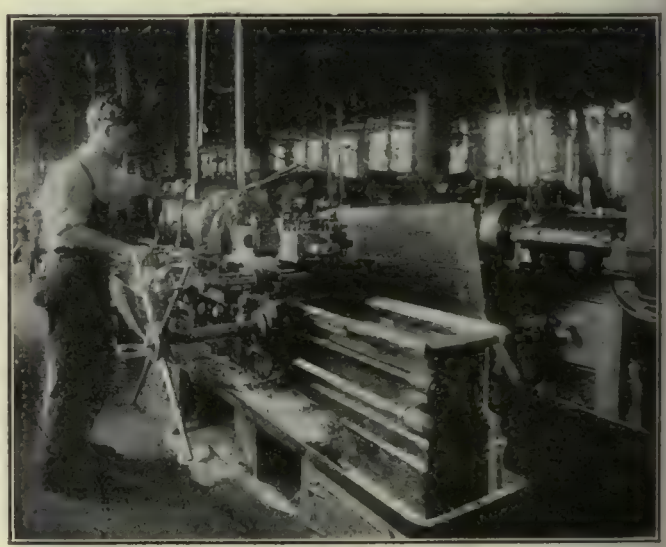


FIG. 54. RUNNING A TURRET LATHE IN THE SHOP

The apprentices are in the charge of a supervisor, who is a technical graduate with extended shop experience. He has authority to arrange transfers of apprentices about the shops to give variety of experience at all types of machines. He is assisted in the school instruction by a technical graduate for the drafting classes. The scope of the work is broad, Fig. 54 showing an apprentice at a turret lathe, and Fig. 55 another one at work as a body designer.

In the indenture which all apprentices must sign, together with their parents, the apprentices are required to deposit $25 as a guarantee of good faith to complete the apprentice course. This fee is returned at the expiration of the apprenticeship, together with a $100 bonus. The rates of pay for the six 6-month periods are, respectively: 30, 34, 38, 42, 46, and 50 cents per hour. "Graduates of the Detroit high schools, well recommended by the principal, may have their term of apprenticeship shortened at the discretion of the company."

Some twenty-one technical college graduates are being transferred about the plant in a two-year course designed to give them the requisite experience for ultimate positions as executives, or as engineers. Their pay starts at 40 cents an hour. They have a fifty-hour week, the same as the regular production force.

The outline of the training programs follows. There are now fifteen in the course of executives.

OUTLINE OF ADVANCED TRAINING COURSE FOR EXECUTIVES

Weeks		Class of Work
21		Machine shop practice
	4	(a) Preliminary instructions
	3	(b) Drill press
	4	(c) Milling machine
	6	(d) Lathe
	4	(e) Gear cutting and grinding
4		Forge
	1	(a) Stamping
	1	(b) Drop forge
	2	(c) Tools and dies
4		Foundry
	1	(a) Wood pattern making
	1	(b) Metal pattern making
	2	(c) Moulding
4		Inspection
	1	(a) Rough and finish
	1	(b) Gages and tools
	2	(c) Materials testing and chem. lab.
3		Hardening and Tempering
6		Assembling
	3	(a) Rear axle and transmission
	3	(b) Clutch and motor
4		Testing motor and dynamometer
4		Employment
4		Factory routine
6		Purchasing
8		Production
6		Stock methods
8		Engineering
8		Time study
4		Industrial organization and shop management
10		Electives
104		

NOTE. — APPLICANT MUST BE A COLLEGE GRADUATE OR EQUIVALENT.

OUTLINE OF ADVANCED TRAINING COURSE FOR MECHANICAL MEN

Weeks		Class of Work
21		Machine Shop Practice
	4	(a) Preliminary instructions
	3	(b) Drill press
	4	(c) Milling machine
	6	(d) Lathe
	4	(e) Gear cutting and grinding
4		Forge
	1	(a) Stamping
	1	(b) Drop forge
	2	(c) Tools and dies
4		Foundry
	1	(a) Wood and metal pattern
	3	(b) Moulding
6		Inspection
	3	(a) Rough and finish
	3	(b) Gages and tools
3		H rdening and tempering
6		Assembling
	3	(a) Rear axle and transmission
	3	(b) Clutch and motor
10		Machine Repair
24		General Tool Room
	4	(a) Tool repair
	6	(b) Set-up work
	4	(c) Tool grinder
	10	(d) Jigs and fixtures
26		Engineering and designing
	8	(a) Tool design
	8	(b) Time study and routing
	10	(c) Mechanical engineering
104		

NOTE.—APPLICANT MUST BE A MECHANICAL ENGINEERING GRADUATE OR EQUIVALENT.

Five of the graduates are taking the mechanical engineer's course. Fig. 56 shows one at work on a gear-hobbing machine.

TRUCK SALES SCHOOL

The course in the sales school is now only three weeks in length, but it is filled with the best instruction that the company can provide through the co-operation of engineers and department chiefs. It was started as a five-week course, was later reduced to four weeks, and is now being tried with a length of three weeks. Ordinarily, about twenty men are in attendance, sent in by the company's sales offices and distributors, who



FIG. 55. APPRENTICE AT WORK AS A BODY DESIGNER

pay the student's expenses, amounting to $250 to $500 per man.

The course has been carefully laid out as a study of the car's mechanism, of selling methods, and of the competitive points to be met in selling. It is, however, planned to be broader than a mere training course in

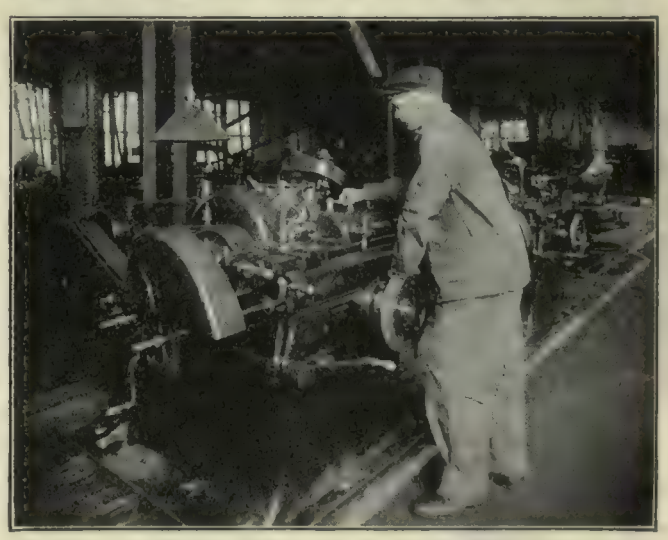


FIG. 56. SHOP WORK ON A GEAR-HOBBING MACHINE

the effective selling of the company's truck, as there are introduced some lectures which should go toward making transportation engineers of the students. We find such lecture topics as: Transportation's Influence Upon Civilization, and How It Has Made the World Smaller; Importance of Correct Specifications; The Coal Industry; The Milk Industry; Professional Haulage.

Design of Helical Springs

Importance of and Factors Entering Into the "Material Index"—Determination of the Torsional Modulus of Elasticity—Control of Unit Fiber Stress

By JOSEPH KAYE WOOD
Engineer, Western Electric Co., Inc., A. T. & T. Co.

IN A recent article by the writer covering the design of small helical springs, an important relation between the "Spring Criterion" and the "Material Index," as given by formula (1), was shown to be applicable to helical spring design in which any size of wire or rod material is used. Formula (1), given below, states that the spring criterion must be less than the material index in order that a spring as designed by the ordinary deflection formula shall be safe for the maximum load applied. The spring criterion includes all the dimensions of the spring, while the material index includes the quantities depending on the properties of the material used.

This article will consider the variations in the different quantities symbolized in this formula which are liable to occur in the making of a helical spring from any size of wire or rod material. It will also outline a method by which these various quantities may be controlled to within definite limits by the designer, and which method, while observing the theoretical laws of spring design, will also be consistent with the standard commercial practice. Only wire or rod of circular cross-section will be considered.

$$\text{Spring Criterion, } \frac{h-H}{H} \div \left(\frac{D}{d}\right)^2 < \frac{\pi S}{G}, \qquad \text{Material Index} \quad (1)$$

1. *The Material Index,* $\frac{\pi S}{G}$. This is by far the most important and doubtful part of the above expression from the standpoint of controlling the various factors in spring design, as the dimensional quantities in the spring criterion are held within satisfactory commercial limits without much difficulty. We will first consider G, the modulus of elasticity for torsion in pounds per square inch, and secondly S, the maximum safe fiber stress for torsion in pounds per square inch.

From the ordinary deflection formula it will be noted that G varies directly as the applied loads and inversely as the deflections. An increase of, say, 1,000,000 lb. per square inch in the value of G for steel, which is generally understood to be equal to about 12,000,000 lb. per square inch, would cause a variation of 8 per cent in the applied load, provided that all other factors remained constant. It would also decrease the allowable safe deflection by 8 per cent, provided that S and $\frac{D}{d}$ remained constant, as may be seen from inspection of formula (1). It is quite obvious, therefore, that a correct value of G should be ascertained if any degree of accuracy is desired. There are four different methods by which the value of G may be determined.

Determination of G

(*a*) *Direct Method*—This method is applicable only to rods and wire of large diameter and consists in noting the loads necessary to produce different angular deflections in a definite length of material. By substituting the average values of these measured quantities in formula (2), which is the definition of G symbolically, the value of G is obtained.

$$G = S_1 \div \frac{\theta}{L} = 583 \times \frac{P L R}{d^4 \theta} \qquad (2)$$

where P = load in pounds (below the elastic limit) applied at a lever distance of R, d = diameter of material in inches, L = length in inches, and θ the angle of twist in degrees.

(*b*) *Ordinary Deflection Formula Method*—This formula, which is derived from the previous formula, is applicable to wire and rod material of any size and it, no doubt, gives the most accurate value of G. Any size of spring is made up, within safe limits, and the diameter of the material, outside diameter of spring, and the solid or free length are carefully measured and recorded. Pressures and deflections are then measured; and by substituting all these quantities in the deflection formula (3), G is computed.

$$G = \frac{8 P D^3 H}{d^5 (h - H)}, \qquad (3)$$

where H = solid length, and h the length corresponding to the load P.

Where accurate springs are required in fairly large quantities, the value of G for any one run of material should be determined in this way, because it represents the value of G for the actual coiled spring after all mechanical and heat-treatment is completed.

(*c*) *Torsional-Pendulum Method*—With this method the modulus G is determined by fastening at one end a piece of material of a measured length and radius, and suspending from the other end a weight whose moment of inertia is determinant. Then, by twisting the material about its axis through any amplitude, the period of oscillation is determined. Mean values of these various quantities are then substituted in the following formula:

$$G = \frac{2 \pi I L}{t^2 r^4}, \qquad (4)$$

where I = the moment of inertia of the weight, L and r the length and radius of the material whose G is sought, and t the time of one oscillation. This method is only practical for material of small radius, such as music wire, because from the formula it can be seen that for large values of r the time t would be extremely small, unless an extremely heavy weight were used. The derivation of this formula may be seen at the end of this article.

(*d*) *Elongation Method*—This method is perhaps the most practical method for material having a diameter greater than 0.05 in., it being easily adapted for imposing commercial requirements on the raw material. A sample of the material of known length is submitted to a testing laboratory for a determination of the modulus

of elasticity for tension E; in which pressure-deflection curves are plotted, showing the "elastic limit" point. Curves are also plotted on the same coordinate paper showing the reduction in diameter of the material for each applied load. From this data, the factor of lateral contraction λ for the material is first determined, and then by substituting this value λ and the modulus E in the following formula, the value of the modulus G is determined:

$$G = \frac{E}{2(1+\lambda)}, \qquad (5)$$

where λ is equal to the ratio of the contraction in diameter of the material per unit of length to the elongation per unit of length ϵ. This formula is also derived at the end of the article.

The Fiber Stress

The value of S, which is the maximum safe fiber stress in pounds per square inch, should be somewhat below the elastic limit of the material in question, varying with the condition of service, although the factor of safety for springs need not be as high as for more rigid mechanical structures. Although accuracy in spring design, considered according to the ordinary deflection formula and special formula (1), does not depend upon an *exact* value of S so much as it does with the value of G, yet heat and chemical influences affect the value of S considerably and do not affect G to an appreciable extent. Therefore, it will also be important to know the elastic limit of the material when in the state it will be as a finished spring, in order that the maximum safe fiber stress will not be exceeded, or according to formula (1) that the material index will not be exceeded by the spring criterion. In view of this, the material which is submitted to the testing laboratory for an elongation test should be brought to the same condition, metallographically speaking, as it will be in as a finished spring. Then, about 50 to 60 per cent of the value of the elastic limit for tension will be equal to the elastic limit for torsion. It is also important that the material have as high an ultimate strength as can possibly be obtained, because this will insure a high ultimate torsional strength, the latter being determined by the number of twists through 360 deg. a material will stand before breaking.

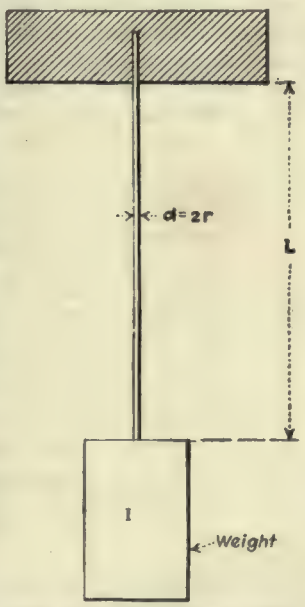


FIG. 1. TORSIONAL PENDULUM FOR DETERMINING "G"

Controlling the Material Index

Having considered the various means of determining the quantities contained in the material index, we will now consider the means of controlling the properties of the various materials used in helical springs, in order to obtain the highest and most suitable value for this index. The desired properties of a material are obtained by controlling the amount of chemical impurities and by giving it the proper heat-treatment. At the same time it must not be overlooked that certain other influences affect the material, such as mechanical or cold working and plating of the material.

Therefore, the important considerations for controlling the properties of a material which affect the value of G and S, and consequently the material index, may be grouped as follows: (a) Chemical impurities; (b) Degree of physico-chemical unequilibrium, due to mechanical and heat-treatment; (c) Frequency of operation as related to fatigue, shock; (d) Electroplating; (e) Corrosion. These classifications will be discussed here in the relative order shown, referring in each case to steel and phosphor bronze (steel particularly), as these two metals are most commonly used for making springs. However, the general principles referred to can also be applied to other metals such as German silver and brass, although these metals generally make poor springs.

(a) Chemical Impurities

Elasticity is the tendency of deformed bodies to resume their former shape. The elastic limit is the limit of stress within which the deformation completely disappears after the removal of the stress, and in certatin materials, in which the stresses are proportional to the deformations. Certain materials, especially steel and phosphor bronze, are highly elastic and in them the ratio of the stress per unit of area to the deformation per unit of length, i.e., the modulus of elasticity, is consistent with the requirements of load and travel of springs used in machine design. The elasticity and strength of relatively pure iron and copper are greatly increased by the addition of certain impurities in definite quantities and decreased by other impurities.

In the case of pure iron which consists of ferrite crystals of high ductility, soft and relatively weak, the addition of small amounts of carbon up to 0.85 per cent content decreases the ductility and increases ultimate strength and hardness, resulting in the material called hypo-eutectoid steel. This is due to the formation of pearlite (a solid solution of carbon and iron) and free ferrite. With the addition of 0.85 per cent carbon to pure iron, which amount goes entirely into solid solution forming all pearlite, eutectoid steel is produced which has the maximum tensile strength, lowest ductility and is very hard. More than 0.85 per cent carbon in iron or hyper-eutectoid steel results in pearlite and free cementite, the latter being low in tensile strength, brittle and extremely hard. In fact, the effect of carbon in steel may be summed up approximately by means of the following formulas, provided that the material is in a normal state of equilibrium:

$D = 40 - 36\,C$;

$T = 50{,}000 + 90{,}000\,C$;

where

D = Ductility in per cent elongation in 2 inches;

and

T = Ultimate strength in pounds per square inch;

and

C = Percentage carbon.

Therefore, in order to have the most suitable steel for making springs, one having a carbon content of 0.85 per cent to about 1 per cent would be the best from the standpoint of carbon content alone, as this would give the highest value for the elastic limit, or material index, and the ultimate strength. This com-

position would also give the best compromise for resistance to shock and fatigue. The modulus of elasticity for torsion or G would also be a maximum, although a somewhat lower value would not be objectionable.

Other impurities in spring steel and their effects are as follows:

Silicon—Small traces of silicon up to about 0.07 per cent go into solid solution in steel and do not affect its physical properties except to make it slightly more shock resisting. Over 6 per cent will cause brittleness.

Phosphorus—When phosphorus is present in quantities exceeding 0.08 per cent it enlarges the grain size of steel, thereby causing brittleness which would lower the allowable value of S, and the material index because G is probably increased.

Sulphur and Manganese—Sulphur may be present up to 0.1 per cent, but steel of ordinary quality usually contains only about 0.05 per cent. Manganese will combine with the sulphur at high temperatures, thus eliminating the effect of some or all of the latter, which if in excess will cause red shortness, i.e., brittleness. This red shortness is caused by weak FeS membranes forming in between the grains of pearlite. Excess manganese and silicon in moderate amounts will increase S in resistance to shock, but will decrease G slightly.

Nickel—Nickel will increase S, the ultimate strength, and G. Nickel-steel with about 30 per cent nickel content is non-corrosive.

Chromium and vanadium in steel will increase both S and G, but are expensive.

The following steels have been recommended for springs:

U. S. N. Analysis

Open-hearth crucible or electric furnace steel of a minimum of 0.70 and a maximum of 1.1 per cent carbon, a minimum 0.25 and maximum of 0.5 per cent manganese, a maximum of 0.25 per cent silicon, a maximum of 0.04 per cent phosphorus and a maximum of 0.04 per cent sulphur.

Vanadium or other elements may be used to obtain the physical requirements, in which case only the phosphorus and sulphur requirements need be adhered to. Ultimate tensile strength after heat-treatment, 180,000 lb. per square inch, and an elastic limit of 75 per cent of this value.

Pennsylvania Railroad Analysis

Carbon: maximum, 1.0 per cent, minimum, 0.09 per cent. Phosphorus: minimum, 0.05 per cent, maximum, 0.07 per cent. Manganese: minimum, 0.25 per cent, maximum, 0.50 per cent. Silicon: maximum, 0.10 per cent. Sulphur: maximum, 0.03 per cent.

Impurities of Phosphorus Bronze

The chief impurity in phosphor bronze is phosphorus, which reduces the oxides of copper and tin that are formed in melting. Any phosphorus above this necessary amount acts deleteriously and injures the metal. The presence of zinc has a bad effect. Temper is produced by cold rolling or drawing, in which the tin content is the dominant factor. Remelting phosphor bronze will increase its strength. A phosphor bronze of the following composition will give the best value for the material index:

Copper, 90 per cent; tin, 9 per cent;
5-per cent phosphoric tin, 1 per cent

Hence, with steel in the normal state of equilibrium, consisting of iron and impurities within definite limits, as outlined above, we may expect an ultimate tensile strength between 140,000 and 160,000 lb. per square inch, a tensile modulus of 30,000,000 lb. per square inch, with a corresponding value for G of 12,000,000 lb. per square inch, and S (torsion) equal to about 50,000 lb. per square inch. For phosphor bronze, as outlined above, G is equal to about 6,000,000 lb. per square inch and S equal to about 30,000 lb. per square inch.

(b) Mechanical and Heat-Treatment

The values of G and S, as given in the previous paragraph, may be somewhat further increased by mechanical and heat-treatment. Mechanical working or cold wire drawing and rolling distorts the granular structure, pressing it toward the center of the circular section, making it very compact and fibrous, which results in a great increase in the hardness, but which makes the material quite brittle. This brittleness is removed by the annealing process, which consists in heating the steel just slightly above the critical points between 1,455 deg. F. and 1,490 deg. F., in which range the steel is brought into a solid solution or a homogeneous mass. After a sufficient length of time in this range the mass, whose grain structure is now very fine,

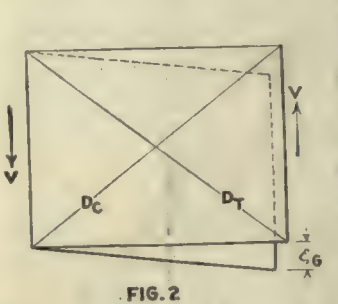


FIG. 2. ELONGATION METHOD FOR DETERMINING G FACE OF CUBE IN SHEAR. FIG. 3. ELONGATION METHOD. UNIT CUBE UNDER PRESSURE

is allowed to cool at the proper rate, i.e., by plunging it into a blast of cold air. The closer the annealing temperature is to the minimum limit, 1,455 deg. F., the smaller will be the grain size. Wire treated in this way will be very high in tensile strength, and very much greater for small sized music wire. This mechanical and heat treatment increases the strength, the elastic limit considerably, and the modulus only slightly.

Tempered springs of low carbon steel or special alloy steel are usually hardened first by heating to about 1,490 deg. F., and plunging quickly into oil, then giving the desired properties by tempering to about 500 deg. F. The higher the tempering temperature, the lower will be the elastic limit or S. But heat-treatment does not increase the modulus of elasticity G appreciably. Water should not be used as a plunging bath, as it will cause the material to become brittle. Springs which are treated after coiling in order to relieve the internal strains, usually have their dimensions affected, but this will be considered later under spring criterion.

Therefore, with heat and mechanical treatment, the values of S and G may be increased to 130,000 lb. per square inch and very nearly 13,000,000 lb. per square inch, respectively, by using small sized steel music wire, or to about 90,000 per square inch and 12,500,000 lb. per square inch by using steel of relatively large cross-section.

(c) Frequency of Operation, Fatigue, Shock

Fatigue is the loss in molecular strength of a certain material due to an often-repeated stress, depending upon the frequency of application and magnitude of a load below or above the elastic limit. Mr. Guthrie, of the Widney Test Laboratories of Chicago, gives some interesting facts concerning fatigue, in which he shows that the area of the hysteresis loop, i.e., the area between the loading and unloading lines on a pressure-deflection chart is a measure of the material's susceptibility to fatigue. Material whose pressure-deflection chart shows a relatively very small hysteresis loop will probably withstand fatigue fairly well. Therefore, it is recommended that the unloading line be plotted on this chart in order that a suitable factor of safety may be applied to the value of S consistent with the probable service conditions to be imposed upon the spring made from this material.

A greater factor of safety should be applied for sudden and impact loads or shocks. A sudden load or weight dropped from an unappreciable distance on a spring will produce twice the stress that the same load would if gradually applied, while an impact load or one having considerable initial velocity will produce from three to four times the stress of a gradually applied load. The chemical composition and heat treatment as recommended previously are such as to lend maximum resistive power to the material against fatigue or shock.

(d) Electroplating

Small steel springs are plated with silver or nickel and copper in order to protect them from corrosion. Previous to plating, the springs are dipped in a weak solution of HCl to remove the film of black oxide resulting from the heat treatment, the red oxide or rust, and the grease. They are then well plated with either silver or nickel electrolytically, after which they are electroplated in a solution of copper cyanide. A final rinsing in cold water removes all acid.

Certain precautions are necessary in both the cleaning and plating operations. First, the wire to be plated must be kept entirely free from tool nicks and excessive rust, because this will limit to a minimum the length of time necessary to remove the rust. This time should be as short as possible, due to the well-known embrittling effect on steel of the accluded hydrogen evolved in an acid bath.

Also, in the plating operations, the wire is plated first with some metal such as a silver or nickel, which will give off a relatively small amount of evolved hydrogen in the electrolytic bath, because the evolution of hydrogen due to steel in a copper cyanide solution is great enough to cause embrittlement when immersed for only short periods of time. The action of atomic hydrogen on steel is probably due to its penetrating in between the grain structure and building up a pressure which breaks down the cohesive power of the membranes, thereby producing brittleness.

Tinning and japanning tend to temper steel springs, or lower S, but do not affect the modoulus G appreciably.

(e) Corrosion

Corrosion of the raw material, especially the small sized wire, during storage will give considerable trouble. For small sized wire this action will increase the length of time necessary to remove the rust previous to plating, thereby promoting brittleness. The importance of protecting the stored steel wire with grease or chalk dust cannot be emphasized too much.

Plated wire will rust in time if placed in a high humidity, due to the inadequateness of any plating known to give complete protection against corrosion. Phosphor bronze should be resorted to where severe corrosion is expected to occur. The action of CO_2 will form a protective coating on phosphor bronze in contrast to the accelerating action of rust on steel.

With the selection of a material whose properties have been controlled and whose S and G values have been determined as outlined by the above methods, we may expect a high and fairly accurate value for the material index, varying between 0.020 and 0.032 for steel, which will allow a greater value for the spring criterion. In the next article the control of the spring criterion will be considered, along with the results of experiments on music wire.

Derivation of Formulas

Formula (4) $G = \dfrac{2\pi I L}{t^2 r^4}$ Torsional Pendulum.

Let M equal the moment of the couple P, which will twist the material whose G is sought through one radian; I, the moment of enertia of the suspended weight, see Fig. 1; α, its angular acceleration; and θ, the amount of twist.

Now, as the twist is proportional to the torque, we have

$$\theta M = P = I\alpha \qquad (a)$$

and the torque tending to restore the vibrating pendulum to rest is directly proportional to the angular displacement. Therefore, from the laws of motion, every point in the vibrating pendulum has a simple harmonic motion, which gives

$$\alpha = \frac{\pi^2}{t^2}\theta \qquad (b)$$

where t equals the time of one oscillation. But from the expression above we have

$$M = \frac{I\alpha}{\theta} \qquad (c)$$

By substituting (b) in (c) and multiplying by θ we obtain

$$P = \theta M = \frac{\pi^2}{t^2} I\theta \qquad (d)$$

Now, the deflection formula is

$$\theta = \frac{2PL}{G\pi r^4} \qquad (e)$$

Substituting (d) in (e) we get,

$$G = \frac{2\pi I L}{t^2 r^4} \qquad (4)$$

Formula (5) $G = \dfrac{E}{2(1+\lambda)}$ Elongation.

The action of shear produces internal stresses of tension and compression. Let Fig. 2 represent the face of a cube whose edge is equal to unity and is acted upon by the shear V. This shear causes the cube to become distorted, as shown by the dotted lines, the shorter diagonal of the rhombus being in compression and the longer one in tension. The unit stress S in both cases is equal to V.

By definition, $\varepsilon_G = \frac{S}{G}$ where $\varepsilon_G = \frac{e}{1} = e$.

From the figure we have,

Before distortion, $D_T = D_C = \sqrt{2}$.

After distortion

$D_C = \sqrt{(1-e^2) + (1-e)^2} = \sqrt{2}\ (1 - \frac{1}{2}e)$ approx.

$D_T = \sqrt{(1-e^2) + (1+e)^2} = \sqrt{2}(1 + \frac{1}{2}e)$ approx.

Hence, in either case, the change in length for each diagonal is $\frac{1}{2}e\sqrt{2}$ and per unit length is equal to $\frac{1}{2}e = \varepsilon_T$

$$\therefore \varepsilon_T = \tfrac{1}{2}S/G \qquad (a)$$

Now, the change per unit of length ε_T will be found by another method, as follows:

Unit Elongation, ε_T due to S equals $\frac{S}{E}$

But the lateral contraction due to S_1 equals $\frac{\lambda S_1}{E}$ in the opposite direction and the lateral contraction due to S_2 equals $\frac{\lambda S_2}{E}$ in the opposite direction, see Fig. 3.

Hence the total effect is given by the following:

$$\text{True } \varepsilon_T = \frac{S}{E} - \left(\frac{-\lambda S_1}{E}\right) - \left(\frac{\lambda S_2}{E}\right) \qquad (b)$$

λ is sometimes called Poisson's Ratio.

In the case above, $S_2 = 0$ and $S = S_1$ numerically.

$\therefore$ (b) becomes

$$\varepsilon_T = \frac{S}{E} + \lambda\frac{S}{E} = (1+\lambda)\frac{S}{E} \qquad (c)$$

Equating (c) equal to (a) we obtain

$$(1+\lambda)\frac{S}{E} = \tfrac{1}{2}\frac{S}{G}$$

or

$$G = \frac{E}{2(1+\lambda)} \qquad (5)$$

ERRATUM

In the first article published by Mr. Wood under the title of this article, some typographical errors occurred. On page 631 in the first column the fifth line from the bottom of the page should read

$$P = \frac{\pi}{8} \times \frac{S^2d^2L}{Gf},$$

and the third line from the bottom

$$P = \frac{\pi^2S^2d^2DN}{8\,Gf},$$

the f being transposed in both cases. The last line should, then, read

$$P = \frac{\pi^2S^2dDH}{8G(h-H)}.$$

Also, the third line from the top of the second column on the same page should be

$$\frac{\pi}{8} \times \frac{Sd^3}{D} = \frac{\pi^2S^2dDH}{G(h-H)}$$

On page 632 in the last line of the article, the bracket $\left(\frac{D}{d^2}\right)^2$ is incorrect and should read $\left(\frac{D}{d}\right)^2$, as is evident from the other formulas in the article.

Annual Report of American Engineering Standards Committee

The forthcoming report of the American Engineering Standards Committee will contain a resumé of the work done by the organization during the last year which should be of interest to every manufacturer and engineer.

The plan of organization and functions of the committee are clearly outlined in the following abstracts from an address by P. G. Agnew, Secretary of the American Standards Engineering Committee, at the Standardization Conference of the American Mining Congress, Nov. 17, 1920.

"During or since the war, national engineering standardizing bodies have been formed in all of the leading countries excepting Japan, where one is now in process of organization. All of these are similar in form of organization and method of operation to the British Engineering Standards Association, which has existed since 1901.

"Our own organization, the American Engineering Standards Committee, was organized in October, 1918, and has been actively at work for about a year. The functions of the committee are: To unify methods of arriving at engineering standards; to secure co-operation between various interested organizations in order to prevent duplication of work and promulgation of conflicting standards; to act as an authoritative channel of co-operation in international engineering standardization; to promote in foreign countries the knowledge of recognized American standards; to collect and classify data on standards; and to act as a bureau of information regarding standardization.

THE WORK OF THE COMMITTEE

"The scope of the work which is being carried out under the auspices and rules of procedure of the committee is very broad. The following types of projects are among those under way: (a) Definitions of technical terms used in engineering work, specifications, and contracts; (b) specifications for materials; (c) methods of tests, especially acceptance tests for materials and apparatus; (d) dimensional standardization to secure interchangeability of supplies, for example, screws, nuts, and bolts; (e) dimensional standardization to secure the inter-working of parts and of inter-related apparatus made or assembled by different manufacturers, such as shafts, pulleys, etc.; (f) safety codes to secure uniformity in requirements for safety in apparatus and equipment, and in industrial processes; (g) the limitation of the number of types, sizes and grades of manufactured products—an exceedingly important and far-reaching subject.

"The standardization movement is one of co-operation throughout each branch of industry and the different branches of industry whose interests touch or overlap, and a large measure of international standardization must inevitably result. For years there has been growing feeling among leaders in industry, which was heightened by the experiences of the war, that our industries function too much as independent units and not enough as articulated parts of a national whole. It is not too much to say that standardization offers a major opportunity toward the integration of our industries on a national scale, so that they may function in a truly national way."

Machining the Rolls-Royce Cylinders

Machining Each Bore Separately—Securing Uniform Compression — Lapping Cylinders After Careful Grinding

BY FRED H. COLVIN
Editor, *American Machinist*

THE cylinders for the Rolls-Royce motor are cast in blocks of three cylinders each, as in the case of a few motors of American design. The castings are first sand-blasted, and then marked out on a layout table for boring. This is done to equalize the distribution of metal in the various cylinders and to be sure that the casting will clean up properly in the various machining operations.

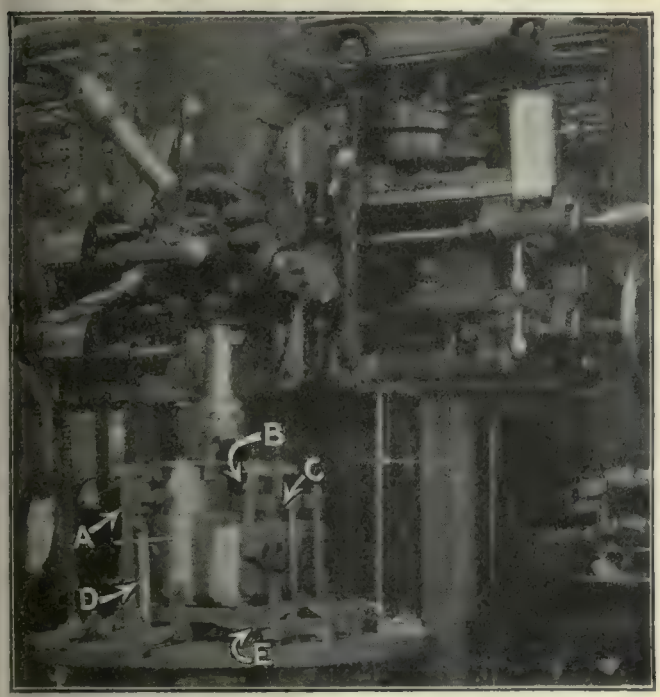


FIG. 1. BORING AND FACING THE CYLINDER BLOCK

The first machining is to bore, face and chamfer on a Bullard boring machine, as shown in Fig. 1. A special indexing fixture is provided by which the cylinder block can be moved from one position to another, as each cylinder is bored separately. The tool layout can be readily seen as well as the arrangement of the fixture and some of the gages. The fixture consists primarily of the angle plate *A*, the cylinder being properly located by means of the scribed layout line shown. The clamp *B* holds the cylinder flange firmly against the upright of the angle plate, while the clamp *C* holds the cylinder against the lower half of the plate.

The cylinder head is domed in the compression space, the gage *D* being lowered into the bore to see that the length is correct. Special calipers *E* measure the undercut for the over-run of the piston ring. Great care is taken to secure the uniform cubical contents of each cylinder, the tolerance being only one-half cubic inch variation between them. This is measured, as will be shown later. If the volume of any cylinder is too great, the whole block is brought back to this machine and the flange faced so as to reduce the volume to the desired amount.

The top of the cylinder casting is next milled on a large Becker milling machine, after which the holes in the top are drilled, spot-faced, countersunk and the water plug holes tapped. Next comes the drilling and facing of the lugs on the cylinder base, after which the cylinders go for the usual water test, as illustrated in Fig. 2. Then come the usual milling and drilling operations, boring and tapping for valve cover plugs, valve seating, recessing valve pockets, etc. After all the drilling and tapping has been done, all burrs are removed and another water test is given the cylinder block on the same fixture as before.

The rough grinding of the cylinder bores on a Heald machine comes next, the fixture used being shown in Fig. 3. A circulation of water is maintained through the cylinder jackets and the dust of grinding is taken away by the exhaust pipe shown at the rear. It will also be noted that a holder for the wheel-truing diamond is fastened to the face of the fixture at *A* so that the wheel can be kept in good shape with the least trouble. After the cylinders are rough ground, they are also very carefully finish ground. Great care is taken to have the finishing machine in the best possible condition with all bearings snugly taken up so as to secure the best results it can produce.

MEASURING THE VOLUME

The cylinders are then ready for the volume or capacity test, which has been previously referred to and

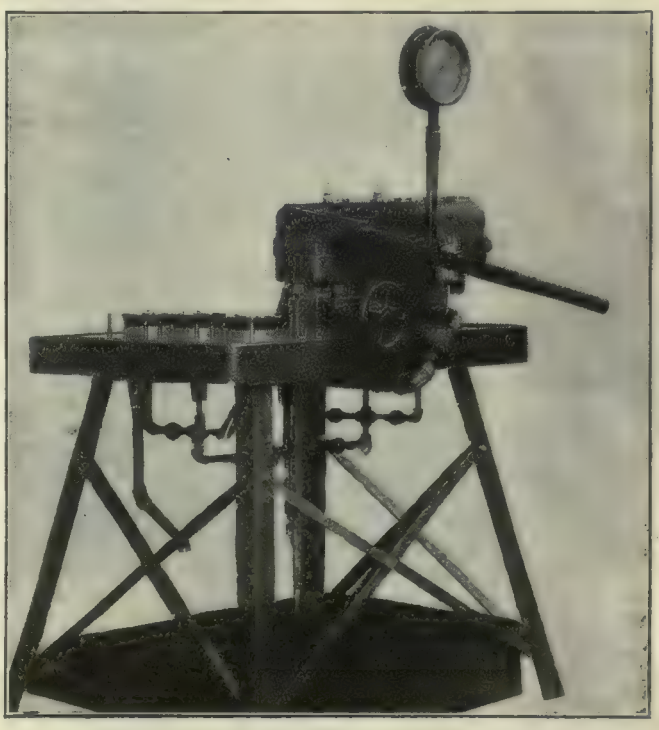


FIG. 2. THE WATER TESTING FIXTURE

which is shown in Fig. 4. This shows a micrometer gage in place in the right-hand cylinder to measure the length of the bore and the compression dome. At the left is a

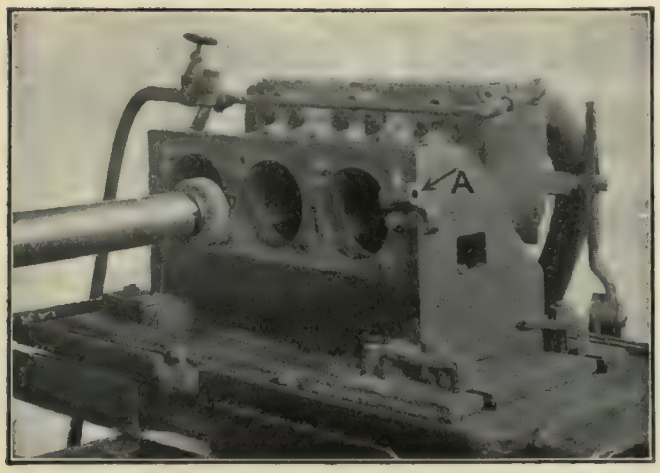


FIG. 3. GRINDING THE CYLINDER BORE

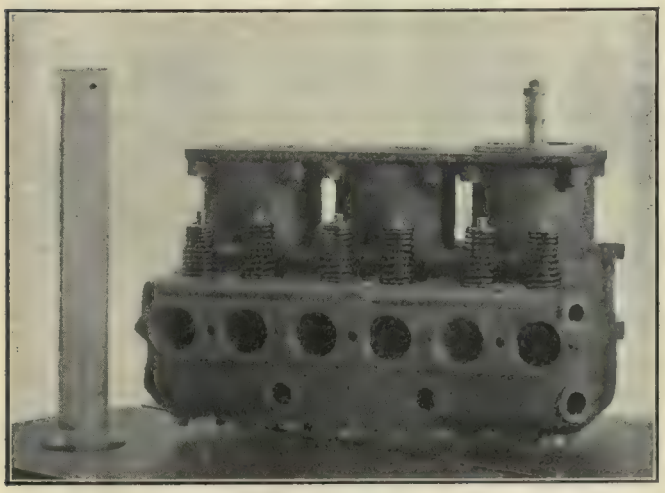


FIG. 4. MEASURING THE CUBICAL CONTENTS

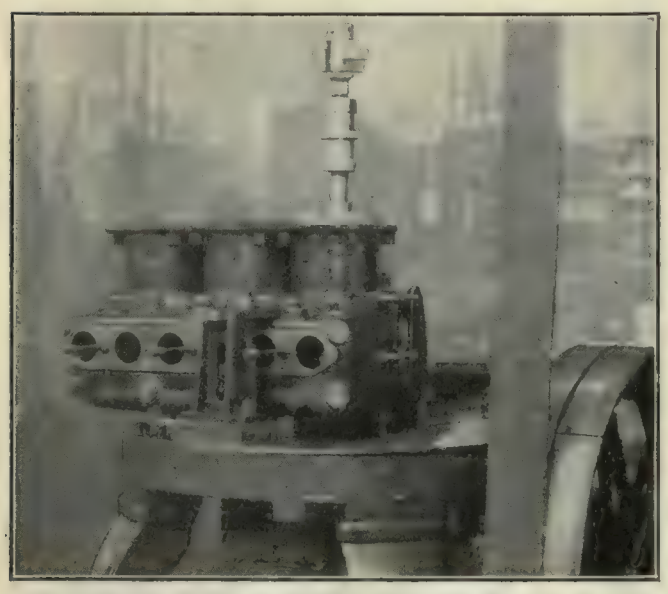


FIG. 5. THE CYLINDER LAPPING MACHINE

graduate to measure the liquid which is poured into each cylinder bore in turn. Should the variation exceed one-half cubic inch, suitable correction is made to bring each cylinder within this limit.

Before assembly, each cylinder is carefully lapped on the device shown in Fig. 5. This machine has a turntable on which the cylinder block is mounted as shown, and on which any desired cylinder of the block can be brought under the lapping spindle. In order to avoid any erroneous impressions in regard to the lapping, it may be here stated that the finish grinding is as perfect as can be secured. The lapping, which is of extremely short duration, is only done to make sure that there is a good bearing in every portion of the cylinder wall. The cylinder block can be readily shifted from one bore to another, exact alignment being unnecessary owing to the flexible connection in the lapping spindle.

A Student Apprentice Course

By A. W. Forbes

I am thinking of taking some apprentices on the basis outlined herewith and thought it might be of interest. I have never heard of apprenticeship being run on such a basis, but presume it has been tried thousands of times. I should be glad to have comments from any source.

(1) Object: Training for positions of foreman, tool maker, tool designer, machine designer, electric motor designer.

(2) Requirements for admission: Sex, male; age, from 14 years up; must have shown ability in school to keep up with normal requirements in all subjects. Must have shown technical or scientific ability by studying some technical, mechanical or scientific subject for not less than two years, outside of school, and not under the direction of an older or experienced person. Personal character must be satisfactory.

(3) Work and Study: Work for shop or office as assigned. The work will in a general way be preparatory for the position that the apprentice has in view, but the management reserves the right to require temporarily any work in the shop or office. A moderate variety of work will be offered which must be thoroughly learned, but no attempt will be made to include all operations.

School study will consist of one or possibly two courses at a high school or college. The selection will be for general education and in no way vocational. The selection will be made by the apprentice, subject to the approval of the management.

Vocational study will be done independently in consultation with the management. This will be specialized on topics related to the work, and will take the form of research work. In general these topics will be such as have never been thoroughly studied and the results will be published. A new topic will be selected about once in three months, and part of the former topics continued. One or two topics should be continued for three or more years.

(4) Hours: Work from 25 to 35 hr. per week; school study from 5 to 10; vocational study from 10 to 15, and total from 45 to 55.

(5) Compensation to start at from 20 to 30 cents per hour, according to age and experience, to be increased once in three months without limit. In addition, three dollars per month will be allowed for special books and laboratory supplies for vocational study, to remain the property of the firm.

A satisfactory quality and quantity of work will be required in all lines, as well as reasonable progress in all branches of learning. Both parties reserve the right to terminate the agreement should it prove unsatisfactory.

Magnetic Chucks



ORIGIN DEVELOPMENT CONSTRUCTION

Ellsworth Sheldon
ASSOCIATE EDITOR AMERICAN MACHINIST

VI. The Heald Chuck

First of the Multiple Magnet Chucks—Does Not Depend Upon the Shell for Magnetism—Differs Little in Appearance from the Single Magnet

THE Heald Machine Co. builds grinding machines. Like the Blanchard Co. its entrance into the field as a manufacturer of magnetic chucks was due to a desire to make a table for a rotary grinding machine that should be better adapted to the peculiar needs of

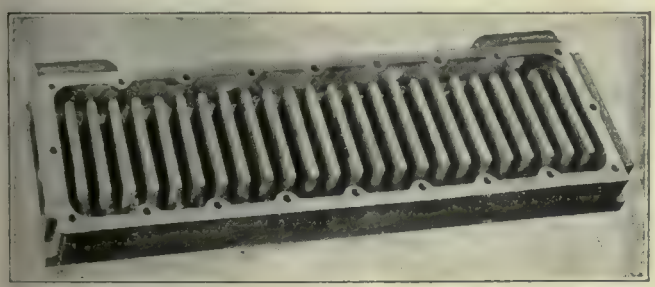


FIG. 88. BODY OF HEALD RECTANGULAR CHUCK WITH SINGLE ROW OF CORES

Heald machines than anything already in existence. Investigation and experiment led to the development of a device somewhat different in principle from any magnetic chuck on the market in that each pair of poles presented to the work-holding surface constituted a complete magnet in itself, not depending upon the shell or chuck body as a part of the magnetic circuit except such small portions of the casting as lay between each pair of cores.

The exposed poles were therefore alternate in polarity as in the single-magnet chuck, but with the difference that between each pair there would be a neutral zone

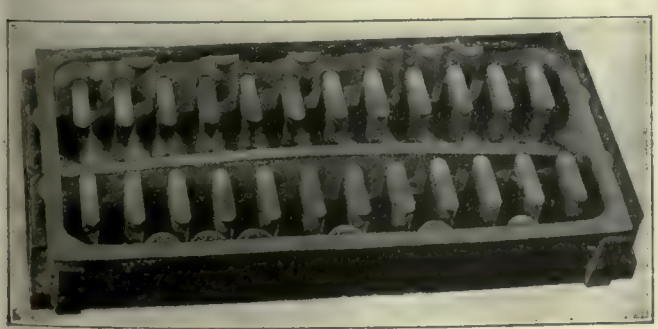


FIG. 89. BODY OF HEALD RECTANGULAR CHUCK WITH TWO ROWS OF CORES

that became an induced or extended pole, either north or south-seeking, according to the way in which work was laid upon it.

Instead of one large central core with a correspondingly large coil of current-carrying wire wound upon it, there were several pairs of narrow cores, each with its individual coil, and though they were still cast integral with the chuck body they were practically independent of it magnetically. This chuck is regularly built in both the rotary and rectangular form, and in many sizes.

The body, or shell, of the rectangular chuck is shown in Fig. 88. As may be seen, it is a single box-like casting of malleable iron with the magnet cores extend-

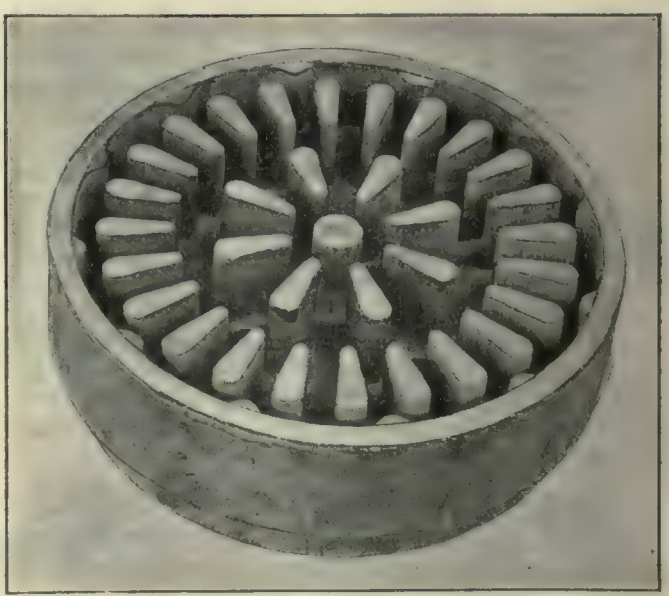


FIG. 90. BODY OF HEALD ROTARY CHUCK

ing flush with the open top. There is but one opening in the body of the casting below the top, and that is the one that carries the leading-in wires. In machining the top plate and body great care is taken to secure true and accurately finished surfaces, thus when the top plate is put on and the lower opening sealed with the pipe-plug which is a part of the current-carrying cable, the chuck becomes water tight.

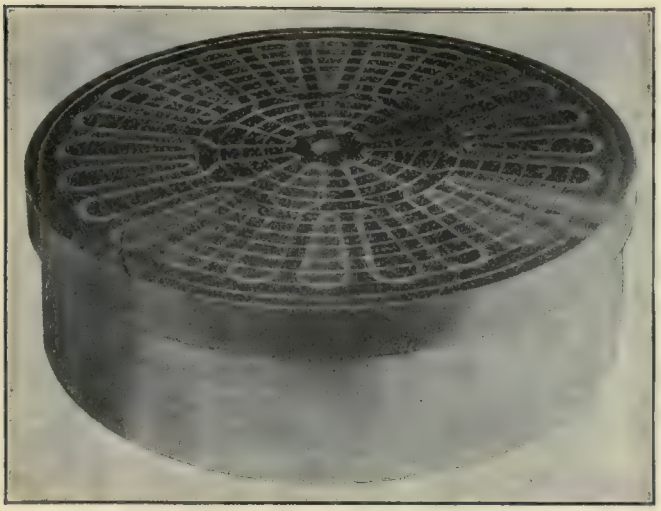


FIG. 91. A HEALD ROTARY CHUCK



FIG. 92. GRID OR TOP PLATE OF HEALD ROTARY CHUCK

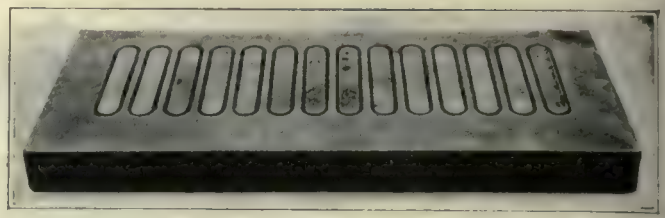


FIG. 93. GRID OF RECTANGULAR CHUCK WITH POLE-PIECES SET FOR POURING



FIG. 94. SECTION THROUGH CENTER OF TOP PLATE



FIG. 95. STAKING IN THE FILLER

The magnet cores are always even in number and a chuck can be built to any desired length without any change in design. If a wider chuck is wanted, the cores are disposed in two rows instead of one, as shown in Fig. 89, but the magnetic construction is not different.

Adjacent cores are of opposed polarity; thus each pair constitutes a complete magnet of which that section of the shell bottom lying between the cores becomes the back-bar. When two rows of cores are used, each two that are in line widthwise of the chuck are really but two parts of the same core, and are both covered by the same polepiece in the top plate. Two coils, so joined that the electric current flows the same way in each, cover these parts; thus forming what is practically one coil surrounding one core.

The Rotary Chuck

In the larger rotary chucks, a shell for which is shown in Fig. 90, the cores are disposed concentrically in two circles. The cores in the outer circle alternate in polarity, as do those in the rectangular chuck. In the inner circle the cores are so disposed that each core is radially in line with one core of the outer circle and, as explained with reference to Fig. 89, becomes in effect a part of that core.

As the relative number of cores in each circle is so calculated as to bring one core of the inner ring into radial conjunction with every third core in the outer ring, it naturally follows that these inner cores also alternate in polarity. As may be seen in Fig. 91, every third polepiece of the magnetic surface is extended toward the center of the chuck and enlarged to cover the corresponding core of the inner circle. The arrangement not only makes each adjacent pair of cores a complete magnet, but each pair of the extended cores also forms a complete magnet. Any piece of work, therefore, that is placed in any position upon the chuck shown in Fig. 91 will cover at least one pair of magnet cores and thus complete a magnetic circuit.



FIG. 96. STAKING TOOL

Turning and facing operations on the rotary chuck parts are performed on the Bullard vertical turret lathe. The rim and tops of the magnet cores are first swept off and the outside of the shell turned as far as the jaws of the holding chuck will permit; then the piece is turned over to finish this cut and to machine the back. All these operations are followed by what is called finish cuts but the actual finishing cut on many of the chucks is by grinding. No machining is done on the inside of the casting.

Machining the bodies of the rectangular chucks is regularly performed while they are held by their counterparts, the finished chuck.

Roughing cuts are made upon a double head Ingersoll milling machine. Some of the finish cuts are

made upon the same machine and some upon the planer, but the real finishing cuts upon which the product depends for accuracy and uniformity is, as in the case of the rotary chucks, by grinding.

The top plates, or grids, of the Heald chucks, one of which for the rotary chuck is shown in Fig. 92, are of grey iron. These parts are not expected to carry magnetic currents and therefore material of high magnetic permeability is not necessary. The polepieces are malleable iron castings thoroughly annealed. In this condition malleable iron approaches soft steel in its magnetic characteristics.

No machining is done on the polepieces previous to setting them in the grid, except to remove burrs or fins that may be on the castings and to hand grind one face so that they will lay flat on a surface plate. The grids, both round and rectangular, are rough milled on both sides. A rectangular top plate with the polepieces set for pouring the binding material is shown in Fig. 93. A section through the openings of the grid with the polepieces in place is shown in Fig. 94.

Pouring the Non-Magnetic Binder

The non-magnetic binding material used by the manufacturers of Heald chucks is linotype metal. The same property is required here as in the casting of type; the property of filling sharply at the instant of setting all the little crevices and irregularities that must of necessity exist in the unmachined surface of a casting from a sand mold. This roughness of surface presents



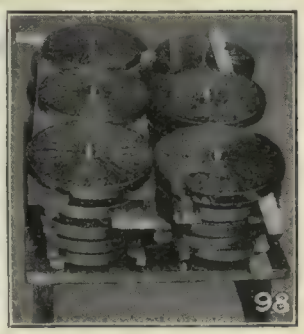


FIG. 97. RECTANGULAR TOP PLATES AFTER STAKING
FIG. 98. TOP PLATES OF ROTARY CHUCK AFTER STAKING

a decided advantage as it tends to increase the firmness with which the polepieces are held in the cast iron grid and make the chuck more able to withstand the somewhat rough usage to which it is likely to be subjected in service.

Placing a grid on a heavy surface plate in position convenient for pouring, the operator sets in the polepieces, gaging them by appearance to show an equal amount of space all around. The molten linotype metal is then poured into the openings, filling them up and piling up on the surface of the grid. After cooling, the surplus metal is melted off with a gas torch and any remaining imperfections corrected. The metal in the grooves is then staked or calked by means of a pneumatic hammer, as shown in Fig. 95, the tool used being shown in Fig. 96. A number of top plates after this operation are shown in Figs. 97 and 98.

Following the staking the top plates are milled or planed on both sides, and one side is ground to make the water tight joint between itself and the body of the chuck.

(Continued in next week's issue)

Selection and Use of Diamonds for Truing Abrasive Wheels

By C. C. Hill

A diamond when used with a little common sense is the cheapest tool with which to true a grinding wheel for either rough or finish cylindrical grinding.

The foregoing statement is based upon an exhaustive study made by the writer, running through a period of twelve years, after trying every known substitute that is supposed to replace the diamond.

After many competitive tests in which complete service records were kept, I found that the two best stones adapted to truing cylindrical grinding wheels were the African brown bort and the African grey bort. The stone should be mounted in a special metal nib which has a very low melting point and which at the same time has a high coefficient of expansion. The molten metal cast around the diamond contracts upon cooling and holds the stone firmly as if it were an integral part of the nib.

The resetting of a diamond is not a tool room proposition. It should be returned to the manufacturer who is equipped to do this correctly and more economically than the tool room with its makeshift methods.

Many diamonds are broken or cracked by the operator running the wheel into the diamond when bringing the wheel forward preparatory to truing, or by taking one or two cuts across the wheel face dry and then flushing the diamond with cold compound.

I have found the majority of grinding machine operators can soon be taught the proper method of using the diamond to produce quality work on a productive basis.

Careful Usage Prolongs Life

The following hints should help reduce the diamond costs and increase production in the grinding department:

(1) Be careful not to jam the wheel into the diamond.

(2) Use a copious supply of compound when truing the wheel, as this dissipates the heat and keeps the diamond at an even temperature.

(3) Turn the nib in the holder often, as this causes a new surface to come in contact with the wheel and prevents wearing a flat spot on the diamond.

(4) Keep a card-index system and keep records of your diamonds and the operator. Instruct the careless operator and commend the careful one.

(5) Special attention should be given the selection of a diamond for shaping the wheel for form grinding or truing radii. For these operations a diamond of oblong shape should be selected so that the stone will protrude far enough that the wheel will not grind away the mounting and loosen the diamond.

There is no economy in using small stones. The larger the stone the more economical it is. The accompanying table may be used as a guide for computing the size of diamonds for a given diameter of grinding wheel:

Wheels, Medium and Softer		Wheels, Medium and Harder	
Wheel Size, Diameter, In.	Diamond Size, Carats	Wheel Size, Diameter, In.	Diamond Size, Carats
14	1½	14	2
16	2	16	2½
18	2½	18	3
20	3	20	3½
22	3½	22	4
24	4	24	4½
26	4½	26	5

Ideas From Practical Men

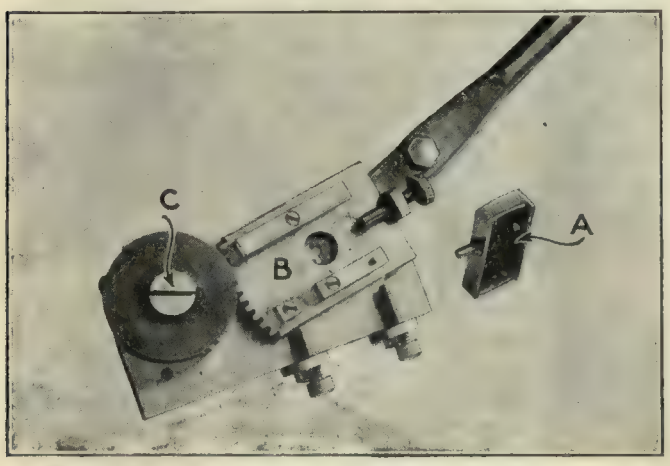
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Device for Rolling Graduation Marks

By Amos Ferber

The part shown at *A* in the illustration had to have the graduations put on the end, and to keep down manufacturing costs it was necessary to provide some means of doing the work quickly and well. The device shown here, though necessarily made with care, involves no expensive parts other than the die.

The part *B* swivels near the center upon a stud that is attached to the hand lever, and upon one end are cut teeth to mesh with the small gear that turns upon the stud *C*. This small gear may be of any diameter not too large, and such a gear can be found in almost any machine shop without going to the expense of making a special one. The disk in which the die is dove tailed must, of course, be of a size to equal the pitch diameter of the gear used and the teeth on part *B* must also be made to mesh properly with those of the gear. The disk and gear are screwed and dowelled together. The die blank is made separate from the disk in order that it may be replaced when worn out without making a new disk. It is turned up in place and the graduations (the reverse of those to appear on the work) cut on a milling machine. It is also made in two parts —the lines on one part and the figures on the other— both because it is easier to make that way and because lines and figures do not always wear out together.



DEVICE FOR MARKING GRADUATIONS

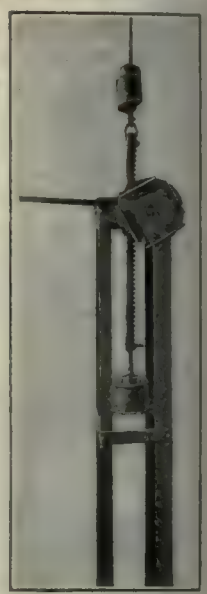
The whole device is held in the jaws of an ordinary bench vise, and to operate it, it is necessary only to drop in a piece of work, hold it down with the fingers and pull down the lever. The work fills the channel in part *B* and is gaged for impression by the knurled head screw at the end. The other two screws are in the block and limit the movement of part *B*.

The device was made by M. B. Hill, of Worcester, Mass., for the purpose of graduating the shells of a test indicator manufactured by him.

A Home-Made Arbor Press

By Milton Wright

A serviceable arbor press, every part of which except the rack and pinion and the screws that hold it together came from the stock rack or the scrap pile, is shown in the accompanying illustration. Besides the advantage of low material cost the press was built at odd times by the boys, and thus the total cost was insignificant. The construction is so obvious from the illustration that little description is necessary.



A HOME-MADE ARBOR PRESS

Two pieces of 2 x $\frac{5}{8}$-in. cold-rolled bar and two small L-section structural bars form the uprights which are tied together in two places by short pieces of the angle iron and pieces of cast iron—old parallels. The parallels on which the work is resting are movable, to accommodate different sizes of arbors.

The disk to which the lever is applied is a piece of scrap to which four pieces of angle iron have been riveted, so that a bar can be used in almost any position. The ram is counterweighted by another piece of scrap hung on a cord which runs over a sheave in the floor above. As the press was made in a shop where autogenous welding is regularly done many of the joints are reinforced by welding, but this is not necessary to render it serviceable for the ordinary run of jobs.

Aligning Shafting by a Steel Wire

By Henry J. E. Reid

Some time ago you wrote me inquiring about my comments concerning the use of steel wire for aligning shafting. I am sorry to say that conditions at the factory made it almost impossible for me to follow this up promptly. However, the following is a brief description of the method used and the calculations for the tables:

In Fig. 1 is shown the set-up used. The upright members were pieces of 4 x 4-in. spruce so as to give rigidity. The pulleys were approximately 10 in. in diameter, being mounted so that they revolved easily and were adjustable, both vertically and horizontally. The vertical adjustment is shown in Fig. 1, while the horizontal adjustment is shown in Fig. 2. The weights, as shown, were 60-lb. castings, while the wire was No. 76 gage stubbs steel wire, 0.018 in. diameter and weighing 0.0009 lb. per foot.

In Fig. 3 is shown the position of the aligning wire

with respect to the shaft, the wire being placed so that it was directly under the same side of the shaft at each end of the set-up. To obtain this condition a plumb bob was dropped over the shaft at each end and the wire adjusted so that it was directly under the plumb bob, as shown in Fig. 3. It was then easy to align the shaft in a horizontal plane by dropping a plumb bob at each successive hanger and moving the shaft over so that the plumb bob was directly over the wire.

To obtain the vertical alignment the sag of the wire had to be known. Upon checking up the tables given on page 490 of "American Machinists' Handbook" it was found that for No. 17 gage Birmingham wire the sag was too small. It was also found that the tables could be used only for shafting up to 280 ft. in length, while our longest line was 330 ft. It then became necessary to find a formula and from it calculate a table. For these calculations I used the formula for the parabola, which, as stated on page 1693 of "Pendler's Electrical Handbook," is accurate within 2 per cent for sag of 60 ft. or less in 1,000 ft. This was, therefore, far more accurate than we were able to measure it with our apparatus as the sag was so very much smaller than 60 in 1,000. That is, the percentage of error was not so much with a small sag. The true form of the curve, of course, is the catenary, but this formula is rather difficult to work out.

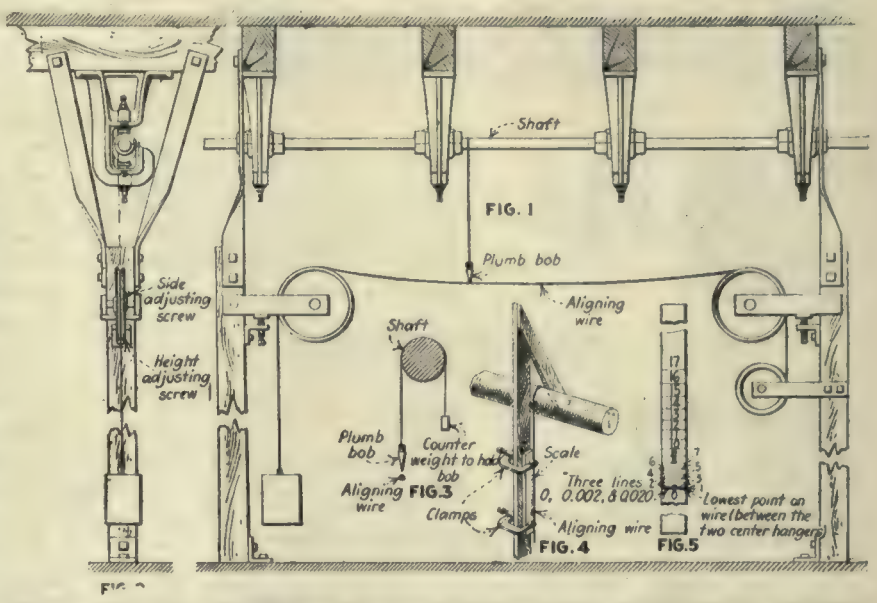


FIG. 1. THE SET-UP USED. FIG. 2. PROVISION FOR HORIZONTAL ADJUSTMENT. FIG. 3. POSITION OF ALIGNING WIRE IN RELATION TO SHAFT. FIG. 4. THE SCALE IN USE. FIG. 5. THE SCALE (ACTUAL SIZE)

The following calculations were used in determining the table:

The general formula of the parabola is: $y = kx$; y then $= \frac{0.0009 \times 12}{2 \times 60} x$, substituting the constants below; 0.0009 is weight in pounds per foot of wire tending to carry the wire down; 12 is to bring y in inches when x is in feet; 2×60 is the force applied to each end of the wire; y in inches then, equals $0.00009 \times x^2$ when x is in feet.

The sags, then, for 10-ft. intervals on the 320 and 330-ft. shafts are as follows:

320-Ft. Shaft		330-Ft. Shaft	
x	y	x	y
10	0.009	5	0.002
20	0.036	15	0.020
30	0.081	25	0.063
40	0.144	35	0.110
50	0.225	45	0.182
60	0.324	55	0.273
70	0.441	65	0.380
80	0.575	75	0.506
90	0.729	85	0.649
100	0.900	95	0.812
110	1.088	105	0.995
120	1.295	115	1.190
130	1.520	125	1.405
140	1.765	135	1.638
150	2.025	145	1.890
160	2.303	155	2.160
		165	2.450

From these tables two scales were prepared, one for shafting having an odd number of hangers, the other for shafting having an even number of hangers. In other words, for shafting on which the center was at a hanger, or $x = 0$, in the formula and where the center of the shaft, or $x = 0$, was between two hangers. Fig. 5 shows one of the scales for 330-ft. shaft. To use this scale for other than 330 ft. the number of hangers were counted, divided by two, and that number marked on the scale was used as a starting point. The scale was mounted on a hook, as shown in Fig. 4, and the aligning wire adjusted to the starting number on the scale at each end of the shaft. It was then only necessary to proceed from hanger to hanger and bring the shafting down or up until the aligning wire came opposite the corresponding mark on the scale. This aligned the shaft both horizontally and vertically. As a matter of fact, the two alignments were made at one setting at each hanger.

With a good mercury plumb bob, a carefully prepared scale, and careful work of aligning, one should be able to get the alignment within $\frac{1}{64}$ inch.

[The alignment of line shafting in machine shops is accomplished in various ways according to the experience and inclination of the men in charge. The plan of using steel wire and measuring its sag was brought out in the *American Machinist* about fifteen years ago and has been used to a considerable extent since that time.

Some of the users of this method found that the amount of sag given in the tables published at that time was too small for the wire now used for this purpose and we are indebted to Mr. Reid for his experiments along this line.—EDITOR.]

Babbitting Mold for Bearings

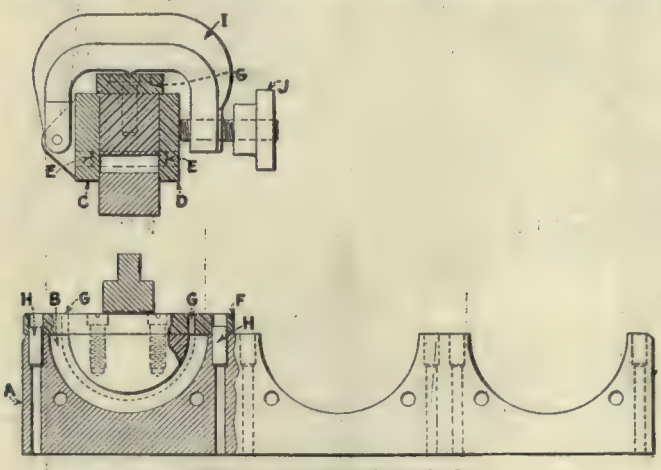
BY C. H. DENGLER

The fixture shown in the illustration is used to babbitt three engine crankshaft bearings, simultaneously, by the puddling process. It consists of a baseplate *A* into which three half-moon shaped forms *B* fit snugly. The two sides of the fixture or mold are inclosed by the loose plates *C* and *D*, which are located by the dowel pins *E*. The top plate *F* covers the mold completely and has two slots *GG* in each section into which the babbitt is poured.

The slots are so formed that the babbitt will stay with the bearing when the mold is broken. Dowel pins *HH* line up the top plate, to which the forms *B* are fastened, in relation to the bearing. Clamp *I* is hinged to the cast-iron sidepiece and holds the three loose plates together. It is quick acting, the screw *J* being offset to secure a two-way clamping effect.

The fixture is used as follows: The bearings are

clamped in place and the mold is heated in a gas furnace to about 800 deg. F.; it is then taken out and the melted babbitt is poured into each bearing, being



THE BABBITTING MOLD

puddled with a wire through the slots to force the air out and make a non-porous bearing. We obtain fine results with this method. The bearing shells are steel and in order to make the babbitt adhere to them, they are first tinned.

The bearing produced in this way has the same expansion as the steel crankshaft and works equally well, hot or cold, the running clearance being always the same. This is not true of a bronze-to-steel bearing due to the different coefficient of expansion.

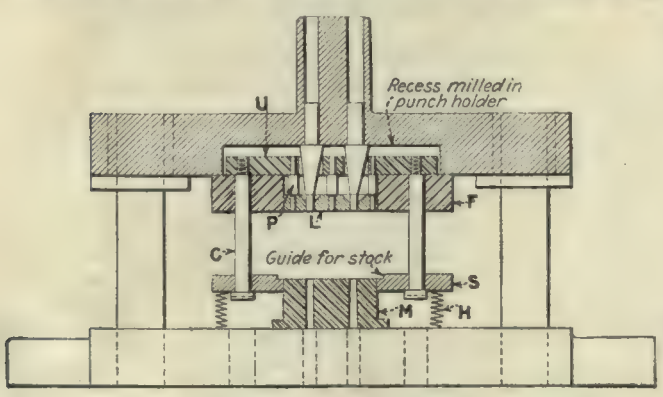
Positive Stripper for Compound Dies

By J. F. Thornton

The sketch illustrates a stripper and knockout for use in compound blanking and forming dies, which does not necessitate the use of springs or rubber.

The stripper *S* is connected to the knockout or shutter *U* by the connecting links *C*, which slip in the stripper as the punch descends. The lower member of knockout *L* is secured to the shutter by riveted shoulder pins *P*. The male member *M* is held to the shoe in the conventional manner, as is the female member *F* to the punch-holder.

The links *C* slip in the piece *F*, allowing the knockout to rise as the punch descends. Four light helical springs *H* are furnished to support the stripper until the punch finishes its descent. This is necessary only



POSITIVE STRIPPER FOR COMPOUND DIES

to steady the stock until the punching operation is completed. This method cannot be used to force the punching back into the stock.

Estimating the Horsepower Required to Drive Machinery

John S. Watts

In providing for the power to drive a machine, it is often a matter of some difficulty to determine the amount of power which will be absorbed in overcoming the internal friction of the mechanism. If the machine is of a new type, trouble is often experienced in its operation because the driving gears are made too weak, through the friction having been underestimated.

Generally speaking, the power required to operate a machine, neglecting friction, can be calculated with a very close approach to accuracy, and if a similar machine of a different size is in operation and available for test, the friction load can be determined and calculated as a percentage of the useful load. The percentage so determined, can be used with confidence in the design of the new machine. When the apparatus is new in type, the friction load should be calculated in detail from a study of the friction of each unit of the moving parts and of the component parts of the driving gearings.

It is to be regretted that very little has been published on the friction losses of the various types of machines in use, outside of the most common ones, such as electric motors, engines and hoists. By this, I mean the total loss in the machine as a whole in relation to the useful work performed.

On the other hand, numerous tests on the various kinds of power transmission appliances, such as gears, worms and screws, have been made and the results published, but the information is so scattered among technical journals, text books, etc., and usually so mixed up with a mass of other information, that it takes considerable time to arrive at the desired data.

The common method of assuming an average of, say 75 per cent for all classes of machines is apt to be very wrong and to lead to serious errors, because the actual efficiency may be as low as 15 per cent, as in the case of a screw thread, and up to 95 per cent for a pair of cut gears.

In some cases the friction load is the full load, as, for example, in the case of a revolving screen or a horizontal conveyor; and in order to be able to design a satisfactory machine, it is necessary to be able to estimate the power required to overcome the friction, with a fairly close approach to accuracy. For the above reasons I have found it useful to collect for quick reference all the available information on the efficiency of the various gearing, and no doubt the table which follows will be a help to others.

Belt pulley, with two bearings	95 per cent
Chain sprockets and bearings	97 per cent
Spur gears with two bearings (at low speed)	90 per cent
At high speed	98 per cent
Bevel gears, including thrust	90 per cent
Worm (depending upon the inclination of the threads)	50 to 95 per cent
Bearings—Co-efficient of friction, 0.15 for plain, to 0.015 for flood oiling.	
Ball or roller bearings, co-efficient of friction, 0.0015.	

The efficiencies are those obtained in average practice, under average conditions as to loads and pressures; and under reasonably good conditions they may be regarded as the maximum, and used as such in calculating the power required.

To illustrate the procedure recommended in calculating the friction power requirements of a machine, we will take as an example the power required to drive a revolving screen, 6 ft. in diameter, by 20 ft. long, at 16 revolutions per minute. The material passing

through the screen is coal, the maximum quantity to be 100 tons per hour, with an inclination of the screen of 2 in. per foot. Referring to Fig. 1, the front end of the screen is supported on rollers, and the back end on a central pintle, while it is driven by a pair of bevel gears.

Generally it is best to start the calculations at the end furthest away from the driving gear, so that we can add to this as we proceed, and so arrive at the total power required when we finish up at the driving end. We will, therefore, first calculate the power required to overcome the friction of the idler rollers at the front end. To arrive at this we must know the weight of the revolving parts of the screen, and the maximum weight of coal which will be in the screen.

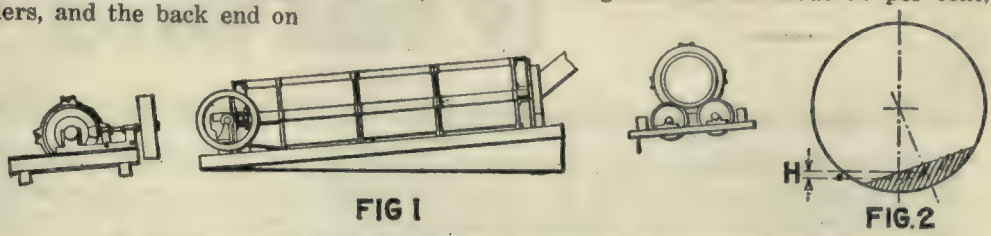


FIG. 1. REVOLVING COAL SCREEN, SHOWING BEARINGS AND DRIVE.
FIG. 2. ACTION OF COAL IN SCREEN

The inclination of the screen being 2 in. per foot, the speed of the coal through the screen will be 2 ft. per revolution, or 32 ft. per minute. The maximum delivery specified being 100 tons per hour, or 1.7 tons per minute, the amount of coal in the 20-ft. length of the screen will be $1.7 \times 20/32$, or practically one ton. Taking the weight of the revolving parts of the screen as 12,000 lb., we have a total weight of 14,000 lb. to support on the bearings. It will be near enough for our purposes to assume that the weight is equally distributed between the two ends of the screen, and this gives us 7,000 lb. as the weight on the two idler rollers, acting vertically. The resultant re-action of the rollers will be 4,800 lb. on each, this being determined by the triangle of forces.

Taking the co-efficient of the bearings to be 0.15, the friction load at the surface of the shaft will be $4,800 \times 0.15 = 720$ lb. This amount is reduced by the leverage of the roller, in the ratio of the diameter of the roller to the diameter of the shaft. Taking this as 5 to 1, we have 144 lb. pull required at the periphery of the roller, or 288 lb. for the two rollers at the periphery of the screen.

The velocity of the periphery of the screen being 300 ft. per minute, the horsepower required will be

$$\frac{144 \times 2 \times 300}{33,000} = 2.6 \text{ hp.}$$

To this must be added, the friction load due to the pintle bearing at the rear end, which will be $7,000 \times 0.15 = 1,050$ lb. This load acts on the surface of the pintle shaft, which will have a peripheral velocity at 16 revolutions per minute of about 100 ft. per minute. Converting this into horsepower we get

$$\frac{1,050 \times 100}{33,000} = 3.2 \text{ hp.}$$

The coal in the screen has to be raised to that height at which it will commence to slide back, as shown in Fig. 2, which involves supplying power to raise 1.7 tons per minute through a height H. In a 6 ft. diameter screen, the angle required to cause the coal to slide being 20 deg., the height H will be 0.17 ft., and the horsepower

$$\frac{3,400 \times 0.17}{33,000} = 0.017 \text{ hp.}$$

To this must be added the friction between the coal and the screen. Taking a co-efficient of friction of 0.2, the horsepower required will be

$$\frac{2,000 \times 0.2 \times 300}{33,000} = 3.6 \text{ hp.}$$

Adding together these amounts, we get a total of 9.42 hp. to be transmitted by the bevel gears. As the efficiency of the bevel gears will be about 90 per cent, the power required at the pinion shaft will be $\frac{9.42}{0.9} = 10.5$ hp. The belt drive having an efficiency of 95 per cent, the actual total power required at the pulley will be $\frac{10.5}{0.95} = 11$ hp.

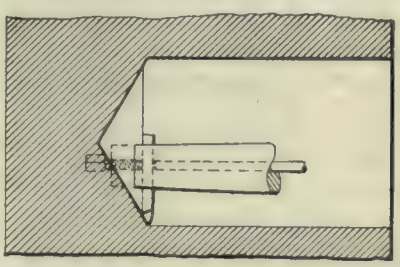
In some classes of machinery it will be necessary to calculate the additional power required to accelerate the moving parts at the starting up of the machine. Also for machinery that is to be operated in exposed places, where the lubricating oil may become frozen, it will be necessary to use much higher coefficients of friction to allow for the extra power needed.

The point I wish to emphasize is that unless some calculation is made to determine the power that will be absorbed in friction, the power allowed is very likely to be much under the actual requirements, so that if the driving gear is designed without careful estimation of the friction it will most likely prove to be too weak to stand up.

A Boring Bar of Merit—Discussion

BY JOHN HOUSSMAN

In answer to the article by E. Lytton Brooks, on page 113 of *American Machinist*, the sketch of the tool is correct—with three minor exceptions. The wall at the end is too thick. There is no need to have it thicker than $\frac{1}{8}$ in. and this is the reason for case-hardening. The wedge is a round rod, filed flat on one side and fitting in a drilled hole. The hole for the central rod is, of course, drilled from the end, which the sketch fails to show. This tool was never intended for bottoming holes, a small clearance being required, as pointed out previously. As seen from the attached sketch, the end of the tool enters the drill-point depression, requiring less room than would a setscrew, as indicated by the dotted lines. The sizes of drills used in oil-well shops range up to No. 5, so that the big drill-point depression is not an exaggeration.



BOTTOM CLEARANCE OF BORING BAR IN LARGE DRILLED HOLE

A "blind hole," as I understand it, is one that does not go through the metal, for instance, a hole for a stud. A time when a bar of this type is appreciated, is when a casting is chucked too close to the chuck-face to clear the setscrew on the ordinary boring tool.

IN THIS ISSUE

THE leading article this week takes up the design of traveling cranes from a very important standpoint, that of safe operation. The traveling crane is probably second only to the motor truck in its potential ability to figure in serious accidents. Built, as it is, to carry heavy loads of solid or sometimes molten metal through busy shops or foundries, serious harm may result from the failure of any of its numerous working parts. Mr. Nicolaas Prakken, the author, takes up in turn the girders, bridge machinery, trolley and switches and points out the ways in which they should and should not be designed. In conclusion he mentions briefly a typical transfer crane installation and brings out the prevalent bad practice of over-loading traveling cranes. We might compare the traveling crane to the motor truck in this instance also, as very few owners or operators of motor trucks have not been guilty at some time of badly overloading them. In either case this practice is bound to shorten the life of the mechanism as well as to create dangerous conditions for those who happen to be in the vicinity.

The description of a high production French ship building plant, which begins on page 766, has been given the title, "A French Hog Island." The particular plant referred to does not turn out nearly so large a product as did our own Hog Island yard during the war, but the methods employed in its operation are very significant of the advance made in France in developing large scale production. In his article Mr. Carpenter also takes up the recovery of French industry since the war and the development during the war of big armament and munition plants that must now be transformed to peace time production. Living in Paris, as he does, the author is in an excellent position to draw an accurate picture of French industrial life. We hope to have more from him in the near future.

The second of the articles on tool engineering by Dowd and Curtis starts on page 770. Having cleared the field of general considerations in their introductory article last week the authors get down this week to details of drill jig design. For the benefit of the novice in jig and fixture design the first part of the article is devoted to a study of the method of analyzing a jig problem. Then the points to be considered in designing a jig are given as follows: "Method of locating the work so that it will be machined in a uniform manner, the clearance between the jig body and the work, chip clearance, accessibility in setting up and removing the work, distortion in clamping, etc." The rest of the article is devoted to a detailed discussion of the first of these considerations—the method of locating the work

The next article is our railroad shop article for the issue. The material for it was gathered in one of the big shops near Pittsburgh by S. Ashton Hand, the efficient conductor of our editorial information bureau. Mr. Hand used to drive a locomotive a good many years ago and he has not forgotten how to appreciate the fine points in the design of our modern and near-modern motive power. The principal things discussed here are the repairing of broken cylinders and some ingenious gages used for gaging various parts that are most often handled in a locomotive repair shop.

The current installment of our "Program of Apprenticeship" series deals with the training course at the plant of the Packard Motor Car Co., of Detroit. These courses must of necessity cover a wide field, as the Packard people train not only the young apprentices but also technical graduates and a number of truck salesmen.

The second of Joseph K. Wood's articles on the design of helical springs begins on page 780. In addition to deriving various formulas, he takes up the effect of corrosion, electroplating and mechanical and heat-treatment. Something is also given on the constitution of various alloys used for spring manufacture.

Part VI of Ellsworth Sheldon's series on magnetic chucks follows on page 787. This week Sheldon takes up the chuck built by the Heald Machine Co. Unfortunately, there was too much to fit into one issue so we had to split it and will continue it next week.

In our News Section, on pages 800f and 800g, are found first-hand accounts of two important conventions of the past week; the fifth annual meeting of the American Gear Manufacturers' Association, held at Cincinnati, Ohio, and the ninth annual convention of the Chamber of Commerce of the United States, held at Atlantic City, N. J.

Coming Features

Our next issue will be devoted in large part to the several series in which we suffered something of a setback when we eliminated them entirely from our April 21 issue.

Part IX of Metal Cutting Tools will be concluded. We had expected to finish it in this issue but a wealth of other material prevented. It is concerned with the design and grinding of form milling cutters.

Dowd and Curtis go on with drill jig design, in the third installment of Tool Engineering, with particular attention to clearance for work and chips, provision for wear on locating surfaces, and the setting up and removing of work.

Another far Western railroad shop article will be contributed by Frank A. Stanley. This one discusses machining operations on locomotive connecting rods.

EDITORIALS

Reducing Losses—With Improved Machinery

THE average industrial plant in this country is facing the unpleasant necessity of running at a loss. The owners would save money—for the time being—by closing down altogether. But fortunately the managements are farsighted enough to realize the ultimate disaster likely to result from such a step.

Smooth-running organizations in office or shop do not grow overnight and discharged men are not always considerate enough to wait around in idleness until their services are needed once more. They usually go and hunt themselves another job." The cost of breaking in new men has been commented upon so many times that it is superfluous to enlarge on it.

Everyone will admit that modern machinery will reduce costs and enable a manufacturer to undersell his competitors and at the same time make a fair profit. But when no sales are being made and he wants to hold his organization together this factor shrinks in importance before the vital need of keeping losses as low as possible.

For the present, then, until business becomes brisk, it will be well to give careful thought to the ability of the best of modern tools to keep your losses down to the irreducible minimum.

Business Insurance

IN SPITE of the business depression due to the necessity of drastic readjustment there have been very few business casualties in the machine-building industry. But this should not lull us into a feeling of security which is liable to be rudely jarred when business begins to pick up in earnest.

Just at present the question of prices and costs is not so vital as it will be a little later. Buyers are still holding off and orders are not being placed, regardless of price reductions. But when buying starts, and this promises to be in the near future, the real competition will begin, and when it does, the hopes of those who are not prepared will go a-glimmering.

Now is the time to look facts squarely in the face. We must not make the mistake of thinking of business as it existed from 1915 to 1920 as normal and expect to equal it this year or next. It is far safer to take 1913 as a basis, and add whatever percentage seems right to tally with the natural increase of the country. But forget the past five years as a yardstick of normal business.

There is business ahead, lots of it. But it will go to those who are prepared to fight for it and to meet severe competition. Old methods and old ideas of management will not suffice. Those who survive must be prepared to produce at a lower cost than ever before.

This is a case where each concern must carry its own insurance against accident. Management must be prepared against casualties and the mortality may be higher than we think.

There is only one form of insurance that will count in the days to come, and this is within the reach of every live manager. Modern machine equipment is the only safe insurance policy against business mortality. The shop with out-of-date equipment cannot meet the competition that is to come and this is true regardless of the kind of business. Production costs must go down. Some of the decrease may come from lowered wages but the manager who depends on this factor alone is doomed.

Now is the time to put your plant in order, to put in the best machinery that can be had. This is the best preparation for the future, and of itself will help to start business on its upward way. Study the question of costs and the new machinery that will help you reduce them. Then begin to get ready for business when it comes, by being prepared to handle it at the lowest cost.

And in considering different phases of your business, the handling of material, both in and out of the shop, should not be overlooked. Inter-shop trucks and motor trucks have both come to be a part of the equipment of every large plant.

Insure your business against financial accident by equipping it with modern machinery. And do it now!

Several Good Signs

ONE of the encouraging signs of the times is the building of machine tools for the manufacture of huge turbines for hydro-electric work. Some of the big builders of electric machinery are increasing their shop equipment with the addition of some of the largest machines ever built in this country. Need we ask for better evidence of their faith in the future business of the country?

Makers of such supplies as hangers and couplings also report a decided increase in orders and inquiries. These supplies go into a great variety of industries and are going to various parts of the country. They all indicate a return of confidence which is the backbone of good business.

A large and well-known maker of motor trucks also reports an increase in orders and inquiries. The orders will bring the output for May up to 500 trucks, varying from 1½ to 7½ tons capacity. This makes a remarkably good output for one builder and shows an increasing interest in motor truck transportation.

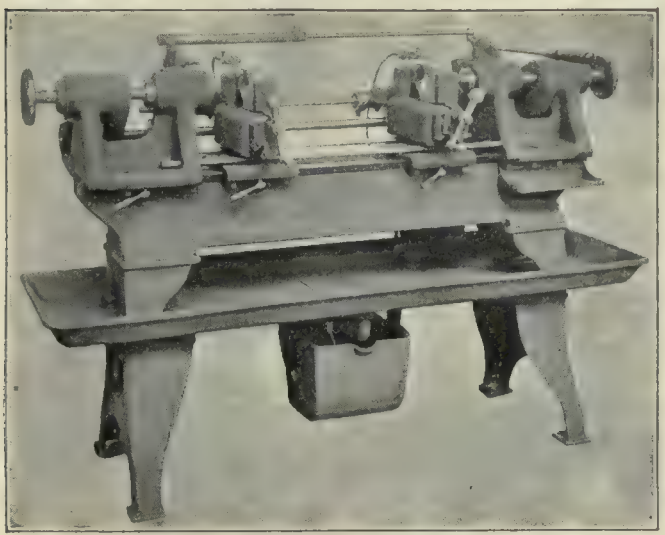
This is about half the maximum output ever secured under the stress of war and after-war demand, which means that it is much more nearly a true normal than appears on the surface. And when we consider that the motor truck is distributed among all the industries instead of being confined to any one line or to any special section of the country, the increased demand is a much more healthy sign than it may appear at first sight.

With more electric power available at lower costs, and more factories equipped with modern transmission machinery, more machine tools and other machinery are sure to be needed a little later. We have started on the up-road!

Shop Equipment News

Hendey Double-Head Centering Machine

The Hendy Machine Company, Torrington, Conn., has brought out the double-head centering machine shown in the illustration. Instead of the usual belts



HENDEY DOUBLE-HEAD CENTERING MACHINE

Specifications: Front taper bearing of spindle, 1⅞ to 2⅛ x 5½ in. Length of bed, any number of feet from 5 to 12. Capacity between spindles with 5-ft. bed, 30 in. Maximum distance vise to support, 38 in. Capacity of vise, ⅛ to 4 in. Pulley diameter, 12 in. Countershaft speed, 300 r.p.m. Spindle speed, 1,200 r.p.m. Floor space, with 5-ft. bed, 71 x 23 in. Net weight with 5-ft. bed; single spindle, 1,350 lb.; double-spindle, 1,550 lb.

driving direct to the spindles from an overhead drum a single belt drives a countershaft running on ball bearings and supported on brackets extending from the rear of the bed. From the countershaft the power is transmitted to the spindles by means of silent chains.

The front journal of each spindle is tapered and provided with ring-nuts, by means of which the wear of the bearing may be compensated for. The bearing is a bronze sleeve sliding in the cast-iron bracket of the head. Rack teeth are cut directly into the metal of the sleeve. A ball thrust bearing takes the thrust of the drills. The rear bearing of each spindle is a steel sleeve running on two ball bearings. The inner end is formed into a sprocket to receive the drive chain, the thrust of the drive thus being sustained by the ball bearings and not coming upon the spindle. The spindle is splined to the sleeve and is free to move endwise through it.

The feed lever is not connected directly to the pinion shaft, but a powerful compensating spring is interposed so that, although one spindle is brought against its stop, the lever may still be moved forward until the other spindle is against its stop. One feed lever operates both spindles, insuring that both drills reach the full depth for which they are set.

The spindles are fitted with spring collets to hold the centering tools, and a spring-operating locking pin is provided to prevent the spindles from turning while tightening the collets. This pin must be held in engagement by the pressure of the operator's finger, and is automatically withdrawn when the pressure is released.

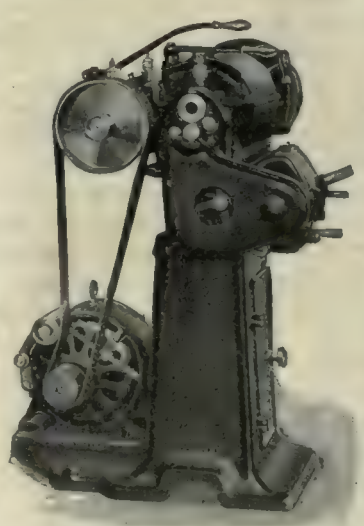
The work-holding jaws are operated in unison through the medium of bevel gears on a splined shaft; and here again the compensating feature is used, so that both sets of jaws will grip with equal force.

Once set to give the proper depth of countersink in each end of a piece of standard length, and the spindle stops adjusted, the machine will continue the countersink evenly and to standard length, even though the pieces themselves vary slightly in length. This is accomplished by leaving the gripping jaws just slack enough to allow the work to float, and bringing up the drills by moving the feed lever until the work adjusts itself endwise between the drills, and then finally tightening the jaws.

The machine is provided with a coolant tank, pump and hose to each drill, although the single-spindle machine is fitted with an oil pot only. Individual motor drive may be used, the motor being mounted on the rear of the bed, and connected to the drive shaft by a chain. A ½-hp. motor is said to be sufficient to operate the machine.

"Economy" 14-Inch Geared-Head Motor-Driven Lathe

The Rockford Lathe and Drill Co., Rockford, Ill., has developed a geared head and motor-drive for its "Economy," 14-in. swing, quick-change engine lathe. The illustration shows only the headstock end of the machine, the lathe itself being similar, except for the drive and the head, to that described on page 771, Vol. 51, of the *American Machinist*.



"ECONOMY" 14-IN. GEARED-HEAD MOTOR-DRIVEN QUICK-CHANGE LATHE

The headstock is driven by a single pulley and provides twelve spindle speeds in geometrical progression with the use of but thirteen gears. These gears are of large diameter, wide face and coarse pitch, are cut from solid steel and run in an oil bath. The spindle and all shafts are of high-carbon steel. The spindle has a special thrust bearing consisting of alternate collars of hardened steel and bronze. The bearings are of bronze and are equipped with sight feed oilers. The quick-change gear box provides thirty-two changes of threads and feeds obtained through sliding steel gears and hardened steel clutches.

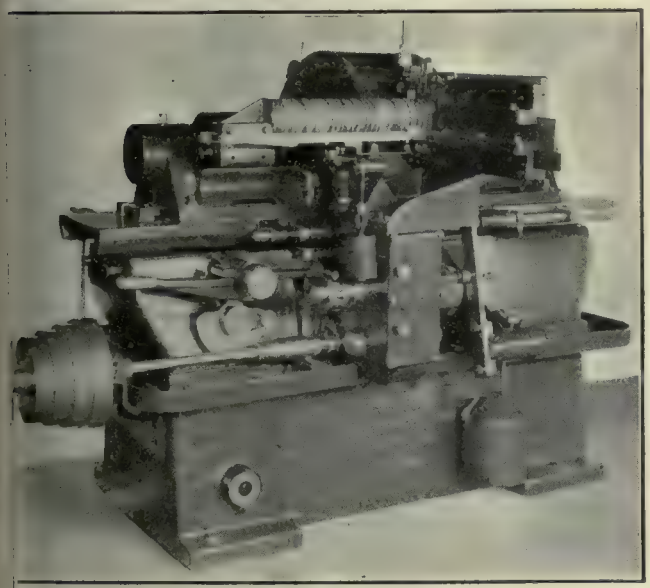
The motor may be of any standard make, preferably of 1½ or 2 hp. with a constant speed of not more than 1,200 r.p.m. It is mounted on a detachable plate secure

fastened to a base cast integral with the cabinet leg, and driving through a belt kept at the proper tension by means of an adjustable idler pulley. This construction eliminates the necessity of removing the motor should occasion arise to lift the cover of the headstock for inspection or adjustment, such as would be the procedure where the motor is mounted directly on the headstock. The motor may, however, be placed on the floor, wall or ceiling and belted direct to the headstock pulley. As the motor is of constant speed, no elaborate electrical control is necessary, starting and stopping being handled by a shifter-bar running the full length of bed, and operating a double-end friction clutch in the head stock.

Specifications: Swing; over ways, 14½ in.; over carriage, 8 in. Length of bed, 6, 8 or 10 ft. Pulley diameter, 10 in. Width of belt, 3 in. Speed of pulley, 400 r.p.m. Cuts threads, 4 to 56 per in. Feeds, 18 to 252 per in. Spindle speeds, 15 to 400 r.p.m. Size of tool, ½ x 1 in. Weight with 6-ft. bed; net, 1,725 lb.; domestic shipping, 1,973 lb.; export, 2,175 lb. Export, box, 48.6 cubic feet.

Badger Automatic Piston-Ring Grinding Machine

The Badger Tool Co., Beloit, Wis., has recently placed on the market the automatic piston-ring grinding machine shown in the illustration. The machine consists



BADGER AUTOMATIC PISTON-RING GRINDING MACHINE

of the company's No. 220 grinding machine fitted with special attachments for handling the rings. The function of the machine is to rough-grind the parallel sides of individually cast rings, bringing them down to approximate size preparatory to the finish-grinding operation on a high-precision grinding machine. It is stated that the machine can grind an average of 8,000 rings per 10-hr. day, with but little variation in size. One man can operate two machines. All warp or twist in the casting is said to be removed, producing a very flat rough-ground ring, and ring breakage being greatly reduced.

The illustration shows a front view of the machine with some hoods and guards removed to show the construction. The hopper track holds one hundred ring castings, and can be extended to receive two hundred if desired. The column of rings is backed up by a pusher attached to a cable and weight. A reciprocating arm, driven by a cam, arm and weight, forces one ring at a time between the two grinding wheels held in chucks. Guide bars are placed above and below the ring. The grinding wheels are automatically opened just as a ring enters at the front, and at the same time a finished ring leaves at the back, falling into a chute, and from thence into a box or suitable container.

The ring castings are made to pass across the entire grinding faces of the opposed cupped wheels, which are 18-in. in diameter and have 5-in. center holes. The wheels are brought together by means of a lever and weights, the pressure being varied by adding or removing weights. The positive micrometer stop screw is located at the front. A wheel-truing attachment is furnished, and the wheels can be dressed rapidly and without disturbing the setting. The machine is adjustable to take rings varying in diameter from 2¾ to 4½ in., and in thickness from ⅛ to ½ in.

The countershaft is supplied with an extra cone pulley for driving the automatic parts of the machine. Four speeds are obtainable, so that small sized rings can be put through faster than larger sizes. A throw-out clutch is placed in the drive shaft just to the left of the reduction gear case. All moving parts such as gears, cams, rollers and slides are covered with guards, for protection against dust or injury to the operator. All bearings are bushed. The machine is furnished for either dry or wet grinding. The complete equipment weighs 4,500 lb., and 10 to 15 hp. are required for capacity operation.

Winfield Type-B6 Butt-Welding Machine for Drills

The illustration shows the Type-B 6 butt-welding machine recently placed on the market by the Winfield Electric Welding Machine Co., Warren, Ohio. The machine is self-contained, and is intended for flash welding high-speed-steel drills, handling stock from ¼ to ¾ in. in diameter.

A 15-kw. transformer and a 6-step self-contained regulator are provided. The switch is located on the hand lever and is operated semi-automatically. It is set by a thumb latch on the lever and is automatically tripped after the weld is made. The lower dies are



WINFIELD TYPE-B6 BUTT-WELDING MACHINE FOR DRILLS

copper and the upper dies tool steel. Water circulates through all copper terminals, it not being necessary to break the water connections when changing the dies.

The work is clamped by hand in dies located at the front of the machine, and a single toggle hand lever is used for upsetting the weld. The left-hand slide is adjustable to regulate the amount of take-up in welds, and also for aligning the work. Adjustable stops are provided for backing up the work.

The machine is said to be so constructed that the small particles formed by the flash are prevented from getting into the movable parts and bearings. The upsetting slides are faced with hardened steel plates. All movable bearings have hardened steel bushings and pins, and are protected by felt wherever possible. The dies are set at the front of the machine so that the flash is away from the bearings and slides. The clamping levers are placed back of the dies and clear of the flash, and clamp the work by means of hardened steel cams, no toggle being used.

One set of four welding dies arranged for the work to be welded is included. The floor space is 42 x 40 in., the height of the dies, 36½ in., the height over-all 56 in., and the weight approximately 1,000 pounds.

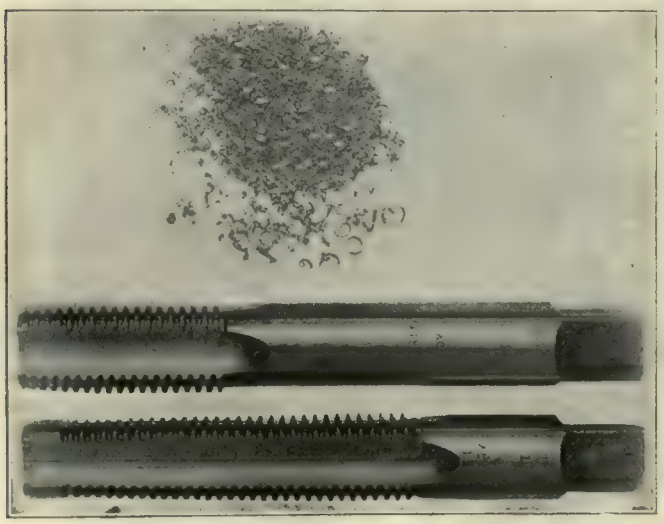
Bath "Easy-Cut" Ground Taps

The accompanying illustration shows a roughing and a finishing tap lately placed on the market by John Bath & Co., Inc., 8 Grafton St., Worcester, Mass.

The roughing tap is provided with a pilot to square it and keep it concentric with the hole. The first few teeth are similar to the U. S. form but are gradually blended into the Acme form. Alternate sides of the teeth are relieved so that only one side of each tooth does any cutting. It is said that the teeth have the cutting action of side tools, rather than that of a series of broad-nose tools, as is the common practice, and roll the chips out easily into the clearance of the flutes. There being no jamming of chips in the flutes to choke the tap, the effort exerted in hand-tapping is greatly reduced and the danger of breakage is minimized, resulting in increased life. The tap being tapered, the cutting is distributed over the full length.

The finishing tap, besides having the teeth relieved alternately on the sides, is ground after being hardened to correct any distortion of the lead and helix angle due to the hardening process. It is claimed that while the tap is essentially a production tool, it will produce work in conformity with the close fit tolerances laid down by the National Screw Thread Commission. For all ordinary sizes of taps with 60-deg. threads, the use of a roughing tap is said to be unnecessary, as the thread can be started and completed with a single tap.

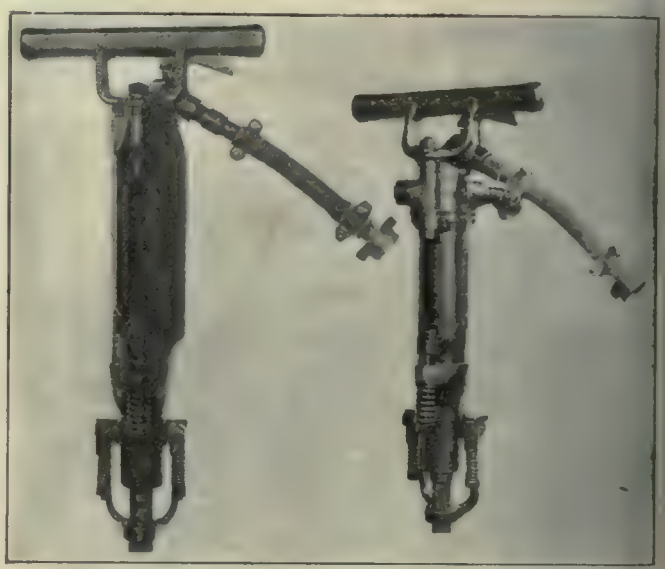
The character of the chips made by these taps is shown in the illustration. "Easy-Cut" taps are available in U. S. Standard and National coarse, and S. A. E. or National fine thread sizes; also in Lowenhertz or International Metric sizes and in special diameters and pitches.



BATH "EASY-CUT" TAPS AND THEIR CHIPS

Ingersoll-Rand Pneumatic Paving Breaker

The Ingersoll-Rand Co., 11 Broadway, New York, N. Y., has recently placed on the market a pneumatic paving breaker. The device is made in two types, BC-25 and CC-25, both shown in the illustration, the former type being intended for operation with higher air pressure than the latter. The device is intended primarily for the breaking up of asphalt and concrete pavement, but is adaptable to a wide range of work. Its outdoor application is the cutting of ditches in the repairing and repaving of streets, the tool being used chiefly in conjunction with a portable air compressing outfit. For indoor work, as for tearing up the pavements in shops, it can be connected directly to the air line of the plant.



TWO TYPES OF INGERSOLL-RAND PNEUMATIC PAVING BREAKERS

Specifications: Made in two types, BC-25 and CC-25. Air pressure recommended, over 80 lb. and under 80 lb., respectively. Size of hose, ¾ in. Size of steel, 1⅛ in. solid hexagon. Length of stroke, 4 in. Bore of cylinder, 2 in. and 1⅞ x 2¾ in., respectively. Length overall, 24 in. and 25 in. Weight, 58 lb. and 68 lb.

The tool is said to be simply and sturdily made of steel, most of the parts being drop forgings. The handle is of T-shape, being sand-blasted so as to afford a good grip for the operator. The throttle valve is controlled by means of a trigger. The joints are bolted instead of screwed, the working parts being easily accessible. The spring connections provide for the absorption of undue shock.

The steel or cutting point is secured to the device by means of holders, so that the operator may lift the steel with the drill. Steels having collared shanks are employed, a chisel-edged tool being used for cutting asphalt, and a moil point for breaking concrete. The

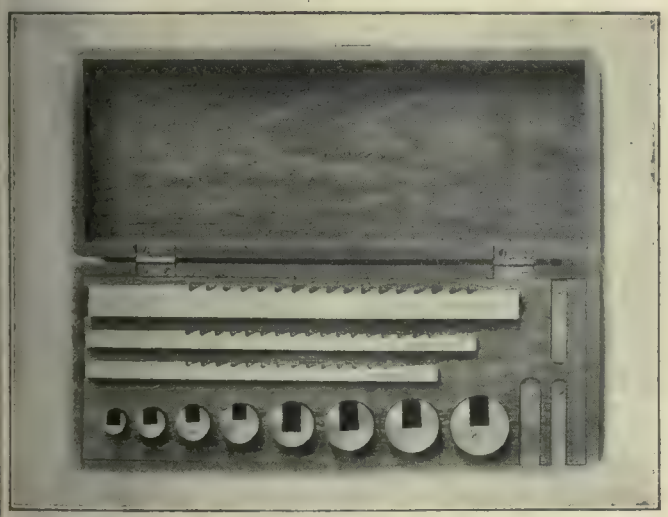
BC-25 breaker employs a "butterfly" valve, the action being very rapid, and all opening passages being large so that small particles of dirt entering the machine are blown through and out the exhaust. The CC-25 machine uses a differential piston, which controls the admission and exhaust of the air; and an exhaust release valve allows the expansion of the air to be effectively utilized.

Lapointe "Handy" Keyway Set

The J. N. Lapointe Co., New London, Conn., has brought out a broaching set intended to meet the requirements of manufacturers and jobbers who have a comparatively small number of parts in which keyways are to be cut, the quantity not being sufficient to warrant the installation of a broaching machine.

The set consists of three broaches to cut $\frac{1}{8}$ in., $\frac{3}{16}$ in. and $\frac{1}{4}$ in. keyways, respectively, and eight bushings for holes ranging in size from $\frac{5}{8}$ up to $1\frac{1}{2}$ in. in diameter. Liners are furnished for each broach, so that two passes of the broach may be used to cut a keyway. The set is packed in a wooden box with a separate receptacle for each part, so that the set may be kept together and protected against injury. With this set twelve combinations may be obtained, and keyways cut in holes up to 2 in. long.

The broaches may be used in connection with any standard arbor press, the operation being very simple and not requiring skilled or experienced help. The keyways are cut to exact size, and the location of the keyway with respect to the axis of the hole is determined by the guide bushing. The broaches are of standard high-carbon steel, and they, as well as the bushings, are ground all over after hardening.



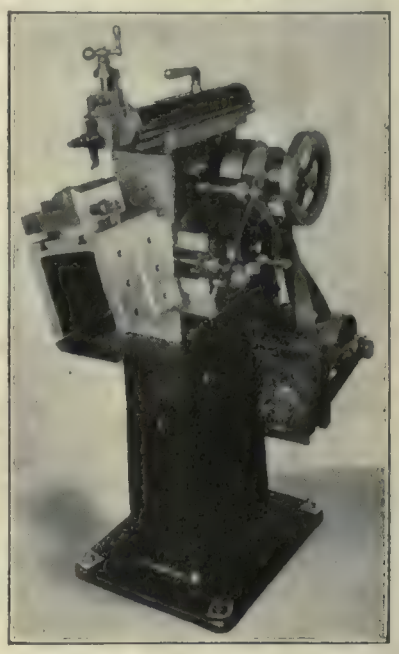
LAPOINTE "HANDY" KEYWAY SET

Rhodes Improved Shaper

The Rhodes Manufacturing Co., Hartford, Conn., has recently added a swivelling knee to the shaper which it manufactures. Also, the shaper has been made an entirely independent unit by casting suitable brackets on the column and mounting a $\frac{1}{2}$-hp. motor, with a starting box so located as to be within easy reach of the operating position. The machine is shown in the accompanying illustration.

To provide against injury to the machine or motor by accidental stalling, a countershaft is interposed between the motor and the machine, being driven by a Whitney chain from the motor and, in turn, driving the shaper through a $1\frac{3}{4}$-in. leather belt running on three-step cones.

The knee is arranged to swivel to any desired angle, the face of the saddle being graduated to facilitate setting. A closely fitting pin determines the zero setting, so that after using the knee at any angular setting it may be brought back to the vertical position with ease and certainty. The knee is finished accurately square in all directions by means of a jig, used in connection with a a grinding machine, that provides for the finish grinding of all surfaces at one setting. All parallel surfaces on the tool-slide are also finish-ground in a jig, rendering it easy for the shaper operator to apply a square or bevel protractor in any convenient position without danger of error arising from inaccurate surfaces.



RHODES IMPROVED MOTOR-DRIVEN SHAPER

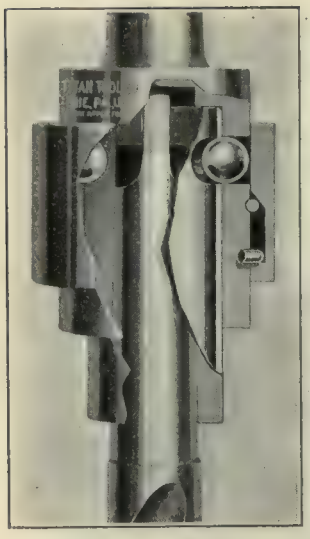
The specifications for the machine are the same as heretofore, except that a slightly larger floor space is required for the motor-driven machine. The stroke is $7\frac{1}{2}$ in.; the traverse movement of the saddle, 9 in.; the vertical movement of the table, 7 in.; the vertical movement of the tool-slide, $2\frac{1}{2}$ in., and the maximum distance from the upper surface of the table to the ram is $8\frac{7}{8}$ in. The vise jaws are $1\frac{5}{8}$ x 5 in., and the vise opens $3\frac{1}{4}$ in. The weight of the machine complete is approximately 650 lb., and the floor space required is about 22 x 32 in., including the overhang of the motor.

Titan Quick-Change Drill Chucks

The Titan Tool Company, 26th and Holland Sts., Erie, Pa., has recently placed on the market a line of quick-change drill chucks. The chuck is of the collet type, collets being provided to fit either straight-shank or taper-shank drills, the latter being illustrated. The speed of operation of the chuck is emphasized, it being necessary to use only one hand to insert or to remove the collet carrying the drill.

On taper-shank drills the tang projects through the upper end of the collet, so that the drill may be removed by merely striking the end of the tang, no drift or key being necessary. A special type of collet is provided for use with broken-tang drills, so as to give a positive drive. The chucks for taper-shank drills are made in sizes from No. 0 to 5, so that any taper shank drill, counterbore, or reamer may be held.

It is said that a positive drive is provided for straight-shank drills, so that scored shanks are eliminated and the drill will continue to cut throughout a job to the



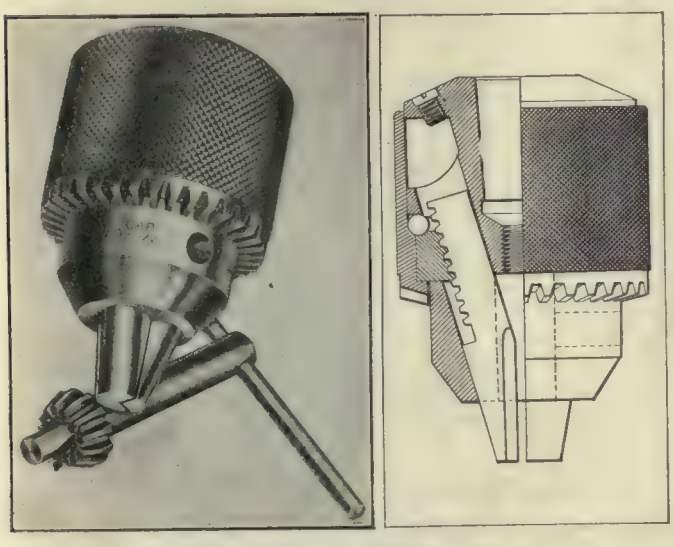
TITAN QUICK-CHANGE DRILL CHUCK

depth to which it has been set. Because of the fact that the collet is securely held, very close positioning of the hole may be done, which makes the tool particularly adaptable for multiple drilling. The chuck for straight-shank drills is built in two sizes, the No. 000 chuck having a capacity up to $\frac{5}{16}$ in. drills, and the No. 00 up to $\frac{1}{2}$ in. drills. Bushings can be furnished for all decimal, letter and fractional sizes of drills within the capacity.

The chucks are made of high-carbon steel and are hardened and ground. Because of the fact that the ring is spring actuated, it is possible to operate the chuck in any position, so that either horizontal or inverted drilling may be performed. Speed and safety of operation, as well as accuracy of work, are claimed for the chucks.

Jacobs "Super" Drill Chuck

The Jacobs Manufacturing Co., Hartford, Conn., now has ready for the market an improved form of its drill chuck, called the "Super-Chuck." In principle it



JACOBS "SUPER" DRILL CHUCK

is the same as the former design of Jacobs chuck, but it has been redesigned to reduce the weight relative to the capacity and at the same time to increase the strength of the parts and give it a stronger grip. The accompanying illustration shows the appearance of the chuck, as well as the interior construction.

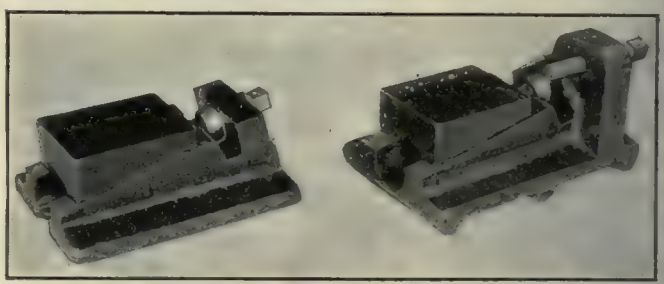
A ball thrust-bearing has been added to reduce the friction of the sleeve in tightening the chuck on a drill, and the lead of the thread on the nut and jaws has been increased, giving the effect of a coarser pitch and increased cross-section of the thread, which results in increased resisting power at this point.

The body of the chuck is made of a spcial grade of steel, deeply casehardened, and the taper hole for the shank is ground after hardening. A large size hole through the body permits the passage of long rods through the chuck. This central hole is threaded and fitted with a correspondingly threaded plug which, while giving the effect of a solid body, may quickly be removed with a screwdriver whenever the chuck is to be used for holding long pieces. An oil hole in the back of the chuck body, closed with a threaded plug that is removed by means of a screwdriver, provides means for lubricating the working parts.

The chuck is made in seven sizes, giving a range from 0 to 1 in. capacity. The smallest size, which holds drills from 0 to $\frac{1}{4}$ in., weighs 7 oz., and the largest size, with a range of from $\frac{3}{8}$ in. to 1 in., weighs 6 lb. 8 ounces.

Cincinnati Leveling Wedges

The leveling wedges shown in the illustration have been placed on the market by the Cincinnati Engineering Tool Co., 4659 Spring Grove Ave., Cincinnati, O.



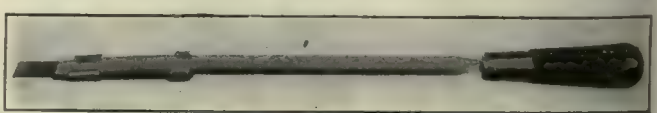
LEVELING WEDGES MADE BY THE CINCINNATI ENGINEERING TOOL CO.

The wedges were originally developed for use on planers, but it is said that, due to the accuracy of the adjustment and the conveninece, they can be used successfully on all types of machines where a high degree of accuracy is to be maintained. The angular surfaces are machined, as well as the top of the wedge. The fine pitch screw allows accurate adjustment.

The blocks are furnished in two types, the plane leveling wedge and the abutment block, which has an additional screw to press against the foot of the machine and to serve for moving it. The blocks ordinarily set in concrete. For merely leveling, the plain wedge is used. The abutment block also serves for positioning and holding the planer or other machine.

Anderson Hand Scraper

The Anderson Bros. Manufacturing Co., Rockford, Ill., makes the hand scraper shown in the illustration. The tool is an outgrowth from the development of pneumatic scrapers, since it was found necessary to obtain a special alloy capable of withstanding severe scraping service. This steel is used for the blade of the hand scraper; and it is said that it takes a greater hardness, holds a keener edge, does not scratch, and that one blade lasts as long as four ordinary hand-forged



ANDERSON HAND SCRAPING TOOL

scrapers. The body is of a tough steel. The clip is notched on the inside to receive and hold the blade in place, and a lug prevents the blade from slipping back. This lug causes the clip to automatically tighten when pressure is applied.

The British and the American Inch Identical*

A Reply to a Statement to the Contrary Appearing in the European Edition of the American Machinist

By C. C. Stutz
Secretary, American Institute of Weights and Measures.

OUR attention has been called to some statements contained in an article written by Sir J. E. Petavel, director of the National Physical Laboratory, which recently appeared in your publication (issue of Jan. 8, 1921).

These statements are evidently based on widely circulated reports which nevertheless are contrary to the facts. Our object in sending you this communication is to correct these erroneous impressions and thereby avoid wrong deductions.

Sir J. E. Petavel says:

"In America the International Meter is accepted as the primary standard of length, and the yard is defined by the relation,

39.370000 inches = 1 meter,

an American inch of course being taken as 1/36 part of this American yard. Now the relation between the Imperial Standard Yard and the International Meter is

39.370113 inches = 1 meter.

Consequently the U. S. A. inch is longer than the inch as used in Great Britain by nearly three millionths of an inch."

This is a great mistake. There is no difference between the inch in the United States and the inch in Great Britain.

The United States law of 1866 defines the meter in terms of the inch, the equivalent being 39.37 inches. This inch is the inch of England, which is thus made the fundamental standard of the United States by statute law, as it has been under common law since the first English settlement in 1607.

To make this perfectly clear we shall quote the law on this subject. To begin with we find the following passage in the Constitution of the United States: "The Congress shall have power to . . . fix the standard of weights and measures."

We quote the metric law as enacted by Congress, July 28, 1866. (From Federal Statutes annotated, Vol. 9, page 1401.)

(11) Standard Weights and Measures.

Sec. 3569 (Use of the Metric System authorized) It shall be lawful throughout the United States of America to employ the weights and measures of the metric system; and no contract or dealing, or pleading in any court, shall be deemed invalid or liable to objection because the weights and measures expressed or referred to therein are weights and measures of the metric system.

Sec. 3570 (Authorized tables of Weights and Measures). The tables in the schedule hereto annexed shall be recognized in the construction of contracts, and in all legal proceedings, as establishing in terms of the weights and measures now in use in the United States, the equivalents of the weights and measures expressed therein in terms of the metric system; and the tables may be lawfully used for computing, determining and expressing in customary weights and measures the weights and measures of the metric system.

MEASURES OF LENGTH.

Metric denominations and values		Equivalents in denominations in use
Meter		39.37 inches
Decimeter	1/10 meter	3.937 "
Centimeter	1/100 meter	0.3937 "
etc.	etc.	etc. etc.

To bring out more fully the intent of section 3570 we requote it in the following abbreviated form:

"The tables . . . shall be recognized . . . as establishing *in terms* of the weights and measures *now in use* in the *United States*, the equivalents of the weights and measures expressed therein in terms of the metric system."

Here the "inch" is taken as fundamental, the meter being expressed in terms of the inch. Clearly the object of this law was not to change our basic units but to make the use of the metric system permissible. This is further evidenced by the title of section 3569 which reads: "Use of the metric system authorizes," and by the expression in the section reading: "It shall be lawful throughout the United States of America to employ the weights and measures of the metric system."

The difference to which Sir J. E. Petavel refers is merely a difference between the bars used for comparison and results from the Mendenhall order of 1893 by which the reciprocal 3600/3937 of the legal expression 3937/3600 was ordered for comparing United States standards (39.37 inches = 1 meter and 36 inches = 1 yard).

This order is quoted on page 60 of Circular No. 47 of the Bureau of Standards, Washington, D. C., under the title: "The Metric Standards Adopted as Fundamental" and reads as far as given there:

"The office of weights and measures . . . will in the future regard the international prototype meter and kilogram as fundamental standards, in accordance with the act of July 28, 1866." (Order approved by the Secretary of the Treasury, April 5, 1893.)

This quotation undoubtedly gives the impression that the meter is for use in America the fundamental unit, unless one gives heed to the qualifying expression "in *accordance with* the act of July 28, 1866."

This act of 1866 should have been quoted in full. The title given: "The metric standards adopted as fundamental" is therefore incorrect. This order had no effect whatever on the legal length of the inch and yard. As pointed out previously, standards of weights and measures *cannot* be changed in the slightest degree except by act of Congress.

The United States Bureau of Weights and Measures in 1893, and its successor the Bureau of Standards, could legally conform to the Mendenhall order only so far as the bar used for comparison was concerned. Under the law and the Constitution the sworn duty of the officials of those bureaus was and is to treat any variation between standards resulting from the use of the reciprocal (3600/3937) of the legal meter as merely a variation between bars used for comparison, just as

*From a letter to the Editor, European Edition, *American Machinist*.

the differences between the London yard and Sevres meter or between the different meter bars are taken into account in verifying standards.

Two facts should always be kept in mind.

(1) The U. S. yard and the British yard are exactly the same and can be made to vary only by act of the British Parliament or by act of the Congress of the United States.

(2) The Act of 1866 defining the meter as 39.37 inches established a U. S. standard meter differing slightly from the standard meter accepted by the International Bureau of Weights and Measures at Sevres.

The equivalent of the International meter is taken:

as 39.370113 inches in England,

as 39.370000 inches in United States of America,

therefore the United States meter is shorter than the International meter and the difference is expressed by

39370000/39370113 = .99999712902
287098

1.00000000000

approximately 287/100,000 millimeter,
or nearly 3/1,000 millimeter.

This question cannot be settled by asserting that the differences are negligible for ordinary measurements, and are material only when the highest degrees of precision is involved. The principle is as important in one case as in the other. If it is conceded that an order of a bureau official at Washington can change the U. S. standard of the yard to any extent whatever, no matter how slight, then the same official can change this standard or any other standard by a larger amount.

Attempts have been made in the United States through the introduction of bills in Congress to secure the acceptance of the meter as the sole U. S. standard by the authority of Congress, but these attempts so far have failed. An incident of this kind is recalled by the Ashbrook-Stratton-Thurman bill of 1907 framed by the U. S. Department of Commerce. This bill was not passed, nor have similar bills found favor.

The temperature at which a bar is declared standard is naturally of great importance. The International prototype meter is standard at 0 deg. C. (32 deg. F.). The Imperial standard yard is standard at 62 deg. F. There is no legal statement in the United States as to the temperature at which a yard is standard. Such a legal statement is unnecessary until a legal physical standard of length is adopted. This we do not have. No physical standard of length has ever been established by Congress. Thus, legally, we must go back to the British Imperial yard at 62 deg. F.

It is for this reason that bars on measuring machines are generally made standard at 62 deg. F. in the United States. According to the Act of 1866 both the "inch" bars and metric bars must be made standard at the same temperature in order that the relation between English and metric measurements made on such machines under similar conditions be in accordance with that act.

Present Conditions in the German Machine Industry

Business Very Poor But Marked by Strong Feeling of Confidence—Labor Leans Away from Radicalism—The Formation of the Big Trusts—Wage Rates

BY OUR BERLIN CORRESPONDENT

THE present situation is somewhat like that in which German industry found itself after the end of the war, when the shops were almost out of business. The mental attitude toward the present calamity is, however, entirely different. Strong confidence, entirely missing then, has returned. There are several important facts upon which this confidence rests. The labor situation is greatly consolidated, a fact which the Communistic riots in March emphasized, showing as they did that the majority of the workmen have become tired of radicalism. The spirit of antagonism between employers and employed has abated. Representatives of employers' associations and trade unions are now constantly meeting on boards formed in almost all branches of industry, to co-operate in all matters pertaining to their development.

Another helpful sign is the improving financial position of the country. The total revenue since April 1, 1920, was 100,597,000,000 marks, while the ordinary expenditure was 83,582,000,000 marks. Post and telegraph administrations have again reached a paying basis, and are now contributing to the treasury. Were it not for the large deficit of the state railroads, Germany's finances would be well balanced.

That the trade of the country is on the way to recovery is demonstrated by the increased traffic of the German harbors in 1920. In Hamburg, the traffic amounted to nearly 7,000,000 registered tons, as against 1,919,000 registered tons in 1919. This tonnage is far below the volume of pre-war times, which in 1913 was 23,500,000 tons, but the fact that of the 7,000,000 tons in 1920 nearly half were shipped during the last three months of that year shows that the traffic was rising in a steep line. It is interesting to note how the various nations share in it. Only 24 per cent of it traveled under the German flag, as against 60 per cent in pre-war times, 23 per cent under the American flag, the British and Dutch flags following with 21 and 10 per cent respectively.

That confidence has not been shaken by the present calamities is demonstrated by the fact that inquiries for new equipment have not diminished, but even increased. A firm of Berlin machine-tool dealers has received more inquiries during the first three months of 1921 than all through the preceding year. As an indication of future business, which is only waiting for the end of the present unsettledness, this is decidedly encouraging.

Some interesting data concerning the German machine building industry were given out by the president of the Association of German Machine Building Works at the inauguration of the co-operative board formed between this association and the machinists' union.

According to these data, the total annual production of

The German machine building industry averaged during the years immediately preceding the war 3,500,000,000 marks, of which 20 per cent, or 700,000,000 marks was exported. As regards the volume of exports, the German machine building industry had outrivalled all other branches of industry. As the home consumption is now greatly reduced, the percentage of exports is at present far higher, probably not much below one half of the total output. It was further said that the total export of the machine building industry of the past year exceeded that of 1913, taken ad valorem, but was less in quantity. The number of persons employed in the machine building industry, which during the war was largely increased, has now fallen back to the pre-war level, and is at present 700,000. This figure represents only the workmen of the machine building industry proper, and not those of other branches, which, like the motor-car and electrical industry, belong to it by virtue of their kindred production. One fifth of this number consists of clerical employees. Of 100 workers, 52 are skilled workmen, 27 shop-trained, and only 21 unskilled.

It is a peculiar fact that the machine building industry has so far kept outside of the "vertical trusts," combinations of works of different stages of the manufacturing process, from the coal and iron mines up to the finished product. Only in two such combinations is the machine building industry represented, one of them being the Krupp combine. Without machine building works, vertical trusts would be incomplete and therefore it is to be expected that the movement will include wider circles still. There are, however, indications that the huge combines already existant will in this respect proceed by methods of absorption rather than combination. The extent the movement has taken up to now, is demonstrated by the fact that a considerable number of works, comprising aproximately half of the whole German iron and steel production, have been welded together in fourteen huge groups. How diversified the interests are, is demonstrated by the Krupp combine. This combine comes nearest to the original conception, and its structure is, therefore, of interest. The following diagram shows how the Krupp combine is organized:

COAL MINES

Four Krupp mines—One brown coal mine—Three affiliated mines.

IRON MINES

Krupp's iron mines in the Rhineland.

PIG IRON WORKS

Stahlwerk Annen — Friedrich-Alfred Hütte — Two smaller works.

SEMI-FINISHED STEEL PRODUCTS

Stahlwerk Annen—Capito & Klein—Westph. Eisen- & Drahtindustrie (plate and sheet).

HEAVY MACHINE BUILDING

Maschinenfabrik Buckau — Krupp Works, Essen — Krupp & Fahr (agricultural machines)—Gruson Works —Shipyard Germaniawerft.

LIGHT MACHINERY

Ernemann Works—Krupp Works, Essen.

SALES ORGANIZATIONS

Six limited liability companies.

German industry is always complaining that if wages are not reduced, it will not be able to compete with foreign rivals. The following figures, taken from the official statistics, show that in two towns, Berlin and Chemnitz, the present wages per hour expressed in marks and in cents, at 1.6 cents per mark, are:

	Machinist	Machine Operator	Unskilled Worker
Berlin	M5.40 = 8.6c.	M5.20 = 8.4c.	M4.90 = 7.8c.
Chemnitz ..	M5.25 = 8.4c.	M4.85 = 7.7c.	M4.50 = 7.2c.

More than half of the workmen are now paid by piece work, at rates which make their hourly earnings about 10 per cent higher. But even taking this into account, the best paid workmen receive not more than 10 cents per hour. This cheap labor gives the Germans an enormous advantage over other countries. The German industrials are well aware of it, and this is no doubt the main source of their confidence. As long as they are able to keep the wages at the present level, or thereabouts, and the mark will remain where it is now, their position seems safe.

Another Thoroughly Vicious Compulsory Metric Bill Is Introduced

Congressman BRITTEN introduced the following bill in the House of Representatives, April 11, 1921, which was referred to the Committee on Coinage, Weights, and Measures. It follows the lines of the one lost in the last session but is more drastic and consequently more dangerous. Section 3 in particular merits attention.

A BILL

To fix the metric system of weights and measures as the single standard of weights and measures for certain uses.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That from and after ten years from the date of passage and approval of this Act the weights and measures of the meter-liter-gram or metric system shall be the single standard of weights and measures in the United States of America for the uses set out herein.

SEC. 2. That the national prototypes of the fundamental standards of the metric system shall be the copies of the standards known as meter numbered twenty-seven and kilogram numbered twenty, allotted to the United States by the General Conference of Weights and Measures held at Paris in 1889. These are now deposited in the vault of the Bureau of Standards of the Department of Commerce and are those which are now used and employed in deriving the values of all weights and measures used in the United States. These national representations are hereby adopted as the primary standards of weights and measures for the United States of America, and from these all other weights and measures shall be derived and ascertained.

SEC. 3. That from and after ten years from the date of passage and approval of this Act no person shall do or offer or attempt to do any of the following acts, by weights or measures, in or according to any other system than the metric system of weights and measures, namely:

(1) Sell any goods, wares, or merchandise except for export, as provided in section 12;

(2) Charge or collect for the carriage or transportation of any goods, wares, or merchandise.

SEC. 4. That from and after ten years from the date of passage of this Act no person shall use or attempt to use in any of the transactions detailed in section 3 any weight or measure or weighing or measuring device designed, constructed, marked, or graduated in any other system than the metric system of weights and measures.

SEC. 5. That not later than ten years from the date of passage and approval of this Act all postage, excises, duties, and customs charged or collected by weights or measures by the Government of the United States shall be charged or

collected in or according to the metric system of weights and measures.

SEC. 6. That rules and regulations for the enforcement of this Act not inconsistent with the provisions hereof shall be made and promulgated by the Secretary of Commerce. The Secretary of Commerce shall also take such steps as he may deem expedient for giving publicity to the dates of transition specified herein and for facilitating the transition to the meter-liter-gram or metric system.

SEC. 7. That all Acts or parts of Acts inconsistent herewith are hereby repealed but only in so far as they are inconsistent herewith; otherwise they shall remain and continue in full force and effect. Whenever in any Act, or rules and regulations, or tariff or schedule made, ratified, approved, or revised by the Government of the United States of America weights or measures of the system now in customary use are employed or referred to, and to comply with the provisions of this Act weights and measures of the metric system should be employed, then such references in such Act, rules and regulations, tariff, or schedule, shall be understood and construed as references to equivalent weights or measures of the metric system ascertained in accordance with the required degree of accuracy.

SEC. 8. That nothing in this Act shall be understood or construed as applying to—

(1) Any contract made before the date at which the provisions of this Act take effect;

(2) The construction or use in the arts, manufacture, or industry of any specification or drawing, tool, machine, or other appliance or implement designed, constructed, or graduated in any desired system;

(3) Goods, wares, or merchandise intended for sale in any foreign country, but if such goods, wares or merchandise are eventually sold for domestic use or consumption then this clause shall not exempt them from the application of any of the provisions of this Act.

SEC. 9. That nothing herein shall be understood or construed as prohibiting the enactment or enforcement of weights and measures, laws or ordinances by the various States or cities, and the various States or cities shall have the same powers as though this Act were not in force and effect: *Provided, however*, That no standard weights or measures shall be established for the uses set out herein which conflict in any way with the standards established herein, and such standards which may already have been established shall be null and void for the uses set out herein.

SEC. 10. That the word "person" as used in this Act shall be construed to import both the plural and singular, as the case demands, and shall include corporations, companies, societies, and associations. When construing and enforcing the provisions of this Act the act, omission, or failure of any officer, agent, or other person acting for or employed by any corporation, company, society, or association, within the scope of his employment or office, shall in every case be also deemed to be the act, omission, or failure of such corporation, company, society, or association as well as that of the person.

Conditions Affecting the Selling of Machine Tools in Holland

BY JAN SPAANDER
President Spaander's Optische Slijperij, Lens Works, Amersfoort, Holland

To describe the present economic position of the engineering and allied industries in Holland would be an interesting study, but I will content myself with merely stating how things are going as the practical man sees them.

Things in the engineering line in Holland at present lay flat; and it is not so much a question of those who want to buy and can't and those who can buy and wont, as that so much has been bought during the last few years and so little sold to actual consumers. No further credit can be extended to dealers, the banks having overstepped the margin long ago, not being aware in time that the heavy exchange of machinery about one year ago was more a matter of speculation than the actual selling to manufacturers who were going to put the machinery to production work.

A little over a year ago I had to stock my machine shop and, having been used to American machine tools I visited some dealers to buy what was wanted. They had plenty of American machinery in their showrooms but they did not show the slightest interest in nor talk about these goods. When I insisted upon being told prices and all the ins and outs, one dealer candidly requested me not to waste our valuable time, as he was of the opinion that I was not crazy. After having seen the other machines "made in Germany" I was convinced that buying American machinery at that time would have been madness. The German machinery was not half as good, but the price was a fraction of that of the American tools.

Even buying in a regular store would have been foolish, as Germans came pouring in by rail and even with little sailing vessels loaded to the brim with machine tools. One day I bought out of a little cellar in Amsterdam three heavy drilling machines at not quite $10 reckoning the dollar at 3.30 florins, about the exchange at that time. One Saturday night I was at a small watering place and there came a small German craft, a motor sloop, an old thing of the German navy. The captain, a man who had been shot through the foot, had no Dutch money and he sold me a first rate milling machine with a dividing head and a complete set of cutters for not over $300. No wonder that Holland was saturated with machinery in no time.

The German government, of course, was well aware that this kind of business was not to the advantage of Germany, and to put a stop to the "Verschleuderung" of materials, they did not give any further consent for export unless the home price was multiplied by some number, depending partly on the exchange of the country to which the material was being exported. This action put a considerable check on the importing of German machinery into Holland, but at the same time gave the Dutch machinery speculators a better opportunity to dispose of their wares.

The conditions still excluded sales of the more common American machines, but opened up a limited field for special heavy machinery, especially grinders, which will still have a chance, as the American stones are far superior, and the German stones that I have come across are of very poor quality. Heavy machines, of course, could not be articles for speculation, and were bought only when actually needed. As the American machines were far superior throughout and as the users of heavy machinery make quality a first consideration, the previous dumping of German goods has no effect in this case.

Besides the two reasons stated, that is "no credit" and "saturation," there is a third reason why manufacturers do not buy, and that is the entire lack of order. Germany sells its raw materials at a tremendous price; and, in competition with German manufacturers, it happens time and again that the Dutchman cannot get the raw materials for which the German also delivers the finished articles. This pertains especially to large machined castings and structural work.

Besides the German competition, the English also are on the warpath and try to force sales by giving machinery in commission, because they know that sales often depend upon time of delivery.



NEWS SECTION

Huston Appointed to Assist Hoover in Department of Commerce

A business man has been selected to erve as chief lieutenant to Herbert Hoover in his capacity of Secretary of Commerce. The new Assistant Secretary of Commerce is Claudius H. Huston, of Chattanooga, Tenn. He is the resident of the Tennessee River Navigation Co., the largest operator of teamboats on the Tennessee River. He s also the president of three wholesale obbing houses and is connected actively n the management of a number of manufacturing enterprises. Mr. Huston is a director of three Chattanooga anks and is president of the Lee Highway Association, vice-president of he Dixie Highway Association and resident of the Tennessee River Improvement Association. Mr. Hoover tated some weeks ago that the problem n finding an assistant secretary was o induce a $25,000 man to work for 5,000.

Mr. Huston was born on a farm in Harrison County, Indiana, on Feb. 15, 876. He became a country schoolteacher at the age of sixteen and later worked his way through Valparaiso University. In 1898 he went to Chattanooga to teach in the Chattanooga Normal University. He gave up his business college work to undertake the management of the Chattanooga Machinery Co., which was later merged with another company and at present s one of the largest plants in the United States making heavy sawmill machinery.

Laminated Shim Co. Moves Into New Factory

The Laminated Shim Co. of New York, manufacturers of "Laminum" or shims, will remove on May 1 to its ew plant and offices situated at 14th t. and Governor Place, Long Island City, N. Y. The popularity of laminted shims and the ever-growing demand for them is responsible for the evelopment of the new plant. The uilding is of concrete and brick construction and the manufacturing space vailable totals 25,000 sq.ft.

Annual Meeting of the Machinery Club of Chicago

The annual meeting and election of the Machinery Club of Chicago was held on Tuesday, April 19, 1921. The day opened with a spirited election held to select the members of the Board of Governors, three chosen to guide the club's affairs for one year and four for a term of two years. After this election had been decided, the hold-over members met with the new members of the board and elected the officers who will guide the destinies of the club for the coming year.



J. R. PORTER
President of the Chicago Machinery Club

The complete roll of officers was announced at a dinner meeting and smoker held that same evening. They are: President, J. R. Porter, Marshall & Huschart Machinery Co.; vice-president, H. E. Procunier, Moon Manufacturing Co.; secretary, A. G. Bush, Minnesota Mining & Supply Co.; assistant secretary, H. F. Kempe, H. F. Kempe Co.; treasurer, H. J. Reeve, Dale Machinery Co. The new Board of Governors consists of the following members: J. R. Porter, H. E. Procunier, C. M. Robertson, D. R. Hoffman, E. L. Essley, S. A. Ellicson, H. F. Kempe, A. G. Bush, H. J. Reeve, C. J. Becker, A. W. Smith and H. S. White.

Following the dinner in the evening, at which in the neighborhood of two hundred members were in attendance, an entertaining program was provided in connection with the smoker.

Inspection Trips Arranged for A. S. M. E. Spring Meeting in Chicago

Industrial Chicago has many things to show the mechanical engineer and is going to throw them open to inspection by those attending the spring meeting of the American Society of Mechanical Engineers, May 23 to 26. The places which offer to entertain guests are scheduled for each day so that the individual may suit his taste by selection daily, without feeling that he is missing something he would like to see. The arrangement is as follows:

Tuesday — International Harvester Co., McCormick & Deering plants; Sears, Roebuck & Co., wall paper manufacture, handling and shipping merchandise; Mandel Brothers, package handling, coal and ash handling, connection to sub-street tunnel system; Western Electric Co., manufacturer of telephone apparatus and cable for the Bell telephone system.

Wednesday—Illinois Steel Co., South Works, South Chicago, plate mill, rail mill, bessemer converters and general steel mill equipment; Commonwealth Edison Co., modern turbine central station at Fisk St.; Pennsylvania Lines terminal, freight handling plant, in connection with which there may be visited the neighboring warehouse of Marshall Field & Co. and the U. S. Terminal Building; Crane Co., manufacture of valves and fittings in cast iron, malleable iron, steel and brass, the fabrication of pipe work.

Thursday—Chicago Mill and Lumber Co., 120-in. paper machine, manufacture of fiber, corrugated board and paper boxes; Clemetsen Co., manufacture of veneers and "Clemco" office desks; Pullman Co., Pullman cars, passenger coaches and freight cars; Underwriters Laboratories, testing of appliances and devices for fire prevention; Yellow Cab Manufacturing Co., where the ubiquitous cabs come from.

Friday—Milwaukee Railway and Light Co.'s Lakeside plant, trip by rail to Milwaukee; Joseph T. Ryerson & Sons Co., warehouse of about a million square feet devoted to machinery and steel products. Other features will be announced later.

Chamber of Commerce of the United States Holds Ninth Annual Meeting

Following the meetings of the National Council and of the National Association of Commercial Organization Secretaries and the American Trade Association Executives the reception of the president of the Chamber of Commerce of the United States was held on Young's Pier at Atlantic City, April 26, as the formal opening of the Ninth Annual Meeting of the Chamber.

The first general session of the chamber took place at eleven o'clock on Wednesday morning and was featured by the address of the president, Joseph H. Defrees. In his remarks Mr. Defrees stressed the importance of taxation, tariff and transportation problems and sounded the keynote of the meeting, "More Business Methods in Government—Less Government Management of Business." He also replied to the charge that the chamber was identified with a conspiracy to crush organized labor, with a complete and emphatic denial. He said that the organization stood for the open shop with equal opportunity for all. Among the other big problems touched upon were those of housing, immigration and education.

The second general session was held Wednesday evening. The speakers were Willis H. Booth, vice-president of the Guaranty Trust Co. of New York, who took up the problems of foreign financing; and A. C. Bedford, vice-president of the International Chamber of Commerce, who spoke on the service which the International Chamber can render to American business.

Thursday was devoted to the tariff and taxation problems. At the general session in the morning, R. G. Rhett, chairman of the committee on taxation of the National Chamber discussed the findings of the committee on the taxation problem and the Hon. Marion DeVries, Judge of the United States Customs Court of Appeals made a strong plea for basing customs levies on American valuations of imports. He was followed by Harvey J. Sconce of Illinois who stated the case of the farmers in able fashion.

The only speaker at the Thursday evening session was the Hon. Herbert Hoover, Secretary of Commerce. It was estimated that nearly all of the 3,000 delegates registered, with their wives, managed to get into the big hall to hear what Mr. Hoover had to say. He reviewed briefly the various economic problems facing us and gave it as his opinion that we had turned the corner and were on the uproad to better times. The work which his department might do to which he seemed to attach the greatest importance was that of collecting and distributing business information for the benefit of all. He suggested that to the slogan of the convention be added the clause "More and better government service to business."

On Friday morning the delegates listened to Dr. Barnes, on education, Edward N. Hurley, on public utilities, and Col. Galbraith on the purposes of the American Legion—of which he is commander.

As usual, the afternoons were devoted to meetings of the various sections, Wednesday being set aside for purely sectional matters while Thursday was spent in further consideration of taxation and tariff matters.

The meeting ended after the Friday afternoon session at which the reports of the committees on nominations and resolutions were submitted and the resolutions discussed and acted upon.

Gear Manufacturers Meet at Cincinnati

Cincinnati lived up to almost all of the advance notices given the members of American Gear Manufacturers' Association, which held its fifth annual meeting at the Hotel Sinton. The only thing in which it may be said to have fallen down was the weather, and it is probable that any of the other cities that might have been selected would have done the same. There is no serious criticism as it was.

The A. G. M. A. has grown in four years from an organization with nine member companies to one of nearly one hundred. The Cincinnati meeting was attended by some 200 members and guests.

The first day's sessions were given over to addresses by President Sinram, J. B. Doan, president of the American Tool Works, G. M. Bartlett of the Diamond Chain and Manufacturing Co., and to reports of various committees. These reports, with those presented on the second day, indicated that the association is progressing in the matters of uniform cost accounting and standardization.

The third and fourth day's sessions were devoted to business, the reports of committees and the presentation of papers.

Ladies Entertained

The entertainment program aided greatly in making the meeting a success. The ladies were taken on a shopping tour through the large department stores, were given a theater party, and were entertained by a symphony concert.

A feature of the entertainment which was partaken of by members, guests and ladies was a four-hour automobile tour of Cincinnati and environs, conducted by the Cincinnati members and their friends of the machine-tool industry. The trip included inspection of the plants of the Cincinnati Gear Co., the Tool Steel Gear and Pinion Co. and the Acme Machine Tool Co. Refreshments were served. The typewritten itinerary stated, "left Spring Grove Ave., passing the Acme Machine Tool Co." Those present will remember with pleasure that this detail was altered to include a brief stop-over and inspection of the Acme plant.

Among other enjoyable features of the program were the Thursday luncheon, at which Senator Cartwright, of California, gave a talk that was received with earnest applause.

The informal banquet held on Friday evening was a successful climax to the first three days of a noteworthy meeting. F. W. Sinram was toastmaster. Edward S. Jordan, president of the Jordan Motor Car Co., spoke on "Looking Ahead" and Charles Woodward, vice-president in charge of personnel of the Hydraulic Steel Co., spoke on "The Human Element in Business."

Many of the members attended the meeting of the Cincinnati section, American Society of Mechanical Engineers on Thursday evening. W. F Zimmerman, chief engineer of the Gould & Eberhardt Co., gave an illustrated lecture on "Methods of Gear Manufacture," and Major Earle Buckingham of the Niles-Bement-Pond Co. spoke on "Maag Gears and Methods of Cutting."

Germans Cornering Latin-American Steel Markets

The report that the Krupps had been granted a concession by the government of Chile for the erection of an immense steel and munitions plant in that country caused no surprise here for the reports from all parts of South and Central America to the Department of Commerce indicate that the German commercial activity interrupted by the war is making itself felt with renewed vigor in Argentina, Brazil, Mexico and Chile and other countries to the south of the United States.

Competition for U. S.

It was alleged recently that Americans were financing Germans in Mexico and the State Department was asked to investigate, but no official report has been made on it. Uruguay is also reported to have extended credit to Germany and Austria, and all signs point to the prospects of the United States having to work hard to keep the lead in business with the countries of South and Central America.

The proposed tariff legislation is being regarded with some apprehension by Latin-American countries, and the assertion is made by representatives here that if the United States makes it difficult for them to sell goods in this country it will be found that they will buy in other markets.

Specifically, one of the reasons for an emergency tariff has been the alleged necessity of preventing the dumping of agricultural products from South American countries in the United States, where there is already a surplus.

The effects of German agents in the field in the Latin-American countries are already evident, and it is alleged that they have been able to deliver goods before the trade representatives of other countries have learned that there was a demand for them.

Personnel Research Federation Is Organized

Under the auspices of the National Research Council and Engineering Foundation, in the building of the National Research Council, Washington, D. C., the organization of the Personnel Research Federation was effected March 15. The federation includes in its membership scientific, engineering, labor, management and educational bodies. It has been organized to bring about interchange of research information among the numerous organizations who are engaged in personnel research. It is reported to the new federation by the Bureau of Labor Statistics, of the Department of Labor, that there are 250 such organizations in the United States. The Personnel Research Federation will collect research information, will encourage research through individuals and organizations and will co-ordinate research activities.

Temporary officers were elected as follows: Chairman, Robert M. Yerkes, representing National Research Council; vice-chairman, Samuel Gompers, representing American Federation of Labor; treasurer, Robert W. Bruere, representing Bureau of Industrial Research; secretary, Alfred D. Flinn, representing Engineering Foundation; acting director, Beardsley Ruml, assistant to the president of Carnegie Corporation, of New York.

Aims and Purposes

The aims of the new organization are: Increased efficiency of all the personnel elements of industry—employer, manager, worker — and improved safety, health, comfort and relationships.

The immediate purposes of the Personnel Research Federation will be: To learn what organizations are studying one or more problems relating to personnel and the scope of their endeavors; to determine whether these endeavors can be harmonized, duplication minimized, neglected phases of the problems considered, and advanced work undertaken.

Commercial Possibilities of South Africa

The National Foreign Trade Council has just issued a survey, in booklet form, of the recent industrial expansion and the mineral and agricultural resources of South Africa—a market presenting great possibilities for American enterprise.

The subject matter covers an extensive field including manufacturing, mining, agriculture and stock raising. Statistics on all these enterprises are furnished. The text also includes a general survey of the population, climate, railways, principal cities and harbors.

Copies of this book may be obtained free of charge by request to O. K. Davis, secretary of the Foreign Trade Council, Hanover Square, New York City.

Weir Co. To Open Factory in Canada

G. and J. Weir (Canada), Ltd., has started the construction of a foundry at Ville la Salle, near Montreal, for the manufacture of Weir pumps of all kinds, including oil fuel pressure pumps, oil fuel transfer pumps, service pumps (for ballast fresh water and general purposes), turbine-driven circulating pumps, dual air pumps, direct-acting feed pumps, turbo-feed pumps, and others.

For the past twenty-five years these pumps have been imported from Glasgow, but since 1918 the Canadian subsidiary of the Weir company has been importing the parts and assembling them in the works here. With the operation of the new foundry, which is expected to be ready for work in a couple of months, the whole process of manufacture can be carried out in the vicinity of Montreal, and will offer special facilities for ships arriving in the port of Montreal and requiring repairs or replacement of any parts.

It is purposed to start with a staff of some fifty molders and the necessary complement of other workers, but with the steady development of the port of Montreal it is anticipated that the industry will rapidly grow.

Machinists' Union To Act for Mexican Government

The International Association of Machinists, with headquarters at Washington, D. C., under an agreement just reached, has been named commercial representative of the Mexican government in this country. The machinists' organization will act as official advisers to the Mexican government which binds itself to use products of "union shops" only in the establishment under its control.

An active movement now exists in Mexico, according to E. C. Davidson, secretary of the machinists, for farm machinery and standard railroad equipment. The policy of his office under the agreement, he said, would be to assist manufacturers of those products who have been fair to organized labor in placing orders with the Southern republic.

It is understood the Mount Vernon Savings Bank, which is controlled by the machinists' association, will be utilized for necessary financing operations.

Negotiations looking to a similar appointment of the association by the present Russian government is understood to have been started. Officials of the machinists are now awaiting a reply to definite proposals they have made to Russia.

Who Knows?

One of our readers wants to know who is the manufacturer of the Herman internal combustion engine. It was intended for use in a one-man motor car. We will be glad to have any information bearing on the subject.

Plenty of Tungsten Ore in the United States

Tungsten stocks in the United States probably are sufficient for the requirements of this country for more than three years. This is the opinion of Frank L. Hess, tungsten specialist for the U. S. Geological Survey. His further comments on the tungsten situation are as follows:

"Tungsten is used mostly for making high-speed tools for cutting steel, so that the demand for tungsten ore rises and falls with the steel business. In 1920, the steel business was very dull and the demand for tungsten was correspondingly small. At the same time in spite of the small demand, the imports were rather large for peace times and consisted in part of very cheap ore from the shallow placers of China. A good deal of the ore was apparently shipped to this country with the expectation that a heavy duty would be imposed on it and that ores in stock would accordingly increase in value. The imports for 1920 were 1,740 long tons of ore, probably averaging 65 per cent or more tungsten trioxide (WO_3) and were equivalent to about 2,111 short tons of concentrates carrying 60 per cent WO_3. Of this quantity, 1,386 short tons of 60 per cent concentrates were shipped from China and most of the remainder came from South America. Besides the ore, 1,997,719 lb. of tungsten and ferrotungsten were imported, equivalent to about 2,250 short tons of 60 per cent ore, and probably more than enough to supply the needs of the high-speed tool industry, so that there was added to the already large stocks in this country somewhat more than the quantity of tungsten represented by the imports of ore."

Educational Bulletin Issued by Chamber of Commerce

What a "Cost System" Should Do for You, is the subject of a small pamphlet issued by the Fabricated Production Department, Chamber of Commerce of the United States.

The Fabricated Production Department is one of several service departments recently created by the Chamber to assist its members in dealing with their common problems, especially those concerned in manufacturing and production. These include such subjects as Cost Accounting, Standards, Elimination of Excess Variety, Production Statistics and Industrial Relations, etc.

Its service will be largely educational and co-operative in character, bringing together those interested in a given problem, and by the interchange of experiences and expert advice, reaching a satisfactory conclusion whenever possible.

These pamphlets will be issued only after careful preparation and will deal with the broad fundamentals of business efficiency and service. It is hoped to keep them practical and to the point.

Business Conditions as the Big Banks of the Country See Them

Guaranty Trust Co. Sees Renewal of Business Activity—Readjustment Slow—Wages Must Come Down

The abrogation by the Railroad Labor Board of the national agreements defining working conditions in the railroad shop crafts is a well-directed contribution toward the solution of the urgent railway problem. The abrogation of the agreements is to become effective July 1. The rules and regulations embodied in these agreements have in many ways unduly restricted the freedom of railway managers and unjustifiably increased operating costs. It is desirable that the handicaps imposed upon the railways by those war-time regulations which no longer serve a useful purpose should be removed as speedily as possible. The ruling of the board in favor of separate negotiation between individual roads and their employees was accompanied by the announcement of a set of sixteen principles for the guidance of both parties in their negotiations. These principles would fully safeguard labor's rights in the matter of working conditions.

Events seem to be leading to other significant developments in the field of transportation. Both wages and rates may be revised without much delay. More than one-half of the 200 railroads reporting to the Interstate Commerce Commission failed to earn expenses and taxes in each of the first two months of the current year. The necessity for an improvement in the relation of earnings to expenses is urgent. A further general raising of rates is not to be considered. The remedy for the existing situation must, it seems, include reductions in wages, which constitute the major part of railway operating costs.

Recession in Steel Prices

Reductions in prices of a number of iron and steel products, ranging from $1.50 to $15 a ton, announced by the United States Steel Corporation on April 12 and later, represent a step of fundamental importance in the continued industrial readjustment.

The full effect of these price reductions on the volume of new contracts may not be known for several weeks. It is significant, however, that the International Harvester Co., basing its action upon the revision of steel prices, promptly announced a reduction of 10 per cent in the prices of its products in which steel is the principal element, the new prices to become effective in 1921.

Shortly before the steel corporation's reduction of prices was announced, however, a number of prices were raised by independent producers. The degree of uniformity in prices throughout the trade which has been introduced by these revisions may measurably stimulate confidence that the present prices will continue for a comparatively long period, with a consequent increase in orders for steel and iron products.

Instance of Renewed Activity

Increased production has followed the reviving demand for passenger automobiles and trucks. As was to be expected, the renewed demand was first for the lower priced cars, but now the producers of higher priced automobiles also are finding a growing demand. One large producer reported early in the month that the sales of its cars for delivery in April, May, and June were far in excess of sales for the corresponding period of any other year in the company's history. While this favorable showing is not typical of the industry as a whole, other makers are expanding their production and sales. In Detroit and other automobile manufacturing centers plants that were closed have recently resumed operation and others have increased the scale of activities, some to full time operation. This has materially reduced the number of the unemployed in those centers.

Readjustment Is Incomplete

The low points already reached by many prices and the increased activity noted have resulted in a growing confidence in business circles that some branches of industry are now experiencing what will prove to be the beginnings of a general revival of activity.

Until the liquidation of inventories and the readjustment of individual prices has gone further, an adequate basis will be lacking for the confidence which must serve as the foundation for normally active business.

Revision of Wages Essential

Any broad readjustment of commodity prices necessarily involves changes in wages also. There are exceptions, of course, and the readjustments in directly related prices and wages are frequently not simultaneous. As in the case of prices, some wage scales now remain at the high levels reached in the boom period. On the whole, however, wages are being reduced, without extreme opposition on the part of the workers.

The necessity for initial or further wage reductions is quite generally recognized. Wage agreements, some covering protracted periods, have obstructed the inevitable readjustment in transportation, mining, building, and other industries.

The lagging of living costs in relation to wholesale prices in the downward revision adds to the continuing complexity of the industrial problem as a whole. Many retail prices have only very tardily reflected the decline in wholesale prices. Nevertheless, it is apparent that significant wage reductions must precede the establishment of any durable equilibrium in industry.

Export Trade With Mexico Doubled in Last Year—Imports Also Increased

The purchasing power of our neighbor across the Rio Grande—Mexico—shows a less decline than that which characterizes conditions in many other countries. Our exports to Mexico in the fiscal year which ends with next month will, according to a statement by the National City Bank of New York, be double those of the preceding year and six times as much as the annual average prior to 1918 when her great oil outturn multiplied her purchasing power.

Exports from the United States to Mexico, continues the bank's statement, which averaged less than $50,000,000 a year prior to 1917, suddenly jumped to $107,000,000 in the fiscal year 1918, $120,000,000 in 1919, $144,000,000 in 1920, and will be approximately $280,000,000 in 1921. This tremendous growth in our exports to Mexico in the very recent period and especially the current fiscal year has continued down to the latest moment despite the fact that exports to nearly all other parts of the world show for the latest month a decline. Total exports to Mexico in the single month of February, 1921, the latest for which figures are now available, were $25,000,000 against $12,000,000 in the same month of the preceding year and for the eight months ending with February, 1921, $187,000,000 against $87,000,000 in the same months of the preceding year. In fact, no other country shows this unique record of having more than doubled its takings of United States merchandise in the fiscal year 1921.

On the import side, the growth has also been large, though not so great proportionately as in exports. The total imports from Mexico, which prior to the oil period averaged about $75,000,000 a year, were $112,000,000 in the fiscal year 1917, $158,000,000 in 1919, and will be about $170,000,000 in 1921. Thus our imports from Mexico in 1921 will be approximately three and one-half times as much as the "pre-oil" average, and the exports to that country nearly six times as much as that of the period in which the plentiful petroleum supplies gave to Mexico a high purchasing power.

Washington Notes

By Paul Wooton
Washington Correspondent

Authority has been given for the transfer of the ordnance school of application from the proving grounds at Aberdeen, Md., to Massachusetts Institute of Technology. All of the equipment at the Aberdeen school is being moved to Boston. The school now is to be known as the Ordnance School of Technology and will handle all of the theoretical side of the training of ordnance officers. The shop practice portion of the training will be continued at Watertown Arsenal. The commanding officer at Watertown will have immediate jurisdiction over the school, although the instruction will be entirely in the hands of the teaching staff of the institute. The course is to include advanced mechanics, applied mechanics and the various types of engineering which must be applied to ordnance. After the course at Boston Tech the officers must take the prescribed courses in shop practice at Watertown. This constitutes the basic course. Specialized training then is begun.

The technical staff of the Bureau of Ordnance of the War Department has extended an invitation to the American Society of Automotive Engineers to visit the Aberdeen proving ground. It is hoped that the association will make this side trip one of the features of its meeting this fall.

One of the lessons which the war taught to ordnance officials was the inadvisability of making public the results of ordnance development. An effort now is being made to adopt a policy which will prevent the results of ordnance research and development from falling into the hands of other governments and at the same time will enable technical men of unquestioned loyalty, who may be relied upon to keep a secret, to be acquainted with the intimate details of the work. This gives the government the advantage of their thought in connection with these problems and it is believed that any undesirable circulation of the information can be prevented. Special lectures are to be given before the new ordnance section of the American Society of Mechanical Engineers. Membership in this section is to be limited to Americans who are known to be persons of discretion.

One of these executive sessions of the ordnance section of the American Society of Mechanical Engineers is to be held at the Rock Island Arsenal May 27.

Commerce Appropriations

Machine tools and other heavy machinery are items slated by the Secretary of Commerce to receive governmental assistance in the matter of extension of their export market. Secretary Hoover has asked Congress for supplemental appropriation aggregating $618,728.34. Of that amount Mr. Hoover would like to allot $250,000 to assist in promoting the foreign trade of certain of the export industries. His plan is to establish twelve divisions in the Bureau of Foreign and Domestic Commerce, each of which would work on the problems confronting one of the following industries: machine tools and heavy machinery, cotton and cotton goods, paper and paper products, leather and leather products, chemicals (including dyestuffs), electrical goods of all kinds, automobiles and accessories, lumber and lumber products, metal products, vegetable oils, hardware, jewelry and silverware. Two experts are to be assigned to each of the industries, whose time is to be divided between field investigations and service in the bureau at Washington.

Investigations looking to the prevention of industrial waste also are proposed by Mr. Hoover. He has asked Congress to allow an expenditure of $100,000 for that purpose. The work will be assigned to the Bureau of Standards.

Secretary Hoover also asks for $100,000 to be used in the standardization of equipment. His plan is to have the Bureau of Standards co-operate with manufacturers, engineers, government departments and the public in establishing manufacturing and commercial standards of machinery and equipment with the idea of eliminating unnecessary forms, varieties and qualities. He declares that such standardization is of the utmost importance in the economical construction and use of equipment and one of the dominant factors involved in both foreign and domestic trade. Mr. Hoover believes that his department is in a position to co-operate with both manufacturers and users in bringing about voluntary acquiescense in the use of standards of this kind.

N. Y. Postal Problems

Reorganization of the motor truck fleet of the New York post office so as to employ electric, rather than gas driven trucks, will result in a large saving of money and will increase the efficiency of the service, according to a report made by W. B. Richards & Co. to the Federal commission which is examining the mail facilities in New York City. Richards & Co. was employed by the commission to report on the engineering phases of New York's postal problems.

A. S. M. E. at Atlanta

A joint meeting of the Birmingham, New Orleans, Mobile and Atlanta sections of the American Society of Mechanical Engineers was held Friday, April 22, at Mobile, Ala. Several members of the council of the national society attended the meeting. While in Mobile a tour of inspection was made by the visiting engineers through the plant of the Chickasaw Shipbuilding and Car Co.

Business Items

Gowdey & Craig, Inc., of Providence, R. I., has recently been incorporated with a capital stock of $35,000 to deal in machinery, etc. The incorporators of the new concern are: William B. Gowdey, Edward G. Lyon and H. G. Commangton, all of Providence.

Announcement has been made that the Traction Foundry and Machine Co., organized under the laws of Michigan, will establish a branch at Laporte, Ind. H. E. Strawbridge, of Laporte, has been named as the company's representative in that state. A total of $50,000 of the capital stock of the company is represented in Indiana.

The Barrett Coal Co., 349 West McCarty St., Indianapolis, Ind., will begin work shortly on the construction of a machine shop to be used for general repairs for the equipment of the company. The building will be one story high, 32 ft. wide and 90 ft. long, of brick construction.

The Wheel Trueing Tool Co., importers of industrial diamonds and manufacturers of diamond pointed tools, with general offices in Detroit, Michigan, announces the removal of its Western office from the Wells Bldg., Milwaukee, Wis., to its branch office in the Great Northern Bldg., 20 Jackson Boulevard West, Chicago, Ill.

William J. Sansom will be in charge at the new location. The change was effected April 1. Mr. Sansom has been representing the Western office for the past three years. He was formerly night superintendent of the Milwaukee works of the International Harvester Corporation and prior to that instructor of mechanical practice, University of Wisconsin.

The Austin Machinery Corporation, Chicago, Ill., announces that it will rebuild its plant which was recently destroyed by fire. This company also has factories at Muskegon and Toledo, and only recently consolidated with the Fairmont Mining Machinery Co., at Fairmont, W. Va.

Papers have been filed in Massachusetts for the incorporation of the Clark-Hunter Co., of Boston, Mass., with a capital stock of $100,000. The company will manufacture machinery and motors. The incorporators are Thomas Clark, Foster J. Finley, Robert H. Hunter and A. P. Norris.

The Atlas Crucible Steel Co., with plants at Dunkirk, N. Y., and Welland, Ont., Canada, has moved its general offices, including general sales, to the Hanna Building, Cleveland, Ohio. The company has recently extended its facilities and in addition to its regular production of tool steels, is now in a position to furnish alloy steels. Frank P. Case will be in charge of the sale of tool steels and Harry J. West will be in charge of the sale of alloy steels.

D. J. Renaud & Son, Inc., has been recently organized to do general manufacturing business including foundry and machine shop work.

Hickok & Hickok opened offices on April 1 in the Title Insurance Building, Los Angeles, Cal., with Horace J. Barton as manager, representing the United Steel Alloy Co. of Canton, Ohio; the Pollak Steel Co.; Keystone Bronze Co.; Edgewater Steel Co.; Stroh Steel Hardening Process Co.; Fort Pitt Spring and Manufacturing Co. and the Iron City Products Co.

The Monon shops at Lafayette, Ind., re-opened April 1, taking back between 500 and 600 men who were laid off recently. The same force of workmen, representing all crafts, will be employed as before the close of the shops, officials announced.

The Black & Decker Manufacturing Co. will be represented in the South by Thomas W. Peters who has for the past fifteen years been located in Columbus, Ga., where he has occupied responsible positions in executive and engineering capacities. The southern territory includes all the southern states east of the Mississippi River and, in the very near future, a regular branch office will be established at Atlanta, Ga., where Mr. Peters will make his headquarters.

The Bellis Heat Treating Co. of New Haven, Conn., has recently been organized to deal in machinery, tools, heat-treating fixtures, etc. The company is incorporated with a capital stock of $75,000, and the incorporators are Howard E. Adt, Harrison Hewitt and W. B. Gumbert, all of New Haven, Conn.

The Waldron Tool and Metal Manufacturing Co. of Norwich, Conn., has recently added $150,000 to its capital stock.

The International Metal Specialty and Manufacturing Co. of Bridgeport, Conn., has recently been organized and incorporated with a capital stock of $25,000. The company will manufacture metal specialties, etc. The organizers are Martin Karmark, of Milford, Conn., and G. O. Gabriel, of Bridgeport, Conn.

The Frey Variable Speed Gear Co., of Holyoke, Mass., has been recently organized and incorporated with a capital stock of $50,000, to manufacture gears, etc. The officers of the new company are Ellsworth Frey, president; Charles H. House, treasurer. Mr. Frey and Mr. House, together with F. H. Gross, form the board of directors of the company. All are from Holyoke, Mass.

Perrigo, Inc., of New Haven, Conn., has recently been organized and incorporated in the State of Connecticut, with a capital stock of $250,000, to engage in and carry on a general manufacturing and jobbing business. The incorporators are Harry B. Perrigo, W. L. Harlow, E. C. Burwell, S. T. Haskell, W. M. Grant and N. E. Davidson, all of New Haven, Conn.

At a meeting of the directors of the Victor Saw Works, Springfield, Mass., the resignations of Frank M. Baldwin and William P. Jeffery, as president and vice-president respectively, were tendered and accepted. William F. Pollock was elected president, and Guy W. Donahue, vice-president. The board of directors was increased to five members.

The W. T. Dunn Co., 10 High St., Boston, Mass., has been appointed New England sales agent for B. M. Jones & Co., Inc., 192 Chambers St., New York, importers of Mushet and Titanic tool steels and Taylor's best Yorkshire iron. W. T. Dunn, a member of the firm, was for a number of years general manager of the International High-Speed Steel Co. of Rockaway, N. J.

Personals

RUSSELL B. REID, for several years past with Edw. R. Ladew Co. as assistant sales manager, has been made manager of sales for the Sharon Pressed Steel Co., of Sharon, Pa., manufacturer of motor car frames, industrial trucks and pressed steel automobile parts. Mr. Reid will direct the sales of the company from the New York office at No. 66 Broadway.

CLYDE E. DICKEY has resigned as general manager of the Hammond Steel Co., Inc., Syracuse, N. Y., effective May 1, 1921. Mr. Dickey is president of the Dickey Steel Co., Inc., 233 Broadway, New York City, and will devote all of his time to this company in the future.

F. C. HERMANN, for some years associated in the Chicago territory with the Stocker-Rumely, Wachs Co., and who has lately been associated with the Reed-Prentice Machine Tool Co. and the Becker Milling Machine Co., has joined the selling organization of the Dale Machinery Co., Chicago. In his new connection Mr. Hermann will handle the sales of the two machine-tool companies which the Dale Machinery Co. has taken over in the Chicago territory since the recent Prentice and Becker companies discontinued their Chicago store.

LESLEY POWELL, for several years sales manager of the Rowe Calk and Chain Co., Southington, Conn., has resigned to accept a similar position with the Tropical Paint Co., Columbus, Ohio.

JOHN B. PURVES is now with the Port Arthur Shipbuilding Co., Ltd., Port Arthur, Ontario, Canada. He was formerly mill manager for the Interlake Pulp and Paper Co., Appleton, Wis.

H. B. MACFARLAND has resigned his position as engineer of tests for the Atchison, Topeka & Santa Fe Ry. Co., and is now engaged in work as consulting engineer, Chicago, Ill.

GORDON LEFEBVRE, associated with the Chevrolet Motor Co., has been transferred from Tarrytown, N. Y., to Detroit, Mich.

CHARLES R. SEABROOK, recently member of the firm and chief engineer of the H. M. Lane Co., Detroit, Mich., is now associated with E. H. Owen, formerly superintendent of construction and chief draftsman of the H. M. Lane Co., under the firm name of Owen & Seabrook, industrial engineers, with offices in Detroit, Mich.

JAMES W. ARMOUR has recently been transferred from the Murphy Iron Works plant in Detroit, to the factory of the Sanford Riley Stoker Co., Ltd., at Worcester, Mass. The Murphy Iron Works is a subsidiary of the Sanford Riley Stoker Co.

BERNARD E. MOHR has resigned as manager of the machine-tool department of the Fairbanks Co., St. Louis, Mo., and has opened up offices at 5407 Easton Ave., where he will deal in new and used machine shop equipment.

H. W. TORNEY, head of Torney & Co., of New York, has been elected president of the Sharon Pressed Steel Co., Sharon, Pa., succeeding J. D. Cochran.

Forthcoming Meetings

The seventh annual convention of the American Association of Engineers will be held at Buffalo, N. Y., on May 9, 10 and 11, with headquarters at the Lafayette Hotel.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The spring meeting of the National Association of Manufacturers will be held in New York, May 16, 17 and 18 at the Waldorf-Astoria Hotel. The headquarters of the association is at 30 Church St., New York City.

The Taylor Society will hold its Spring Meeting at the Hotel Statler, Cleveland, Ohio, May 19 to 21

The spring meeting of the American Society of Mechanical Engineers will be held at the Congress Hotel, Chicago, May 23-26. Calvin W. Rice, Engineering Societies Bldg., 29 West 39th St., New York, is secretary.

The Society of Automotive Engineers, 29 West 39th St., New York announces that its summer meeting will be held at West Baden, Ind., on May 24 to 28 inclusive.

The American Railway Master Mechanics Association will hold its Spring Meeting at the Drake Hotel, Chicago, Ill., on June 15 and 16.

The 1921 annual meeting of the American Society for Testing Materials will be held at Asbury Park, N. J., on June 20 to 24, with headquarters at the New Monterey Hotel. C. L. Warwick, Engineers Club, Philadelphia, Pa., is secretary.

Condensed-Clipping Index of Equipment

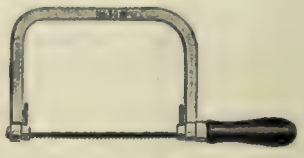
Patented Aug. 20, 1918

Chuck, Drill, Slip-Collet, Quick-Action
Dompier Chuck Co., 446 Book Bldg., Detroit, Mich.
"American Machinist," Feb. 17, 1921



The chuck is intended for use in drilling, boring and reaming. The illustration shows the collet out of the chuck, the removal being accomplished by raising the collar. The collet can be inserted without lifting the collar, thus requiring the use of only one hand. The chuck and collet are made of hardened and ground steel, the wearing parts being chrome-nickel steel. The grip is positive and instantaneous. The device is capable of operation at any speed or in any position. The chuck is made in four sizes, having from Nos. 2 to 5 Morse taper shanks. The collet is made in sizes to fit the different chuck sizes, and to take from Nos. 1 to 5 Morse tapers.

Saw, Coping, Adjustable, No. 30
Consolidated Tool Works, Inc., 261 Broadway, New York, N. Y.
"American Machinist," Feb. 17, 1921



This is a type of coping saw in which the position of the blade can be easily adjusted by means of the pins at both ends of the blade, so as to cut in any desired direction, without shifting the position of the hands. The blade is tightened by turning the handle and may be locked at any angle. The frame is made of flat stock and is nickel plated and polished. The wooden handle is finished in black enamel.

Gage, Plug, Tolerance, Replacable-End
C. E. Johansson, Inc., Poughkeepsie, N. Y.
"American Machinist," Feb. 17, 1921



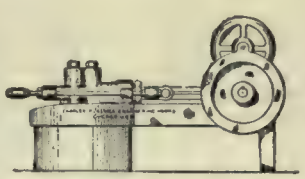
The company formerly made tolerance plug gages below ¾ in. in diameter in one piece. By making the gage with replacable ends it is possible to save the unworn member (No-Go member) and the handle, and simply replace the worn member. The useful life of the gage is said to be extended indefinitely. The measuring members are securely locked in position by locking nuts, so that the ends will not unscrew when in use. The gage is made in sizes from ⅛ to 47/64 in. in diameter, inclusive.

Bolt Combination T- and Extension "Ashmac"
Ashley Machine Works, 714 University Ave., Rochester, N. Y.
"American Machinist," Feb. 17, 1921



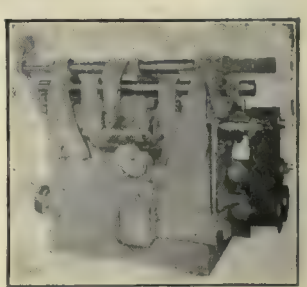
The bolt is intended for use in the T-slots of machine tools. It consists of a short T-bolt and a stud which can be connected to it by means of a nut, so as to give the necessary length. The bolt is fully machined, and is made of heat-treated and hardened alloy steel. The T-bolts and connecting nuts can be used with extension studs of different lengths, so as to provide T-bolts of whatever length desired for clamping work on a platen. The sets are ordinarily made in ⅝ in. size, the T-bolts being made in lengths of 2 to 4 in. in ½-in. steps, and the studs in even inch lengths, from 2 to 10 in.

Pump, Hydraulic, High- and Low-Pressure
Charles F. Elmes Engineering Works, Morgan and Fulton Sts., Chicago, Ill.
"American Machinist," Feb. 17, 1921



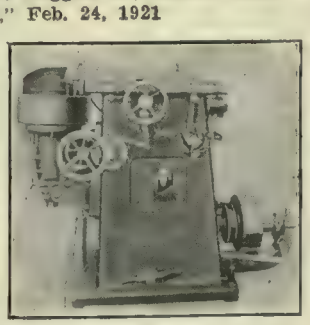
The pump is adapted for use with hydraulic presses. It will give a pressure up to 5,000 lb. per square inch by means of the high-pressure plunger, and up to 250 lb. per square inch by the use of the low-pressure plunger. A ¼-hp. motor will operate it at a speed of 100 r.p.m. The pump is arranged to automatically shift from the low pressure to the high pressure when the limit of the low-pressure cylinder has been reached. It is provided with a 1½-gal. tank for oil or water, and has a motor direct-connected and mounted on the frame at the right.

Grinding Machine, Form, No. 40
Bryant Chucking Grinder Co., Springfield, Vt.
"American Machinist," Feb. 24, 1921



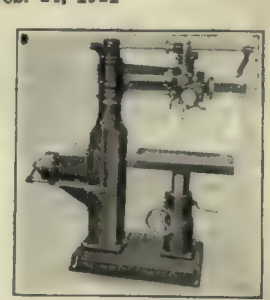
The machine is intended for the grinding in large quantities of pieces up to 10 in. long and having diameters up to 12 in. The wheel is fed straight toward the work, either with no traverse movement or with a traverse of only ¼ in. Pieces circular in section, but tapered or having different diameters on them, can be ground with but one contact with the wheel. This is accomplished by dressing the profile of the wheel to correspond to that required on the work, the master form being so mounted as to guide the diamond while dressing. The wheel is mounted on the bed. The work is held in centers so pivoted that they can be fed toward the wheel. The machine is semi-automatic in its operation, the work automatically feeding in and withdrawing.

Grinding Machine, Surface, 12-In. Rotary-Table
Boston Scale and Machine Co., 100 Ruggles St., Boston, Mass.
"American Machinist," Feb. 24, 1921



The tool is adapted to production work. The reciprocating motion of the head which carries the grinding-wheel spindle is obtained by the use of oil flowing under pressure, the direction of flow being controlled by a balanced reversing mechanism. A wide range of speed is provided for the reciprocating head. Change gears providing four rotative speeds for the chuck run in oil in a box which can be readily removed. The machine is arranged to carry a 12x1½-in. wheel, and it is furnished with a 12-in. circular magnetic chuck. It will grind the whole of a 13-in. disk. The sliding head can be set back, so as to grind a 6½-in. face on any disk up to 16 in. in diameter. A diameter of 17 in. can be swung inside the water pan. The machine weighs 2,800 lb. and takes up a floor space of 6x3 ft.

Drilling Machine, Radial, Sensitive, 2½-Ft.
The Crescent Tool Co., Second and Elm Sts., Cincinnati, Ohio
"American Machinist," Feb. 24, 1921



The machine, intended for high speed, heavy-duty work, is entirely gear driven and can be furnished in two styles, one being equipped with hand feed only. The other, in addition to the hand feed, has two changes of power feed and also a quick return motion. Specifications: Drills to center of 60-in. circle. Maximum distance end of spindle to base, 42 in. Maximum distance end of spindle to table, 20 in. Vertical traverse of spindle, 6¼ in. Drilling capacity, 1⅜ in. in diameter in steel. Size of table, 18x30 in. Vertical adjustment of table, 18 in. Size of base, 24x38x4 in. Spindle speeds, 132 to 1,100 r.p.m. Spindle feeds, 0.0055 and 0.017 in. per revolution. Floor space, 26x72 in. Approximate weight: net, 1,200 lb.; crated, 1,300 lb.; boxed for export, 1,400 lb.

THE WEEKLY PRICE GUIDE

This Week's Market

The metal market is quiet. Copper remains unchanged, but tin and lead have strengthened slightly. A new basing card on wrought pipe has been issued and we will publish the new discounts (four points cheaper) next week. Rivets are down in Pittsburgh, Cleveland and New York. Semi-finished materials are down slightly in Cleveland in keeping with lowered basic material costs and small demand.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$29.50
Northern Basic	27.52
Southern Ohio No. 2	28.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	35.26
BIRMINGHAM	
No. 2 Foundry	25.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75 sil	26.25@28.50
Virginia No. 2	*28.00
Basic	†26.25
Grey Forge	*27.00
CHICAGO	
No. 2 Foundry local	26.00
No. 2 Foundry, Southern, sil 2.25@2.75	32.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26.96
Basic	26.86
Bessemer	27.00

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.23	$3.33	$3.09	$3.23
Soft steel bars	3.13	3.23	2.99	3.13
Soft steel bar shapes	3.13	3.23	3.48	3.13
Soft steel bands	4.18	4.28	6.25	
Tank plates	3.23	3.33	3.78	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	4.25	3.85	4.13
No. 12	3.15	4.30	3.90	4.18
No. 14	3.20	4.35	3.95	4.23
No. 16	3.30	4.45	4.05	4.33
Black				
Nos. 17 and 21	3.75	4.95	4.60	5.20
Nos. 22 and 24	3.85	5.00	4.65	5.25
No. 25 and 26	3.90	5.05	4.70	5.30
No. 28	4.00	5.15	4.80	5.40
Galvanized				
No. 10 and 11	4.00	5.30	4.70	5.70
No. 12 to 14	4.10	5.40	4.80	5.80
Nos. 17 and 21	4.40	5.70	5.10	6.10
Nos. 22 and 24	4.55	5.85	5.25	6.25
No. 26	4.70	6.00	5.40	6.30
No. 28	5.00	6.25	5.70	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$4.73	$4.63	$4.25
Flats, squares and hexagons, per 100 lb	5.23	4.63	4.75

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	65%
Cleveland	50%
Chicago	50%

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	41
Electrolytic	43
Monel Metal	
Shot and blocks	35
Ingots	38
Sheet bars	40
Hot rolled rods (base)	42
Cold rolled rods (base)	56
Hot rolled sheets (base)	55
Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 5/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.50	8.00	8.25
Spring steel (light)	8.00	7.00	10.50
Coppered Bessemer rods(base)	8.00	8.00	6.20
Hoop steel	4.28	3.69	3.83
Cold rolled strip steel	6.00	8.25	7.90
Floor plates	5.30	3.09@3.40	5.78

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Steel Inches	Steel Black	Steel Galvanized	Iron Inches	Iron Black	Iron Galvanized
⅛ to 3	57½%	44%	⅛	15½–16½%	+10½–11½%
			¼	19½–20½%	1½– 2½%
			⅜ to 1½	24½–25½%	8½– 9½%

LAP WELD

2	50½%	38%	2	20½–21%	6½– 7%
2½ to 6	53½%	41%	2½ to 6	22½–23%	9½–10%
7 to 12	50½%	37%	7 to 12	19½–20%	6½– 7%
13 to 14	41%				
15	38½%				

BUTT WELD, EXTRA STRONG PLAIN ENDS

⅛ to 1½	55½%	43%	⅜ to 1½	24½–25½%	9½–10½%
2 to 3	56½%	44%			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	48½%	37%	2	21½–22½%	8½– 9%
2½ to 4	51½%	40%	2½ to 4	23½–24%	11½–12%
4½ to 6	50½%	39%	4½ to 6	22½–23%	10½–11%
7 to 8	46½%	33%	7 to 8	14½–15%	2½– 3%
9 to 12	41½%	28%	9 to 12	9½–10%	+2 –2½%

Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 2½ in. steel butt welded	52%	37%	52½%	33½%	62½%	44%
3½ to 6 in. steel lap welded	49%	35%	49½%	29½%	58½%	41%

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13.62½
Tin in 5-ton lots	32.50
Lead	4.87½
Zinc	5.60
ST. LOUIS	
Lead	4.47½
Zinc	5.20

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.00	22.00	23.50
Copper wire (carload lots)	15.00	17.50	20.00
Brass sheets	17.25	24.00	24.50
Brass pipe	21.00	22.00	20.75
Solder (half and half) (case lots)	18.00	20.50	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	15.25
Cleveland	19.00
Chicago	18.75

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill + less 8% for carload lots..... 11.50

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	13.70	14.30
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.25
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	$9.75
Copper, heavy, and wire	9.00	9.50	8.50
Copper, light, and bottoms	8.00	9.00	8.00
Lead, heavy	3.25	3.50	3.50
Lead, tea	2.00	2.50	3.00
Brass, heavy	6.00	7.00	9.00
Brass, light	4.50	4.50	4.50
No. 1 yellow brass turnings	5.00	5.50	5.00
Zinc	3.00	3.00	3.00

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.4	25.50@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.00
Chicago	20.50
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	42.00	35.00
Commercial	30.00	15.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$2.00	1.60
Hot pressed hexagon	List	2.00	1.60
Cold punches hexagon	List	2.00	1.60
Cold punched square	List	2.00	1.60

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	50%
Cleveland	75-10%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50-10%	60-10%	50%
1¼ and 1½ in. by 3 in. up to 12 in	50%	50-5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $4.00 Chicago..... $4.00
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $3.75 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	40%	50-10%	40%
Larger and longer up to 1 in. by 30 in.	40%	50%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	50%	60%	45%
Tinned	45%	60%	30%

Structural, ¼, ½, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.65 Cleveland...$4.60 Chicago....$4.88 Pittsburgh..$3.70
Boiler, same sizes:
New York...$4.75 Cleveland...$4.70 Chicago....$4.98 Pittsburgh..$3.80

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	25.50
Brass	21.00	24.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ½-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$8.50 per 100 lb.; New York price is 8c.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	10.00@13.00	12.50	14.25
Colored mixed	7.00@11.50	9.50	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$3.50@$4.25
Prompt foundry	4.50@ 5.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.67	$0.66	$0.68
5-gal. cans	.70*	0.81	0.93

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

D. C., Washington—The D. C. Comrs. Dist. Bldg., will receive bids until May 12 for furnishing machine shop equipment for use in surface division.

D. C., Washington — A. L. Flint, Genl. Purch. Agt. of the Panama Canal will receive bids May 11 for furnishing miscellaneous hand tools.

Md., Baltimore—D. C. Elphinstone, 408 Continental Bldg.—15 in. swing turret lathes, 6 ft. to 8 ft. long, also 20 or 25 ton locomotive crane.

Md., Baltimore—The Engineering and Sales Serv. Corp., 810 Lexington Bldg., H. L. Clapham, Pres. (agents for Alabama Mica & Mfg. Co.)—machinery for wet process mica grinding, and machines and tools for cutting discs on washers.

N. Y., Buffalo—The Eberhart Steel Products Co., 825 East Ferry St., W. C. Robbins, Mgr.—lathes and other machinery for the manufacture of steel products.

N. Y., Ellis Island—(New York P. O.) The Dept. of Labor, Bureau of Immigration—precision bench lathe, 14 in. lathe, Universal cutter and tool grinder, sensitive drill, portable electric drill and other miscellaneous machine tools.

N. Y., Lincoln Park—The Kneeland Mfg. Co., manufacturers of paper making machinery, L. W. Kneeland, Purch. Agt.—welding machine.

N. Y., Long Island City—The Harolds Motor Corp., Jackson Ave.—1 turret lathe.

N. Y., New York—(Borough of Manhattan) The Imperial Japanese Navy, 1 Madison Ave.—1 Universal grinding machine.

N. Y., New York—(Borough of Manhattan) The Laminated Shim Co. Inc., 47 West 34th St.—one 11 x 5 ft. tool room lathe, quick change gear with draw in chuck and collets.

N. Y., Rochester—G. Humbert, 304 Cornwall Bldg, (jeweler)—small drill press.

N. Y., Rochester—The Taylor Instrument Co., West Ave. and Ames St., C. D. Hart, Purch. Agt.—medium size lathe.

N. Y., Woodhaven — J. Pauzera, 4205 92d Ave., (plumber)—No. 300 A. Oster pipe threading and cutting off machine, capacity 1¼ in. to 2 in. Pipe complete with counter shaft.

Pa., Philadelphia — N. C. Rorke, 43 South 17th St., manufacturer of sheet metals—one 8 ft., one 4 ft. and one 10 ft. power brakes and one 36 in. squaring shear.

Ky., Owensboro—The Wright Machine Co. Inc., S. S. Wright, Purch. Agt.—24 in. heavy duty lathe, 14 ft. bed, quick changing gears, Leblond type preferred and a 1½ to 6 in. pipe cutting and threading machine, Landis preferred.

Va., Richmond — The Jefferson Garage, 5-7 West Main St.—electric drill, arbor drill and lathe.

Va., Richmond—The Natl. Auto Top Co., 810 West Main St., H. D. Cox, Purch. Agt.—machinery for making metal rollers and corner breaks.

Va., Richmond—The Walton Garage, 1207 and 1209 West Main St., L. L. Walton, Purch. Agt.—lathe and drill press.

W. Va., Weston—G. S. Kenner—equipment for proposed garage.

Ill., Annawan — The Bd. Educ., J. E. Moon, Pres. — manual training equipment for proposed school.

Ill., Carlinville—The Bd. Educ., C. J. Lumpkin, Pres.—manual training equipment for proposed school.

Ill., Chicago—E. A. Rotter, 220 Wisconsin St.—16 in. shaper.

Ill., Hartsburg—The Bd. Educ., H. Van Girpen, Secy.—manual training equipment for proposed high school here.

Ill., Manito—The Bd. Educ., F. Tollard, Secy.—manual training equipment for proposed school.

Ill., Pocahontas—The Bd. Educ., N. P. Nelson, Pres.—manual training equipment for proposed high school here.

Ill., Quincy—The Wiebner Machine Shop Co., A. Wiebner, Pres.—lathe, drill presses, etc.

Ill., Tallula—The Bd. Educ.—manual training equipment for proposed school.

Ind., Terre Haute—The Hossier Rolling Mills Co.—one key seater to key seat up to 2 in., one bolt cutter to thread bolts up to and including 2½ in. diameter; one 18 in., 20 in. or 22 in. x 10 or 12 ft. lathe.

Ind., Terre Haute — The Terre Haute Auto Spring Co. — 2 new or used punch presses with thrust 10 in. to 12 in. deep, with bed at least 12 in. wide, to take ⅝ in. holes through ¼ in. steel stock.

Mich., Detroit—The Gray Motor Co., Mack Ave.—miscellaneous machine shop equipment.

Mich., Detroit — The Street Ry. Comn., 320 Murphy Bldg., will receive bids until May 19 for 4 pneumatic tamping outfits complete, necessary tools and accessories. G. J. Finn, 710 Marquette Bldg., Comr. of Purchases and Supplies.

O., Cleveland—The Wheeling & Lake Erie R.R., Electric Bldg.—double head drill press with adjustable spindles for drilling splice bar holes in railroad rails.

O., Columbus—The Rogers Auto Sweeper Co., James Bldg., H. C. Rogers, Pres. and Mgr.—machinery for manufacturing sweepers and shop tools including drill press, grinders, cutters, lathes, presses, etc.

O., Sandusky—The Hinde & Dauch Paper Co., 401-419 West Water St. — general equipment for machine shop for paper plant at Ft. Madison, Ia.

Wis., Ft. Atkinson—The Bull Milking Machine Co., J. W. Meyer, Mgr.—2 engine lathes, one 24 in. shaper and a universal grinder.

Wis., Milwaukee—A. Kerner, 745 7th St. (machinist)—machine shop equipment.

Wis., Milwaukee—C. F. Stirnell, 336 21st Ave.—sheet metal working machinery.

Wis., Sheboygan — The Wald Mfg. Co., 18th St. and Martin Ave., (wire workers)—1 double head bolt cutter, 1 in. capacity, 1 tumbling barrel and 1 wire straightener ⅜ in. to ½ in.

Ia., Sioux City—The Bd. Educ., City Bldg., H. C. Roberts, Secy.—manual training equipment for the proposed 2 story, 120 x 230 ft. school.

Ia., Vinton—The Bd. Educ., M. E. Bickel, Secy.—manual training equipment.

Mo., Kansas City—The Standard Steel Wks., 1722 Tracy St.—additional machinery for manufacturing steel tanks, steel wagons beds and sheet metal work.

Mo., St. Louis—The Excelsior Laundry Co., Grand and Bell Sts., S. W. Burley, Secy.—lathe and drill press.

Mo., St. Louis—The Davie Motor Car Co., 1900 Washington St., A. F. Davie, Pres.—lathe and drill press.

Mo., St. Louis—The Missouri Car Co., Central Natl. Bank Bldg., 7th and Olive Sts., G. F. Weizel, Vice Pres.—general machinery and tools for the manufacture of electric railway cars.

Cal., Los Angeles—E. W. Smart, 1641 South Berendo St.—one small inclinable power press, 5 to 7 tons.

Que., Montreal—T. Rioux, Grant St.—repair equipment for garage.

Alaska, Ketchikan—The Supt. of Lighthouses will receive bids until June 6 for motor driven shaper and lathe.

Machinery Wanted

Conn., Middletown — The Forest City Laundry Co., 56-66 Hamlin St.—laundry equipment.

Mass., South Hadley—J. J. O'Toole, manufacturer of sash, doors, blinds and screens—1 shaper and 1 planer in good condition.

Ky., Auxier—The United Block Coal Co., W. White, Genl. Mgr.—coal mining machinery.

N. C., Charlotte — S. L. Williams, Box 962 (woodworker)—complete machinery to equip plant for cabinet work, including jointers, moulders, small planers, mortising machines, etc.

N. C., Kinston—The Chesterfield Mfg. Co.—complete machinery for the manufacture of rope.

N. C., Lincolnton — The Champion Tire Patch Co., M. M. Rudisill, Secy and Treas. —buffers and paste and labeling machines, etc.

N. C., Raleigh—The State College, W. C. Riddick, Pres.—laundry equipment.

Va., Richmond—Jerry Bros., 1823 East Main St., manufacturers of leather belting —scarfing machine, trimming machine, belt press, etc.

O., Columbus — The Franklin Adis Tile Co., Gugle Bldg., J. J. Morgan, Pres.— roller conveying machinery, tile making and track laying machinery.

Wis., Butternut—L. S. Barber & Son— saw mill machinery.

Wis., Milwaukee — The Natl. Paper Can Co., 576 Clinton Ct.—1 band saw.

Mo., Boonville—W. S. Mitchell—machines for the manufacture of tires.

Wis., Sparta—The Sparta Brush Co., J. C. Johnson, Purch. Agt.—special brush making machinery.

Okla., Enid—The Western Battery Mfg. & Supply Co., Inc., 224 West Bway., manufacturers of batteries and parts, etc.—wood-working machinery including machinery for sawing and grooving cedar and other timber, making separators used in storage batteries and machinery to make dove tailed battery boxes.

Okla., Okmulgee—The Okmulgee Brick Co.—equipment for making hollow building blocks and Spanish tile roofing, etc.

Ont., Haileyburg — H. S. Hennessy — $1,000,000 worth of equipment for proposed pulp mill.

Ont., Kingsville — W. T. Conklin — machinery and equipment for proposed sash and door factory and planing mill, on Erie St.

Ont., Southampton — The Panels Ltd. — $15,000 worth of special machinery and equipment for the manufacture of wood products.

Metal Working

NEW ENGLAND STATES

Conn., Collinsville — The Collins Co., manufacturer of edge tools, is having plans prepared for the construction of a 1 story steel rolling mill. Private plans.

Conn., Hartford—H. P. Townsend Mfg. Co., 10 Hoadley Pl., has awarded the contract for the construction of a 1 story, 70 x 75 ft. addition to factory for the manufacture of machinery on Chestnut St. Estimated cost, $20,000.

Conn., New Haven — A. Criscuolo, 22 Franklin St., has awarded the contract for the construction of a 1 story, 45 x 140 ft. garage on Wooster St. Estimated cost, $22,000.

Conn., New Haven—J. Heller, 33 Cottage St., has awarded the contract for the construction of a 1 story, 35 x 110 ft. garage on State St. Estimated cost, $15,000.

Conn., Plainville—The Plainville Casting Co. plans to build a 1 story foundry along the tracks of the New York, New Haven & Hartford R.R.

Me., Bangor — V. Hodgkins, Archt., 39 Hammond St., will soon award the contract for the construction of a 4 story, 100 x 130 ft. garage on Franklin St., for the Sweet-Mullen Co.

Mass., Dorchester — P. H. McCue, 29 Speedwell St., will soon award the contract for the construction of a 1 story, 100 x 180 ft. garage on Talbot Ave. Estimated cost, $60,000. S. S. Eisenberg, 46 Cornhill St., Boston, Archt.

Mass., New Bedford—LaBrode & Bullard, Archts., 251 Union St., will soon award the contract for the construction of a 1 story, 70 x 80 ft. garage on Emerson St., for F. W. Greene, Jr., 252 Union St. Estimated cost, $25,000. Noted Nov. 25.

Mass., Pittsfield—G. L. Hoskins, Cheshire, will build a 2 story, 50 x 75 ft. garage on South St., here. Estimated cost, $35,000. Noted Feb. 17.

Mass., Somerville — (Boston P. O.) A. E. Hughes, 5 Bow St., will soon award the contract for the construction of a 2 story, 52 x 70 ft. garage on Highland Ave. Estimated cost, $40,000. Private plans.

Mass., Springfield—W. Sacks, 47 Churchill St., is having plans prepared for the construction of a 2 story, 95 x 100 ft. garage, on Liberty and Sharon Sts. Estimated cost between $65,000 and $70,000. J. W. Foster, 38 Stockman St., Archt.

Mass., Springfield—The Winchester Sq. Realty Co., Winchester Sq., will build a 1 story, 70 x 150 ft. addition to its garage on Catherine St. Estimated cost, $30,000.

Mass., Westfield — A. Peck, Park Blk., will soon award the contract for the construction of a 1 story, 35 x 115 ft. garage. Estimated cost, $20,000. M. B. Harding, 33 Elm St., Archt.

Mass., Williamsett—S. Boisvert, Chicopee St., will soon award the contract for the construction of a 1 story, 30 x 90 ft. garage. Estimated cost, $15,000. Stuart & Tessier, 405 Main St., Springfield, Archts.

Mass., Worcester—H. Glick, 36 Portland St., will build a 1 story, 65 x 150 ft. addition to his garage. Estimated cost, $40,000. Noted April 21.

Mass., Worcester—The Worcester Buick Co., 799-803 Main St., has awarded the contract for the construction of a 1 and 2 story, sales room and service station, on Shrewsbury St. Estimated cost, $150,000. Noted March 31.

R. I., Newport—Booth & Nelson, West Bway., have awarded the contract for the construction of a 1 story, 50 x 50 ft. service station. Estimated cost, $10,000.

R. I., Providence—C. E. Brissette, 685 North Main St., has awarded the contract for the construction of a 1 story, 55 x 125 ft. garage and station, on Duncan and North Main Sts. Estimated cost, $30,000. Noted March 10.

R. I., Providence—Donnelly Taxi Motor Service, Inc., Chestnut St., plans to build a 1 story, 90 x 115 ft. garage and service station. Estimated cost, $40,000.

MIDDLE ATLANTIC STATES

N. Y., Buffalo—The Eberhart Steel Products Co., 828 East Ferry St., will build a 1 and 2 story, 100 x 100 ft. factory for the manufacture of steel products. Estimated cost, $40,000.

N. Y., Long Island City—The Durant Motor Co. of New York, 1764 Bway., New York City, is having plans prepared for altering its 8 story auto assembling plant, on Jackson Ave. and Honeywell St. Estimated cost, $200,000.

SOUTHERN STATES

N. C., Raleigh—The State College plans to build and equip a laundry and do general repair work to cost about $40,000, also construct a 2 story addition to its mechanical building, to cost, $100,000. W. C Riddick, Pres.

W. Va., Weston—Hood & Dent have had plans prepared for the construction of a 2 story, 70 x 150 ft. addition to their garage. Estimated cost, $30,000.

W. Va., Weston—G. S. Kenner will build a 2 story, 103 x 118 ft. garage. Estimated cost, $50,000.

MIDDLE WEST STATES

Ill., Chicago—C. Maerz, 29 East South Water St., is having plans prepared for the construction of a 1 story, 50 x 125 ft garage, on Shields and 26th Sts. Estimated cost, $25,000. R. C. Harris, 190 North State St., Archt.

Ill., Quincy—The Wiebner Machine Co. has awarded the contract for the construction of a 1 story, 60 x 90 ft. machine shop on 7th and York Sts. Estimated cost, $40,000

Ill., Rockford — The Petroleum Motor Corp., 220 South State St., Chicago, will soon award the contract for the construction of a 2 story, 270 x 720 ft. factory. Estimated cost, $2,000,000. R. C. Dale, Mgr. Arnold Co., 105 West Monroe St., Chicago, Archt.

Ind., Kokomo—The Worth Wire Wks. will soon award the contract for the construction of a 1 story, 60 x 100 ft. wire factory on Washington St. Estimated cost, $25,000. C. Ferriter, Kokomo, Archt. Noted March 24.

Ind., Lafayette—The Lafayette Tractor & Machinery Co. plans to build a 2 story machine shop and warehouse on 4th St. Estimated cost, $75,000. Riedel & Zink, Archts.

Ind., Rushville—The Dill Fdry. Co. plans to build a 1 story pattern shop. Estimated cost, $40,000. Private plans.

Mich., Detroit — The General Spring & Wire Co., 550 Marston St., will open bids about May 15 for the construction of a 1 story, 200 ft. x 250 ft. factory on Fort St. and Oakwood Blvd., here. Estimated cost, $200,000. E. D. Shank, 38 South Dearborn St., Chicago, Ill., Archt.

O., Canton—The Lewis Electric Co. plans to build a factory for the manufacture of safety switches. Estimated cost between $125,000 and $150,000.

O., Cleveland—H. L. Kollin and J. Roodman, 12001 Tuscora Ave., are having plans prepared for the construction of a 1 story, 50 x 90 ft. garage on East 140th St. and Lakeshore Blvd. Estimated cost, $40,000. M. Weis, 618 Union Bldg., Archt.

O., Warren—D. A. Miller will open bids May 18 for the construction of a 2 story, 80 x 120 ft. garage, on West Market St. Estimated cost between $60,000 and $75,000. R. J. Keich, West Reserve Bldg., Archt.

Wis., Appleton—A. Brandt Co., 987 College Ave., has awarded the contract for the construction of a 2 story, 80 x 158 ft. garage and repair shop on Superior St. Estimated cost, $45,000. Noted March 17.

Wis., Cudahy — J. Wagner, c/o Hotel Cudahy, has awarded the contract for the construction of a 1 story, 50 x 120 ft. garage, repair shop and show room, on Main St. Estimated cost, $75,000.

Wis., Ft. Atkinson — The Bull Milking Machine Co. will build a 1 story, 63 x 143 ft. factory on North Water St. for the manufacture of milking machines. Estimated cost, $50,000. J. W. Meyer, Mgr.

Wis., Ladysmith—R. J. Clark has awarded the contract for the construction of a 1 and 2 story, 66 x 100 ft. garage. Estimated cost, $45,000.

Wis., Manitowoc — The Globe Plating Wks. is having plans prepared for the construction of a 2 story, 75 x 150 ft. plating works factory on 8th St. Estimated cost, $75,000. M. Mrotek, Mgr. Private plans.

Wis., Milwaukee—The Nash Motors Co., Clement Ave. and Oklahoma St., is having plans prepared for the construction of a 3 story, 100 x 600 ft. auto body and sheet metal plant on Clement Ave. Estimated cost, $500,000.

Wis., Platteville—The Fiedler Motor Co., c/o E. C. Fiedler, Mgr., Mineral Point, will soon receive bids for the construction of a 1 story, 100 x 136 ft. garage, etc., on Water and Main Sts. Estimated cost, $75,000. H. Kleinhammer, Archt.

STATES WEST OF THE MISSISSIPPI

Ia., Davenport—G. A. Koester, Jr., 741 Perry St., has awarded the contract for the construction of a 3 story, 60 x 150 ft. auto sales building and garage, on Harrison and Scott Sts. Estimated cost, $100,000.

Minn., Minneapolis — The Kramer Motor Co., 1518 Hennepin Ave., is having plans prepared for the construction of a 2 story, 154 x 162 ft. garage. Estimated cost, $50,000. P. E. Crosier, 3725 Duport Ave. S., Archt.

Mo., North Kansas City—(Kansas City P. O.) The Standard Steel Wks., 1722 Tracy St., Kansas City, will soon award the contract for the construction of a 1 and 2 story, 118 x 226 ft. factory and office building. Estimated cost, $75,000.

Mo., St. Louis—The Davie Motor Car Co., 1900 Washington St., plans to build a 1 story garage and machine shop, on Hodiamont Alley east of Taylor St. Estimated cost, $40,000. A. F. Davie, Pres.

Mo., St. Louis—The Excelsior Laundry Co., Grand and Bell Sts., is having preliminary plans prepared for the construction of a 2 story, 80 x 135 ft. laundry and a 100 x 140 ft. power house, engine room and machine shop, on Grand and Washington Sts. Estimated cost, $200,000. L. Harger, 3844 Utah Pl., Archt.

Mo., St. Louis—The Walsh Motor Co., 4919 Delmar St., plans to build a 2 story garage and service station at 5135 Delmar St. Estimated cost, $75,000. W. D. Walsh, Pres.

Tex., Beaumont — The Beaumont Iron Wks. Co. has awarded the contract for the construction of a 1 story, 42 x 300 ft. machine shop. Estimated cost, $75,000.

CANADA

Ont., Chatham—The Weaver Mfg. Co., 2171 South 9th St., Springfield, Ill., has purchased a 2 acre site here and is having plans prepared for the construction of a factory for the manufacture of garage equipment. Estimated cost, $100,000.

Ont., Galt—R. Hall, Archt., Barrett Martin Bldg., will soon award the contract for the construction of a 2 story, 80 x 100 ft. garage on Wellington St., for Servis-Willard, Wellington St. Estimated cost, $25,000.

Ont., St. Thomas—The St. Thomas Metal Sign, Ltd., plans to purchase the old city power house and remodel and equip same for its own use. Estimated cost, $15,000.

Que., Montreal — T. Rioux, Grant St., plans to build an addition to his garage. Estimated cost, $10,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Middletown — The Forest City Laundry Co., 56-66 Hamlin St., is having plans prepared for the construction of a 1 story, 50 x 100 ft. laundry on William St. Estimated cost $20,000. W. D. Johnson Co., 174 Bond St., Hartford, Archt.

Conn., Stamford — The Stamford Candy Co., Main St., will soon award the contract for the construction of a 3 story, 40 x 80 ft. factory, on Beckley Ave. Estimated cost, $40,000 W. R. Steinmetz, 442 Atlantic Ave., Archt.

Me., Rumford—The Mt. Zircon Water Co., 103 Arch St., Boston, Mass., plans to build a bottling plant here. Estimated cost, $125,000.

Mass., Framingham—The Dennison Mfg. Co., 26 Franklin St., Boston, has awarded the contract for the construction of a 4 story, 70 x 100 ft. factory for the manufacture of tags. Estimated cost, $75,000. Noted March 10.

Mass., Leominster—The Union Novelty Co. plans to rebuild its woodworking plant on Whitney Ave., which was recently destroyed by fire. Estimated loss, $30,000. P. J. Gaudet, Pres. Private plans.

Mass., Salem—G. H. Fanning, Archt., 221 Essex St., will soon award the contract for the construction of a 2 story, 40 x 100 ft. shoe factory on Canal St., for the Michaud Shoe Co. Estimated cost, $20,000. Noted March 24.

Mass., Salisburg—W. H. Butler, Essex St., Haverhill, has awarded the contract for the construction of a 2 story, 45 x 150 ft. shoe factory, on Beach St., here. Estimated cost, between $35,000 and $40,000.

Mass., Worcester — The Grocers Bread Co., 306 Main St., has awarded the contract for the construction of a 2 story, 60 x 100 ft. bakery on Mann St. Estimated cost, $50,000. Noted April 28.

Mass., Wrentham — The Commonwealth of Massachusetts, Mental Diseases Comn., 109 State House, Boston, will soon receive bids for the construction of a 2 story, 35 x 105 ft. industrial building, at the State School, here. Estimated cost, $50,000. Kendall, Taylor & Co., 142 Berkeley St., Boston, Archts. and Engrs.

R. I., Pawtucket — The Automobile Journal Publishing Co., Exchange St., has awarded the contract for the construction of a 1 story, 40 x 160 ft. publishing plant on Montgomery St. Estimated cost, $60,000.

R. I., Providence — The Grocers Baking Co., North Main St., has awarded the contract for the construction of a 1 and 2 story, 28 x 97 ft. addition to its bakery. Estimated cost, $20,000. Noted March 31.

MIDDLE ATLANTIC STATES

N. J., Camden—The Pub. Service Gas Co., 418 Federal St., has asked the Pub. Utility Comn., for permission to issue $1,496,000 to construct a battery of ovens at its plant.

N. Y., Mt. Vernon—The Yonkers and Mt. Vernon Ice Corp., 29 South 11th Ave., is having plans prepared for the construction of a 100 x 130 ft. ice plant, on 13th Ave. and 3d St. Estimated cost, $100,000. J. Conte, Pres. Sibley & Featherston, 101 Park Ave., New York City, Archts. T. J. Bird, 103 Park Ave., New York City, Engr.

N. Y., New York—(Borough of Brooklyn) —The Empire Biscuit Co., 30 Waverly Ave., has awarded the contract for the construction of a 4 story, 50 x 100 ft. bakery on 3d and Waverly Aves.

Pa., Williamsport — The West Branch Silk Co., 800 Race St., has awarded the contract for the construction of a 2 story, 54 x 75 ft. factory on Race St. Estimated cost, $10,000.

SOUTHERN STATES

Fla., Ft. Pierce—The St. Lucie Ice Co. plans to build a new 50 ton unit, 2 story. H. Whyte, Pres.

N. C., Hamlet—The Carolina Pine Products Co. will build a factory for the manufacture of wood turpentine, tar, oil, etc. Estimated cost, $25,000. C. R. Poole, Pres.

Va., Richmond—Jerry Bros., 1823 East Main St., will receive bids until May 12 for the construction of a 3 story, 25 x 130 ft. factory, at 1902 East Main St., for the manufacture of leather belting. Estimated cost, $20,000.

MIDDLE WEST STATES

Ill., Chicago — Worthman & Steinbeck, Archts., 155 North Clark St., will soon award the contract for the construction of a 3 story, 75 x 135 ft. printing plant on Calumet Ave. and 20th St., for the Wartburg Publishing Co., 623 South Wabash Ave. Estimated cost, $125,000.

Ind., Ft. Branch—The Swinney Printing Co. plans to build a 1 story, 40 x 120 ft. printing plant. Estimated cost, $40,000. Anderson & Stingle, Evansville, Archts.

O., Bedford—The B. L. Marble Chair Co. has awarded the contract for the construction of a 3 story, 80 x 300 ft. factory. Estimated cost, $200,000. Noted March 31.

O., Cleveland—The Messinger Candy Co., 28 North State St., has had plans prepared for the construction of a 3 story, 44 x 112 ft. factory and warehouse, at 1213 Central Ave. Estimated cost, $75,000. C. Messinger, Pres. Robinnett, Bruyere & Cameron, Spitzer Bldg., Toledo, Archts.

Wis., Chippewa Falls — The Chippewa Falls Woolen Mills, 901 Prairie St., has awarded the contract for the construction of a 2 story, 62 x 130 ft. woolen mill. Estimated cost, $25,000.

Wis., Manitowoc—The Cereal Products Co., c/o F. Miller, Secy., 6th and Washington Aves., has awarded the contract for the construction of a 4 story, 60 x 210 ft. cereal factory. Estimated cost, $175,000.

Wis., Ripon—C. D. Storck, Mgr. of the Ripon Brewery, plans to build a 4 story, 50 x 140 ft. ice cream factory, on Main St. Estimated cost, $75,000.

Wis., Two Rivers—The Wisconsin Textile Mfg. Co., c/o G. C. Krist, Pres. has awarded the contract for the construction of a 1 story, 60 x 180 ft. factory on Main St. Estimated cost, $100,000. Noted April 14.

STATES WEST OF THE MISSISSIPPI

Ia., Fairfield—C. E. Moore, Pres. of the Albia Packing Plant, Albia, is representing a stock company which plans to build a packing plant here. Estimated cost, $75,000.

Ia., Ft. Madison — The Hinde Dauch Paper Co., 401-419 West Water St., has awarded the contract for the construction of a paper mill to include a 2 story, 45 x 130 ft. rotary building, a 4 story, 65 x 110 ft. heater building, a 2 story, 40 x 300 ft. machine shop, 120 x 220 ft. storage building and a 75 x 125 ft. power house. Estimated cost, $700,000.

Minn., Littlefork — The Universal Mfg. Co., plans to build a plant for the manufacture of ironing boards, clothes racks and other woodenware. Estimated cost $100,000. C. P. Serenson, Secy. Engineer not announced.

Minn., Minneapolis — The Amer. Kersey Co. and Sherlock Merrill Co., 323 2d Ave., North, will soon award the contract for the construction of a 2 story, 48 x 144 ft. factory. Estimated cost, $40,000. Fallows, Huey & Macomber, 501 New York Life Bldg., Archts.

Minn., Minneapolis—The Hennepin Laundry Co., 8th St. and Hennepin Ave., is having plans prepared for the construction of a 2 story, 108 x 129 ft. laundry, on 4th Ave., and 17th St. Estimated cost, $75,000. I. W. Lawrence, Secy. H. A. Kennison, 411 Plymouth Bldg., Archt.

Mo., Boonville—W. S. Mitchell plans to build a 2 story tire factory. Estimated cost, $200,000.

Mo., St. Louis—The Boyd Welch Shoe Co., 4401 Cook Ave., has awarded the contract for the construction of a 3 story, 50 x 160 ft. shoe factory, on Cook and Newstead Aves. Estimated cost, $175,000.

Mo., Warrensburg—The Missouri Dairy Co., 1207 Locust St., Kansas City, plans to build a 2 story, 50 x 120 ft. milk bottling plant, here. Estimated cost, $150,000.

Okla., Okmulgee — The Okmulgee Brick Co. plans to build a plant for the manufacture of paving brick. Estimated cost, $200,000. R. E. Buckles, c/o owner, Engr.

Wyo., Douglas — The Western Alfalfa Milling Co., Denham Bldg., Denver, Col., plans to build an alfalfa mill here. Estimated cost between $10,000 and $15,000.

CANADA

B. C., Victoria—The Sidney Roofing & Paper Co., Sidney, plans to rebuild its 1 story roofing and paper factory, on Vancouver Island, near here, which was recently destroyed by fire. Estimated cost, $50,000. R. W. Mayhew, Mgr.

B. C., Victoria — The Victoria Gas Co., Store St., has awarded the contract for the construction of a gas making plant. Estimated cost $125,000.

Ont., Haileyburg—H. S. Hennessy is having plans prepared and will receive bids about June 15, for the construction of a pulp mill north of here. Estimated cost, $1,500,000.

Ont., Kingsville—W. T. Conklin plans to build a sash and door factory and planing mill on Erie St. Estimated cost, $60,000.

Ont., Kitchener—The Dumarts Ltd., Breithaupt St., has awarded the contract for the construction of a 4 story, 50 x 140 ft. meat packing house on Guelph St. Estimated cost, $100,000

Ont., Leamington—The Diamond Tobacco Co. plans to build additions to its plant. Estimated cost, $100,000

Ont., Ottawa—The Nukol Fuel Co., Ltd., 88 Bay St., Toronto, will have plans prepared for the construction of an artificial fuel factory here. Estimated cost, $250,000 A. Heffernan, Jackson Bldg., Mgr.

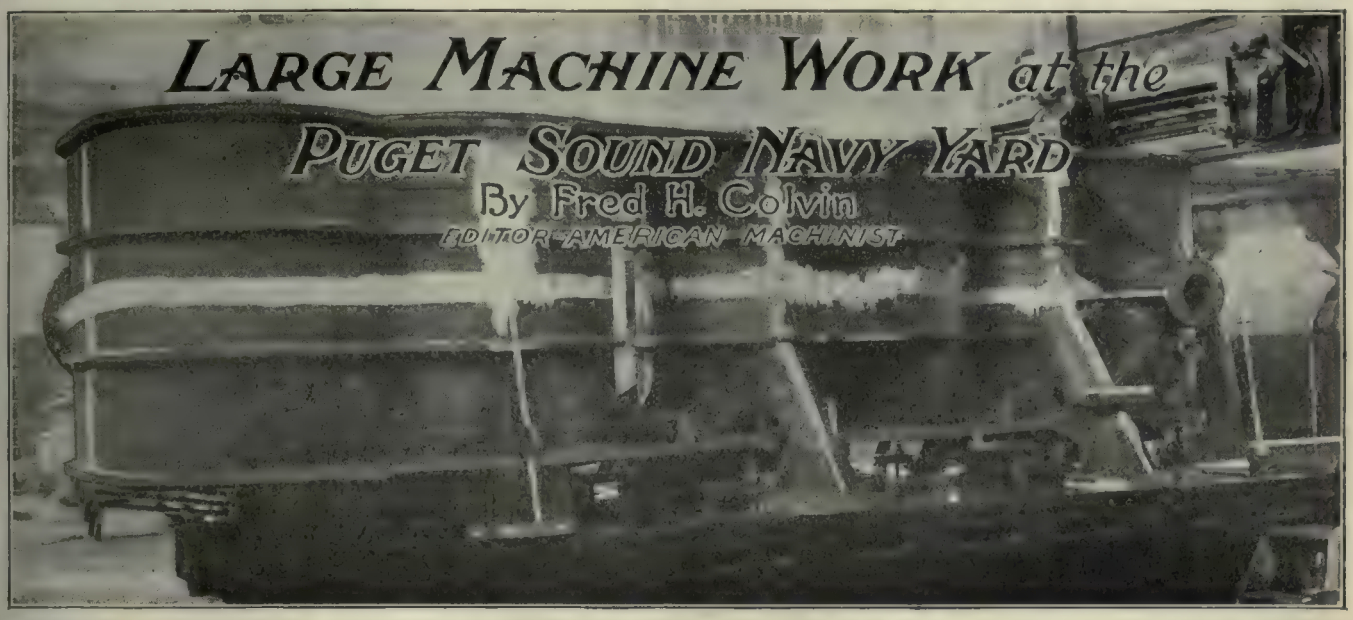
Ont., Toronto — Aked & Co. Ltd., 1067 Ossington Ave., has awarded the contract for the construction of a 2 story, 80 x 110 ft. woolen mill factory. Estimated cost, $100,000.

American Machinist

Volume 54 NEW YORK, MAY 12, 1921 Number 19

Large Machine Work at the Puget Sound Navy Yard

By Fred H. Colvin
EDITOR AMERICAN MACHINIST



THE set of cylinders shown in Fig. 1 are for an 1,800-hp. triple expansion engine. The extreme width of the cylinders is 88 in., the extreme height 5 ft. 8¾ in. and the total length 19 ft. 8 in., the finished weight being 38,200 lb. This view shows the method of clamping and also the use of braces as at *A* to take the thrust of the cutting tool. The other side of the job is shown in the headpiece, which indicates clearly the capacity of the planer necessary.

An interesting feature of this job is the fact that the planer was reconstructed in the navy yard and enlarged from a 72-in. x 12-ft. capacity to 120 in. x 18 ft., as it is at present. A better idea of the planer itself can be had from Fig. 2, where the engine base is being planed, both for the pillow block caps and on the side. This view shows the widened housing at the left and gives a good idea of its capacity. Fig. 3 shows the bedplate to better advantage. Boring the cylinders is shown in Fig. 4. The cylinders are first mounted on their uprights, which raise them a sufficient distance from the floor to enable the boring-bar housings to be fastened to the lower side. This gives room for the boring bar to pass through the cylinder, as it is fed down from the top.

The Boring Rigs

Two boring rigs are used at once, as can be seen, the smaller bar in the foreground being driven from the motor *A*, which belts on to the pulley *B*. In a similar manner the motor *C*, which is largely hidden behind the first boring bar, drives the other boring bar by means of the pulley *D*. It is interesting to note how the driving heads of the boring bars are supported in position by means of the distance pieces or thimbles shown at *E*, *F* and *G*. Bolts running through these thimbles screw into the stud holes for the cylinder or valve chamber heads and hold the boring equipment rigidly in position.

Similar methods are used on the lower end. The

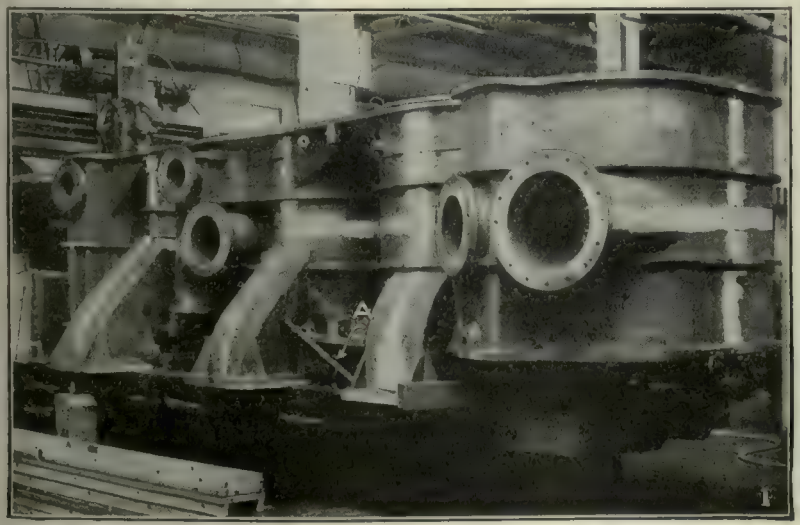


FIG. 1. PLANING TRIPLE EXPANSION CYLINDERS

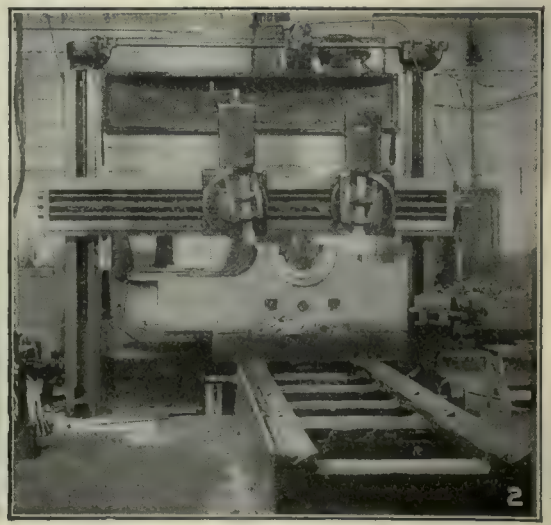


FIG. 2. PLANING THE ENGINE BASE

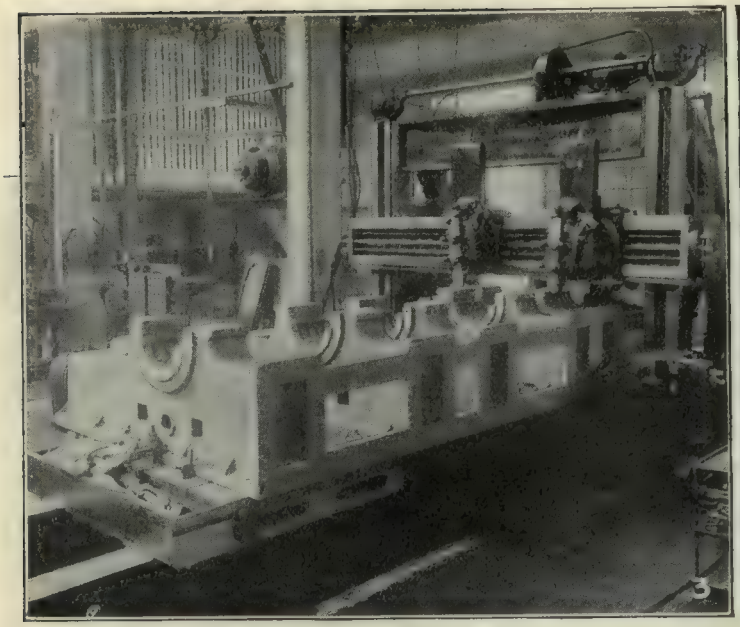


FIG. 3. PLANING THE PILLOW BLOCKS IN THE BASE



FIG. 4. BORING THE CYLINDERS

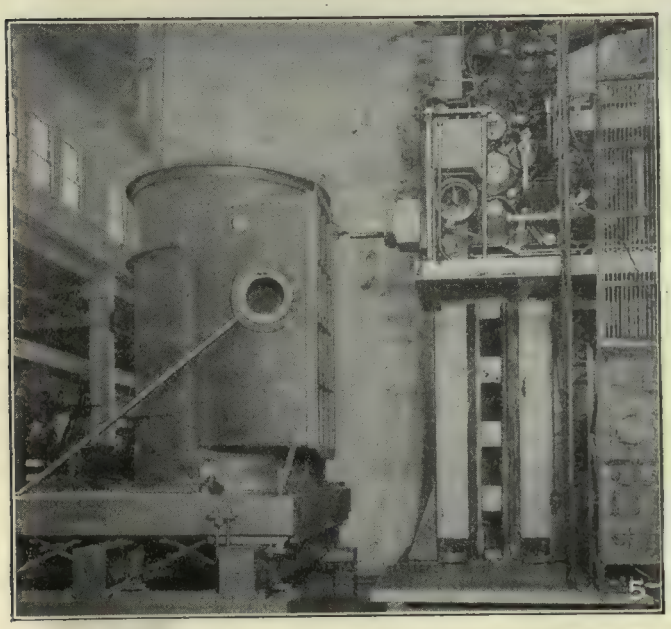


FIG. 5. MILLING EXHAUST INLET FOR CONDENSERS

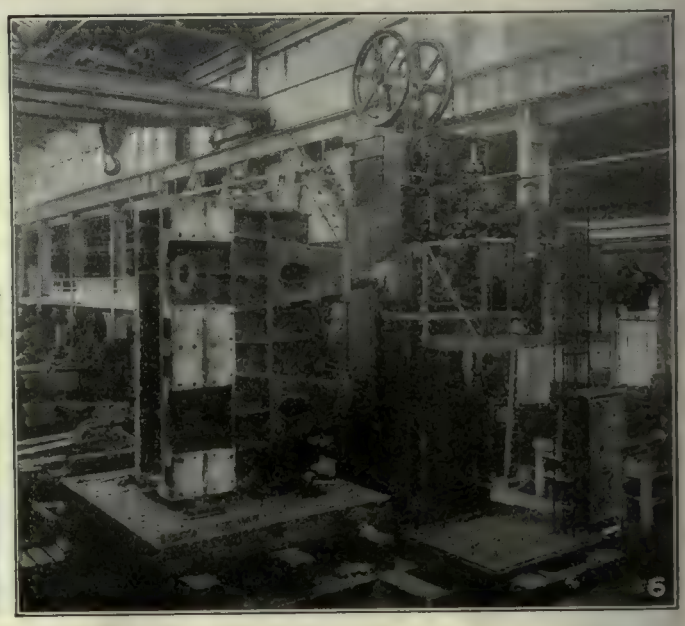


FIG. 6. MILLING COLUMN SEATINGS FOR CONDENSERS

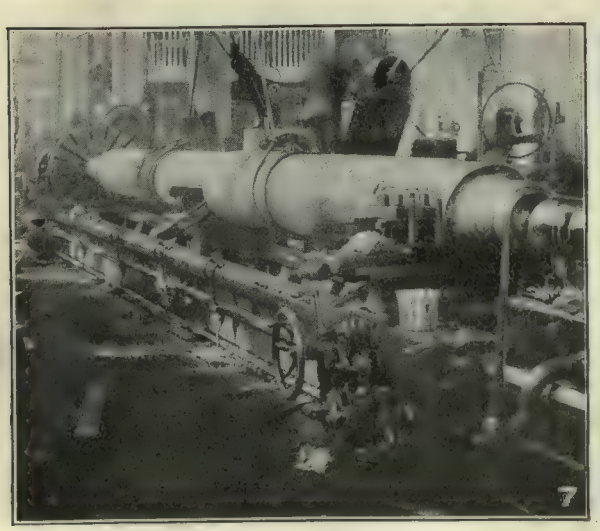


FIG. 7. ROUGH-TURNING A LARGE BENDING ROLL

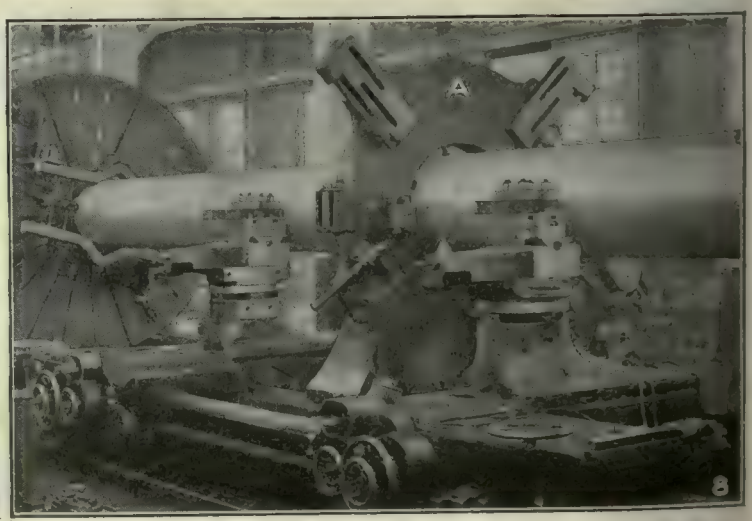


FIG. 8. THE BENDING ROLL IN THE FINISHING LATHE



FIG. 9. THE ROLL AND ONE END OF THE MAIN SHOP

usual star feed is used, as can be seen at the end of the boring bars. At the same time a reversing shaft is being installed at *H* and other portions of the erecting being done so as to hasten the completion of the work.

Two other interesting views are shown in Figs. 5 and 6, both being operations on a Morton combination machine. The latter view also gives a good idea of the construction of the main machine shop. In Fig. 5 the work shown is an exhaust inlet for the condenser of ammunition ship No. 2, which was built during the latter part of 1919. Fig. 6 is also a condenser job, being for sea-going tug No. 31.

The Lathe Department

Going to the lathe department we have the large plate bending roll shown in Fig. 7, ready to be rough-turned as soon as the wire rope slings have been released. Fig. 8 shows the roll mounted in another lathe for the finished turning. This is a 120-in. lathe, each carriage being equipped with a motor. The handwheel on the vertical shaft at the top of the carriage controls the motor, and in fact both motors can be controlled from either carriage by means of the rod which can be seen between them, near the floor. This view shows the type of dog or driver used at the faceplate end and also the revolving carrier inside the steadyrest at *A*. This carrier is clamped to the shaft by means of the internal screws shown and revolves with it, the outer edge bearing in the steadyrest and supporting the roll against sag.

The Crane Operator

The need for supporting the roll becomes apparent when we consider that it weighs 38 tons. An idea of the size of the roll may be had in Fig. 9, where it is suspended from the 40-ton crane. This crane, it will be noted, is operated by a girl; girls in many cases having proved especially proficient in this kind of work.

This same view shows more of the shop construction, such as the small traveling crane at *A*, in the side bay. Beneath the suspended bending roll is the engine base shown on the planer in Fig. 3, and now located in the combination machine, shown in Figs. 5 and 6, with the boring bar for the crankshaft bearings, already in place. Fig. 9 also shows the 120-in. lathe at *B*, the crane having recently lifted the bending roll out of this lathe. At *C* is a large vertical boring mill, a very necessary adjunct to the equipment in shops of this kind.

Comment on Shop Politics

By W. K. Campbell

I heartily endorse everything that Cecil K. Perkins has written under the above title, on page 443 of the *American Machinist*.

It is the old story in many of our industrial plants today where some inexperienced leader is still trying to put a quart into a pint bottle, and it can no more be accomplished today than in the days of Jack Cade. While there may have been an excuse for putting the unskilled and uninitiated in high places in war times, I very much doubted it at the time and doubly doubt it now. If it takes years to train our professors and instructors in the arts and sciences, who must be trained along general lines and in the fundamentals before they take up their special lines, why should it not require a little time to train men in the many and varied fields of industrial sciences? True, our young technical graduate may do the designing and compute the stresses, but he has qualified by years of study for the work. The putting together and the knowing how to make fits and adjustments should and does require time and study, not necessarily book study, but the careful and calm consideration of the whys and wherefores, and yet some men are as Mr. Perkins says "passing the buck and bluffing" to the detriment of the mechanical field, and with such conditions prevailing is it any wonder that Joe Gilbert is constrained to write as he does on page 458, under Want Ads?

A Modern Tractor Building Machine Shop

General Layout of Tools and Equipment—Heating and Lighting Systems—Cranes and Conveyor Arrangement—Work Benches Are Protected—Fireproof Storage

By J. V. HUNTER
Western Editor, *American Machinist*

AMONG the older manufacturers of farming machinery standardization has not been carried to that length where the entire shop facilities are devoted solely to the production of a single size and type of unit. They realize the different requirements of widely separated farming localities and build a full line of equipment so as to fill all needs, and for this purpose the shop here described well satisfies all productive demands.

Some time ago the expansion in its business caused the Minneapolis Threshing Machine Co., Hopkins, Minn., to build a new machine shop which stands as one of the most modern of its type of construction in the Northwest. This shop was built and laid out with a view to handling the varied line of gas and steam engines which are built by this concern, and this necessitated a method of construction and layout that does not employ the features of progressive machining and assembly found in automotive plants, which can be devoted solely to one standard product.



FIG. 1. GENERAL VIEW OF TRACTOR ENGINE MACHINE SHOP

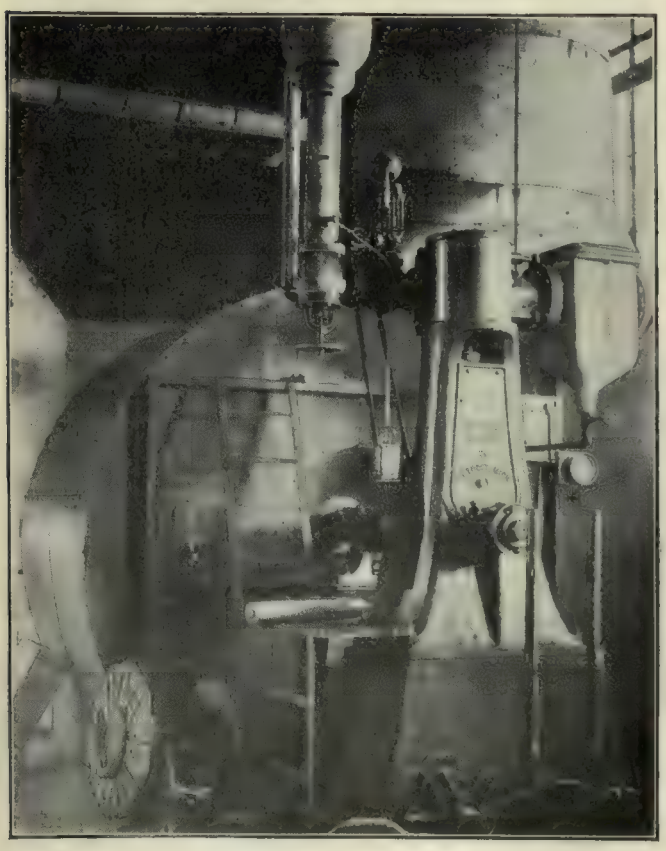


FIG. 2. ENGINE DRIVEN CIRCULATING FAN FOR HEATING SYSTEM

The main machine shop consists of a building approximately 280 ft. long by 96 ft. wide. This is constructed with a long center bay 48 ft. in width and side bays over which are located manufacturing galleries. The center bay is equipped with crane service of 10-ton capacity.

The side walls have an abundance of lighting space, which will approximate 60 per cent of the total wall area. The roof is also plentifully supplied with skylights, in fact even too much so, as the management states that in extremely hot weather the reflection and heat cast down by the skylights on the upper working galleries often becomes uncomfortable. To counteract this some of the skylights have been equipped with shades.

A general view of this shop, Fig. 1, shows that the center bay of the floor is used almost entirely for the assembly of gas engines and for the storage of finished machine parts and raw castings. This center-bay storage conveniently places all parts for access and the raw material may be quickly transferred from one part of the shop to another to bring it in line with the manufacturing machine tools, which are all located in the side bays.

Heating and Ventilating Systems

A heating and ventilating system for this shop was built by the American Blower Co. It consists of two steam coil units, one of which is shown in Fig. 2, located on opposite sides of the center of the shop. The cold air is drawn into the heating system directly from the shop through a series of steam coils in a large sheet-metal body on the far side of the centrifugal fan. The blower is driven by a "Type A" vertical steam engine, which is shown in the foreground of the illustration. From the fan the main heating pipe extends



FIG. 3. DISTRIBUTING PIPES AND HEADERS OF HEATING SYSTEM



FIG. 4. GROUP OF PARTS USED IN ENGINE ASSEMBLY



FIG. 5. MONORAIL TROLLEY HOIST AND SUPPORTS OVER AREAWAY

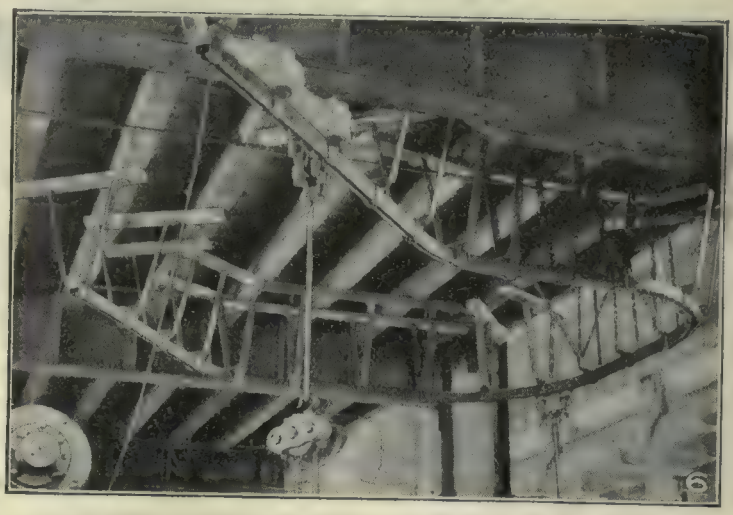


FIG. 6. TRACKS FOR SHIFTING CASTINGS BETWEEN MILLING MACHINES

upward through the gallery floor to a distributing header located along the ceiling.

The heated-air distributing system is shown in Fig. 3. The main pipe runs from the fan up an elbow near the roof that turns it toward the center of the shop and at a point parallel with the crane beams a great Y divides the flow between the two main headers extending to the opposite ends of the shop. On the back side of the headers are numerous openings, each regulated by a shutter, which throw the heated air to all points in the gallery. On the forward side of the header branch pipes (tapering into rectangular section as they run down along the side of the crane beams) carry the air through flared and shuttered openings into the side bays beneath the gallery.

The opposite side of the shop has a heating unit that is identical in its construction with the one shown. Although the climate of the Northwest is noted for the rigor of its winters this heating system has proved adequate.

As has been mentioned, the main bay of the shop is served by a single 10-ton crane. There are loading

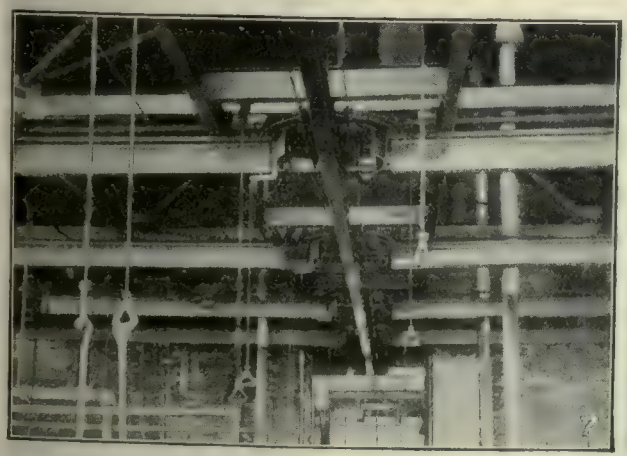


FIG. 7. OVERHEAD TROLLEY RAILS FOR SERVING TESTING ROOM

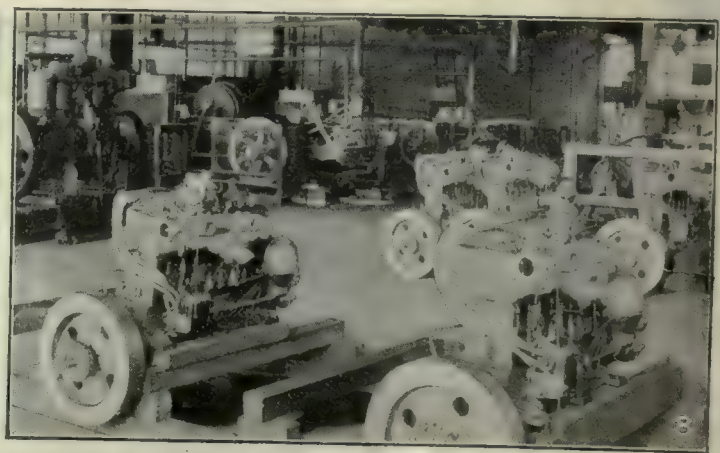


FIG. 8. ENGINES AWAITING TEST AND TESTING STANDS

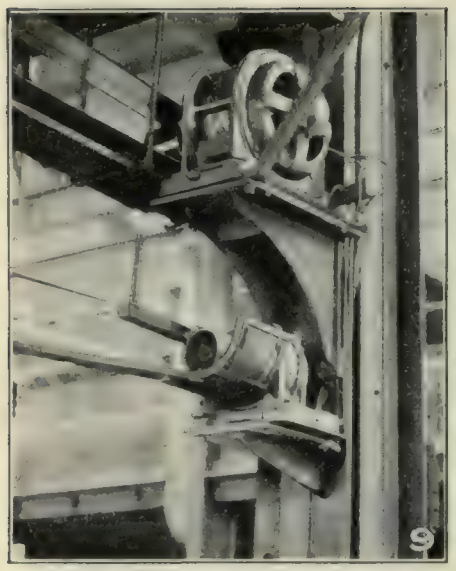


FIG. 9. BRACKET SUPPORTS AND BELT GUARDS FOR MOTOR DRIVE



FIG. 10. WORK BENCHES, CHIP SCREENS AND TOOL BRACKETS

platforms located on the galleries at both ends of the shop, so that material may be trucked to these and lowered as required to the main assembly floors. The balcony on the side shown in Fig. 3 is almost entirely devoted to bench work and to a large group of drilling machines. The balcony on the opposite side is occupied by light engine and turret lathes, except at the far end where one type of cooling radiator is made. Some space is also given to the storage of jigs and fixtures.

The main parts of the heavy tractor engine assembly are stored in the center bay, and their general character is indicated by Fig. 4. The heavy crankshafts shown in the foreground are for four-cylinder tractor engines.

Overhead Conveying Systems

The doorway in the far background shows a monorail trolley which picks up all material at the end of the travel of the main crane and either loads it on yard-trucks outside the building or carries it across into a parts-storage building.

The monorail hoist is shown in Fig. 5, at the point where the extension of the trolley system passes out of the west end of the machine shop. The trolley system is supported across this wide areaway by two heavy I-beams placed side by side with the necessary web-plates and frame to carry the trolley beams. Minor crane runways are provided at all points beneath the gallery bays where the work or machines to be handled necessitates hoist service. The special overhead construction shown in Fig. 6 employs the U-shaped form of runway. An extension bar connects the trolley with the chain hoist used for placing heavy engine castings on the tables of two Ingersoll planer type milling machines. The trolley hoist runway permits the casting to be picked up from the center bay and carried to either machine or from one to the other.

An I-beam trolley hoist serves the testing room. Its construction is shown in Fig. 7. The main track extends through the open doorway (shown in the background of the illustration) and underneath the balcony floor of the main machine shop to a point where it can be served with completely assembled engine units by the main crane. The cross-over switches permit the trolley-hoist to carry the engines out along the branch rails to the testing stands, one of which is served by each rail.

Gas Engine Testing Room

The testing room for the gas engine extends in a wing from the south side of the main machine shop, and the sloping nature of the outside ground level has permitted a high basement beneath the testing floor while keeping the latter level with the machine shop. The basement is used for the storage of finished and unfinished parts. The general construction of the testing room is somewhat similar to that of the machine shop and it is provided with ample lighting facilities.

Some of the many different types of engines built are shown awaiting test in the illustration, Fig. 8. Among these a 15-hp. vertical light tractor engine can be seen in the immediate foreground, and larger horizontal and vertical tractor engines ranging up to 40 hp. on the different testing frames. Water dynamometers are used for testing and the engines are directly connected to the same type of cooling radiators which they will use when in service, so as to detect any tendency to overheating. The engines exhaust through the pipes extending out through openings in the side windows. In the main machine shop group drive is employed for a limited number of machines but



FIG. 11. GENERAL VIEW OF PARTS-STORAGE BUILDING

by far the greater number are driven by individual motors. Among the latter many of the machines were purchased without attached motors and later equipped with individual motor drive. Arrangements were made to support these motors at convenient points close to the ceiling, or on floor columns as shown in Fig. 9, driving from these to countershafts supported from the wooden floor beams above. The motors that are attached to the floor columns are mounted on heavy cast-iron brackets, varying in size with the weight of the motor they sustain. In most cases the motors are provided with adjustable bases so that the belt can be tightened when required. Belt guards have been built beneath all main-drive bolts. The general character of this safety precaution is shown in the illustration.

Arrangements for Bench Work

Practically all of the workbenches, both on the main assembly floor and for the bench workers in the balcony, are double, one bench unit facing the other as shown in Fig. 10. Screens have been provided to prevent the chips and particles flying from one side and injuring the men working on the opposite side of the bench. This safety provision is obtained by a closemesh wire screen of heavy texture that is supported by a frame extending along the center of the tool benches.

An interesting form of toolrack is also provided which avoids the promiscuous throwing of all sharp-edged tools together in drawers beneath the benches. These brackets hang down the side of the wire screen partition, and the two sides of the frame are spaced far enough apart so that they will carry ordinary files, socket wrenches and similar tools which the workman usually has in his daily possession. These racks are made of No. 16 galvanized sheet-metal and have hooks at the top which go over the upper frame of the screen, while the bottoms are nailed to the woodwork at the back of the bench so that they will not swing out of place.

The supply storage building, which has been mentioned previously, adjoins the main machine shop, from which it is separated by an areaway. It is built two stories and basement in height, of exceptionally heavy slow-burning timber construction with brick walls. It was designed to sustain a floor load of 200 lb. per square foot, and its heavy construction is indicated in Fig. 11.

A single freight elevator is located in the center of the building.

Metal Cutting Tools—IX

By A. L. DeLeeuw

(Continued from issue of April 28.)

IN FIG. 150 is shown the principle of construction of the form-mill. *ABCD* is one tooth which is built up out of small sections; each section has two lines which run toward the center of the mill. All the sections are exactly alike. Each one is provided with the necessary clearance. If we should make a cutter in this fashion and grind away the first section there would be left a cutter of exactly the same contour. Grinding away the second section will still leave the contour unchanged, an so on. As a matter of fact, these sections are of infinitesimal thickness, in other words, the tooth is not made up out of layers which we can observe and the outline of the tooth is not stepped but is made continuous as shown in Fig. 151. This is done by the backing-off machine, and by using a tool which has the same outline as the piece to be milled. The method of making these backed-off cutters is too well known to go further into detail.

What we have said so far is to bring out clearly that what we should do to preserve the form is to remove by grinding one complete section. However, there is no way of finding out where one section ends and another begins in a form cutter. This is the cause of a great deal of trouble. If formed cutters had the teeth spaced absolutely evenly, if the hardening had not spoiled this spacing, and if then we should grind to the center and take care that with the last grinding cut we remove only a very small amount of metal, so that the teeth will be spaced evenly just as when the cutter was new, then we would have a proper cutter after grinding.

However, we cannot rely on the original spacing of the teeth, and we can say almost with certainty that the subsequent hardening has distorted this spacing to some extent; so that there is no way of finding out just how we should grind a form-mill in order to have all the teeth act to the best advantage. This faulty grinding of the form-mill is one of the main reasons why this mill is not as productive as it might be, and why a form-mill, as a rule, takes very much lighter cuts than a spiral mill.

Various methods are employed by careful shopmen to make the teeth of a form-mill act as evenly as possible. The teeth are indicated after grinding so as to make sure that all work to the same diameter and there are grinding machines in existence which are built on this principle of indicating the teeth. A better plan—better because the methods employed are more rugged and require less skill and care—is the following:

Referring to Fig. 150, let us imagine that a form-mill is made as indicated in this illustration. Let us imagine that every tooth has four sections, such as shown in the one tooth. Let us further imagine that the teeth are not evenly spaced and that the first sections of the various teeth are not necessarily set to the same diameter. In order to grind such a cutter we would place a stop somewhere so that one of the sections of tooth No. 1 rests against this stop. Let us say that section No. 1 of tooth No. 1 will bear against the stop, and further, that section No. 3 of tooth No. 2, section No. 1 of tooth No. 3, section No. 2 of tooth No. 4, all would bear against this same stop. Then if we employ this stop for holding the cutter while we grind the back of the teeth, we will produce a cutter of which the backs of all the teeth are located in the same relation to some section of the teeth. And if, then, we should grind the front of the teeth all alike relative to the back of the teeth, these teeth would all be of the same diameter.

In actual practice we place a solid stop and bear the cutter hard up against it, as shown by the arrow, Fig. 151, after which we grind the back of the teeth. After grinding one tooth we lift the cutter up, turn it through a certain distance, bring it down and bear the next tooth up against the stop. If the tooth bears against the stop at the point *A*, the point *A* of every tooth would be the

same distance from the center of the cutter, and as all the backs of the teeth are ground in the same relation to these points A, the backs are now a starting point for future sharpening.

The life of a form cutter becomes much greater and it becomes possible to take much heavier cuts when this method of sharpening is followed. Although it is somewhat of a bother to lay out the form tool with which the backing-off is done in such a manner that rake can be given to the cutter, this should be done in most cases for the effect of rake on the productivity of the cutter is even more marked with a form-mill than with plain or spiral cutters.

As a rule the movements produced by the backing-off machine are such that the amount of clearance at the various points of the cutter tooth are not the same, so that the conditions of cutting change somewhat after each successive resharpening. However, this change is so small that generally speaking it is of no practical importance. What is of importance, though, is the fact that the amount of clearance at various points of the cutter may vary largely on account of the shape of the cutter itself. In Fig. 152 a single tooth of a form-mill is shown. This mill would produce a half-round groove.

The form tool used in backing-off this mill is shown in close proximity to the tooth. The tool moving in the direction of the arrow will back off the tooth from A_1 to A_2. In doing so it produces two half circles going through A_1 to A_2 respectively. Any two points of these two half circles situated in a line parallel to the movement of the form tool will always be the same distance apart. For instance, A_1A_2 equals B_1B_2. This distance A_1A_2 is what produces the clearance at A_1, but the distance B_1B_2 does not produce the clearance at B_1. At that point we would have to draw a line at right-angles to the work, B_1B_3, and the distance between the two half circles on that line would be the distance which produces the clearance. In this case it would be the distance B_1B_4. At the point C this distance would be very small, and still further down the clearance would entirely disappear. This condition is very marked whenever the cutting portion of the tooth approaches a direction at right-angles to the arbor. The full effect of the clearance is only felt when the surface of the tooth is practically parallel with the longitudinal axis of the arbor.

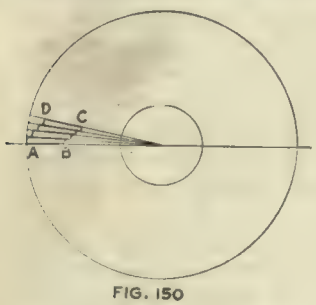


FIG. 150

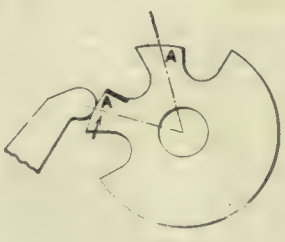


FIG. 151

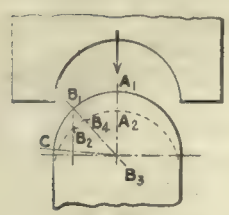


FIG. 152



FIG. 153

FIG. 150. PRINCIPLE OF CONSTRUCTION OF FORM-MILL. FIG. 151. FORM-MILL AND GRINDING STOP. FIG. 152. ONE TOOTH OF FORM-MILL FOR SEMI-CIRCULAR GROOVE. FIG. 153. A FORM-MILL SECTION

Fig. 153 shows a form-mill. From A to B the cutter has the full benefit of the clearance. From B to C the the clearance has almost disappeared. From C to D the clearance is diminished but not lost. From D to E the cutter has the full benefit of the clearance. From E to F the clearance gradually diminishes again and is zero at F. From F to G the cutter again has the full amount of clearance.

If a cutter were required of an outline as shown in Fig. 154, there would be no clearance at the points A and further to the center because the clearance would be formed by the dotted line which meets the full line at A. However, it is possible to make such a cutter with clearance all around. To do this the form tool is made as shown in Fig. 155, and is placed on the toolslide of the backing-off machine in such a manner that its movement will first be in the direction of the arrow No. 1. After the left side of the cutter has been backed off, the toolslide is changed so as to move in the direction of arrow No. 2. The result will be that clearance will be provided as shown by the dotted line.

This method solves the problem of providing clearance at all points but introduces a new problem. If we should imagine the cutter being ground away down to the dotted line, we would again have a cutter of the same general configuration, but not of the same size as the original cutter. The problem, however, is easily solved by making the cutter interlocking. Wherever a complicated cutter has somewhere a straight line in its contour and parallel with the direction of the arbor, this method can be employed.

This method, then, could be employed on a convex

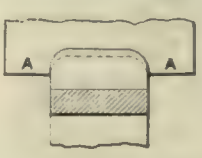


FIG. 154

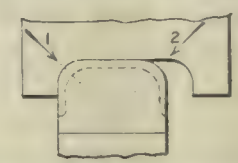


FIG. 155


FIG. 156

FIG. 154. CUTTER WITHOUT SIDE CLEARANCE. FIG. 155. ARRANGEMENT TO GIVE SIDE CLEARANCE. FIG. 156. INTERLOCKING CONCAVE CUTTER

cutter. On a concave cutter, such as is shown in Fig. 156, we can make it again interlocking, but we would not succeed in getting a perfect half circle. There are many cases where it is of more importance to have some clearance than to have a perfectly correct outline, and this method of giving side clearance and making the cutter interlocking can be used many times to good effect in practice.

The beneficial effect of rake on form cutters was mentioned before. This good effect is not only due to the fact that less power is required to take the chip, but also because, to a certain extent, rake produces the same effect as spirality of the teeth. In Fig. 157, OA is the radius to the farthest projecting point of the cutter, and OB is the radius to the deepest point of the tooth. When the tooth AB has reached the work at A a cut begins at that point, but the cut does not yet begin at B, and will not begin until B has reached the point C. This is exactly what would happen if there were no rake, but if the points A and B had been located on a spiral.

The amount of spirality depends on a number of things: on the diameter of the cutter, the angle between OB and OA, the depth of impression AC and the contour of the cutter. If, for instance, the cutter had a shape as

shown in Fig. 158 in which *ABCD* is the cutting tooth, we would find that the rake does not have the effect of spirality from *A* to *E* or from *B* to *F*. From *E* to *G* the effect would be quite marked; from *G* to *H* it would be very little; from *H* to *I* it would be considerable; from *I* to *K* it would be practically nothing; from *K* to *L* it would be much like that from *E* to *G;* from *L* to *M* it would be very marked, etc.

This peculiarity of the cutter with rake is so marked that to the casual observer the action of a form cutter with rake resembles much more the action of a spiral cutter than that of an ordinary form cutter.

The fact that the amount of rake is not the same at *A* and *B*, or for that matter, at any of the intermediate points has been mentioned before. In Fig. 159 the rake at the point *A* is given as 10 deg., the diameter of the cutter is supposed to be 3½ in. and the depth of impression is ½ in. Under those conditions the rake at point *B* will be 14° 2′. Under ordinary circumstances this difference in rake is not very great, but with gear cutters, or any other cutters where the depth of impression is great as compared to the total diameter, the difference in rake is enough to require careful consideration. Not

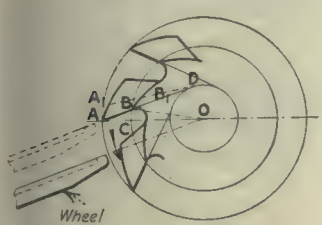


FIG. 157

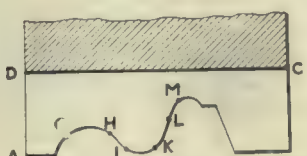


FIG. 158

FIG. 157. GRINDING RAKE ON A CUTTER. FIG. 158. CUTTER WITH VARYING SPIRALITY

only is the rake different at the points *A* and *B*, but this amount of rake changes again after the cutter has been ground a number of times, because then both the points *A* and *B* will be located on smaller diameters. As a rule this difference is not great enough to cause trouble. However, when formed end mills are used which are naturally smaller than cutters of the same contour, but used on an arbor, the diameter at *B* may be so small relative to the diameter at *A*, and the diameter at *B* may become so small after repeated grinding, that it is well to calculate the amount of rake which should be given at the point *A* in order not to have too much rake when the cutter is nearly worn out.

Though the following points might properly be taken up in the chapter on grinding cutters, it is perhaps better to point out here how a form cutter with rake should be ground in order to preserve the same contour. In Fig. 157 the line *AB* is drawn tangent to a circle *OD*, the circle being of such a diameter as to produce the desired angle at the point *A*. If the cutter is dull and we wish to regrind it, we must grind off a slice until we get the line A_1B_1, and this line A_1B_1 should again be tangent to the circle *OD*. At first glance it might be thought that we would set the cutter with the line *AB* horizontal and then turn it downward through an angle equal to the rake angle at *A*, say 10 deg. But if we did so we would also make a rake angle of 10 deg. at the point A_1 and this would cause a change in the contour of the cutter. What we should do, therefore, is to find the diameter of the circle *OD*, place the wheel central with the cutter as shown in the illustration and then move the cutter at right-angles to the wheel a distance equal to the radius *OD*. As a rule, form cutters with rake have the rake angle marked on the cutter. This is not correct, as there is not one single rake angle even when the

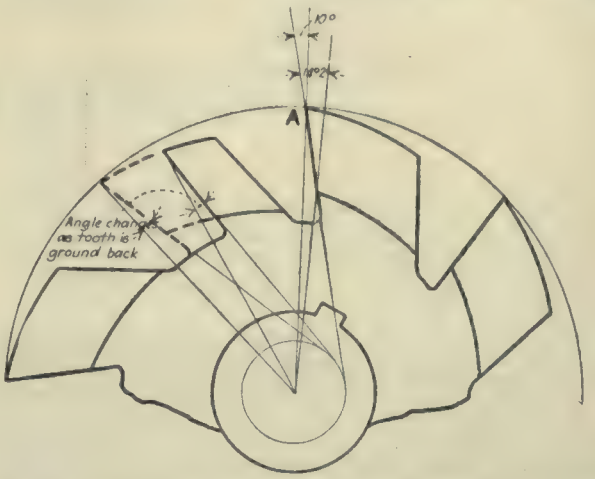


FIG. 159. CHANGE OF RAKE ANGLE DUE TO GRINDING

cutter is new, and if there were, it would be lost at the first grinding. *The cutter should be marked with the size of the circle OD.*

To illustrate the effect of this faulty grinding on the contour of the cutter a cutter of simple shape is shown in Fig. 160. The conditions are somewhat exaggerated because it is not very well possible to show defects of a few thousandths of an inch on a small scale drawing. The full line shows the original contour. The compound line shows the contour we should have after grinding, while the dotted line shows the contour we will get if we maintain the original rake angle at the extreme point. The angle *OAB* is the original angle. The cutter is supposed to be ground so that the angle *OCD* equals angle *OAB*, whereas the angle to which it should have been ground is angle *OCE*. The two lines *CD* and *CE* intersect the cutter at *F* and *G*, and when projected give the points F_1 and G_1. It will be noticed how this changes the outline of the cutter after grinding.

The manner in which a cutter is backed off is well known. If the cutter is without rake a form tool of the desired shape is placed with its cutting edge on a level with the center of the cutter. The slide to which this tool is bolted has a motion toward and from the cutter center, controlled by a cam, and making one movement for each tooth in the cutter. A greater amount of eccentricity of the cam would give more clearance, an irregular shape of the cam would give an irregular clearance, etc. Whatever the peculiarities of the cam may be, any section of the tooth taken toward the center of the cutter will have the same contour, namely, the counterpart of the contour of the form tool.

Conditions are not so favorable when a form cutter with rake must be backed off. In order to do this properly the tool must be set above or below center and must have a contour different from the contour of the work to be made by the mill. In Fig. 161 a cutter of 3½ in. diameter is represented, with a depth of impression of about ½ in. The point *A* is shown on the horizontal line. The point *B* will make its proper impression when it has reached that line. It reaches the line *OA* by swinging around the point *O* as center. This point will be point *C*. Another point is shown on the line *OA* obtained by drawing a perpendicular from *B* to *AO*. A number of

these perpendicular lines are shown indicating that we had obtained the contour of the form tool by laying out the proper shape in the plane of *OA* and raising per-

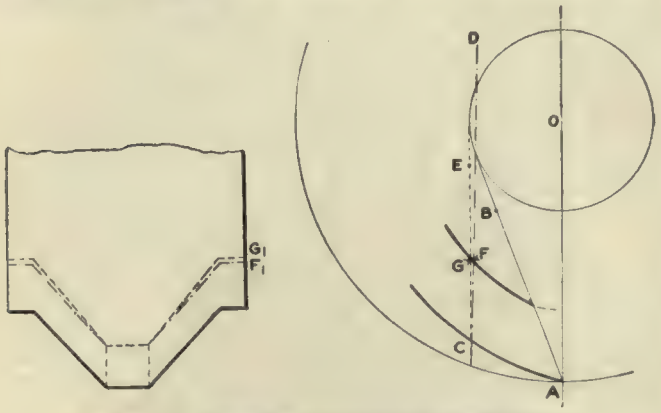
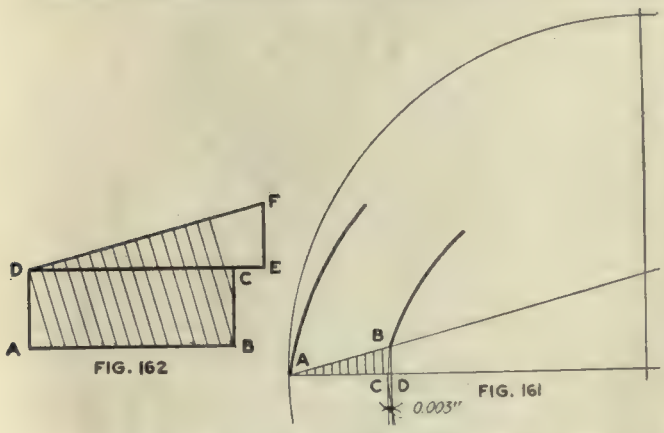


FIG. 160. EFFECT OF FAULTY GRINDING

pendiculars at the various points of that form and intersecting a plane going through *AB*. In this manner the point *B* is the projection of *D*. If we make *AB* exactly ½ in. we will find that *AC* is 0.003 in. less than ½ in. In other words, if we have made our form tool in the manner described we will get a shape which is 0.003 in. undersize.

This error may, or may not, be more than what is per-



FIGS. 161 AND 162. METHODS OF LAYING OUT FORMED CUTTERS

missible. If it is not permissible then the manner of making the form tool should be this: The various points of the form tool should be laid out along the line *AO* and should be circled over until they strike the line *AB*. The points thus obtained would be the corresponding points for the form tool. This is an elaborate method of laying out and might easily lead to a greater error than 0.003 in.

The other method, the raising of perpendiculars on the points of *AO*, leads to a simple way of making the form tool. In Fig. 162, *ABCD* is the piece of steel of which the form tool should be made. A wedge *DEF* with the same angle as *BAC* is placed on top of the piece of steel. The form tool is laid out so as to give the exact shape desired on the plane *DF*, and is then filed out perpendicular to that plane as shown in the figure. If the wedge is then removed the shape of the impression in the piece *ABCD* is the same shape as we would have obtained by projecting the various points of *AD* (Fig. 161) and that without the necessity of transferring drawings or dimensions. The piece *DEF* may be a separate piece clamped to *ABCD*, or it may be made in one with it and planed off later. The first method may be preferable, especially if the form tool is made of high-speed steel.

The Unostentatious Foreman

BY L. L. THWING

Speaking of foremen, every shop has several varieties, particularly if it is an old shop and has developed, or rather selected, them from its own ranks. Some are placid, some are nervous, some make a lot of fuss and appear to get results only by constant agitation, while others never seem to be doing anything but still they get out the work. I have one of these in mind now. Whenever you went into his room you would find him at his desk; only rarely would he seem to be giving his personal direction to any work. He was never hurried, and his men never seemed to be, but we never had to worry about his part in the chain of production. But for all his being so inactive, he knew what was going on in the shop. If Bill Smith telephoned down that he must have 200 No. 7 boxes by the next morning, he knew whether Bill was stating facts or getting ready an alibi for some of his own shortages. He knew, too Bill had fifty of these hidden away for an emergency.

If the foundry stopped work on some of his jobs he knew about that also, and he was nearly always able to get it put back, even when other work was more badly needed. In short he knew "the ropes" around the shop, and had a good pull on most of them. He belonged to the generation that started work at 6 o'clock and he still clung to these hours.

He was clever, too, at choosing and handling men, and most of them had been with him a long time. He had a few that none of the other foremen could handle, but he seemed to be able to put up with one or two periodical drunks, two Armenians with a tendency to run amuck, and one epileptic. He may have figured that these five men were worth about four from a productive standpoint, and when he saw signs that Joe Egan was due for a drunk, he began to accumulate an extra supply of "P-sixes" against the Monday morning when Joe's lathe would be idle. When he saw the epileptic begin to jump and fidget, he took him off the shaper and set him to lapping out bushings. And right after one Armenian ran his truck over the other's toe, he put one in one corner of the room riveting on striker arms, and the other in the most distant corner chipping snags off a lot of die shoes.

I do not believe he was much of a mechanic himself, and I suspect that he relied on his ability to pick out men who were skilled in that line and then left all question of method with them. He would listen to any explanation or suggestion without a word but if there was anything wrong or anything that he did not understand, sooner or later there would come a ring on the drafting room phone, and we might be asked a few questions that we could not readily answer.

I do not know that old Dan could qualify as a modern type of foremen; appearances were against him and one had to live with him a long time to appreciate that even if he was no hustler, he did get the work out. His specialty was operating men and not machines, and who shall say that the generally accepted methods of the general manager's office are not to a large extent applicable to the foreman's desk.

Machining Operations on Locomotive Connecting Rods

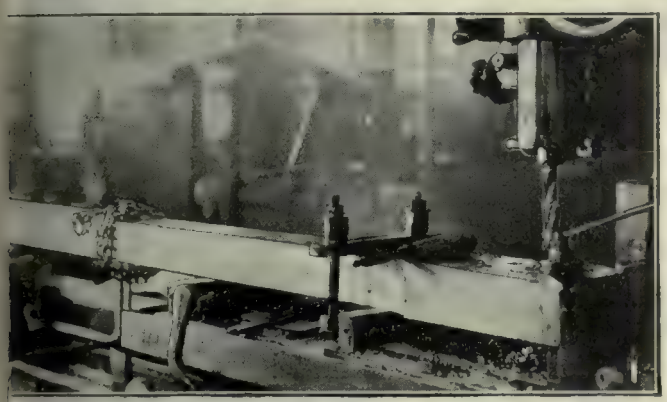
A Number of Operations Are Required in Making Connecting Rods—The Principal Machining Is Done on a Milling Machine

By FRANK A. STANLEY

THE illustrations show some machining operations on heavy forged connecting rods for locomotives, including work on both the main and the side rods. The photographs were taken in the shops of the Southern Pacific Co. at Sacramento, Cal., and represent the practice at that place.

Considering first the main rod, Fig. 1 illustrates the drilling of the solid end of the forging after the sides and edges have been milled flat and square. The ends of rods already drilled, as they appear when ready for the machining out for the bearing brasses, are shown in Fig. 2.

After the metal has been cut out between the drilled holes and the opening machined to the required dimensions by means of an end mill in a vertical-spindle milling machine, the brass is fitted in place and the connecting rod is again put in the drilling machine for the boring out of the brass. This boring operation is accomplished in the manner represented in Fig. 3. A single-pointed boring tool is held in a short, solid bar carried by the heavy drilling machine spindle, and this tool bores out the hole in the cast brass to the required diameter.



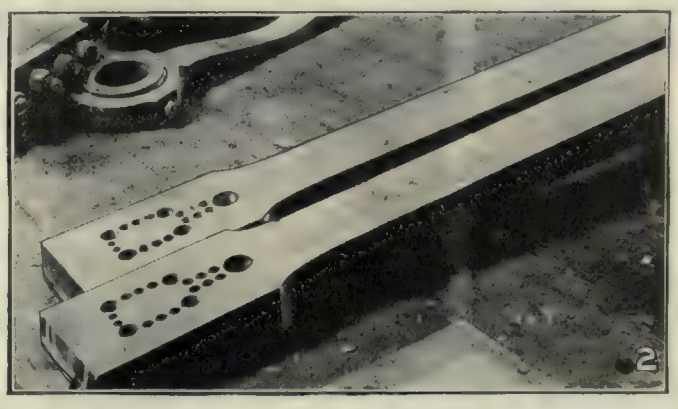
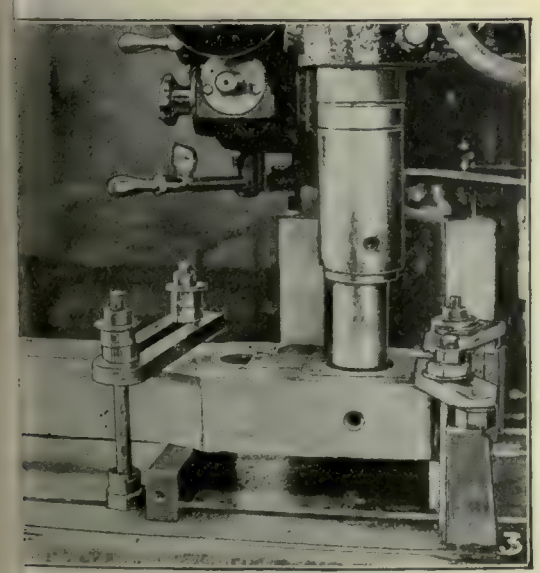


FIG. 1. DRILLING THE SOLID END OF THE MAIN-ROD. FIG. 2. BACK END OF MAIN-ROD READY FOR CUTTING OUT HOLE FOR THE BRASS

Channeling the Main Rod

The milling of the channels along the sides of the main rod to proper depth and width is done on a horizontal milling machine, as shown by Fig. 4. On the sides of the rod illustrated, the channels are cut 3½ in. wide by 1¾ in. deep, leaving ½ in. thickness of metal in the web at the center of the rod. A cutter about 7 in. in diameter is used on the spindle of the milling ma-



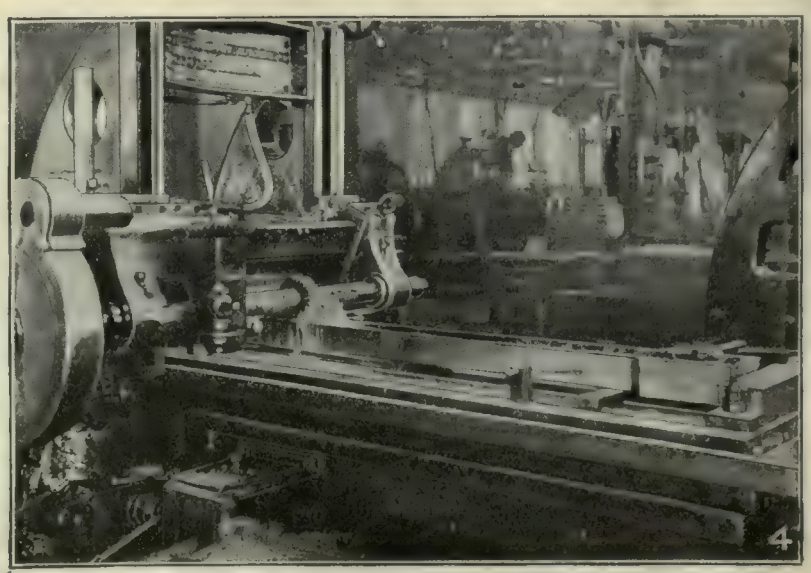
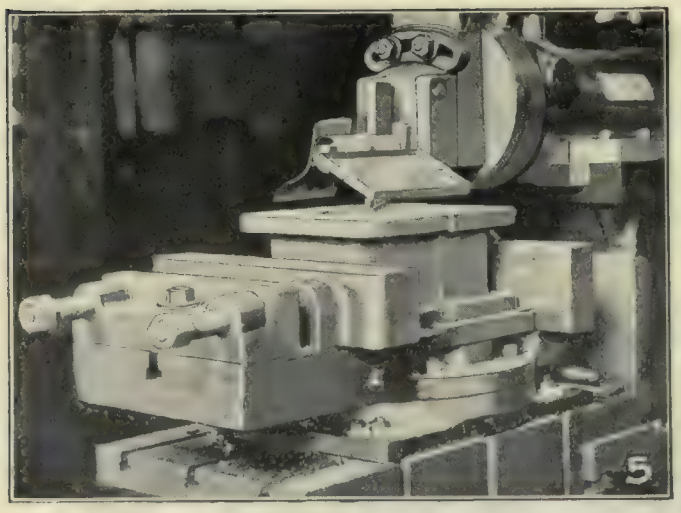


FIG. 3. BORING OUT THE BRASS IN THE SOLID END OF THE ROD. FIG. 4. MILLING CHANNELS IN MAIN-ROD



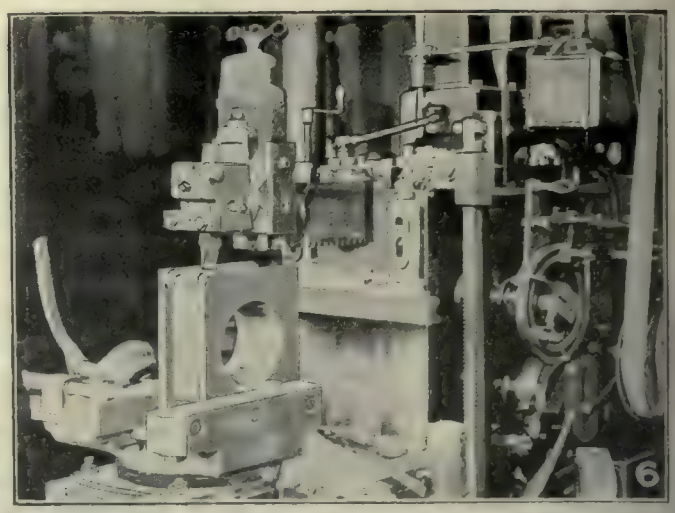
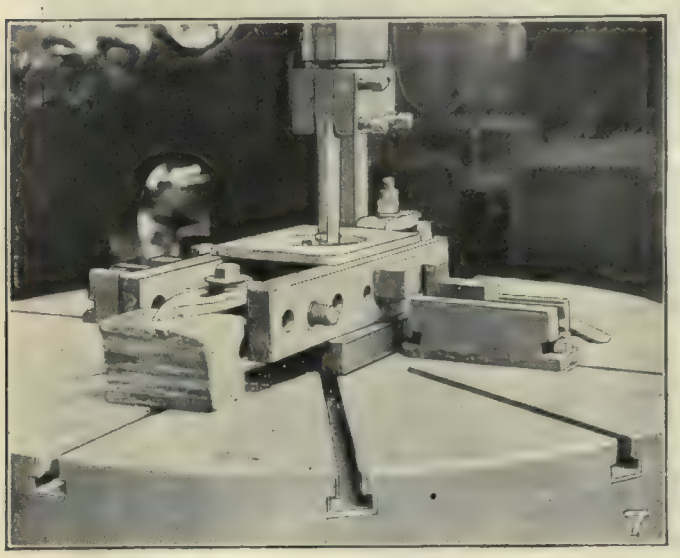


FIG. 5. FACING THE BRASSES FOR THE STRAP END IN A SHAPER. FIG. 6. FINISHING EDGES OF BRASSES IN A DRAW-CUT SHAPER

chine, the width of the cutter being 2 in. Two cuts are taken to bring the channel to width, each cut being made to full depth, or $1\frac{3}{4}$ in. The length of the cut is 65 in. In taking the channeling cut, the cutter is operated at 50 revolutions per minute, which means a surface speed of 84 ft. per minute. The rate of longitudinal feed given the work against the cutter is 2 in. per minute.

The machining of the flanged brasses for the strap end of the connecting rod is shown in Figs. 5 and 6. The first of these views illustrates the shaping of the sides of the big brasses, with the work held in the



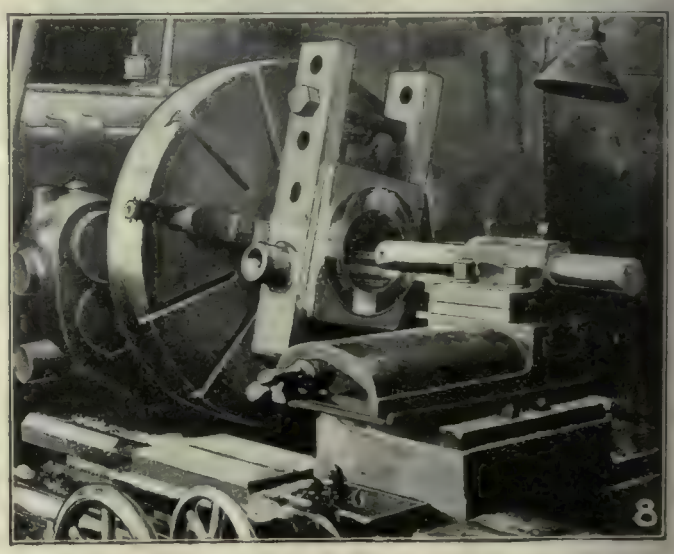


FIG. 7. BORING A BRASS FOR A ROD IN A BORING MILL. FIG. 8. BORING A BRASS IN A LATHE

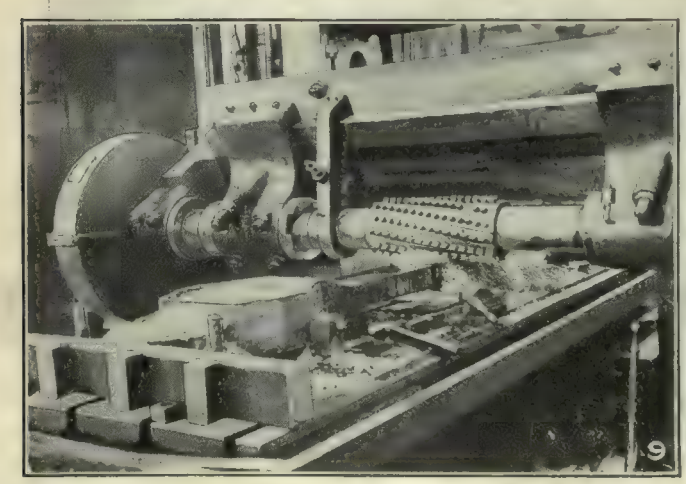
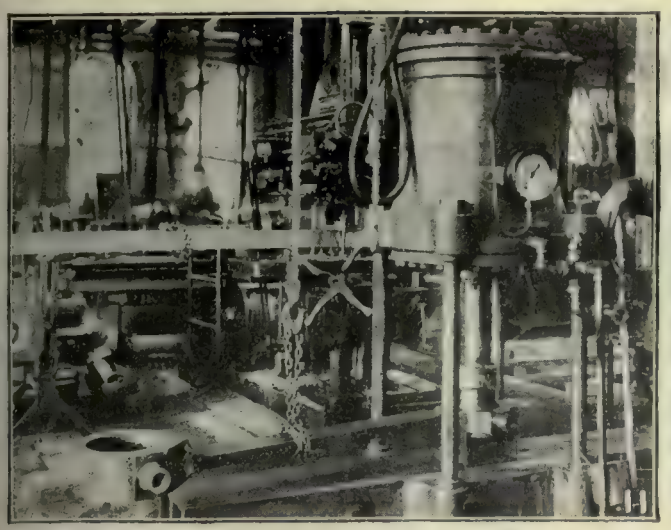




FIG. 9. MILLING SIDE OF FORGING FOR SIDE-ROD

FIG. 10. MILLING EDGE OF SIDE-ROD FORGING



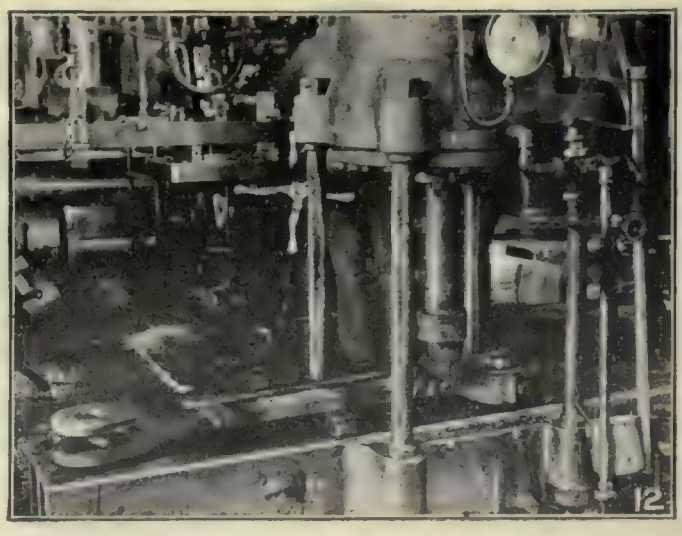


FIG. 11. PRESSING BUSHING IN FRONT SIDE-ROD. FIG. 12. STRAIGHTENING A BACK SIDE-ROD

vise on the table of a shaper. In this operation a transparent guard in a metal frame is carried by the toolpost, so that the brass chips are prevented from flying and at the same time the machinist can examine the work freely. A draw-cut shaper is shown in Fig. 6 in the operation of machining the flanged edges and bearing surfaces around the four sides of the brass. Here the work is again secured in the vise of the shaper, but this time in an upright position.

Two different ways of boring the main-rod brasses are represented in Figs. 7 and 8. In the first method the work is held in the strap, with the latter mounted on parallels on the table of the vertical boring mill. The other method is to mount the strap and brass in the four-jawed chuck of a big lathe, as shown in Fig. 8, and bore the brass with a toolbar carried on the toolslide of the lathe.

Milling the Side-Rod

The milling of a side-rod forging is illustrated by Fig. 9. The removal of the heavy cuts from the sides of the forging is accomplished on a horizontal milling machine with a big inserted-tooth cutter, shown in place on the arbor of the machine. This cutter is over 22 in. wide across the face and 10½ in. in diameter. It is fitted with twelve rows of 1-in. high-speed-steel teeth inserted in helical lines across the face of the cutter body. In taking the cut shown, the cutter is rotated at 28 turns per minute, or at a surface speed of 66 ft. per minute. The rate of feed is 1½ in. per minute. The amount of metal removed from the side of the forging in the one cut is ⅜ inch.

The edges of the side-rod forgings are milled in the manner shown in Fig. 10. In this case there are two of the large inserted-tooth mills set up on the machine spindle, each cutter being adapted to milling the edges of two side-rod forgings at once. Thus, four forgings can be edged at one setting, although the view actually shows only two, both of which are being machined under the further cutter. The amount of metal to be removed from the edges varies from ⅜ to ½ in. until the large end is approached, where the stock milled away is 2 in. or more in depth for a distance of a few inches. The ends of the rods have a thickness of from 3 to 4 in. and about ½ in. of metal has to be removed from each side, this being taken in a single cut. The feed of the work to the cutter is 2 in. per minute. The speed of rotation of the cutter is the same as for the slabbing operation shown in Fig. 9, or 22 revolutions per minute.

The rounded ends of the front and back side-rods are machined to the radius desired by mounting the work upon a rotary table on a vertical-spindle milling machine and using an end mill.

In Fig. 11 a front side-rod is shown under a pneumatic press for the forcing in of the brass. In Fig. 12 the same press is shown in the operation of straightening a rear side-rod.

The milling out of the forked end of the rear side-rod is accomplished upon a large horizontal milling machine with a 2-in. helical cutter 9 or 10 in. long, in order to reach across the widest portion of the rod end, which measures 8 in. across the forging.

"Black Nickel" Plating Solutions*

Numerous formulas have been proposed for the production of "black nickel" deposits such as are used extensively for producing a dark or black finish upon brass or other metals. Two types of solutions have been used, namely, the alkaline, cyanide solutions and the neutral sulphocyanate solutions. Experiments showed that the former were very difficult to prepare and maintain of uniform composition, and therefore they cannot be recommended. It was found that a sulphocyanate solution having the following composition proved satisfactory:

	oz./gal.	g/l
Nickel ammonium sulphate	8	60
Zinc sulphate	1	7½
Sodium sulphocyanate	2	15

It is desirable to keep in suspension an excess of zinc carbonate, which maintains the neutrality and the zinc content of the solution.

"Black nickel" plating may be applied successfully to brass, either directly or after copper plating, to copper, and to steel which has been first coated with copper, nickel, or zinc. Where protection against corrosion is desired, the "black nickel" should be preceded by zinc plating. The wearing properties of the "black nickeled" surface are largely determined by the quality of the lacquer subsequently applied.

*Abstract of Technologic Paper of the Bureau of Standards, No. 190, by George B. Hogaboom, T. F. Slattery, and L. B. Ham. The complete paper may be secured from the Superintendent of Documents, Government Printing Office, Washington, D. C. Price five cents.



The Foreman and His Job

Suggestions for live foremen who wish to go up the ladder; and for firms who want better shop executives

By FRED H. COLVIN
Editor, American Machinist

ONE of the vital essentials for foremen—even more than for others—is open-mindedness, the willingness to hear new ideas, to see new methods and to give them a fair trial. No matter if they seem to be wrong, if they seem contrary to his own best past experiences, there is a bare possibility that they will work just the same. Men of set ideas, who adhere to the past and always try to prove new ideas wrong, do not get very far up the ladder of shop management.

Men who never change their opinions are a handicap to progress. The man who boasts that you "always know where to find him" on all questions is simply advertising the fact that he is too stubborn or too unprogressive to consider or try new ideas. The fear of being called changeable or inconsistent has held many a good man in bondage to old ideas. The sphinx is unchangeable but it does not progress.



CHAINED TO THE PAST

The man who can keep an open mind for new things, who will neither favor nor condemn them just because they are new, but who keeps a sane viewpoint and balances the possibilities of the new against his experiences with the old, is the man who will go far in these days when real executives are needed as never before.

Learn Why Things Fail

It often happens that a plan or an idea which failed in the past, may work well now because of changed conditions. This makes it necessary to analyze the *reason* for failure in the past, before condemning any plan or idea to make sure whether the reason for failure still exists or not.

Snap judgments may appeal to some but they frequently work injustice to individuals and cost the firm money. Indecision is equally bad. Study the reasons and arguments on both sides, and then decide as promptly as necessary.

An open mind is especially necessary in shops where workmen's committees are in existence. Plans are likely to be suggested which the experienced executive has good reason for believing impracticable. But no plan or suggestion should be arbitrarily laid aside or dismissed. Reasons must be given in all cases if confidence is to be secured and maintained.

The best way is to ask questions as to details instead of condemning the plan. Perhaps something of this sort might help. "The plan sounds good and seems to have some good points. But what is your idea of handling this detail?" "You know we can't get that kind of stock except as a special order and at a special price—so we have to use the other." "How would you get over this difficulty?" etc., etc.

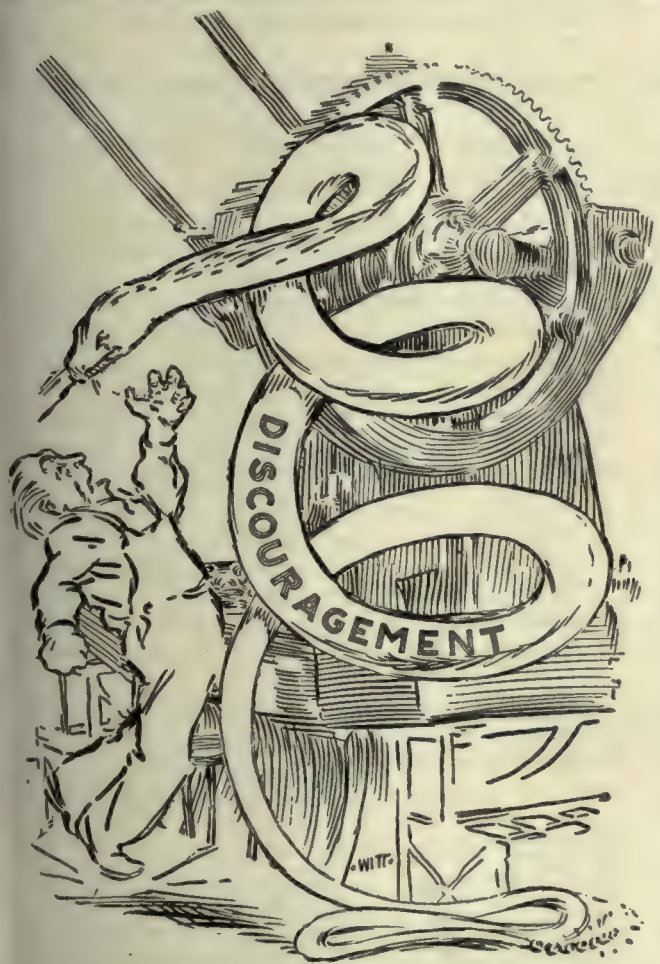
Shop Diplomacy

It is rarely best to decide against a plan instantly or to condemn it without taking a little time to talk with the one who proposed it. Get his point of view, his reasons for thinking it an improvement. Then, if the plan is not practicable, lead him to see it by "I wonder how we would handle such a case as this," and make him see that his plan will not be satisfactory. Don't make the mistake of trying to show him how much more you know about such matters

than he does. You know it and so do others. But you ought to know more—that's what you are hired for and paid for.

By handling the situation with tact and kindly interested, you can make a friend instead of an enemy. You can encourage more suggestions along better lines instead of discouraging them. And discouragement is one of the grave dangers in industry today. We want workers who take an interest in their jobs, to whom the shop is more than a place to work, a place with many things of interest, where the worker helps to build worth-while machinery which adds to the welfare of the world.

With ideas of this kind in his head, the foreman himself will get more out of life. The men in the shop



DISCOURAGEMENT LOOMS LARGE

and the shop problems themselves will take on a different aspect, and life in the shop will become more interesting in every way.

The old idea that the foreman should have all the knowledge and wisdom to propose new ideas, is rapidly passing. His experience and training will naturally give him many new ideas, or new applications of old ideas. But the foreman who can encourage his men to develop new methods of doing work, new plans for utilizing machines, makes himself of great value to his employer.

With practically every man in the department thinking of new and improved methods, the foreman may be sure that his department will be at the top of the list and that his fame will be in no-wise dimmed because some may consider it as reflected glory.

The Present Status of the Metric Argument

By Frederick A. Halsey*

The persistence of old units in so-called metric countries being now established, it is proper to point out its significance.

Prior to this discovery it was accepted by all that the countries claimed to be metric were so in fact. So far as known no one suspected and certainly no one had proved the contrary.

Until the discovery the anti-metric argument was two-fold:

(1) The merits of two systems were discussed and the superiority of the metric was denied. For example, the paper by Dr. Sellers read at the first meeting of the A. S. M. E., showed that the Sellers' works had tried the metric system and did not like it.

(2) The cost of changing systems was also discussed and there was very little to place against the claim for the superior simplicity of the metric system and nothing to controvert the claim that it is universal, except in English speaking countries. The metric party assumed that the countries that had tried to adopt the system had succeeded and from this assumption they argued that the change could easily and quickly be brought about. Granting the assumption, the argument seemed conclusive and against it we had nothing to offer except the opinion of the meeting.

The discovery that the assumption is false, that the so-called adoption of the system was in most cases nothing more than its introduction and in all cases very imperfect revolutionized the argument.

Not Universal

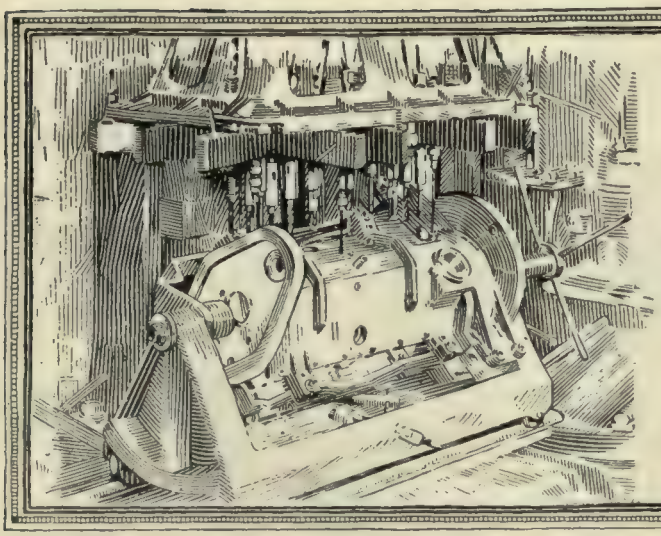
Against the claim that the system is universal nearly everywhere, we now have proof that it is universal nowhere. And against the repeated assertion that the change is easy, we have proof that it is of such difficulty that no country has completed while few have made much progress toward it.

Even more important, the entire case for the system based on its supposed greater simplicity has become purely academic. We must compare what we have with what we will get, not with what it is hoped we will get. And we will get what others have got—a mixed or dual system—a condition in which the new units have merely been added to the old; a condition that not only destroys all arguments that have been advanced by the metricites but inverts them and turns them against their advocates. Thus we will have more, not fewer, units; more and worse, not fewer and better, ratios; more complex, not more simple, calculations; more, not less, for school children to learn and in general diversity and complexity, not uniformity and simplicity; trying situations with most difficult solutions.

Incidentally the facts now established demonstrate the ignorance of those who claimed the contrary. It is now clear that having no knowledge of fundamental facts they assumed as true whatever they wished to be true and based their claims on these convenient assumptions. There never was a better illustration of the aphorism: Repeat a statement often enough and you will be believed.

The simplest possible application of the facts is to show the futility of our trying to do what so many have tried and failed.

*Commissioner American Institute of Weights and Measures.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Drill Jig Design Continued—Clearance for Work and Chips—Provision for Wear on Locating Surfaces—Setting Up and Removing Work—Types of Jigs

WHEN designing, the matter of clearance around the work between the walls of the jig and the work must be given careful consideration. An example to illustrate this point is shown in Fig. 22. In this case the work *A* is located on a stud *D* placed in the body of the jig, which is made of cast iron. Now assuming that the work *A* is a casting, there is likely to be some variation in its outside dimensions; if the jig body *B* is also a casting there is likely to be some variation in its dimensions as well. Therefore the clearance as indicated at *C* between the walls of the jig and the work should be ample to allow for variations in the castings. As a general thing the distance *C* should never be on small work much less than $\frac{3}{8}$ in., that is to say on a piece of work having dimensions about 4 x 6 in. On larger work which may run to 18 or 20 in. or even more the clearance would be correspondingly greater. The writer has known of several cases within the last year where the clearance around rough castings of large size has not been sufficient to take care of variations. In one case the matter became so serious that it involved practically the rebuilding of a large part of an expensive trunnion jig. It is evident therefore that the matter of clearance around the work in a jig must be given the most careful consideration.

Many designers do not pay enough attention to the matter of cleaning a jig. It is evident that when work is being produced on an interchangeable basis by the use of jigs and fixtures there is a great accumulation of chips which must be removed from the jig as each new piece is placed in position. Now, up-to-date production methods call for rapid clearing and there are several methods in vogue depending on what material is being drilled. Some factories use air pressure while others depend on a can of kerosene into which the workman can dip his jig from time to time, but all of them provide the workman with a brush to keep the jig clean. Now it is evident if a brush is to be used to keep the locating surfaces in a jig clean it is important to be able to reach these surfaces with the brush. If this is not possible the jig must be made open so that the chips can be washed out as they accumulate. Locating pads or points should be built up above the surface of the jig.

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A simple type of jig is shown at *B* in the upper par of Fig. 23. In this case the work *A* rests on a stud bu the walls of the jig surround it so that it cannot b easily cleaned. The designer however, by coring som openings at *C* provides means of washing out the chip without difficulty. In the lower part of the illustratio the work *E* is a finished piece which is located on center stud *F* supported on four points *D*. These point are built up above the surface of the jig so that the

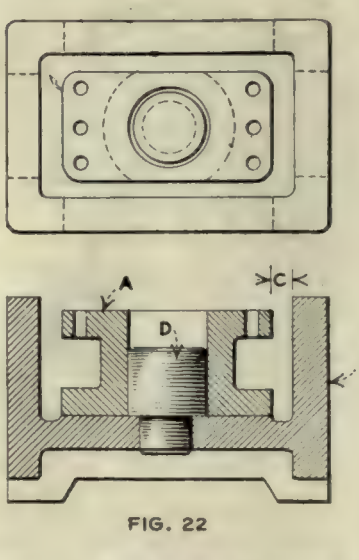


FIG. 22

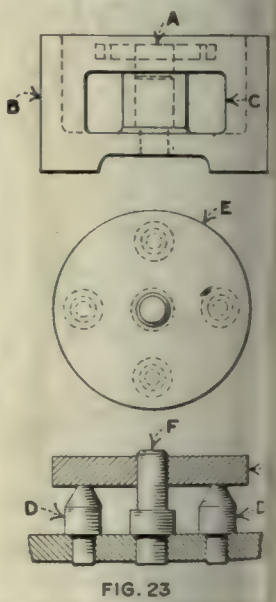


FIG. 23

FIG. 22. CLEARANCE AROUND WORK

FIG. 23. PROVISION FO CLEANING

will not be apt to accumulate chips and they can als be very easily cleaned. Do not neglect the matter c cleaning when designing a jig.

When jigs are used for a great number of pieces a frequently happens in high production methods, th matter of wear and the accuracy depending thereo must always be considered. Not only should locatin points on surfaces be so made that they can be replace by others when worn, but also the manner in which the are likely to wear should be given attention. An ex ample of this kind is shown in Fig. 24 in which th

work *A* is a finished piece which locates on the stud *C* and rests on the hardened locater *B*. Now if this locater is made slightly smaller in diameter than the work so as to allow the latter to overhang a little all around as indicated at *D*, there is no danger of wearing a pocket or recess in the locating member. But if it should be made as shown in the upper part of the illustration at *E* it is very evident that after a number of pieces have been machined a pocket might be worn in the locater as indicated at *F*. In a case of this kind it would be found that the work might take the position shown at *G* and the inaccuracy *H* would result. The tool designer must always consider these points when designing his jig.

If it were possible to break up the chips when drilling so that they would be in the form of dust there would be very little trouble caused by chips, but as this is not the case suitable provision must be made to take care of them as they are produced. Referring to Fig. 25, an example is shown in the work *A* which indicates the provision which has been made in the locating V-block *B* to provide for chip clearance and cleaning. If this V-block extended down the entire length of the work *A* it would be very difficult to clean out the chips that might accumulate around the edges of it, but by cutting it away as shown the trouble is avoided.

In the upper part of the illustration several examples of bushings are shown. Let us assume that the work *C* is to be drilled. Now if the bushing is placed too close to the work as shown at *D* there is no chance for the chips to work their way out except by coming up through the flutes of the drill and packing into the bushing. It is good practice to make the clearance between the bushing and the work about one diameter of the drill as shown at *E*. Care must be taken however not to go to extremes and place the bushing so far away from the work that inaccuracy may result as shown at *F*. In this case the bushing is so far away from the work that the drill may run off and produce an angular hole as indicated.

A peculiar case in connection with chip clearance is shown in Fig. 26. In this case the work which was drilled was of steel and the chips working up through the flutes of the drill became entangled in the thumbscrew *A* in such a way as to loosen it, thus releasing the work and causing inaccuracy. It is evident that this could have been avoided by making the screw *A*

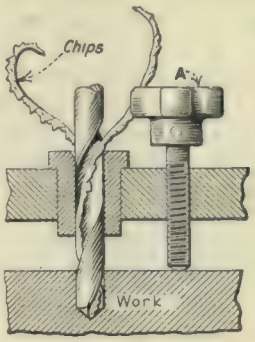


FIG. 26

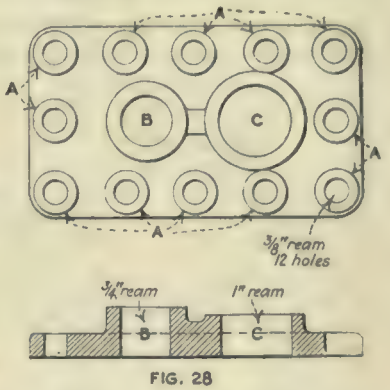


FIG. 28

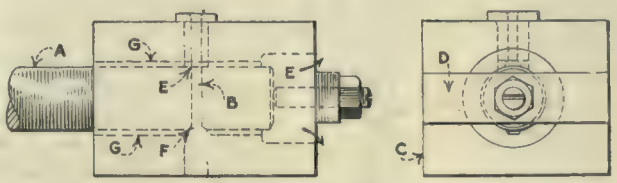


FIG. 27

FIG. 26. CHIP CLEARANCE. FIG. 27. BURR CLEARANCE IN A COTTER PIN JIG. FIG. 28. SIZE OF HOLES TO BE DRILLED IN THE SAME SETTING

a left-hand screw, but this would not be good practice as a left-hand screw is awkward to use.

A matter which is frequently neglected by young designers is the making of provision for the burr which is thrown up by a drill as it passes through the work. In many cases this can be neglected as there is no burr to speak of on cast iron or malleable iron. It is particularly noticeable however on jigs for small steel pins, cotter pin jigs and the like. An example of this kind is shown in Fig. 27 in which the work *A* is to be drilled at the point *B* and a very simple jig has been made to hold it. The jig is a plain block of steel *C* having a strap *D* across it which contains a stop screw *E* that acts as an end location. Now it will be seen that when the hole *B* is drilled burrs will be thrown up around the hole at *E* and *F* and if no provision is made for this burr it will be very difficult to get the work out of the jig after it has been drilled because the burr will prevent it. The remedy for this is to cut a groove slightly larger than the drill diameter at the top and bottom of the jig as shown at *G*. When this is done the piece can be removed without difficulty. It is not advisable to attempt to drill holes of large and small diameters in the same jig unless conditions are such that the jig is very expensive and it would be costly to make other jigs. In cases of this kind it might be possible to arrange two machines side by side so that the jig can be moved from

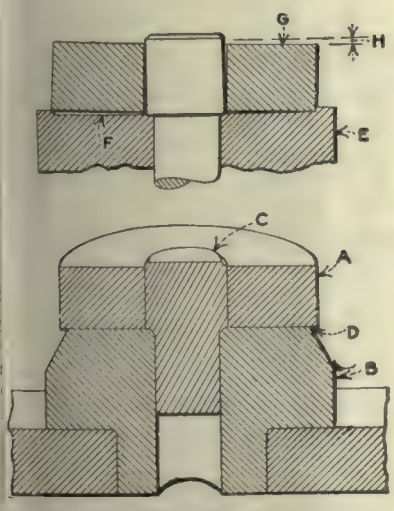
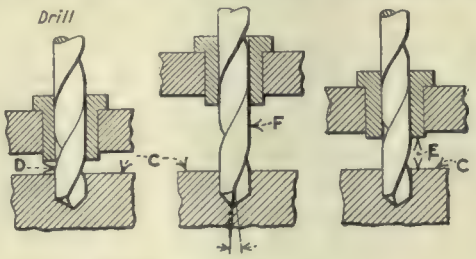


FIG. 24



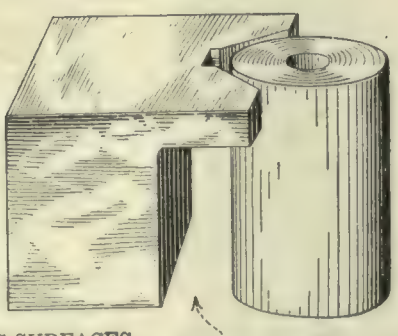


FIG. 25

FIG. 24. PROVISION FOR WEAR ON LOCATING SURFACES
FIG. 25. CHIP CLEARANCE

one to the other in drilling the holes. An example of this kind is shown in Fig. 28 in which there is a series of reamed holes $\frac{3}{8}$ in. in diameter all around the edge of the casting, as shown at *A*. It will be seen that there are also a $\frac{3}{4}$-in. reamed hole and a 1-in. reamed hole in the work. Now, it would be better practice to drill all of the holes *A* in one jig and then to build another jig for the holes *B* and *C*. This point should always be considered by the tool engineer when laying out his operations, but occasionally it is overlooked so that the jig when made is not practical. It happens occasionally that an inexperienced designer will design a jig and after he has worked it up very nearly to completion he will discover (or someone else will discover) that he cannot get the work into or out of the jig. Naturally this is somewhat embarrassing, so that the point may be brought up at this time that it is well for the designer to bear continually in mind throughout the design of his jig that it is necessary to put the work into the jig and to remove it therefrom. Suitable provision should be made so that the operator can reach in and remove the work without difficulty or else an ejector should be provided to take care of the difficulty.

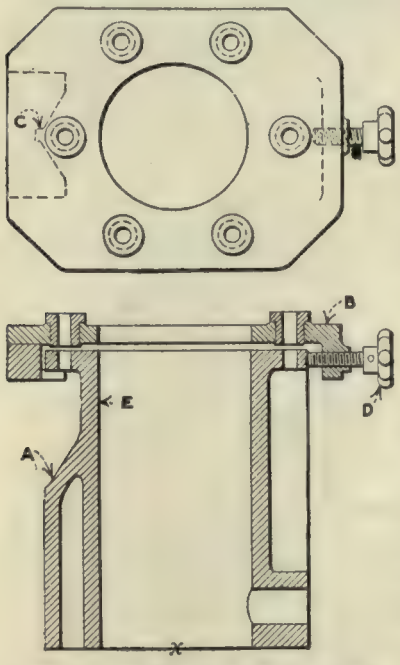


FIG. 29. SET-ON OR PLATE JIG

There are various types of jigs in common use and these will be dealt with in detail in their proper sequence. It is not easy to make a broad distinction between some of the types of jigs, but speaking generally they may be divided into the following: Plate and templet jigs; cast jigs, open and closed; built-up jigs; trunnion and indexing jigs, and standard jigs. A brief discussion will be given of each of these types.

One of the simplest types of jigs is a "set-on" or plate jig, illustrated in Fig. 29. Jigs of this kind are used on heavy castings where one end is to be drilled with a few holes and when the other end is finished so that it can be used as a surface on which to set up the work. In the illustration shown *A* is the work and *B* is the jig. This particular jig is made of cast iron and has a steel V-block located as shown at *C* which is used to locate the jig in relation to a boss on the casting. A thumbscrew *D* is provided at the opposite side in order to make the jig fast to the work and draw it up tightly into the locating block. We might easily imagine a condition in which the hole *E* had been previously machined, thus allowing a plug to be dropped down into the hole to use as a locater instead of working from the outside bosses with a V-block as shown.

FIG. 30. TEMPLET JIG FOR A LARGE RING

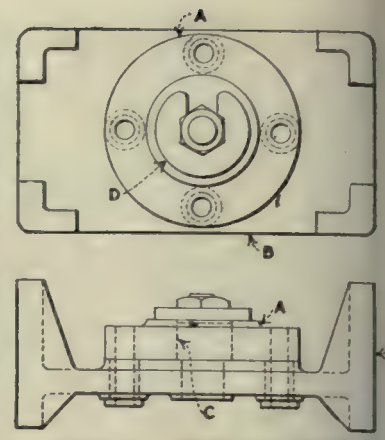


FIG. 31. OPEN JIG TYPE

A templet jig is generally used with a prick punch to locate a series of holes on some pieces of machine work where only a few are required. An example of this kind of jig is shown in Fig. 30. In this case the work *A* is a large ring which has a number of holes *B* drilled in it here and there on the surface of the ring. The templet jig is made of sheet metal and is located in the work by means of several lugs such as those shown at *C*. A special punch like that indicated at *D* is used to mark the centers of the holes by placing it in the templet and striking it a blow with a hammer. After the work has been completely marked the templet is removed and the drilling is done on a drilling machine.

A very simple type of open jig is shown in Fig. 31. Jigs of this kind are used for simple pieces which can be easily clamped and which have only a few holes to be drilled. In the case shown the work *A* is located by means of a center stud *C* and is clamped down by the

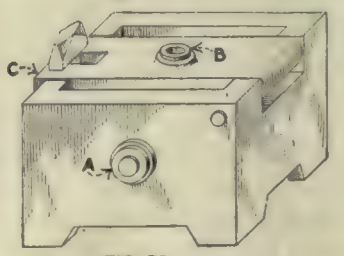


FIG. 32

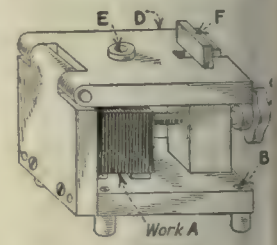


FIG. 33

FIG. 32. CLOSED OR BOX JIG. FIG. 33. BUILT UP JIG

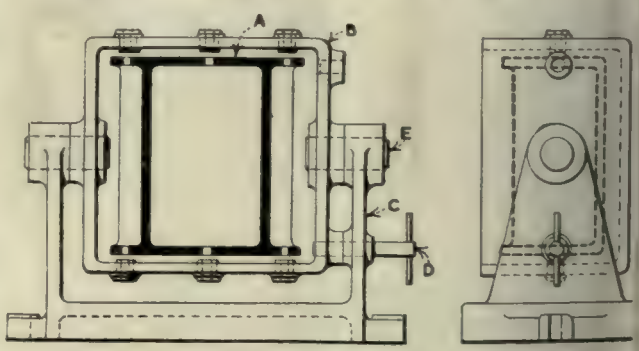


FIG. 34. TRUNNION JIG

C-washer *D*. After this has been done the jig body is turned over and the work is drilled from the other side.

The type of jig shown in Fig. 32 is usually termed a box jig. The body of the jig may be all steel or cast iron but in the case shown it is cast iron. Bushings are inserted as at *A* and *B* and a hinge or leaf *C*

provided which sometimes acts as a clamp to hold the work in place but more frequently it simply provides means for removal of the work after it has been drilled. Jigs of this kind are commonly used for small parts and light drilling.

Fig. 33 shows quite a different type of jig as this is made up of separate pieces of stock which are screwed

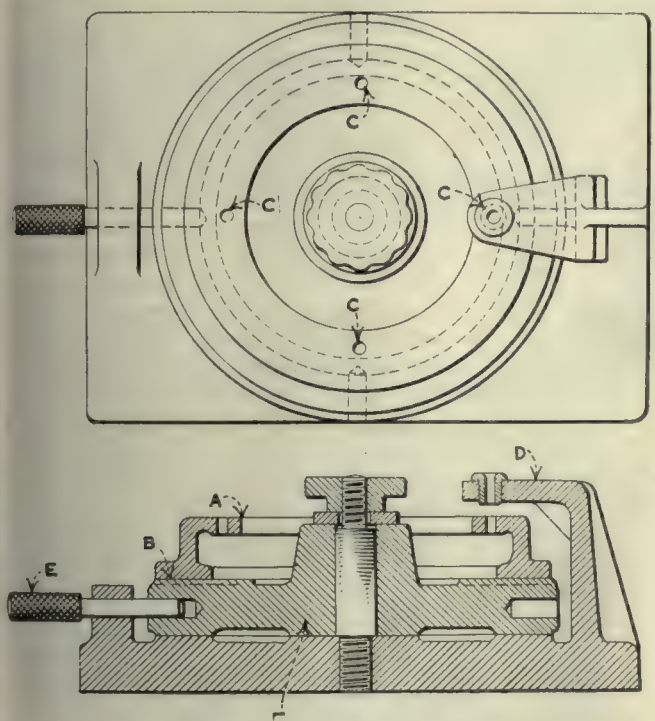


FIG. 35. INDEXING JIG

and doweled together. The advantages of this type of jig are that it can be readily made and that it has many advantages from the viewpoint of replacements when worn. In the particular jig shown, the work *A* rests on the steel base *B* and is held in place by means of the thumbscrew *C*. The leaf *D* has a bushing at *E* and it is located and held in place by the quarter-turn thumbscrew *F*. A jig of this kind can be easily cleaned in addition to its other advantages.

In the drilling of automobile cylinders, transmission cases, housings and many other large castings having holes drilled from several sides and possibly at various angles, a trunnion jig is usually found the most desirable, because after the work has once been placed in the jig all of the holes can be drilled before it is removed and as a consequence correct relation between the holes will always be assured. A simple type of trunnion jig is shown in Fig. 34. In this case the work *A* is located in the crade *B* which in its turn is mounted on the trunnions at *E*. As the various holes are drilled the index pin *D* is removed and the portion *B* is turned over into such positions that the desired bushings come uppermost.

The correct location is assured by means of the index pin which is generally inserted in a bushing in order to insure accuracy. Trunnion jigs are made in great variety and the example shown to illustrate the type is a very simple one.

An indexing jig is somewhat different from a trunnion jig in that the work is indexed into different positions for drilling a series of holes usually through the same bushing. A case of this kind is shown in Fig. 35 in which the work *A* is located by means of some previously drilled holes in the surface *B*. In this case there are four holes to be drilled at *C* and one bushing located in the bracket *D* in the correct relation to the center of the work. A jig of this kind is supposed to be strapped or clamped to the drilling machine table and the work is indexed by pulling it around until the index pin *E* enters the various holes in the revolving member *F*.

Occasionally index jigs are made when two or more holes are close together and a series of these holes is required at equally spaced intervals around the parts. Many methods of indexing are in use and the example shown is a very elementary type. Other instances will be given under their proper heading.

Magnetic Chucks. VI

By ELLSWORTH SHELDON
New England Editor, *American Machinist*

Continued from last week's issue

IN THE multiple-magnet type of chuck instead of one large coil surrounding a main central pole there are individual coils around each core, and as these cores vary both in length and width of section, as well as in the shape (the latter in the case of the rotary chuck) many different sizes and styles of coils are needed.

Coils are wound upon a machine which automatically measures the number of turns of wire in each, so that every coil may have the proper amount, and consequently be of the correct electrical resistance. Enamel-coated copper wire is used instead of wire with fabric insulation, for the reason that it requires less space for a given amount of wire; the size of wire and number of turns depending upon the particular chuck for which the coils are designed. The size of wire, the number of turns in a coil, the thickness of core, and the space between cores, are interdependent factors that must be carefully calculated and checked by experiment in order to assure maximum holding power of the chuck.

Fig. 99 shows how the coils are made to conform to the shape of the magnet cores. This cut shows all the parts (except the wire) of several sizes and shapes of coil. Considering for the moment only the kind of coil for which the machine shown in Fig. 100 is set, we may note at *A*, Fig. 99, the same kind of bobbin. These bobbins (of which there are two or more for each kind of coil) are separable, so that they may be taken out after the coil is wound. The larger ones are made of aluminum and the smaller ones of steel.

The bobbin *A*, Fig. 99, separates along a diagonal line as shown at *BB* which, together, constitute the mate to *A*. At *CC* are shown a couple of arbors for the winding machine by which arbors the two parts of the bobbins are held together and held in the machine.

Girls Operate Winding Machines

Two girls operate two winding machines; one girl handling both machines and the other setting up and taking down the bobbins. Fig. 101 at *A* shows the

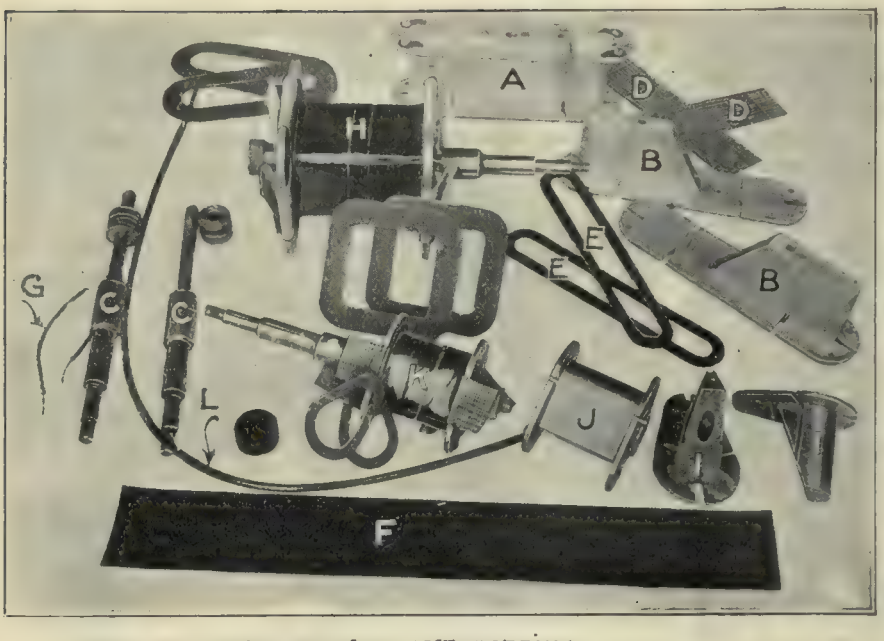


FIG. 99. PARTS OF COILS AND BOBBINS

bobbin *A*, Fig. 99, ready to set up, while in Fig. 100 may be seen the same bobbin on the machine and ready to wind.

To assemble or "set up" a bobbin for winding, the operator takes up one-half *B*, Fig. 99, and lays lengthwise upon it (the shorter way of the bobbin) the two moisture-proof binding strips *DD*. Holding these with thumb and finger of the left hand she slips the two fiber washers *EE* over the binder, fits on the other half *B* of the bobbin, locating it by the dowel pins, and puts the arbor *C* through the bobbin which is then held against coming apart by the round nut of the arbor which the operator immediately screws on. For convenience in handling, the arbor with the assembled bobbin is placed in the post at the end of the assembling bench as shown at *A* in Fig. 101; thereafter leaving both of the operator's hands free for further manipulation.

The binding strips are spread smoothly along the body of the bobbin and pressed sharply down into the corners next to the heads, folded over the latter, and the loose ends caught under spring clips provided on the outside of the heads for that purpose to hold them out of the way during the winding. The fiber washers which are to form the heads of the coil are then separated as far as the length of the bobbin will allow and a strip of varnished cambric, *F*, Fig. 99, is wound around the body of the bobbin and held by a couple of rubber bands.

The machine operator then takes this prepared bobbin, handing over in exchange one that has been wound, and puts it in the machine by turning the arbor into the spindle of the machine which is threaded to receive it.

This operator is provided with a boxful of terminal wires *G*, Fig. 99; short pieces of stranded wire with an asbestos or rubber covering. Near the end of each winding machine, as at *B*, Fig. 101, is a little gas furnace holding a small quantity of molten solder. The winding machine operator scrapes the enamel covering an inch or so off of the end of the wire from the reel on the machine, weaves it into the strands

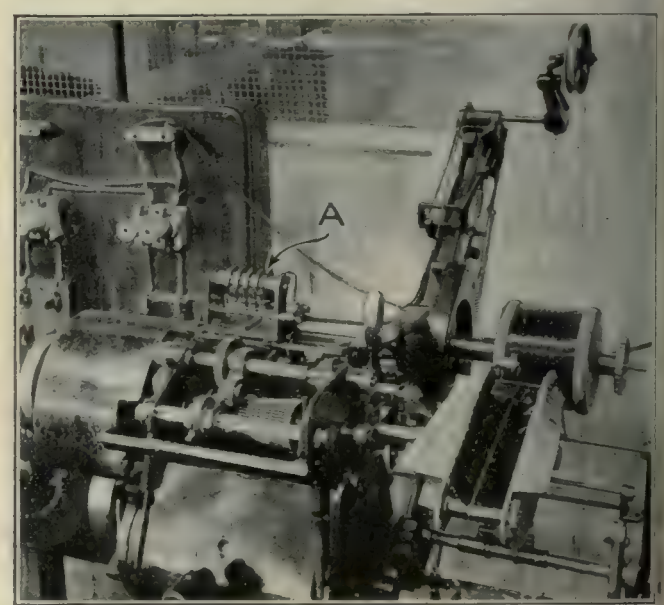


FIG. 100. THE WINDING MACHINE

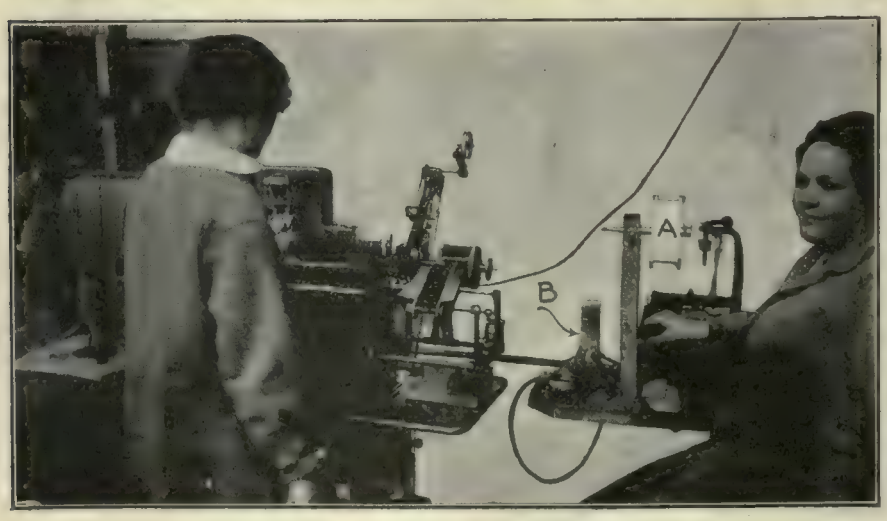


FIG. 101. READY TO WIND A COIL

of the terminal wire and dips the joint in the solder.

Threading the terminal wire through a hole in the fiber washer and a corresponding hole in the bobbin head the operator wraps two or three turns of wire about the embryo coil, takes off the rubber bands, and starts the machine. In the large view of the winding machine, Fig. 100, from which some of the protecting covers have been removed for better observation, may be seen the change gears and the counting device. The change gears are set to allow the machine to make the required number of turns, this number being calculated in advance for each size of coil and based upon the size of wire and the electrical resistance required in the coil.

Before starting the machine each time the operator sets the numbered dials *A* of the counting device to the requisite number of turns of wire. The machine counts off the numbers on the dials as the winding proceeds until zero is reached, when the machine stops.



FIG. 102. FINISHED COILS



FIG. 103. THE ELECTRIC OVENS



FIG. 104. IMPREGNATING THE COIL WITH INSULATING COMPOUND

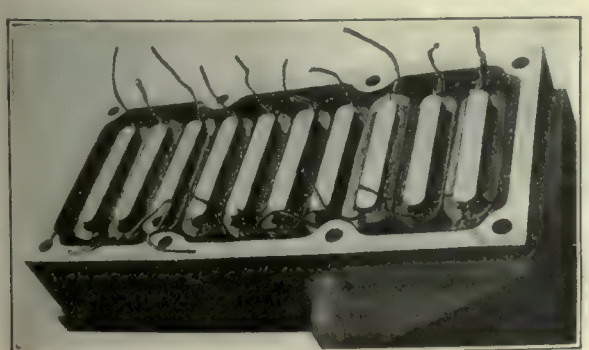


FIG. 105. RECTANGULAR CHUCK WITH COILS IN PLACE

The ends of the binders *DD*, Fig. 99, which it will be remembered were the first parts to go on the bobbins and consequently pass under the wire are then freed from the clips, brought back over the coil, and three or four turns of wire wrapped on outside of them to hold them down. This finishes the work so far as the machine operator is concerned. She cuts off the wire, unscrews the arbor from the machine and hands it over to her companion, who solders on the outer terminal wire, wraps the coil with cotton tape, and takes out the bobbin.

If the coils are small, one machine and two bobbins will keep two girls busy; on the larger coils three bobbins are supplied and two machines are used.

Other bobbins and parts for other coils are also shown in Fig. 99, *H* being a bobbin prepared to wind a coil for the demagnetizer and at *I*, *J* and *K* respectively are the parts and the assembled bobbin used for winding the coils for one of the smaller rotary chucks. In Fig. 102 are two finished coils; one for a rotary and the other for a rectangular chuck.

After winding the coils, they are baked for four hours in the electrically heated ovens, shown in Fig. 103, to expel any moisture that may be in them. They are then impregnated with a moisture-repelling and

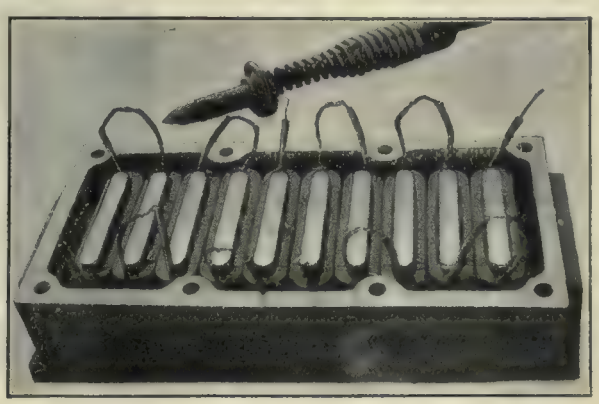


FIG. 106. THE COILS CONNECTED

insulating compound. While hot from the oven they are set in the tank of molten compound shown in Fig. 104 and left until air bubbles cease to form on the surface of the compound, when they are transferred to a draining basket.

Preparatory to assembling the chucks the interior surfaces of the iron body and the cores are given three coats of shellac varnish as an additional precaution against "grounding" or short-circuiting. The coils are set over the cores, taking care that adjacent coils are so connected as to preserve the direction of the electric current. Before joining the terminal wires a piece of tubing made from shellac and cambric, and looking more like a piece of spaghetti than anything else (shown at *L*, Fig. 99) is slipped over every other wire so that when the joints are soldered the insulating tube can be drawn over the joint. In Figs. 105 and 106 are chucks before and after the connections are made.

Coils Arranged for Either 110 or 220 Volts

The coils in all chucks but the smallest ones are joined in two separate series, and four leading-in wires are run to the "volt box" shown in Fig. 107 which is the only outlet from the interior of the chuck. This is done so that by unscrewing the pipe-plug that attaches the outer conductor the resistance of a chuck

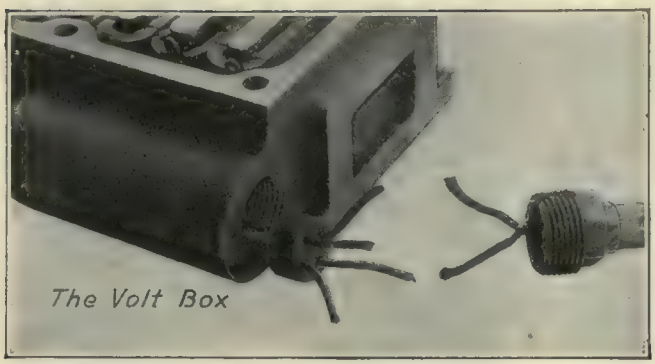


FIG. 107. THE VOLT BOX AND CABLE, SHOWING CONNECTIONS

may be changed to conform to the requirements of a 110- or a 220-volt current supply. In this figure may be seen the four leading-in wires and the two wires from the cable. By connecting one wire of the cable to two leading-in wires and the other cable wire to the other two leading-wires the coils are placed in two parallel groups for the 110-volt current. By connecting one cable wire to one leading-in wire, the other cable wire to another and connecting the remaining two leading-in wires together the two pairs are in series and the chuck is adapted for 220 volts.

This connection must be made understandingly. The leading-in wires are all numbered and any change should be made strictly in accord with the directions. It is possible to render the chuck inoperative on either current, or even to burn out the coils with a 220-volt current if the connections are wrongly made.

The outer conductor is a metal-armored cable impervious to moisture and is sealed into the connecting pipe-plug with an oil-and-waterproof compound. As a test, the Heald chucks have been completely immersed in grinding solution for days at a time, with the current alternating on and off, and when opened were found to be perfectly dry inside.

Finishing Touches Before Closing

Before putting on the top plate, strips of fiber board are placed around the coils between them and the iron, and a sheet of the same material, with openings cut for the cores, placed over them; the whole being then thoroughly shellacked. The object of this is to make it impossible for any part of a coil to come in contact with the iron of the shell or top-plate.

Before and after closing, each chuck is tested for "ground" with a 1,100-volt current from a portable transformer. One terminal from this machine is connected to the shell of the chuck and the other to first one and then the other terminal of the coils. If the milliammeter on the instrument board registers any flow of current the chuck is opened, the defect sought out and remedied.

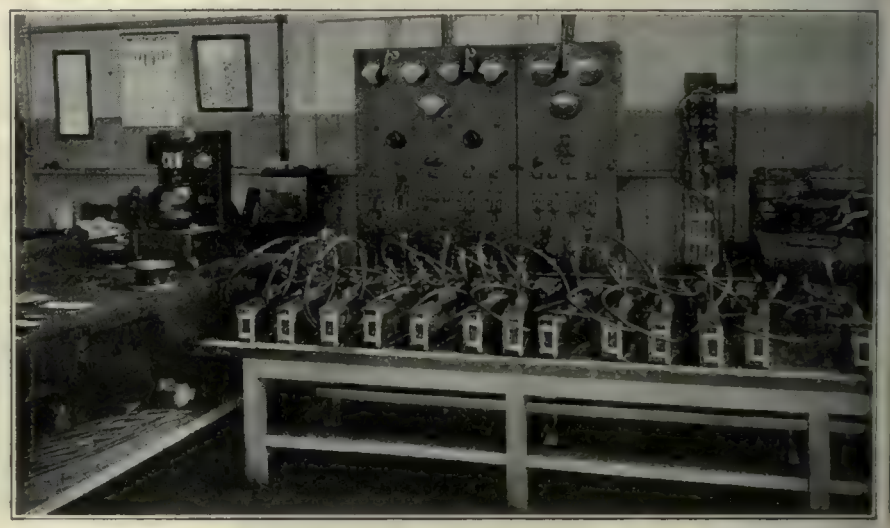
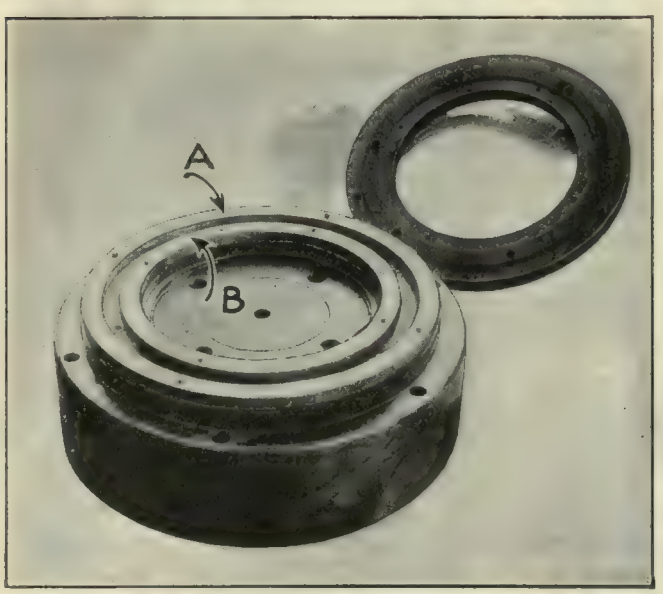


FIG. 108. THE SERVICE TEST; 24 HOURS UNDER FULL LOAD

All chucks made by the Heald Machine Co. are subjected to a 24-hour test under full operating current. For this purpose they are connected up as shown in



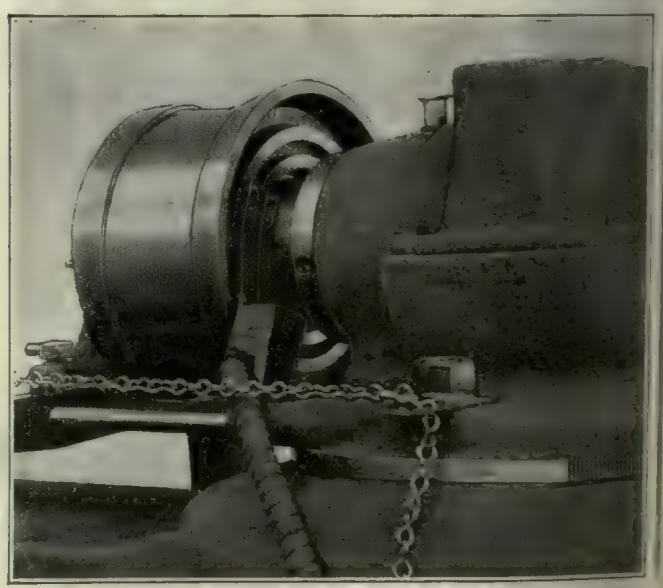


FIG. 109. COLLECTOR RINGS ON ROTARY CHUCK. FIG. 110. SHOWING METHOD OF GETTING CURRENT TO ROTARY CHUCKS

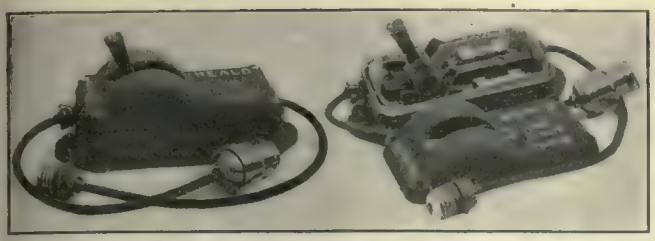


FIG. 111. THE HEALD DEMAGNETIZING SWITCH

Fig. 108 and if at the expiration of the test period a chuck is more than comfortably warm it is sent back to the assembling bench to be opened and the trouble located.

Carrying Current to Rotary Chucks

A current conductor cannot, of course, be attached directly to a rotary chuck. Current must be supplied through a pair of collector rings connected to the terminal of the coils. The back of a rotary chuck with its collector rings is shown in Fig. 109.

A ring of bakelite is attached concentrically to the back of the chuck; this ring having mounted upon it the bronze contact rings *A* and *B*. Bronze studs on the under side of these rings connect with the terminal wires from the coils.

Though the rotary chucks may be connected for either 110-volts or 220-volt current the connections are inside the chuck body and cannot be changed without taking off the top plate of the chuck. It is not advisable to make this change outside the factory.

Current is brought to the contact rings by means of carbon brushes attached to brass springs which act as current carriers and to hold the brushes under a uniform pressure in contact with the rings. Fig. 110 shows the method of holding the brushes on the Heald internal grinding machine. For use on other grinding machines or lathes, special blocks are furnished that can be clamped to a convenient part of the machine frame.

Wherever magnetic chucks are used it has been found expedient to install a pole-changing, or "demagnetizing," switch, to counteract the tendency of the magnetic surface to retain a portion of its magnetism and thus make it difficult to remove small pieces.

The Heald Co.'s demagnetizing switch is shown in Fig. 111. An iron case contains the switch contacts and cut-outs mounted upon a bakelite support and insulated from the iron casing by strips of fiber. A rib of the bakelite extends the whole length of the switch, separating the part of opposed polarity and lessening the liability of accidental short circuit. Being entirely enclosed, there is no possibility of the operator coming in contact with current-carrying parts.

Unemployment

Individual Barter in Goods Not Practical—Standards of Living Regulated Solely by Production—Equalizing Production the Only Remedy for Unemployment

By JOHN S. WATTS

THERE would seem to be need for clear thinking on the subject of unemployment, its causes and possible remedies. That this is so, a perusal of the discussions on this subject in the daily papers and among the people generally, will prove.

For example the commonest criticism heard is, that while there are tailors out of employment in, say, New York and needing shoes, there are at the same time, shoemakers walking the streets of Lynn and in need of clothing. The question is then asked, with an air of deep wisdom, as to why should not the idle tailors be set to work to make clothing for the shoemakers who will pay for them by making the shoes required by "the party of the first part," as the lawyers say.

At the first glance this proposal seems to contain the germ of an idea, but looking into the matter a little deeper we find that it is not to be remedied quite so simply as that.

The main idea, in the minds of those suggesting the above and similar remedial measures, seems to be that scarcity of money is the cause of unemployment, and that therefore, if we revert to the old custom of trading by barter, we avoid the necessity of using money, and it becomes simply a matter of filling ones own wants by supplying the wants of others, which as the bulk of the population are always wanting something or other, should not be difficult.

Now let us examine the feasibility of this proposal by imagining the procedure which would have to be gone through to carry it into execution. Granting the possibility of the shoemakers and tailors arriving at an agreement as to the terms of the barter, we will assume that a contract has been made between the two parties, and we will follow the fortunes of the shoemakers in their attempts to fulfill their end of the bargain.

The first thing to do would be to purchase or rent a shoe factory, which in accordance with the rule of trade by barter, would have to be paid for in either one of the two articles being traded in, namely shoes or clothing. As the proprietor of a shoe factory is necessarily familiar with the sale of its product, it is possible that one could be found to agree to some arrangement by which he would be paid in shoes. At any rate we cannot say that some such agreement is outside of the bounds of possibility.

Supposing the factory to be available, it now becomes necessary to arrange for the supply of leather or whatever material it is that they do make shoes of. I am using leather for the purposes of this example, but am open to correction as its actual use in the manufacture of shoes. Sometimes, in wet weather, I feel in my "sole" that my shoes came from pulp and are returning to pulp.

The supply of leather, then, together with coal or electric power, taxes, packing, shoe findings, freight, and the thousand and one other things that will be needed, must be paid for by such makers of each article as are willing to accept shoes or clothing in exchange for the same.

To merely state the case is to show the fallacy of the whole thing, as even if it could be arranged, consider the amount of time and expense incurred in finding

manufacturers willing to take a contract on such a basis, and the endless trouble in arriving at the relative values in shoes of each of the articles required.

Imagine making a pair of shoes to fit the postmaster in order to obtain a supply of stamps, and how long would the stenographer work for a steady salary paid in shoes.

It may be contended that a part of the output could be sold for money wherewith to pay for these articles, but if this could be done, the shoemakers would have been employed making shoes for money and not have been idle as in the case we are supposing.

Trade by Barter

Having concluded that trade by barter does not hold out any prospects of being able to ameliorate the unemployment, we proceed to state the general outline of the state of affairs in an effort to clear the case of unimportant issues, and bring out the underlying basic causes if possible.

The symptoms are that the state of the demand for labor varies in recurring cycles, from a maximum of unemployment, to a maximum of employment of labor, the period of time elapsing between one maximum and the next being approximately five to seven years.

That these fluctuations of employment are not due to any variation in the total supply of labor, will not be disputed. In actual fact, on this continent, we are favored somewhat by a floating population, which in times of unemployment will generally relieve the situation to some extent by returning to Europe and there await the return of better times.

The period of maximum unemployment is always accompanied by, and usually forecast by, what is known as a scarcity of money, but which would be more truly named as a scarcity of credit.

The greater the boom in any one cycle, the greater will be the depression following, the action being analagous to that of a pendulum which swings as far to one extreme as it did to the other, from which we may judge that if we could arrive at a happy medium, and hold to it, we would damp down the fluctuations till we struck a normal steady demand for labor.

In bad times we have men anxious to work and in need of goods which other men have and are anxious to sell, but in the nature of things, as at present constituted, the sale must be for money, while the out-of-work can only offer labor.

Over-Production

The merchant, not being able to sell his goods, ceases to order from the manufacturer, and he in turn cuts down his production to meet the falling demand, and so increases the unemployment and hastens the collapse of business in general. This condition is sometimes loosely termed over-production, but in the case of necessities, at any rate, it can hardly be said while part of the people are occasionally in want of them, that there has ever been over-production of necessities. In the case of luxuries, it is easily possible to have over-production. In fact until the whole of the people willing to work for them have sufficient necessities, all production of luxuries is over-production, or at least production of the wrong class of material.

The above I think covers all the principal symptoms of the disease in our corporate body of fluctuation of employment, the minor symptoms not mentioned being off-shoots or consequences of the principal symptoms.

Investigating now the conditions under which we live and work, and which conditions must necessarily be the cause of the disease, or more correctly, some part if not all of the conditions, we can assert the following postulates as needing no proof, being obvious.

For any given population, with average crops of grains, vegetables, cotton, wheat, etc., there is an average standard of living which cannot be exceeded, no matter how much money there may be in circulation, unless there is a surplus from previous years.

The average standard of living cannot be higher than that fixed by the average production over a number of years. That is, if we use up all of the production of the fat years during those years, our standard of living cannot be so great during the lean years.

With the natural increase in knowledge and skill, and the increased wealth in the form of machinery of production of each generation over the preceding one, we have the ability to increase the standard of living in the future up to the limit imposed by the possible productiveness of this earth, which limit is so far away that we need not consider it.

If for any reason a part of the population fails to put forward its best efforts in producing, the standard of living must be reduced below what is possible by the amount of the produce so lost.

Intensive Methods

Under the existing intensive methods of production, it is hardly possible for the worker to be skilled in the making of more than one class of article, and if through inefficient leadership, too large a percentage of the workers are trained in the manufacture of any one article we will have more than enough of that article, and a corresponding deficit in the supply of some other article, which could have been made by the labor of those who produced the surplus of the first article. Bear in mind that not only is the surplus of no value, but it is the cause also of a waste of the material and labor entering into its manufacture.

To return to the example of the tailors and shoemakers, the real reason why the demands of these people cannot be satisfied, is that having both produced more of their work than is actually necessary, the rest of the population refuse to give them the money (credit) necessary to supply their wants until this excess of production is absorbed. The remedy mentioned in the beginning of this article, even if it were feasible would make matters worse, as it would add to the already excessive supply of both shoes and clothing.

The remedy then for unemployment is that the requirements of the whole population be carefully estimated; that the production of each and every article be exactly equal to the demand, and that the numbers of the workers in each trade be adjusted to suit the desired output of that trade.

This is admittedly a formidable problem, but I believe not beyond our ability to solve, and in any case it is better to have some plan to strive for than to continue in the happy-go-lucky way in which we are going. We may as well face some of the difficulties which will be incurred in an attempt to balance the production with the demand, and the first that occurs, is that it will involve some form of governmental control of our industries, in so far at least as the control over the starting up of new factories for producing articles, the demand for which is met by plants already in existence.

All governments are notoriously inefficient in the

operation of any business entrusted to their care, but that this need not be so is shown by the fact that large companies owned by a numerous body of share-holders and operated by them through a board of directors, can be and are well managed, and if similar methods were used in the business of governing, similar results should be obtained, as the governing of a large corporation on behalf of a large body of share-holders is not unlike the governing of a people on behalf of the same people. It would be a considerable step forward if the governments simply collected the statistics necessary to strike a balance between the demand and production, and acted only in an advisory capacity.

Supply and Demand

It may be contended that to prevent the erection of a new factory because existing factories could supply the demand, would tend to discourage the bringing out of new ideas and improvements. This would not occur, because with the natural growth of the population the demand would increase and would naturally gravitate to the most efficient plant.

On the other hand, let us see what happens at the present time. Some man, or body of men have a "hunch," it can usually be said to be nothing more than that, that there is an opening for a factory to make a certain product. If they fail, they have used up considerable material in buildings, machinery, etc., which is a loss to the community and have trained up workers to do work which is not required.

If this new factory succeeds, it does so at the expense, probably of the older ones by taking part of their business away from them, and so causing unemployment among the workers of the older companies. All of us know of cases where men have worked for companies for years, have built and paid for their own homes by the thrift of a working lifetime, only to lose them at the end through the closing up of the place they worked through no fault of their own. Bear in mind that the loss in such cases is a loss to the community as well as to the man, in that the material and labor entering into the construction of the employees' homes, are deducted from the available wealth of the community and have to be duplicated in whatever place the discharged employees move to find new work.

Another remedy suggested for unemployment is to reduce the number of working hours per day, and while this will result in the employment of greater numbers, it will also reduce the standard of living by reducing the available production for division among the people.

The Value of Money

There are still some who call themselves Socialists, although they know little of the subject, who claim that if everything was divided up equally all would have enough. A few minutes of arithmetic would prove to them that if all the goods of the few wealthy were divided among the many who are not wealthy, the gain to themselves would be too small to be of any benefit. To take away the money of the wealthy would not in any case increase the real wealth of anyone, as money of itself is of value only when goods are produced to be purchased with it, and a redistribution of money would not increase the available quantity of the necessitiies of life. Moreover, money held in large amounts is of much more value if put to use in providing employment than would be the same amount split up among a large number of people. Not that I am defending the acquisition or ownership of large fortunes, but that their confiscaton for redistribution is not of necessity the cure for poverty.

To summarize our conclusions the cure is: For the leaders to direct labor to work which is required, and only to that which is required; for labor, and when I speak of labor I mean both manual and mental labor, to work to its full capacity, both in effort and intelligence; for the population as a whole through its government, to see that each worker receives compensation equal in value to his production or in other words, a fair and equal distribution of the total production.

If this can be compassed, we can have a certain standard of living for an eight-hour day much above our present standard, because of the increased production that will be possible when labor is continuously employed in the making of goods that are really needed, or a lower standard for a shorter day, as may seem good to the people.

Wet Grinding a Dangerous Occupation

That grinding and polishing by the wet process, instead of being, as has been generally supposed, a dustless and innocuous process, is, under certain conditions, a dusty and exceedingly dangerous employment, seems to be demonstrated by a report prepared by Dr. W. Herbert Drury, of the U. S. Public Health Service, after an exhaustive investigation conducted in a large axe factory in a Connecticut town. Dr. Drury shows that the death rate (1900-1920) from tuberculosis among the workers in the grinding and polishing shops, who for six hours a day breathe an atmosphere of relatively high humidity heavily laden with acutely angular hard siliceous dust, is 19 per thousand; and that of other workers in the same mills (but not in the grinding or polishing shops) is only 1.6. Furthermore, the rate in the general population (not including the mill workers) in the three villages from which the workers are drawn is 1.2, and in the whole State of Connecticut is 1.5 per thousand.

The results of the present study are somewhat complicated by the fact that the grinders are without exception foreigners, mainly Poles, Slavs, and Lithuanians, while the polishers and the other employees of the mills are mainly Americans. The grinders have always been noted as hard drinkers, most of whom have regularly gone from the mills to saloons in their damp clothes to drink for several hours. The other workers have lived in characteristic American ways. These differences, however, though important, are not thought to account for the enormous differences between 19 and 1.6 in the death rate per thousand. Moreover, alcoholism is a well-known consequence of work in a dusty atmosphere irritating to the mucous membranes rather than an independent cause.

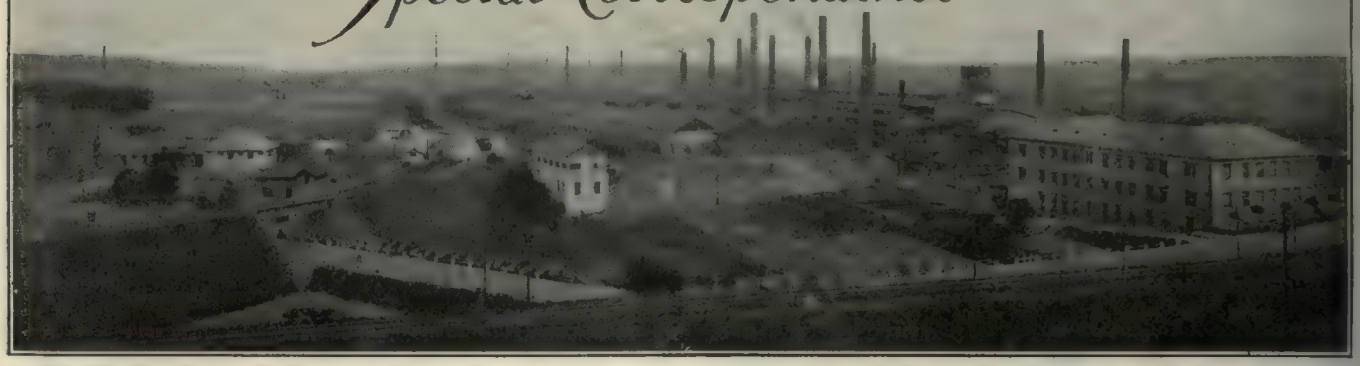
Pulmonary infections other than tuberculosis show 4.3 deaths per thousand among polishers and grinders as against 1.7 per thousand among other mill workers.

It was not practicable to subdivide "polishers and grinders" into "polishers," "dry grinders," and "wet grinders," and to obtain separate figures for each. It is well known locally, however, that the death rate of the wet grinders is much higher than that of the others.

Counts show that there are an average of ten times as many dust particles in wet as in dry grinding shops, and the report recommends the substitution of a dry grinding process properly protected by the installation of exhausts for the present wet process.

The Steel Works of Czecho-Slovakia

Special Correspondence



THE changed geography of Central Europe has placed the Poldi Steel Works in the new country of Czecho-Slovakia. This plant is near Prague in the Bohemian district, which is especially rich in mineral deposits, particularly coal and iron. The ancient town of Kladno is located in the center of the mining district and for this reason was selected many years ago as a site for iron and steel work. The industries of this section grew year after year and from these small beginnings the Kladno Plant of the Poldi Steel Works was developed.



FIG. 1. THE STORAGE YARD AND ITS GANTRY CRANE

In the beginning the steel plant contained only crucible furnaces and various mechanical departments for the manufacture of bar steel and forgings. Strong competition was encountered until an engineer of wide experience, Pazzani by name, became identified with the works and in time became its head. He realized that the only possibility of meeting competition was to concentrate on the manufacture of high-grade steels and every employee was taught and trained with this in view.

The Kladno works is approximately fifty years old and in 1916 it became necessary to enlarge the output, so another plant was built at Komotau, near coal mines owned by the Poldi company. Additions and improvements were also made at the original plant so that both now contain only modern equipment of electric and openhearth furnaces, hydraulic presses, large steam hammers, and electrically controlled mills with complete installations of annealing and heat-treating departments. In addition to supplying high-grade, low-carbon steel, carbon tool steel, high-speed steel, alloy steel, cold-drawn steel and hot-rolled or hammered steel, from small drill rods to large forgings, the Kladno plant also has a large spring-making department for both railroad and vehicle springs. Both plants are equipped with modern chemical and physical laboratories.

The headpiece shows a general view of the Kladno plant, employing about 3,000 men, which is less than half the number employed during the war. This plant now has five basic, openhearth furnaces with an aggregate capacity of 46 tons, one 15-ton electric induction furnace of the Frick type, one Kjellin induction electric furnace of 4½ tons capacity, and a small testing furnace of the same make with a capacity of 250 lb. The

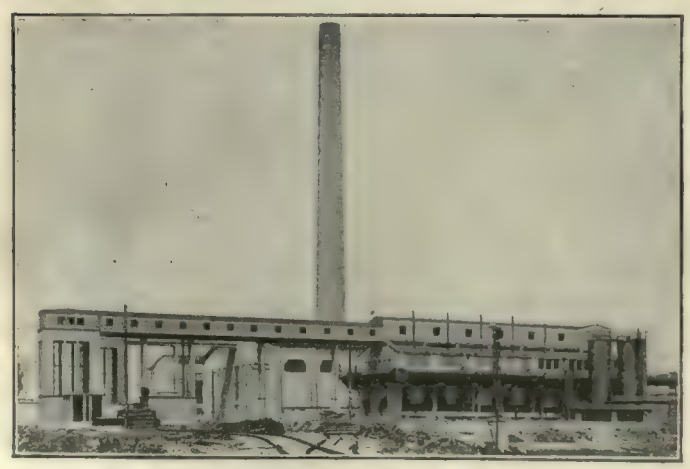


FIG. 2. GAS PRODUCER HOUSE AND COAL CONVEYOR



FIG. 3. THE ROLLING MILLS

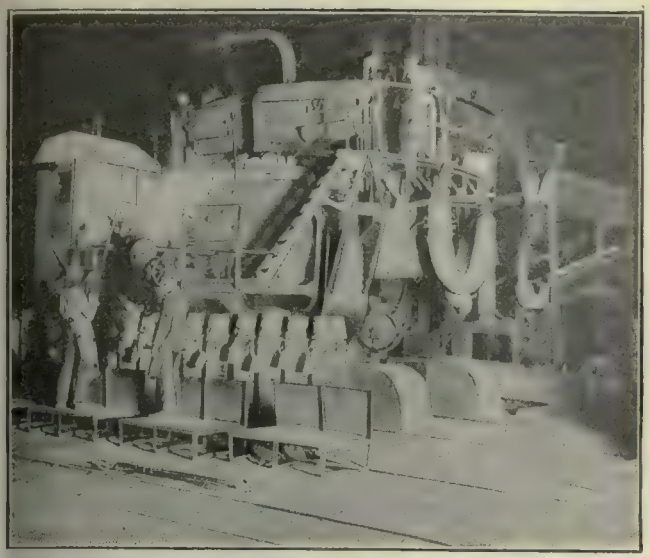


FIG. 4. ONE OF THE LARGE ELECTRIC FURNACES



FIG. 5. HYDRAULIC FORGING PRESS AND CRANE



FIG. 6. ONE OF THE BAYS IN THE MACHINE SHOP

Komotau plant has basic openhearth furnaces of 34 tons capacity and an electric 4-ton induction furnace of the Rochling-Rodenhauser type. The openhearth furnaces average five heats in 24 hours and the electric furnaces from nine to ten heats during the same period.

The Storage Yard

The arrangement of the storage yard is shown in Fig. 1, which also shows the large gantry crane equipped with a lifting magnet apparently operated by a hydraulic plunger. Figs. 2 and 3 show respectively the gas-producer house and coal conveyor, and the rolling mills of the Komotau plant. The concrete construction of the gas-producer house is particularly attractive. The Frick electric furnace at the Kladno plant is shown in Fig. 4, comparison with the men at the left giving an idea as to its size.

Coming to the forge department, Fig. 5 shows a hydraulic forging press of 1,200 tons capacity at the Kladno plant, which also has a 400-ton press and 40 steam hammers varying from 165 lb. to 6 tons capacity. The Komotau plant has three hydraulic presses ranging from 500 to 2,500 tons capacity and two steam hammers of 550 and 3,500 lb. respectively. It will be noted that the crane shown in Fig. 5 is 5,000 kg., or approximately 11,000 lb. capacity. In addition to this there is a drop-forge department well equipped with drop hammers, screw-driven forging machines for heavy crankshafts, crank presses, heading machines, extruding presses for tubes and rings, and cold metal stores.

Attractive Shops

Two views of the machine shops of the Kladnau plant are given in Figs. 6 and 7, and show entirely different types of shop construction, the shop shown in Fig. 7 being particularly attractive



FIG. 7. THE CRANKSHAFT DEPARTMENT

with its arched ceiling beams and roof. Axles, crankshafts and pinion gears seem to predominate in the shops shown in Fig. 6, in which may be seen a traveling crane of 44,000 lb. capacity. It will also be noted that the lathes and other machines are arranged in two rows so as to be readily driven from countershafts arranged directly under the crane ways. The method of guarding the driving belts is shown at the right in Fig. 6.

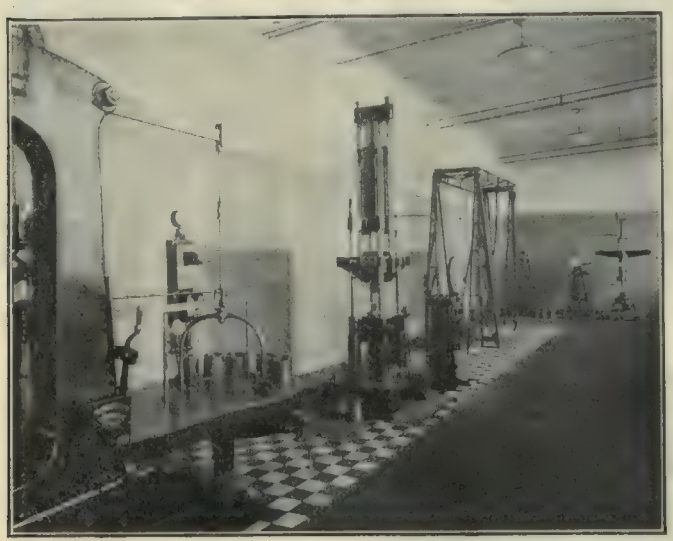


FIG. 8. IN THE PHYSICAL LABORATORY

A like method of machine driving is shown even more clearly in Fig. 7, which also shows the belt guards and the use of the shop railway, a turntable being seen in the distance. This department is devoted entirely to crankshaft work and it will be noted that the lathes at the left are equipped with a special barrel-shaped form of chuck for holding the crankshaft so as to present the desired pin or bearing to the cutting tool. The machine equipment comprises over 800 machine tools of various types.



FIG. 9. ONE CORNER OF THE FIRST-AID ROOM

The plant has a well-equipped physical and chemical laboratory, a partial view of the former being shown in Fig. 8. Ample provision for accident cases is made, a portion of the hospital being shown in Fig. 9. There is also a dining room with a capacity for feeding 4,000 people. Shower baths and similar sanitary conveniences are likewise provided.

As the future of all countries, and particularly those which have seen the stress of the great war, depends upon production in the various industries, Czecho-Slovakia is fortunate in having plants of this kind within its borders. Steel mills with a melting capacity of 8,000 tons per month and plants which can finish 4,500 tons per month are a decided asset to a small country.

For Whom Is Education?

BY ENTROPY

The personnel department of the army found as a result of the immense number of intelligence tests which it made that the average member of our forces had a mental age of about 13 years. That is, the average man's intelligence was somewhere about half of that which any except the abnormal can attain. This is further borne out by the fact that the average soldier had gone only to the sixth or seventh grade in school. We have always looked on this short period which boys and girls spend in school as something to be deplored, we have worried over it a great deal and wondered if the country were going to the dogs on account of it, but we have also looked on it merely as showing how little boys were willing to accept the opportunities which were open to them. It may be that these figures from the War Department will open our eyes to certain deficiencies in our public school systems, and especially so as to the education and training of the men who are doing and will continue to do the work in our shops. The average in the army cannot be far different from the average in our shops. The army was recruited by the most impartial means possible, and while we try to sort out men and put them in the places in industry for which they are best fitted we have to realize that when business is good they all have jobs and that the process of selection means simply that one shop may make a good selection, but that another shop has to accept a poor one.

First let us see just what an intelligence test shows. Briefly and somewhat loosely it shows capacity for learning, either by experience, from books or by precept. It does not show, or should not, how much a man knows, but rather how much he absorbs of what is placed before him. It tests his receptiveness for new ideas, his memory for new things, his ability to associate ideas, etc., rather than his having learned things in the past. It differentiates sharply between the man who learns easily and forgets and the man who learns slowly and retains his knowledge, always in favor of the former. When a man has the mentality of a twelve-year-old child it means that he has only the capacity to remember, reason, and associate ideas which a child of that age has. He cannot do much thinking that could not be done by the child. It does not mean that he has the habits of a child of that age and it does not mean that he has only the knowledge of the child. Such a man may learn to do many things which we would not expect a child to do because by long experience he may have found that it is necessary for his own comfort and safety to do things that way. Experience, in other words, does not enter into intelligence as tested in this way.

Now let us see what the school does with its pupils. First and most important of all it constantly presents new ideas. It gives little time and comparatively little drill to pound home those ideas. An educator says that an idea once understood is taught and that repetition beyond that point is not education. The man in the shop learns by doing a thing the way he is told and after

time that way of doing the thing becomes a habit. The habit is a good one so long as that is the best way to do things, but in the course of progress it becomes a bad habit and one hard to break as soon as a new and better way is discovered. In school the real attempt is to teach people to think for themselves. If the pupils are not endowed by nature with intelligence they can only be taught to think to a limited degree. We are having rather a hard time to convince ourselves that men are not created equal so far as thinking power is concerned, and yet we are confronted by that fact at every turn. It is not the fault of any school that one pupil's quickness of thought and ability to reason are greater than another's. The fault is that schools, both public and industrial, are not organized to do the greatest possible good to the pupils whom they get. That is, the boy with a twelve-year-old mentality goes to school until he reaches the sixth or seventh grade and then he stops almost automatically. He simply cannot do the work of the next higher grade because of his limitations. He may be able to do it, but not at the pace that the other and so-called normal pupils follow readily. If there is pressure at home he may go the second year in each grade and absorb knowledge which he would not get if he had to keep up with the class, but the fact that he goes further does not prove that his mentality is improved thereby.

Now there is a great deal of useful knowledge that is not taught in the first seven grades in schools. The boy who leaves at that time gets it by hard knocks and bitter experiences. It is a very wasteful and inefficient process, which would be unnecessary if our schools were better organized. The boy who goes into an office and always gets his messages mixed learns by being fired from one place after another. He could have been taught in school, but only by slowing down the pace. The girl who never could spell in school does learn in the office, but only as a matter of habit. There are a great many fairly good stenographers who cannot write a letter in longhand and spell it correctly, because the letters do not look the same as in type and she does not recognize her errors.

Rate of Progress Individual

Even our apprentice schools and vestibule schools are apt to be sinners in this respect, especially if they are handled by men who have taught school, in that they set a pace based on the teacher's own mentality, which is usually fully up to normal and therefore about twice as stiff for the average pupil as it should be in order that he may get the greatest good from the work. Each pupil or apprentice has a rate of progress almost as fixed in his case as the rate of vibration of a pendulum, and yet we try to make them all conform to a fixed and arbitrary rate that fits only a small fraction of them closely enough to be considered efficient. Or to put it another way, in the effort to cut down the expense of teaching we make a teaching machine that is adapted to the really best interests of only a small fraction of the material which is fed into it. What if we built a screw machine that would work to advantage on only one bar of steel in ten? We would land in the bankruptcy court. Our schools do no better.

So far we have dealt with speed of learning. There is another more important element. Many can learn to imitate who never grasp the reason why. Take even very bright men, college graduates if you will. Ask them how far they understand mathematics. The answers will vary. Some do not understand algebra, some balk at analytical geometry and most of them will admit that they never understood calculus. And yet all of them made passing marks in all these subjects, but purely on their memory. The method of testing knowledge used in school does not determine so much whether the pupil understands as whether he knows certain words and formulas. A man in the shop may have a most excellent faculty for telling whether or not his cutting tool is running at the best rate of speed and yet not be able to compute its actual speed at all. He gets this sensitiveness through habit, not reason. When high-speed steel came along a great many old-time mechanics simply could not tune themselves up to the new speeds and had to fall back on instructions to "run it on the third step of the cone" and so on until the new habit became a fixed one. On the other hand the man who understood the reason why could figure it out for himself and immediately rose to the situation.

The Best Teacher

So here we have a distinct problem of reducing knowledge to such terms that it can be absorbed by the men who need to have that knowledge. It would seem that the fact that a man had been a college professor makes it very unlikely that he could get down to earth and reduce these things to such simple terms that they can be learned by the rank and file. Part of being a college professor has consisted in the past and probably does now in building oneself a pedestal and climbing up on it. The best professor is the man who can display the most erudition, and by that we mean the most knowledge that the fewest people can understand. The best teacher is the man who reduces the reasoning necessary to understand a subject to its lowest possible terms. A great many things can be taught to a man of low mentality if the teaching is tempered to his condition. The mere fact that he is of low mental age does not debar him from learning a great many useful things, and things which make him a good producer, provided only that he is given time enough to absorb what is put before him, enough practice to make the use of the knowledge habitual and that the thing is put before him in a way that makes it easy for him to learn it. We must teach for the purpose of imparting knowledge rather than for mental gymnastics.

Why Recovery Is Slow

Recovery is delayed by several unsettled factors. These include, in about the order of their importance: (1) The uncompleted liquidation of labor; (2) the unexpectedly poor showing being made by the railroads under the Esch-Cummins law, and apprehension over impending labor developments; (3) tardiness in reducing prices by numbers of basic industries; (4) unforeseen delay in starting machinery to extend credits to foreign purchasers; (5) retention of high money rates for a period almost without parallel in our financial annals; (6) the failure of the retail trade, as a whole, to lower prices commensurate with the drastic declines in wholesale prices; (7) acute dissatisfaction in responsible circles over tax burdens and the absence of any definite plan in Washington to effect thoroughgoing reform and economy; (8) tariff uncertainties; (9) Germany's refusal to meet the Allies demands and the new outbursts of rebellious lawlessness by "Reds." Nevertheless, things are slowly getting better, not worse.—*Forbes Magazine* (N.Y.).

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

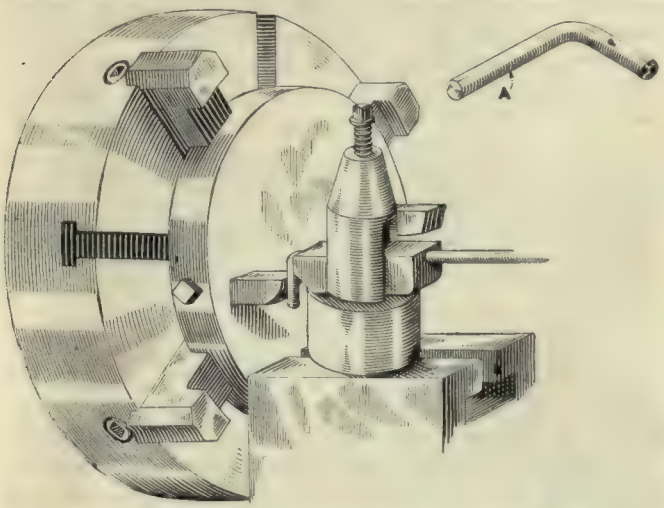
Bending and Cutting Off Wire in a Lathe

By Harry Moore

The sketch shows a unique method of bending and cutting off the piece shown at *A*; original so far as I am aware.

Having several thousands of pieces to make from $\frac{1}{8}$-in. wire stock and only a jobbing shop equipment to do it with, the lathe was rigged up in the manner shown. Two short pieces of square tool steel were turned at one end and a flat filed on; next a piece of round stock was procured and drilled at opposite sides to take the round end of the square tool-steel pieces, which were held in place with $\frac{1}{2}$-in. setscrews. A piece of stock to go in the toolpost was drilled for the wire and the fixture was ready.

The wire was fed through the holder in the toolpost until it touched the face of the piece in the chuck when the first tool, set to clear the holder by a distance equal to the diameter of the wire, bent it downward; the wire was then pushed forward again until the bent portion touched the face of the block when the second tool, which was ground to act as a shear in conjunction with



IMPROVISED BENDING AND CUTTING-OFF TOOL

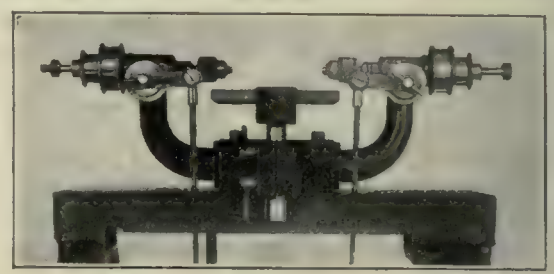
the holder, cut it off. The speed at which the lathe was run depended upon the skill of the operator. Although at first a few were cut off without bending, after a little practice a boy could bend and cut them off with astonishing rapidity.

Improvised Two-Way Drilling Machine

By Milton Wright

A two-way drilling machine was desired to drill holes on opposite sides of a small part that was to be produced in quantities. There did not seem to be just the machine on the market that was wanted and to build a special machine would require considerable time. The solution of the problem is shown in the accompanying illustration.

Two small bench drilling machines were taken from



AN IMPROVISED TWO-WAY DRILLING MACHINE

stock and the columns were cut off and clamped in the central casting, which is the only special part of the machine. This block had to be bored to fit the turned part of the columns and also bored at a right angle to take the post which supports the workrest.

The bed, which is obviously no part of a small drill press, was taken from an idle special machine, as were also the treadle and pull-rods. The whole contrivance was gotten up in a few hours' time and at much less expense than would be involved in the construction of a special machine.

It was made by the Grover File Co., of Nashua, New Hampshire.

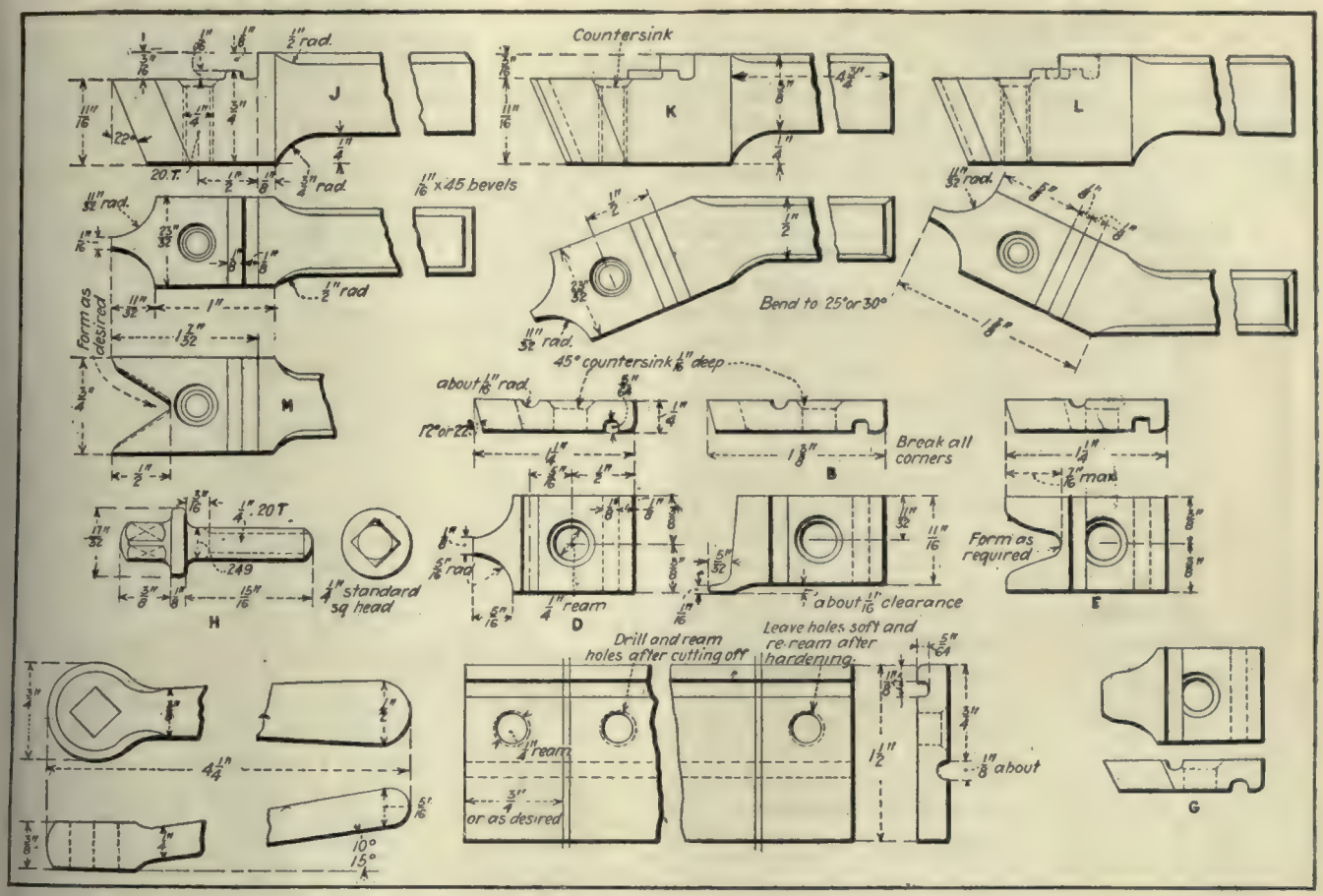
Toolholders and Interchangeable Form Tools

By Frank H. Cox

The types of form toolholders and interchangeable tools shown in the accompanying sketches have proved very satisfactory and useful, especially in the toolroom, showing a considerable saving in tool steel, the tools being readily exchanged or replaced when necessary. The sketches are almost self-explanatory.

The shanks of the holders can be made any desired size, but $\frac{5}{8}$ x $\frac{1}{2}$ x $4\frac{3}{4}$ in. and $\frac{3}{4}$ x $\frac{5}{8}$ x 5 in. are suitable for the class of work for which the tools are designed: cornering, recessing, forming, etc., and backing off small gear, twist drill, reamer, tap-fluting cutters.

It will be noted that all the sharp corners are broken where necessary, thus avoiding most of the dangers of distorting or cracking the tools when hardening, and incidentally eliminating the use of sharp-pointed tools when producing them, a small, but important point which all mechanics will appreciate. It will be noticed that all information and dimensions are shown in a vertical position—this saves the toolmaker the necessity of doing "stunts" to enable him to read the drawing. Also some dimensions are repeated for clearness, and where not repeated reference to one of the other figures will give the necessary information.



DETAILS OF THE TOOLS AND TOOLHOLDERS

The tool blanks, which are machined in one piece as shown at *A*, are afterwards cut off to the desired widths and finished to their individual requirements. However, it will be found most convenient in some cases to drill and ream the hole after cutting off in order that the tool may be set off center if necessary as at *B*.

Tools for ordinary forming are given 6 to 12 deg. clearance, and those for backing off are given 20 to 22 deg. clearance. Most tools are hardened and tempered only to the half round groove, which is put in to facilitate grinding. Grinding should only be done on the top, care being taken not to alter the form by changing the angle of the plane.

In special cases harden and temper only where necessary, as in *B*, where only the point requires hardening. In all cases it is best to leave the holes soft if possible, and ream after hardening. If this is done the tools can be taken off for regrinding, and replaced approximately in the same position, as the maximum clearance or tolerance between the holes and the plain part of the screws is 0.001 in., as will be seen by comparing the screw *H* with the holes in the tool as shown in *D*. In reference to *E*, better results can usually be obtained if the space is made a little wider than the form to be produced, and side cuts taken.

The square head only of the screw *H* is hardened and tempered (or casehardened if mild steel is used) to a dark blue, and the threaded portion left soft, which can then be drilled out should it break off in the holder at any time.

In order to save the never ending discussion about the rights and wrongs of right-hand and left-hand bent toolholders or tools I always use letters or numbers, or a combination of the two, when marking for the operator's guidance and storage, taking care to have blueprints, or their equivalent—showing clearly the system in use—hung or fastened outside the tool stores, and in other conspicuous places in the workshops and drawing office, which makes it a matter of indifference as to the individual's opinion on this debatable point.

The holders shown at *J*, *K* and *L*, being all of the same type, would be marked with the same letter but different numbers and sizes, viz.: MO-$\frac{5}{8}$ x $\frac{1}{2}$ in.; M1-$\frac{5}{8}$ x $\frac{1}{2}$ in.; or M2-$\frac{3}{4}$ x $\frac{5}{8}$ in., as the case may be; the letter being used to designate the type of holder, tool, etc., and the numbers to distinguish whether straight or the direction of the bend. The holder *M* being of a different type would be marked F0, and bent ones of the same type would be marked F1 and F2, according to the direction of the bend, in addition to the sizes of the shanks. Also, there should be marked on the top of all toolholders and the instruction blueprints previously referred to the following: ALWAYS USE PACKING BETWEEN TOOLPOST SCREW AND TOOLHOLDER. The type, etc., of the toolholders should be marked in a conspicuous place, the back end being preferred, where it is less liable to damage; the position also being a convenient one from a storage point of view.

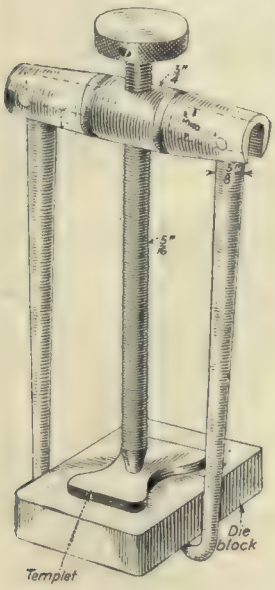
The tools, too, should be marked in the most convenient and conspicuous place, either the top or the edges being preferred.

Of course other systems of designating the tools may be used if preferred, but whatever system of marking is decided upon, cut out the right-hand and left-hand business, and by so doing you will save time, temper and money, to say nothing of language difficulties.

Clamp for Diemakers

By Charles Sehl

A clamp used for holding a templet on the die block to scribe the outline on the die, and also to hold the punch on the die in order to scribe the outline on the face of the punch, is shown in the illustration. This is an improvement over the old-style clamp in that it is made of round stock, making it easier of construction and lighter in weight.



CLAMP FOR DIEMAKERS

The top crossbar is made of cold-rolled steel ¾ in. in diameter with a hole ⅜ in. in diameter in each end within ⅜ in. of the center of the screw, to make it lighter. The side arms are made of cold-rolled steel ⅜ in. in diameter and tapered to ⅛ in. at the point of the hooks. The slots in the bottom of the crossbar are elongated to allow the side arms to swing all the way to the center and to open up to 8 in. wide at the point of the hooks.

The screw is ⅝ in. in diameter with a standard thread long enough to allow for holding a punch the entire length of the side arms.

Should Jigs and Fixtures Be Designed?

By Louis A. Schlossstein

It was with great interest that I read the several articles that have been published recently in the *American Machinist* discussing the question, "Should Jigs and Fixtures Be Designed?"

To my mind, the greatest argument in favor of designing most tools has not been brought out by these articles.

This communication is not an attempt to establish the superiority, if there is any, of the draftsmen over toolmakers, but is merely offered as a defense for the tool designer and his profession.

The tool designer should do the designing and the toolmaker should make the tools. If each does his share and does it well, there will be enough credit and glory for both. Keeping this in mind, the writer will try to show why the toolmaker should not design the tools.

In the first place, the toolmaker has not been trained to do designing in the strictest sense of the word. He cannot handle mathematics as readily as he should for obtaining angles, sizes and locations; his work bench and his surroundings are not at all suited for this branch of the work. He is not informed in regard to stock patterns or old patterns which might be used to advantage on the job in hand. He does not have lists of stock parts at hand from which to satisfy his needs. He does not often have the advantage of past experience on similar jobs or of the most efficient manner of locating or clamping work of a like nature. He cannot consult the blueprints of similar tools which have been made before, and has no way of keeping informed of desirable changes to be embodied on future work. All attempts at standardization are futile if the scheming up of the fixture is left only to the individual toolmaker.

All of the above points consume much more time in the toolroom and are not nearly so well carried out as if they were the product of the specialist—the man on the board who draws up a half dozen designs to the toolmaker's one.

A tool department without tool designers requires much more supervision and the foreman is hampered by details which should by all means be left to the men who have become expert on questions of methods, sizes and materials.

Another important advantage of designing is the economical use of raw material which is attained. Material is thus properly placed in required amounts only where needed for strength, stiffness and durability. As a rule, a tool designer is much better informed regarding properties of materials, mechanical movements and devices, and the construction of machinery. He is better educated; he reads more; has a more active mind and in every way is better qualified to tell how a job should be handled, because he is in close touch with the manufacturing departments. He also has the distinct advantage of being able to record his designs permanently on paper and to classify his information so as to make it instantly available at any future time.

When a tool is laid out on paper, consultations may be had by everybody concerned in its use in the shop. Thus we get the ideas and suggestions of several men embodied in every product of the tool designing department, and, quite frequently, changes have been found necessary which would have proven costly indeed, if the work had proceeded on the job in any other manner than with only paper and pencil. When first drawn up on paper, we know exactly how the jig or fixture is going to look; we can study its functions in advance; we know every detail of its construction; we know what material and how much of it is going to be used; in fact we can even tell very closely how long it will take to make it and how much it is going to cost.

The toolroom foreman has all his data and information given to him on the drawing and he is able to assign the work with more intelligence, greater accuracy and less loss of time. The result is that the work is systematically planned and carried out, delivery promises can be met with more certainty and the striving for the goal of efficiency is rewarded with success.

Know Why You Do Things

By A. W. Forbes

On page 565 of the *American Machinist*, John Brent gives some interesting criticism of a few articles that some of us have been writing. It is most interesting because it is so typical of the machinist and illustrates the points on which I usually start a fight with the same machinist.

"If the tool digs in Mr. Forbes will find that either the cut is too heavy for the tool or the lathe is too light to do the work, or the man who set the tool was careless." The last is probably the commonest cause, but suppose the second is the case. What would Mr. Brent have us do? Buy a lathe for a job that will last only two days? Not if he has to pay for it. It is up to the machinist to use the equipment and accomplish the results, yet I find that the average machinist will cuss the machine and lay down on the job. He will do the job, but will take no interest in it.

and take from twice to four times as long as he should. It is for this kind of work, as well as for the thousand other unusual circumstances that the machinist should know the why of the work.

It is all right for Mr. Brent to place his tool on center or above center as a general thing. I would do the same. But there are exceptions to the rule, and so long as Mr. Brent insists that the "real machinist will not set his tool below center," he is not likely to find these exceptions. If the tool digs in because the lathe is too light for the work, or for any other cause that cannot be controlled by the machinist, and it can be remedied by placing the tool below center it is up to the machinist to place it there, and if he wishes to be considered a first-class machinist he should find out that it should be placed there himself, regardless of any previous experience.

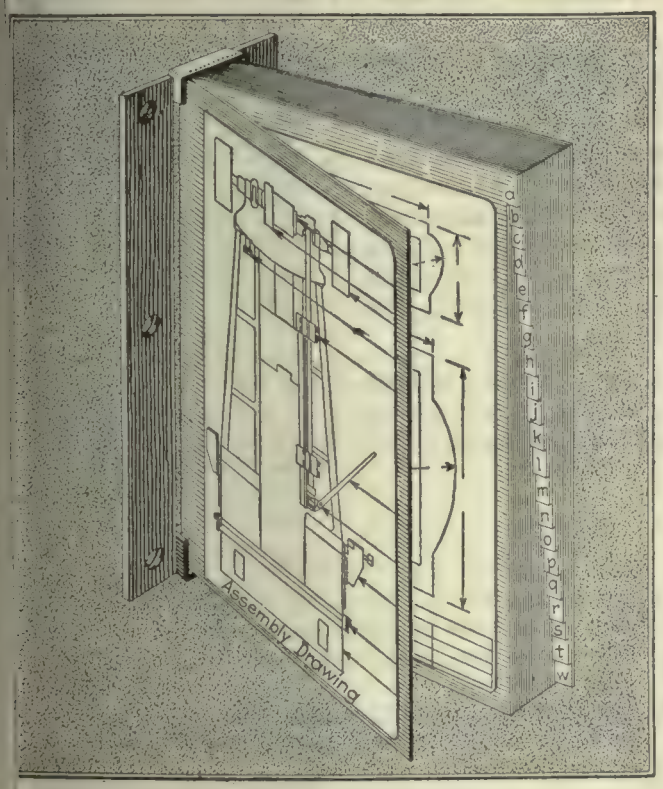
Ready Reference in the Assembling and Engineering Departments

By F. G. Glosh, Jr.

Many machine-tool builders are now using the book form of prints for reference in the assembling of various units. This method involves a continuous "hunt" for the correct drawing, as well as handling of many unnecessary drawings to find the desired one.

The scheme as illustrated by the rough sketch attached, will save considerable time to the employer and considerable annoyance to the workman.

This is a book form of photostats which are mounted on sheet-metal pages and hinged from the back edges, and the entire form supported from the wall to



BOOK FORM OF PHOTOSTATS

allow turning of the pages. These photostats are shellacked for protection. The guide pages as indicated (*a*, *b*, *c*) are in the form of an index, in this manner subdividing the book form into sections, as many of which can be inserted as necessary.

The first leaf on this book form is a photostat of the complete assembly of the machine of one or two views. From this print horizontal lines are drawn from any part of the machine to the outer edge of this leaf. The end of this line will indicate where any particular part can be found and can be therefore turned to immediately.

New horizontal lines in conjunction with their respective pages can be added or taken out at any time, making this construction universal.

Set the Tool Above the Center

By Robert J. Doxsey

Under the title "Know Why You Do Things," on page 565 of the *American Machinist*, Mr. Brent calls Mr. Forbes to task for setting his lathe tool below center.

I agree with Mr. Brent as I find that by setting the lathe tool above center a shearing action is given to the tool and a heavier cut with a coarser feed can be taken with less power consumption.

With the tool above center the force of the cut tends to hold the work down in the machine bearings thus eliminating considerable vibration and the power being used to drive the tool only, whereas with the tool below center the force of the cut has the tendency to spring the work upward causing it to vibrate and ride up on the tool.

Form tools such as radius and thread tools should be set on center as their cutting edges must be radial in order to reproduce their own profile.

About the most conspicuous case of not knowing why you do things is a man setting his compound rest to half the included angle of the thread when chasing threads and then proceeding to feed in with the cross feed screw.

I set my compound over and feed in with it as by so doing the tool cuts on one side only therefore heavier cuts can be taken when roughing and when finishing the cut can be taken first on one side and then on the other thereby obtaining smooth threads with no tears in them; whereas if the tool is fed straight in it cuts on both sides and on the point at the same time causing the tool to spring and tear the work.

When boring holes, especially in long work supported by the steady rest, I turn my tool upside down and cut on the opposite side of the work or hole as this tends to force the work down in the steady rest against the shears of the lathe thus eliminating vibration.

Wherever possible, while using a boring bar with square toolbits, I grind up my toolbit on both ends with one cutting edge cutting up and the opposite cutting edge cutting down and take the cut on both sides of the hole at once. I set my tools so that one edge is in advance of the other thus actually taking two cuts one counterbalancing the other.

This tool acts similar to a drill only it cannot bore through solid metal; the hole must be cored or drilled out first.

I would advise Mr. Forbes to go into the nearest machine shop and when he comes to a lathe that is humming along merrily and the chip is coming off smoking and snaking its way along the floor and the machinist is wearing a satisfied smile or perhaps whistling a tune, to go over and examine the tool and he will find that it is set above center.

IN THIS ISSUE

AN ANALYSIS of the contents of this week's issue seems to indicate that the greater part of it is what is colloquially known as "how stuff." The first article is largely concerned with machine work on heavy parts. The material was gathered by Fred Colvin on his last trip to the Pacific Coast when he visited the Puget Sound Navy Yard. The boring and planing operations on the cylinders for an 1,800-horsepower triple expansion engine would certainly be considered as large work by even the most conservative of us.

Immediately following the navy yard article, on page 804, is one by Western Editor Hunter, describing the lay-out and equipment of the machine shop of a big tractor plant. Hunter says this shop is one of the most modern of its type in the Northwest and his illustrations seem to back up his statement. He has something to say of the equipment of the shop with special reference to conveying systems for parts and assemblies.

Another fact about the contents of the present issue crops up when we get to page 811 and consider the article on the machining of locomotive connecting rods, by Frank A. Stanley. This fact is that most of the articles are from west of the Mississippi River, a region which until recently was hardly considered a machine shop district. Stanley gathered his data in the Sacramento shops of the Southern Pacific. Most of the operations he describes are milling and boring ones on side and connecting rods and brasses. There is also something on shaper work.

"One of the vital essentials for foremen—even more than for others—is open-mindedness, the willingness to hear new ideas, to use new methods and to give them a fair trial." This admonition starts the current installment of the "Foreman and His Job" on page 814. It is undoubtedly sound advice for every foreman. Isn't it equally applicable to all the rest of us?

Following up our articles of the last two weeks on British and French shops of unusual interest, we have one this week from that remarkable new country, Czecho-Slovakia. You will find it on page 826. Czecho-Slovakia has suffered the growing pains of all new countries but has been unusually fortunate in falling heir to the well-developed industries of the old Austro-Hungarian Empire. Most observers predict a brilliant future for this thrifty little republic. The famous Poldi Steel Works is the subject of this particular article which tells of the machine equipment and other facilities of a plant which would be rated in any country as highly modern.

Turning now to the installments in this issue of our three principal technical series, we find on page 807 the beginning of the continuation of Mr. DeLeeuw's "Meta Cutting Tools," Part IX. This particular section take up the details of construction and method of grinding o formed milling cutters. The grinding of formed cutter is not a very simple operation with our present equip ment, and Mr. DeLeeuw's remarks are well worth care ful study. On page 81 will be found more on th subject of drill jig desig in the Dowd and Curtis se ries on tool engineering The authors devote thei attention this week to th design of jigs with prope consideration of clearanc for work and chips, provi sion for wear on locatin surfaces and setting up an removing of the work. The also describe the variou types of drill jigs.

Directly after this articl is the end of Part VI o Ellsworth Sheldon's mag netic chuck series. Th chuck he is describing i this section, you will re member, is the Heald mu tiple magnetic chuck, an this part of it deals princi pally with the winding, im pregnating and connectin of the magnet coils.

Mr. Chubb, our Londo correspondent and editor o the European Edition of th *American Machinist*, has short and rather gloom account of conditions i England, on page 843. He points out that wage reduc tion in the British engineering works are being ser ously considered by employers and if they are put int effect there will very likely be resistance on the pa of the men.

On page 823 there is another article on the labor situ ation by our old friend John S. Watts whose earlie articles on the relations between wages and productio some of you may remember. This time his subject i unemployment and he goes after it in his usual kee manner. Starting off by exposing the fallacy of th suggested return to methods of barter, he goes on t discuss standards of living and how they are constitute and concludes by giving as his remedy the equalizatio of production.

Coming Features

To the average citizen the principal use of paper in the machine shop would probably seem to be for the writing of reports and the keeping of records. But it has other and decidedly important uses as will be brought out by E. A. Dixie in the first article in our next issue.

After an unfortunately long interval we will resume the "Modern Production Methods" series with Part XVI. In this installment Mr. Basset covers methods of checking costs, the distribution of various charges to the proper departments and a discussion of machine-hour rates. As in other recent installments, examples to illustrate the actual figures in each operation are included. The cause of the delay in obtaining the data for this series has now been removed and we are glad to be able to say that the remainder of the articles will be published at short intervals in the near future.

Other series articles in the next issue include Part VII of "Magnetic Chucks," Part III of "Helical Spring Design," and Part IV of "Tool Engineering."

EDITORIALS

Mr. Hoover on the Commercial Situation

THE outstanding address at the recent meeting of the Chamber of Commerce of the United States was Herbert Hoover's. Not because of his official position, for it is our feeling that Mr. Hoover dignifies the office of Secretary of Commerce rather than that the office adds any great luster to his star. But coming from the man who has been justly called our greatest economist the address carried conviction to the hard-headed business men who listened to him.

Mr. Hoover is not blind to the difficulties of the present situation, as his first words show. His hopeful view of the future, therefore, need not be discounted. He said:

"In entering any discussion of our commercial situation it would be foolish not to acknowledge that we are in the midst of great economic difficulties. But it is infinitely more foolish for anyone to think we will not grow out of this situation.

"We have much upon which to congratulate ourselves. Our difficulties are infinitely less than those of Europe; we have weathered the danger point of a great crisis; our financial system has proved its strength and for the first time we have passed safely through a commodity crisis without a monetary panic. . . . We have had a remarkably small ratio of failures. *I am convinced we have fundamentally turned the corner.*

"There are many encouraging signs in this readjustment. There is very much less speculation and profiteering. Many manufacturers and wholesalers are making cuts in their inventories that equal or exceed the increases which they obtained when we were on the up grade. . . . Labor shows a willingness to make reductions in wages in many directions, and I believe is willing to face even further reductions if its sacrifices can be handed on in a general reduction of final price levels, so that the cost of living is in step. Labor is growing in efficiency.

"With the intelligence, productive power and resourcefulness of the American people we will emerge from all this, but the rapidity with which we recover will depend upon the promptness with which we grasp and well understand the nature of our difficulties, and upon the unity and energy of our action."

The Penalty of Bigness

EVERYBODY expects more from the big man than from the little one. This has its advantages for the big fellow in that more attention is paid to what he says even though the words be no more weighted with wisdom than those of his smaller brother. In the slang of the day he can "get away with it."

On the other hand the big man is called upon to carry the lion's share of the responsibility of the community. A failure by one of the small fry affects few others and is generally condoned by public opinion, but when a leader is overwhelmed he carries down many of his neighbors with him and the result is a serious loss to the public.

As with men, so with nations. Until the war the United States was a young and thriving country, making rapid strides toward world power but with the goal still ahead. Four short years have brought about a transformation. We have arrived, and as a big creditor nation with unparalleled resources and more than our share of the wealth of the world, what we have to say commands respectful attention.

With our new power has come the unavoidable responsibility that always goes with it and which we must face with determination. Our splendid isolation is a thing of the past and we are vitally concerned in what the other nations of the world do, just as they must heed our wishes and policies in forming their own plans.

We are facing the biggest job we ever tackled and we cannot afford to fail. The consequences would be too awful to contemplate, for they would bring the whole structure of our civilization tumbling about our ears and we should join the Egyptians, the Greeks and the Romans in being of historic rather than practical importance.

Are Panics Necessary?

WHENEVER an epidemic of some sort sweeps a city or a country, we take steps to find the cause and to prevent its recurrence. The human suffering, the cost to the community and the effect on the welfare of the next generation, all demand that such epidemics must be prevented or at least minimized.

We are now slowly recovering from a business industrial epidemic of cancellations, of pessimism and panic. Does it not behoove every thoughtful man who is interested in the welfare of his country and his family to devote a little time to finding the causes and the cures for bad times?

The bad effect of such business disturbances on the whole people can hardly be over-estimated. To be crying for production and to censure workers for not turning out more product, and then to close factories because of over production, cannot fail to cause dissatisfaction and distrust. Huge profits one year, and heavy losses and wage reduction soon after can hardly fail to bring resentment.

Workers and business men alike are victims of these industrial epidemics. They destroy confidence and cause pessimism. They sap the foundations of our civilization. Are they necessary or may they be avoided?

If depressions come from inflation—let us find some way to prevent inflation. If because of profiteering—then profiteering should be made an unhealthy occupation. If they can all be traced to wars, it certainly behooves us to put our best brains at work devising some methods of prevention.

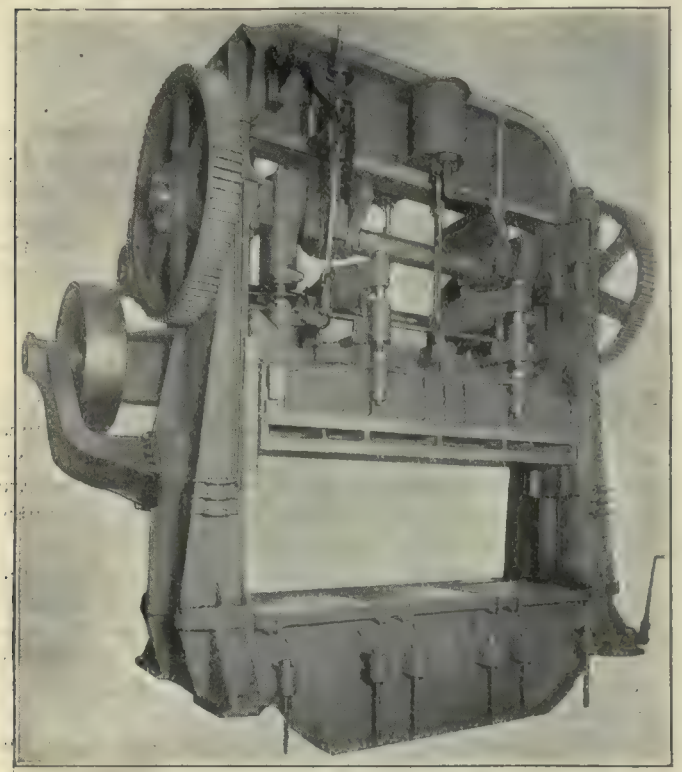
It is not enough to say we have always had panics and wars. Cuba and the southern part of the United States had yellow fever for centuries. But Gorgas found a way out. Has the world no financial, political or economic Gorgas?

Shop Equipment News

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval. Brief descriptions appear later in Condensed Clipping Index in both American and European editions.

Toledo Double-Crank Press

The Toledo Machine and Tool Co., Toledo, Ohio, has recently completed a large double-crank press intended especially for use in automobile manufacture. It is shown in the accompanying illustration. The press is said to be adapted to a wide range of work, and especially suited to the needs of builders of automobiles who do not have a sufficiently large output to warrant a power press for the performing of but one or two similar operations.



TOLEDO LARGE DOUBLE-CRANK PRESS FOR AUTOMOBILE WORK

Specifications: Width between uprights, 173 in. Top of bed, 61x173 in. Bottom of slide, 42 x 164 in. Stroke, 18 in. Distance, bed to raised slide, 73 in. Motor, 100 hp. Weight, about 300,000 lb.

A cam-actuated stripping and holding device and a spring-pressure drawing attachment, both of which may be readily thrown out of action, are provided. The press may be used for blanking, forming and perforating side rails and running boards, for blanking and forming certain kinds of cross members and rear-axle housings, and also for blanking and forming fenders, aprons, doors and other of the large light stampings which enter into the construction of automobile bodies.

The cam-actuated stripper and clamping device is used in connection with the perforating dies, and the spring-pressure drawing attachment with some of the forming dies. The shut height, or distance from the bed to the slide when the same is in its lowest position, is sufficient to accommodate high dies. Ring risers are used to lessen the shut height when blanking dies are being operated.

The press is self-contained. It is fitted with a friction clutch having a hand-lever control and positive automatic stop, which permits of the instantaneous stopping or starting of the press at any point of the stroke, and causes it to run either continuously or to stop automatically at the top center after each revolution of the crankshaft. The power elevator is used for raising and lowering the slide, when setting dies. The centralized forced-feed lubricating system enables the operator to lubricate all of the main bearings from the floor. Two air cylinders, one in front and one in back, are mounted on the crown of the press to counterbalance the slide.

The drive is through twin gears on the main shaft, all gears being cut from the solid and protected by metal guards. No pulleys are furnished, as the press is driven by a motor belted direct to the flywheel. Considering its size, an idea of which may be had from the specifications, the press occupies but little floor space.

Wallace Bending Machines Nos. 8 and 14

The Wallace Supplies Manufacturing Co., 412-20 Orleans St., Chicago, Ill., has placed on the market two different types of bending machine. Fig. 1 shows machine No. 8, intended chiefly for the bending of reinforcement bars in large quantities, but also adapted to bending angle iron, channels, pipe or tubing, and special sections. The machine can be furnished either with an independent motor or arranged with friction clutch pulleys for belt drive.

Square twisted reinforcement bars 1½ in. in diameter can be bent on the machine, or two 1¼-in. bars at one

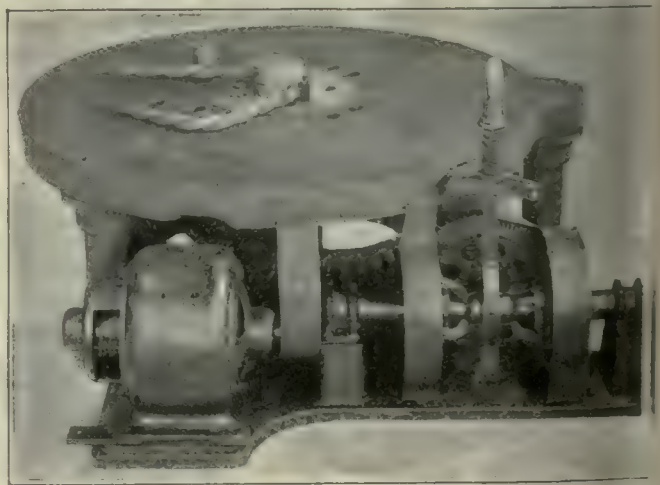


FIG. 1. WALLACE MOTOR-DRIVEN BENDING MACHINE NO. 8

time, or the equivalent in the smaller sizes of bars. By using extra high forming pins and rollers, small bars in quantities of from 8 to 10 can be formed simultaneously. When several bars are thus bent at one time, a U-shaped clip is placed over them for convenience in handling. Bars may be bent either from right to left or from left to right, thus avoiding the necessity for reversing the position of bars in order to make bends.

Special equipment for the bending of flats, rounds, squares, channels, angles, tees, and special sections can be furnished. A motor of 7½ hp. is required to operate the machine. The approximate weight is 3,500 lb. and the floor space required is about 6 x 6 ft.

In Fig. 2 is shown pipe-bending machine No. 14 fitted with friction clutch pulleys for power drive. It is intended for bending standard iron pipe or tubing up to 4-in. pipe size, or 4½ in. outside diameter. The roller bracket is adjustable to take forms up to 48 in. in diameter, and is operated by an eccentric lever to force the tube or pipe into a groove or form, for holding the outside follower bar close to the tube.

The machine is operated by a lever, engaging friction clutch pulleys for forward and reverse drive. Adjustable stops are provided to suit any degree of bend required. The clutch is automatically thrown out of engagement at both the end of the bending operation and at the starting position after the machine has been reversed.

The pipe is secured to the form by means of a strap and eccentric lever, and both the inside follower and the form are grooved to the proper diameter. The outside

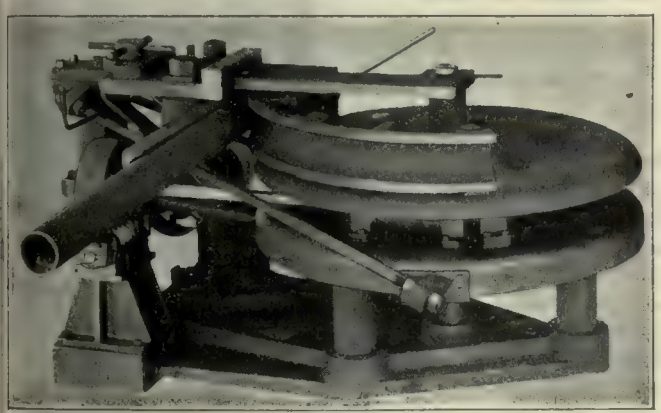


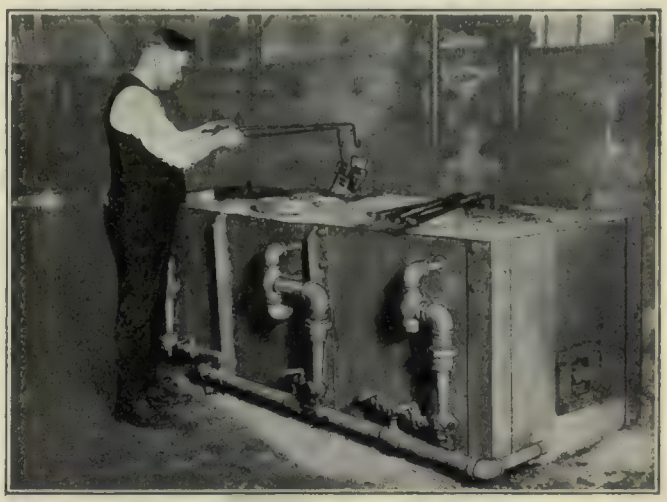
FIG. 2. WALLACE PIPE-BENDING MACHINE NO. 14

follower bar operates between the tube and roller instead of working directly on the tube. Bends can be made cold without the use of an inside follower or floating mandrel. Four-inch pipe can be bent to a radius as small as 24 in. Special forms with inside follower bars or floating mandrels can be furnished for bending light gage tubing to a short radius without flattening or crimping. Six standard forms are furnished with the machine, but special equipment can be provided for bending any desired radius on pipe or on material of other sections.

Bellis Heat-Treating Furnace

The Bellis Heat Treating Co., Blake and Valley Sts., New Haven, Conn., is prepared to install furnaces and supply crucibles and salts for the Bellis process of heat-treating high-speed and other steels.

For high-speed steels a triple-unit furnace, shown in the accompanying cut, is used. Though burners are supplied for all three chambers, those in the outer chambers are for the purpose of bringing the furnace quickly to working temperature, after which they may



BELLIS TRIPLE-UNIT HEAT-TREATING FURNACE

be shut off and the relative heats maintained by the flame from the central chamber passing through suitably disposed flues.

Either gas or oil burners are used. They are set tangentially in circular chambers, so that the flame does not impinge directly upon the crucibles. Crucibles for the higher temperatures are made double, with an outer shell of special refractory material and a lining of steel, which does not react chemically to the molten heating compound. The furnaces are of suitable size for the hardening and tempering of all small parts and tools that can be handled manually.

Hinckley-Myers Cylinder Reboring Mill

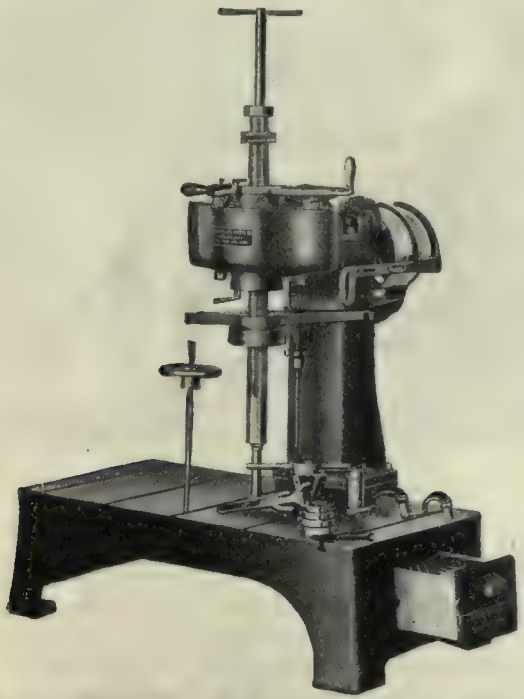
The illustration shows a power-driven machine for reboring automotive engine cylinders. It is made by the Hinckley-Myers Co., 19 N. Michigan Ave., Chicago, Ill., and is designated at No. HM-7. The machine will rebore open-head cylinder blocks not exceeding 20 in. in height and having cylinder bores from 2-13/16 to 5 in. in diameter. The table is low, so that the motor blocks can be easily placed in position for reboring. The pilot bar is lowered through the cylinder, centering in a hardened bushing in the table. A hardened, split, tapered centering fixture is then placed around the pilot bar and forced into the cylinder top, in this way locating the cylinder block so that the pilot bar will be in the center of the cylinder.

The cutter head contains three adjustable cutter blades, each blade being set independently by a micrometer gage to the over-size desired. The head is then mounted on the boring or cutter bar, which is maintained in its proper relation to the cylinder by traveling over the pilot bar. The cutter bar is lowered until the locking clamp rests on the top of the cylinder block, it then being fastened by bolts to the base, no wrench being required.

The cutter bar is hollow and runs in adjustable bronze bushings at both the top and bottom of the power head. It is driven by a hardened steel worm and bronze gear and double-pitched spur gears. The speed of the cutter head is about 40 r.p.m. The cutter bar is fed automatically and is provided with an adjustable stop collar which may be set to stop the boring when the

cutter head has reached the bottom of the cylinder, thus requiring no attention while cutting. It takes about five minutes to rebore a cylinder.

It is said that the machine is free from chatter, because the boring bar is so well-supported, and that the

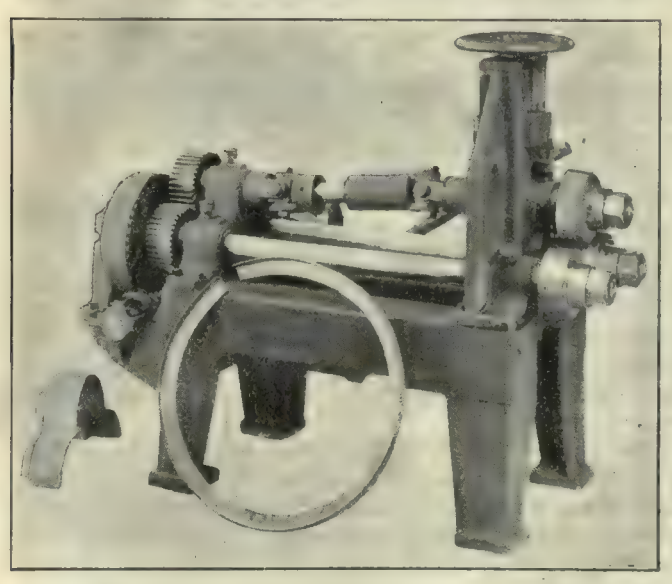


HINCKLEY-MYERS CYLINDER REBORING MILL NO. HM-7

cylinder is bored at right-angles to the crankshaft bearings. The machine consumes only about 1 hp. in operation. The floor space required is 50 x 40 in. and the weight 1,500 pounds.

Wallace Ring-Coiling Machine No. 3

The illustration shows a machine recently placed on the market by the Wallace Supplies Manufacturing Co., 412 Orleans St., Chicago, Ill., and intended for the manufacturing of rings and coils. The rolls are removable and can be changed to suit the character of the section to be bent, handling angles, channels, tees, tubes, and bars of standard or special section. Angle iron 2 x 2 x $\frac{1}{4}$ in. in size can be bent cold to a circle as small as 30 in. in diameter, while lighter sections can be bent to smaller circles. Twisted or deformed structural bars can be bent, as in the forming of helices such as are used for reinforcing concrete columns.

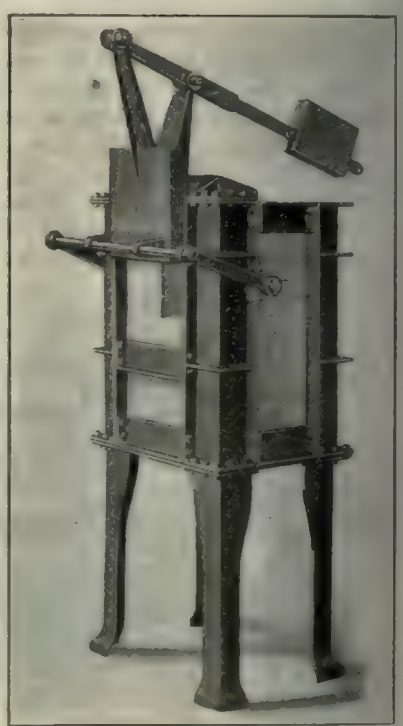


WALLACE ADJUSTABLE RING-COILING MACHINE No. 3

The machine is known as the No. 3. It is driven by belt on friction-clutch pulleys, which can be engaged by means of a hand lever to drive in either direction. The position of the upper roller is adjustable by means of a hand-operated screw to give the required diameter to the coil or ring. The machine occupies a floor space of 42 x 54 in. It is substantially made and weighs 1,200 lb.

Advance Tool-Hardening Furnace

A small furnace designed for the purpose of tool hardening and for the heat-treatment of small parts has been brought out by the Advance Furnace and Engineering Co., Springfield, Mass. It is of the semi-muffle type in which the flame chamber is located below the floor of the heating chamber, the heat being conducted to the latter by flues. The burner is located in the rear of the furnace and may be adapted to the consumption of either gas or oil fuel. A noteworthy feature is the method of suspending the door on three radius rods, so that when it is lifted it does not drag the hot firebrick lining against the furnace front but swings away in a long arc, at all times remaining vertical and coming to rest against the furnace front again when it reaches the full open position. The furnace shown in the illustration is made for handling carbon steel only. Furnaces of the same design for heating high-speed steel have an additional heat-insulating covering and a sheet-iron jacket on account of the higher temperature used.

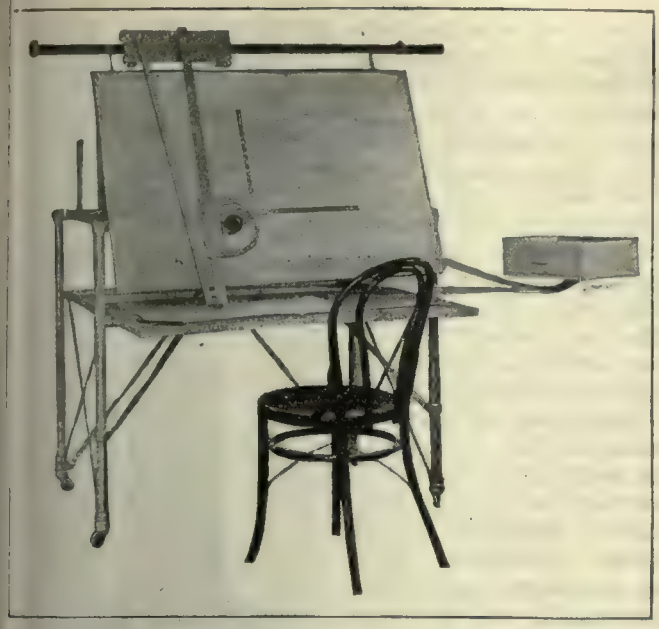


ADVANCE TOOL-HARDENING FURNACE

Simplex Drafting Outfit

The Simplex Tool and Instrument Co., 820 North Third St., Camden, N. J., has recently placed on the market the drafting outfit shown in the accompanying illustration. The equipment consists of a frame carrying the board, on which is mounted the parallel-ruling device holding the scales. In the illustration the frame is shown mounted on an iron table, but it can be furnished separately to place on the top of an ordinary table.

The board may be placed in either a horizontal or



SIMPLEX DRAFTING OUTFIT

vertical position, no notches or screws being required to hold it in place. When in the former position, the operator may use a drafting stool, and when in the latter position, the operator may reach all parts of a 24 x 36-in. drawing while sitting on an ordinary chair, it is said. When the board is raised, all parts of it may be reached from the standing position. The board is independent of the frame, so that any board may be used, it being secured in position by only two screws. Weights placed at the back of the machine counterbalance the board.

The sliding horizontal board shown underneath the main board forms a table to hold reference drawings up to 24 x 40 in. in size, and it may also serve as a desk for clerical work. Removable casters are supplied. A drawer and tray are provided at the side of the machine for holding pencils and drawing tools.

At the top of the board is a track on which runs a carriage holding the bar that extends across the board. The rollers on the carriage are far apart, so that the bar is held rigidly, and the carriage may be locked in position on the track when desired. An indexing head is mounted on the bar, a clamp being provided for holding it in position. Two scales placed at right-angles are held on the head, the scales being swiveled easily by means of the left hand, and leaving one hand free to use the pencil. The indexing device is graduated and provided with notches for quick adjusting. At the top of the board is a spacing device for the making of section lines, the latch of the device being easily disengaged when not in use. Locks on the various movements hold the scales in the position in which they are left.

Elwell-Parker Electric Crane Truck

The Elwell-Parker Electric Co., Cleveland, Ohio, has fitted its low-bed electric industrial truck with a crane. The machine, which is thus adapted for loading, hauling and tiering, is shown in the illustration in use for the handling of castings. It is said that the crane can pick up 2,000 lb., and can stack material to a height of 8 ft. The truck itself can carry a load of 3,000 lb., and travel from 300 to 400 ft. per minute.

The revolving crane column is carried on large ball and roller bearings, and can be swung by hand. The boom may be raised or lowered and locked in any position desired, so that the load may be placed at any point on the truck platform. The power for this movement is obtained from the same motor that winds the cable. A hand brake is provided for use when lowering the load at slow speed. The power unit for the crane consists of a totally inclosed motor, a drum controller, the hoisting mechanism and the battery, so mounted as to counterbalance the load. The boom can be locked in a central position when not in use.

The truck itself uses a standard arrangement of either Exide Ironclad or Edison battery, the battery being assembled in a single box that may be easily removed. A totally inclosed inter-locking drum controller and circuit breaker are provided. It is said that no fuse is necessary. All four wheels are used for steering and the two rear ones for driving. It is said to be adaptable to a very wide range of uses, both indoor and out.



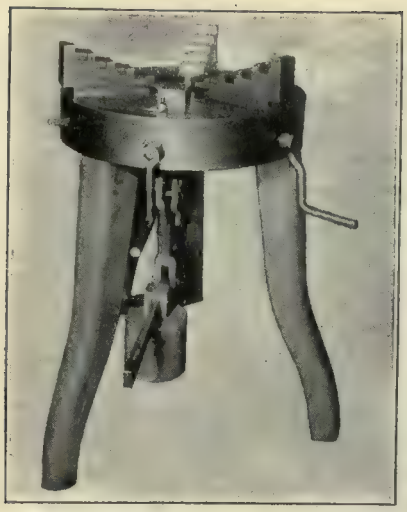
ELWELL-PARKER ELECTRIC CRANE TRUCK

The loading of freight cars and the handling of bulky material may be easily performed, and the crane may be fitted with an 18-in. magnet for the handling of scrap material.

Commercial Wheel-Bushing Chuck

The illustration shows a chuck made by the Commercial Welding and Machine Co. Inc., 21 Commercial St., Worcester, Mass., for the purpose of bushing grinding wheels. The device embodies two independent chucks, one holding the bushing arbor, and the other the wheel or part to be bushed. It is said that the work is centered accurately, and held so that the hole will be at right-angles to the side of the wheel.

The chuck is dust proof, since no openings are uncovered in operation, and felt packing is used under the jaws and at the openings for the screws. The work-holding chuck is said to be very substantial, but adjustable to a fine degree and sensitive enough to hold delicate work without straining or breaking it. The bush-

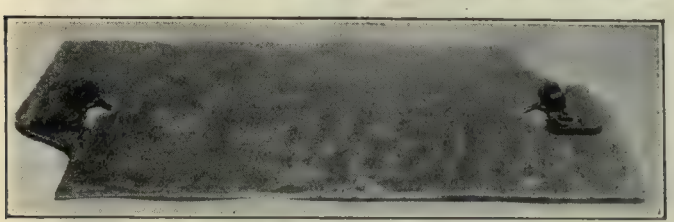


COMMERCIAL CHUCK FOR BUSHING GRINDING WHEELS

ing chuck is made in an 18-in. size, mounted on three legs. A lathe chuck is made in a 12-in. size for turning abrasive wheels. Arbors on which to cast the bushings can be furnished in sets from ¼ to 5 in. in diameter, a standard stem 2 in. in diameter being secured to each one. The arbor or mandrel is made oversize, to allow for shrinkage of the lead or babbitt. The large arbors are hollow, so as to reduce the amount of expansion occurring upon heating. The arbor chuck and the wheel chuck are adjusted by means of wrenches on separate screws on the periphery.

St. Louis Metal Match Plates

The St. Louis Machine Tool Co., 932 Loughborough Ave., St. Louis, Mo., has developed a line of steel and aluminum match plates adapted for light and medium



ST. LOUIS METAL MATCH PLATE

foundry work. The patterns are secured to the plates, thus insuring that the cope and drag parts of the molds will fit each other properly.

The plates consist of flat sheets of metal, each provided with clamps and guides for fitting the flask pins. They are made either round, rectilinear or in any shape desired, and with the ears in the center or at diagonal corners, as shown in the accompanying illustration. The plates are said to be light in weight, and to enable the preparation of sound molds with a minimum of time and work. They are ordinarily used for work done in large quantities, and usually in connection with a molding machine.

The plates are made in ten standard sizes. A plate 12 x 19 in. is used to fit a 10 x 12 in. flask, inside measurement, and a plate 16 x 25 in. to fit a flask having an inside measurement of 14 x 18 in. The steel plates vary in thickness from ⅛ to ¼ in., it being stated that a thickness of ⅛ in. is sufficient for any kind of work in 10-in. flasks, and for squeezer work where both sides are molded at once. The aluminum plates vary from ¼ to ⅜ in. in thickness, and are said to be lighter than the steel plates and non-corrosive.

Austin Power-Head Grinders

The J. L. Austin Mfg. Co., Milwaukee, Wis., builds a line of power-head grinders of the type shown in the illustration. The machine is made in three sizes, and can be furnished either with or without the pedestal, and with single-pulley or double-pulley drive, the latter being used on the machine shown.

The arbors are of high-carbon steel and run in babbitted bearings that are split to take up wear. All bearings are equipped with self-oiling spring oil cups. The collars are pressed onto the arbors, and counterbored for the purpose of excluding dirt and dust from the bearings. The rest arms are equipped with both an angle and a bevel tool rest, and the back bracket is eliminated for the purpose of allowing more room around the wheel. The wheel guards are one-piece grey-iron castings.



AUSTIN NO. 3 POWER-HEAD GRINDER

Specifications: Built in three sizes; Nos. 2, 3 and 4. Respective capacities: Wheel size, 8x1, 10x1½ and 12x2 in. Base of head, 4x7¾, 5x9 and 6x14 in. Height from base of head to center of spindle, 5, 6 and 7 in. Length of spindle, 14, 17 and 25 in. Pulley size, 2½x2, 3½x2 and 4x2 in. Weight of heads; with one pulley, 21, 28 and 65 lb.; with two pulleys and guards, 38, 52 and 95 lb. Height of pedestal, 33, 32 and 31 in. Floor space of pedestal, 10½x12¾, 11x14 and 13x18 in. Weight of pedestal, 60, 80 and 120 lb.

Rhodes Rotary Indexing Table

The Rhodes Manufacturing Co., Hartford, Conn., is bringing out a rotary indexing table intended primarily for use in connection with its shapers, but equally serviceable on a milling machine, drill-press, or wherever such a table may be required. Slotted ears on three sides of the base and a hole through the index bracket on the fourth side provide a way to bolt the device to a machine table.

The wormwheel on the under side of the rotary table has 40 teeth, and three index plates are provided, with



RHODES ROTARY INDEXING TABLE

which any number of divisions up to 360 may be obtained. The position of the index plate is fixed by a latch upon the bracket engaging in a series of notches upon the periphery of the plate, the notches being so spaced as to provide adjustment corresponding to one minute of arc at the rotary table. Adjustable plugs of hardened steel provide means of compensating for the wear of the worm and wormshaft bearings.

The rotary table is graduated in degrees, thus enabling the operator to make angular settings. Four clamping plates hold the table firmly in any position, or they may be adjusted to allow the table to revolve freely. The diameter of the table is 8 in., and the total height of the device above the machine table, 2½ inches.

Notes on Solders and Soldering Fluxes

Preparing Work for Soldering — Composition and Use of Various Solders — Corrosive and Non-Corrosive Fluxes — How To Make and Use Them

By E. ANDREWS

AMONG the many familiar metallurgical processes with which we have to do in the engineering industry, the process of soldering is one of the most familiar. Soldering is a process whereby two pieces of metal are joined by another metal or alloy having a lower melting point than the metals to be soldered; the fusing point of the solder must, however, approach as nearly as it conveniently can to that of the article to be joined, as a more perfect and more tenacious junction may thus be effected. It is also necessary that there should be a certain amount of interfusion or alloying between the solder and the metal to be soldered, an intimate union of the two thus taking place. To achieve this result the surface of the metal must be entirely free from oxide and dirt. There is a great variety of solders termed respectively aluminum, bismuth, brazing, hard, soft, silver, plumbers', tinners' and many others; they are, however, broadly distinguished as hard and soft solders. Hard solder fuses at or above a red heat. Soft solder melts at comparatively low temperatures, and is used for soldering most commercial metals. Metals to be joined may be either of the same or dissimilar kinds; but the solder used must have an affinity for both and should agree with them as nearly as possible in malleability, and hardness.

Soft solders consist chiefly of tin and lead although other metals are occasionally added to lower the melting point. The melting point of lead is 621 deg. F. and that of tin 450 deg. F., yet when these two metals are alloyed in equal proportions to form ordinary solder (half-and-half) the melting point drops to about 370 deg. F.

If bismuth is added to tin-lead alloys the melting point is still lower. Bismuth possesses the property of expanding on cooling, a very unusual one in metals generally. It is, therefore, used not only to make the solder more easily worked by lowering its melting point, but if added in sufficient quantities its expansive tendency counterbalances the effects of the contraction of the other metals. Alloys of bismuth, tin, and lead, have very low melting points, which can be further lowered by the addition of cadmium. A composition of pure metallic tin, and zinc, is in some cases used as a solder, as in the case of soldering articles made from pure tin, and galvanized-iron work.

Most aluminum solders are alloys of tin, zinc and aluminum with from 5 to 15 per cent aluminum, 8 to 10 per cent zinc, and 75 to 95 per cent tin. Some aluminum solders contain a small percentage of copper, phosphorus or nickel—never exceeding 2 or 3 per cent, however.

Soft solders are variously termed common, medium, or best, according to the percentage of tin; those containing the most lead being the cheapest, and having the highest melting points. Fine or best solder is largely used for soldering Britannia metal, brass, and tinplate articles; commoner qualities are used for ordinary work. Solder used by plumbers for wiping joints on lead pipe is made of two parts of lead and one of tin. It is plastic when cooling and it is due to this property that the plumber depends on wiping a joint.

Antimony is an objectionable impurity as it renders the solder less fluid when melted and tends to prevent perfect adhesion of the surfaces. It is sometimes added, however, in small precentages in order to obtain surface appearance of the solder; as the sale of soft solder is influenced largely by appearance rather than by analysis and utility, and solder containing 2 per cent antimony, 45 per cent tin, and 53 per cent lead is superior in appearance to that of the tin-lead alloy in equal proportions.

Zinc, even in very small quantities, has an injurious effect on soft solder, interfering with the soldering properties and dulling the surface. Aluminum acts in a similar way. Phosphorous, in a very small amount renders soft solder very "lively," that is, the solder has a tendency to run freely. Too much phosphorous is injurious. When phosphorous is used it should be in the form of phosphor-tin. One or two ounces of 10 per cent phosphor-tin in 1 cwt. (112 lb.) of solder is generally sufficient.

A rough test of the quantity of tin in solft solder can be made by listening to the characteristic "cry" of the tin when the solder is bent. If is emits a slight cracking noise, it is good; but should the cracking noise be excessive, a little more lead is desirable. The quality of the solder may also be judged by its outward, or surface appearance; with excess of lead, the surface will have a grayish-white color; with excess of tin the surface will be bright with grayish-white spots.

Table I gives the compositions of various soft solders, together with their approximate melting points.

TABLE I. COMPOSITION OF SOFT SOLDERS

Solder	Percentage				Melting Temperature	
	Tin	Lead	Bismuth	Cadmium	C.	F.
No. 1	25	75	00	00	250	482
No. 2	33.3	66.7	00	00	227	441
No. 3	40	60	00	00	215	421
No. 4	50	50	00	00	188	370
No. 5	66.7	33.3	00	00	171	340
No. 6	63	37	00	00	173	344
No. 7	60	40	00	00	175	347
No. 8	33.3	33.3	33.3	00	140	284
No. 9	40	10	50	00	116	240
No. 10	20	30	50	00	100	212
No. 11	25	25	50	00	93	200
No. 12	12.5	25	50	12.5	60	14

Solders 1 to 7, are used by plumbers and tinsmiths. Solder 4, is the one mostly used, while solder 5 is especially adapted for use on thin lead and tin pipes, tinplate work, etc. Solder 8, has a very low melting point, and is often used for soldering delicate sheet metal and artistic metal work. It can be fused on metal surfaces by the flame of a gas jet or candle. Solder 11, known as D'Arcet's alloy, is often used by pewterers, and solder 12 known as Wood's alloy is used in engineering works and factories for fusible plugs in boilers, electric installations, et cetera.

No solder containing over 50 per cent of tin should be used for general soldering work with the soldering copper, and in a great many cases a solder composed of 40 per cent tin and 60 per cent lead will give satisfactory results. Tin being about ten times the price of lead, a small reduction in the quantity of tin makes a considerable difference in the value of the solder.

Cadmium is a promising substitute for part of the tin in solders, and a composition of 80 per cent lead, 10 per cent tin and 10 per cent cadmium gives good results for many purposes. The tensile strength of cadmium solder is about 5,800 lb. per square inch or about the same as that of the 40 per cent tin and 60 per cent lead solder. Its ductility, however, is approximately twice that of the ordinary soft solders. Owing to the high percentage of lead in the cadmium alloy, the price is very reasonable compared with a solder containing a high percentage of tin. Solder that has been exposed to damp atmosphere for some time and has become more or less oxidized on the surface will not give as good results as fresh solder.

With the use of hard solder a higher temperature is required than can be obtained with the ordinary soldering copper; therefore, it is necessary to use either a hearth fire, blowlamp, or gas blowpipe, or to dip the parts to be joined in a bath of molten spelter. When making a joint with hard solder, it is desirable that the solder have a lower melting point than the metal or metals to be united. Absolute cleanliness is as important with hard as with soft solder.

Hard solders are generally used for joining brass, copper, iron, and steel parts. Table II, gives the composition of hard solders with approximate melting points.

TABLE II. COMPOSITION OF HARD SOLDERS FOR VARIOUS METALS

Metal to Be Soldered	Percentage Copper	Percentage Zinc	Characteristic	Variety	Melting Temperature C.	Melting Temperature F.
Iron and steel.....	63	37	Very strong	Hardest	908	1.666
Copper and thin iron work.....	60	40	Strong	Hard	890	1.634
Copper and brass..	50	50	Medium	Medium	880	1.616
Copper and brass..	41	59	Fairly fusible	Fine	840	1.544
Thin brass work...	35	65	Easily fusible	Very fine	816	1.500

Brass for brazing or hard soldering should contain at least 75 per cent copper in order to prevent its melting and flowing away during the jointing process.

Silver solder is a hard solder containing silver, copper, and zinc. It is equally applicable to brass, copper, iron, german silver, sterling silver, steel, etc. The advantage of silver solder lies in the freedom with which it will melt and flow though it is not as fusible as the soft solders composed of tin and lead.

Silver solders are made in a number of different grades of fusibility, cost, and color, but they are generally composed of about 60 per cent silver, 25 per cent copper and 15 per cent zinc. An excellent silver solder of low fusing point is composed of 50 per cent silver; 35 per cent copper, and 15 per cent zinc.

Borax, or borax and carbonate of soda may be used as a flux for silver solder. The heating is usually effected by a blowpipe. The flux should be applied before heating if possible.

Silver solder is remarkably fluid when in a molten state, and penetrates interstices which ordinary hard solders would fail to fill. Another advantage of silver solder is the fact that it may be rolled into sheets or drawn into wire and may, therefore, be employed for many classes of work in which hard or brazing solder could not be used. Furthermore, silver solder is very strong and tenacious, consequently it makes the strongest joint of any known solder, and as it melts so readily there is less danger of "burning" the joint of the metal being soldered.

Soldering fluxes should be determined by the nature of the work. If sheets of soft brass, copper, galvanized steel, tinplate or zinc are to be soft soldered, the common fluxes, as ammonium chloride (salammoniac), zinc chloride, or resin may be used. But if the work is something more delicate or important, as in the case of soldering electrical apparatus, the effect of the corrosion of zinc chloride on the work must be considered.

The rapidity with which a soldering flux acts is an important factor in its usefulness. If the flux be in the form of a dry salt, a comparatively high heat is necessary to fuse it. If an aqueous solution be used, a certain amount of heat is essential to evaporate the water. The function of a soldering flux is to have a solvent action on the oxide, thereby keeping the metal surface clean and excluding the air.

Zinc chloride has several properties which make it a valuable soldering flux for most work, as it remains liquid at the temperature of molten solder, thus being in a condition to act upon the oxides very readily. Some workers add a quantity of water to zinc chloride flux, but that is detrimental, because the stronger the flux can be made and still remain liquid, the better it will be.

To make zinc chloride solution, dissolve clean metallic zinc (preferably in small pieces) in hydrochloric acid until the acid will not take up more. The zinc should lie in the acid for at least twelve hours, when any excess may be removed, and the soldering flux is ready for use. Zinc chloride is poisonous and should not be used in soldering fruit or meat tins, or any utensil containing food. It has a burning action on the skin, and is corrosive, as it frequently contains free acid; consequently it should not be used when soldering electrical apparatus. In all cases where this flux is used, the surfaces of the metal should be thoroughly washed and dried after soldering to prevent the acid action after the job is done.

Resin, either as a powder or an alcoholic solution, is a splendid flux where speed is not required. But it has the undesirable property of leaving a sticky, gummy mass on the metal surface after the evaporation of the alcohol, which is a hindrance in many kinds of work. It is, however, the best flux to employ where a non-poisonous flux is desired. It is also an excellent flux for soldering operations on electrical conductors, as it is free from acid, and is a fair insulator.

Ammonium chloride is extensively used as a soldering flux, particularly on brass or copper work, as it does not tarnish these metals, but when used on zinc, it forms zinc ammonium chloride and causes more or less corrosion.

Table III, gives soldering fluxes for various metals with methods of application.

A good non-corrosive flux can be made by dissolving as much clean zinc in one ounce of hydrochloric acid as the acid will take up and stirring this compound into eight ounces of vaseline to form a paste.

For hard soldering, borax is the best flux, as it dissolves any oxide that may exist on the surface of the metal and protects it from the air, thus allowing the solder to come in actual contact with the metal. Preferably, burnt or calcined borax in powdered form should be used as it will not swell or froth up.

TABLE III. SOLDERING FLUXES

Flux	Metals or Alloys	Used With
Stearin or lard oil..	Aluminum.....	Aluminum bit or blowpipe
Zinc chloride.....	Brass, copper and tinplate...	Copper bit
Resin.....	Lead, lead and tin alloys.....	Copper bit or blowpipe
Ammonium chloride	Brass, copper and iron.....	Copper bit
Hydrochloric acid..	Zinc and galvanized stee.....	Copper bit
Olive oil.....	Britannia metal, pewter and tin.....	Copper bit or blowpipe
Borax.....	Brass, copper, iron and steel..	Blowpipe or hearth fire
Boracic acid or Carbonate of soda..	Brass, copper, iron and steel..	Blow pipe orhearth fire

Business Conditions in England

Wage Reductions in Engineering Works Imminent—Strikes Will Probably Follow—Many Orders Lost to Germany and the United States

BY OUR LONDON CORRESPONDENT

GREAT BRITAIN has been carrying on for a number of years now under continually renewed threats of strikes and similar industrial disputes. It is possible that the worst has been passed, although of course, many more industrial troubles are still ahead. Workpeople generally are under the mistaken impression that the employing side have entered into a conspiracy to reduce wages.

For some time in engineering, employer and employed have disagreed over such matters of detail as the running of machines, working of overtime, number of apprentices, and so on. But for a month or so it has been apparent that the employers would move for a marked reduction in wages and notice has now been given; it will almost certainly be resisted.

As a general kind of justification the Engineering and National Employers' Federations have issued a pamphlet on the present economic position of the industries concerned. It discusses the causes for the present very definite decline leading to the conclusion that "it is very certain that an active state of trade cannot be resumed without lower selling prices, involving a much lower cost of production." A number of examples of lost orders, etc., are given. Outside of certain firms engaged on heavier tools where work for some few months remains yet in view, the industry is so far from being active that it may be described as merely existing. One well-known firm has not received an order of any magnitude for a year, while three working days in the week indicate a relatively good state of employment Obviously the shops are not working on commercial orders, but merely to keep the men together, and the limit to this must pretty quickly be reached.

England Losing Railroad Trade

In engineering Great Britain of late had rather congratulated itself on its success in obtaining orders for locomotives. Armstrong-Whitworth, in particular, have apparently done well. Yet the federations mentioned are able to tabulate a long list of orders lost to Great Britain in competition with America, Germany and, significantly, Canada. Commencing with June, 1919, and ending with February last, the value today of orders that have thus passed us by are estimated at £3,000,000. Both electrical engineers and textile machinery manufacturers are now experiencing the general decline, and the motor industry has not shown that measure of life the period of the year was expected to bring.

Exhibition running has for some years proved to be one of the most profitable branches of business. It might almost be said that recognition of this fact led to the formation of the Machine Tool Trades Association, whose exhibition in the autumn of last year at Olympia, W., proved no exception to the rule. Now the Society of Motor Manufacturers and Traders is able to show from its two exhibitions, held simultaneously at Olympia, W., and the White City, W., last autumn, a profit of more than £28,500. Announcements of reductions in prices in cars continue to be made, the Manchester made Crossley car, for example, having been dropped in price by £325. The Wolseley Co. is reviving a small power car, and the Austin Co. will place a 10-hp. car on the market before long.

While absolute fatalities are confined to the smaller and newer concerns, the larger organizations are not reporting in lively strain as to the financial position.

The Iron and Steel Market

The condition of the iron and steel market need hardly be mentioned. It is reported that the Middlesborough district steel works are shut down, such orders as are coming forward being filled from stock, while forward buying generally is described as quite at a standstill. In shipbuilding a reduction of 146,000 in tonnage launched last quarter and of 113,000 tons commenced is reported. As to shipping, according to an official estimate the deadweight laid up, which was 2½ million tons at the end of January, is now 5 million tons. As something of a set-off to a generally dismal record the statement may be made that Armstrong, Whitworth & Co., Ltd., has obtained a contract for the Ebute Metta workshops, near Lagos, for the Nigerian government railways. The contract includes the supply of new locomotive-, carriage- and wagon-shops, a power station, and so on, and the time for completion is two years.

Living Costs Declining

The cost of living, as officially determined, continues to decline, and at the beginning of April was very nearly back to the figure of a year ago. Taking the average of retail prices into account the Ministry of Labor has calculated that the increase as compared with July, 1914, was 133 per cent, a decline in a month of 8 points, due mainly to decrease in the cost of food and to some extent in clothing. Changes of wage rates during last month officially reported showed that 350,000 workpeople sustained decreases amounting to £60,000 a week, while 11,000 received increases amounting to about £2,900 a week. Decreases occurred in the case of woolen and worsted operatives, the hosiery, silk, carpet and asbestos trades, also iron miners, mill men, and other iron workers, among youths in the Midland district and among some other metal workers in the same area. Unemployment continues to increase and official statistics for April 8, subject to some revision, show that about 1,615,000 persons were registered as unemployed, of whom 1,092,000 were men, and 394,500 women, with in addition about 897,000 workpeople on short time. The districts worst hit appear to be the northwest of England, London, and certain Midland areas, the largest increase of late being in the north of England.

The International Financial Situation

A committee of the London Chamber of Commerce has reported on the international financial situation, ascribing the causes of the present bad trade to poverty and want of purchasing powers of individuals in countries affected by the war; to the exchange levels and their fluctuating character; to depreciation of currency

of various nations as compared with gold and inflated issues of paper; to trade as far as it is carried on "being directed by individuals according to its profitableness or otherwise into entirely different channels from those in which it flowed before the war"; to governments spending more than national income and in some cases balancing by creating paper currency; to war debts and to "dearth of credit caused by the war and by the nations themselves having to borrow from their own subjects to meet their expenses."

Universities Appeal for Funds

The newer universities of Great Britain have for some time been making appeals for funds to the local interests, the appeal ranging from an address from the vaudeville stage to special visits, preceded by luncheons, by representatives of industries that may be supposed to be specially interested. Thus the other day Birmingham University—out to get £500,000 of which £290,000 has been obtained—invited a score or more of the local civil, mechanical and electrical engineers to an inspection of the engineering side at Selly Oak, where, by the way, may be seen the second permanent-magnet electroplating dynamo by Woolrych, made in 1851, and also a Wilde magneto machine, in which, it is understood, Faraday took some interest. Here Prof. F. W. Burstall is undertaking a number of engineering investigations, including one on grinding which suggests that hardness of abrasive is not the most important feature, and another on the heat-treatment of metals.

Against the Metric System

Once more report has been made against the general adaptation in Great Britain of the metric system. A special committee of the conjoint board of scientific societies concluded "that it is not desirable to make the change compulsory except perhaps in one or two special trades." Reforms in British weights and measures are recommended, including the abolition of the pole, furlong, league, grain, stone, quarter, and hundredweight of 112 lb., and the complete abolition of apothecaries weight, and the abolition of the peck, bushel, quarter, chaldron, barrel, and the sq. rod or perch and rood, areas being expressed in acres and decimals or in square feet for small plots. While it is recommended that the British system of units of weights and measures shall be retained in general use the committee favors the compulsory use of the metric system in the whole trade in fine chemicals and drugs.

Babbitt Bearing for Lathe Spindles

By James Ellis

In our shop we have a lathe of about 22-in. swing and of a rather heavy design that gave us quite a bit of trouble about five or six years ago by running hot in the spindle bearings. The lathe was not very old then and should not have given any trouble, but in spite of plentiful oiling and frequent adjustment it would not keep cool for any length of time.

The spindle was all right and the boxes were well fitted up. It was decided to bore out the boxes and babbitt them in the hopes that we could cure the trouble. We lined them with a standard brand of nickel babbitt, tinned to the bronze, and fitted them again. This time we had no trouble in keeping the boxes cool and they would retain their adjustment under any condition of speed. Of course some of the old heads predicted that the job would last only about three months.

Until about two years ago this machine was used on a general run of jobbing shop work, and got more than its share of the heavy work. At that time we fitted the lathe with a special milling attachment, using a gang of cutters which would give the spindle a much more trying test than it could possibly get as a lathe. Since then the machine has run every day, and a good many nights, and has given not a particle of trouble in the bearings.

We had the opportunity to examine these boxes a few months ago when we replaced a gear on the spindle (we worked the lathe hard enough to wear out the gear) and were rather surprised to find that the bearings were in as good a condition as one could want. I do not know how many liners were put between the halves when the job was put up, but we found that there was still about $\frac{1}{8}$ in. there and I doubt if there was much more in the first place. These babbitted bearings have been much more satisfactory than the solid bronze bearings in some of our other lathes.

The bronze bearings seem to have a tendency to score, not bad, of course, but to make little fine rings around the spindles (they might not do this if the spindles were hard) and our experience has been that the bronze will heat much more quickly than will the babbitt. We have two machines with solid bronze boxes that are particularly troublesome on that score whenever any job calling for high speeds is put on them. Our lathes that have babbitted bearings have never given us any trouble by heating.

The putting of babbitt inserts in the bronze boxes seems to help; strips across the box or a few holes drilled in and filled with babbitt. This may be done without changing the alignment of the machine, which is something we must guard against. Whenever we overhaul a lathe now, whether for our own use or for a customer, we put babbitt strips across. This is done quite frequently on engine brasses, and in some cases it is almost impossible to make them run satisfactorily unless it is done.

When the brasses are taken out after a year or so it is generally found that the babbitt strips are worn just a trifle below the brass. Now I do not know how to explain that exactly, except possibly the babbitt has a greater affinity for the oil and gets more of the wear that comes on the bearing because the oil "sticks" to the babbitt more than it does to the brass. It is not because of the location of the strips for they will wear below the brass regardless of where they are put.

As to the style of bearing for a lathe spindle, I prefer those made in halves rather than any of the tapered forms. Those made in the form of a split sleeve adjusted by nuts at each end are apt to give more or less trouble when the time for adjustment comes. It seems to be very difficult to get them adjusted exactly after they are worn a little without setting them up a little too tight and then letting them wear to fit. This is possibly due to the fact that the front and back bearings seldom wear alike nor in the same direction and when they are tightened their relative position is altered slightly. Of course, after the bearings have been adjusted several times the outer cone will no longer fit its hole except at the center of each of the segments. This often will make the lathe chatter, and is hard to find unless you have had similar trouble before. Perhaps it is time to get new boxes by the time this happens.



NEWS SECTION

Cleveland and Chicago Meetings of A. S. M. E.

Leading engineers in thirteen cities will take part in the largest joint local section meeting yet held by the American Society of Mechanical Engineers. Engineering clubs and local sections in Akron, Buffalo, Chicago, Cincinnati, Columbus, Detroit, Erie, Rochester, Toledo, Indianapolis, Ontario, Pittsburgh, and the Engineering Society of Dayton have been invited to participate in the meeting which is expected to rank with the society's big spring meetings in promoting acquaintanceship and giving opportunities for instructive technical sessions.

Cleveland Meeting in June

The Great Lakes Regional Meeting, as it has been termed, will be held on June 13 and 14, in Cleveland, under the auspices of the National Committee on Local Sections, of which Prof. W. H. Kenerson, of Brown University, Providence, is chairman, and Charles Penrose, of Philadelphia; Samuel B. Ely, of Pittsburgh; Thomas L. Wilkinson, of Denver, and J. H. Herron, of Cleveland, are members.

The Spring Meeting

The meeting follows shortly after the 1921 spring meeting of the society which is to be held at Chicago, May 23 to 26, which includes sessions in three cities, the preliminary events beginning on Saturday, May 23, at McCook Field, Dayton, Ohio, and an important two-day program having been planned to follow immedately after the Chicago meeting at the Rock Island Arsenal.

Officers Elected at Gear Manufacturers' Convention

At the fifth annual convention of the American Gear Manufacturers' Association held at Cincinnati, Ohio, the following officers were elected for 1921: F. W. Sinram, of the Van Dorn & Dutton Co., Cleveland, Ohio, re-elected president; R. P. Johnson, of the Warner Gear Co., Muncie, Ind., first vice-president; B. F. Waterman, Brown & Sharpe Manufacturing Co., Providence, R. I., second vice-president.

New President of Manning, Maxwell & Moore Co.

J. M. Davis has been elected president of Manning, Maxwell & Moore, Inc., 119 West 40th St., New York City, in place of the late A. J. Babcock. Mr. Davis was formerly vice-president of the Baltimore & Ohio R.R. and general manager of its New York and Staten



J. M. DAVIS

Island rail lines and terminals. He also served seven years as an operating officer with the Union Pacific and Southern Pacific, known as the Harriman lines, and for a like period in similar capacity with the Great Northern Railroad.

Exhibition Company Acquires Permanent Quarters

Notice has been received of the establishment of the Manufacturers Exhibition Co., Inc., of New York, in the old Siegel Building at 45 West 18th St., which will be the permanent home of the exhibition.

After extensive alterations have been made the exhibition will open with a full display of American manufactured articles including machinery, tractors and trailers, cotton, wool and knit goods machinery, printing presses, hardware and electrical equipment. L. R. Duffield, formerly president and general manager of the International Exposition of Industries, Grand Central Palace, N. Y., is president and general manager of the company.

Krupps Patenting U. S. War Devices

A complete overhauling of American patent laws as they apply to the issuance of patents to foreigners is in prospect as the result of revelations which Secretary of War Weeks has made to Congress.

Weeks in a letter to the Vice-President said that Germans are patenting in the United States, military inventions used by the United States government itself.

The patentee, he said, in 201 instances since July 1, 1920, is Frederick Krupp, of Essen, Germany. The Krupps prior to the great war were the largest manufacturers of armament in the world. Since that time their factory was reported to have been diverted to manufacture of things other than war implements.

Still Have War Interest

But Weeks' information indicates they have not lost their interest in war, and while their factories are supposedly engaged in peacetime industries, they are keeping up with us in military preparedness.

Weeks in explaining how it was possible that the patents might be issued while the two nations still remain in a technical state of war said he had been informed issuance is permissible under the trading with the enemy act.

He suggested changes in all patent laws, as they apply to foreigners, which would protect Americans against alien monopolies, such as Germany acquired in the dye industry.

Anniston C. of C. Favors Open Shop

The Chamber of Commerce of Anniston, Ala., has gone on record in resolutions approving and supporting the open shop policy in the manufacturing plants of that city, and condemning the closed shop policy as detrimental to the general welfare of industry. The action was taken at the request of Anniston manufacturers who recently advocated the open shop policy. Anniston is said to have more foundries and shops which manufacture pipe and fittings than any other city in the United States.

Washington Notes

By Paul Wooton

Washington Correspondent

As a result of the developments during the World War things mechanical have taken on a new importance in warfare. Major-General Clarence C. Williams, Chief of Ordnance for the War Department, believes that the increased importance of mechanics in war has not been grasped by the public and is only partly realized by mechanics and mechanical engineers. If the country is to maintain its military position it must progress mechanically, he points out. As a consequence he believes it to be an important step in the national interest that every mechanical engineer, every machine shop operator, and every mechanic should strive for higher standards and should always keep in mind improvements and developments in the vast machinery equipment of the modern army.

The Civil Engineer

In Caesar's day, said General Williams in conversation with the American Machinist's Washington correspondent, the civil engineer was the all-important adjunct to armies. Roads had to be built, bridges constructed and fortifications thrown up, but the mechanical equipment of the soldier of that period consisted of a short sword and a leather shield. Under conditions then existing the need for mechanical appliances was insignificant as compared with the need for civil engineering.

It was not General Williams' idea to minimize in any way the importance of civil engineering in modern warfare but to contrast the growth in importance in the application of mechanics to warfare. He pointed out that the highest order of intelligence and the greatest of skill alone can cope with the myriad mechanical problems with which a modern army must deal. They range from the niceties of automatic pistol construction to the complicated systems of recoil on great guns. Every army mechanical problem, he declared, is further complicated by the fact that rough usage must be provided for.

The Mechanic in the Army

The design, manufacture, operation and repair of the vast machinery equipment of an army is so great that it means that every soldier and every officer must be something of a mechanic, while a very considerable portion of them must class as experts. There must be specialists in literally thousands of lines. Military operations in the future will be on such a large scale that it will be utterly impossible for the little peace-time army to train more than a fraction of 1 per cent of the mechanics that would be needed were it necessary to enter a conflict with a powerful enemy. The army's specialists must receive their training in the nation's machine shops.

Incidentally, it may be said that General Williams is very much impressed with the success of the British in improving the military tractor. He will not be surprised if artillery traction is revolutionized as an outcome of that development.

No Super-Power Plants at Mine Mouth

Large power plants at mine mouths have been pointed to for years as the ideal development of the future. After a very careful consideration of this subject in the Boston-Washington area the engineers engaged in the super-power survey are understood to have reached the conclusion that such a plan is impracticable, at least so far as concerns plants of the size contemplated for the inter-communicating electric system which may be found feasible for the great industrial region along the eastern seaboard. Much to the surprise of some of the engineers connected with the super-power work there appears to be an insufficiency of water for condensing purposes, either at the mine mouth or elsewhere within the boundaries of any of the larger coal fields. Even the large nearby rivers have been eliminated. The eastern branch of the Susquehanna contains too much sulphur. The Delaware River cannot be used, since the storing and discharging of water in such large quantities would cause an irregular flow of the river, which would greatly impair its use for power purposes. It is conceded, however, that there is little to be gained by having a plant in the vicinity of a mining region since a rail haul would be necessary and once on the cars coal could be carried a few miles further to tidewater where plenty of condensing water would be available. In addition there would be the various advantages of having the plant near large centers of population.

So far as the anthracite field is concerned as a location for one of the super-power plants, it has been found that the steam sizes of anthracite are too valuable for use as fuel in such a plant. There is no locality with sufficient culm or waste coal in the immediate vicinity to supply a plant of that character.

It also is pointed out that should a permanent plant of the size contemplated be erected in the immediate vicinity of even the largest bituminous mine, its requirements would be so great as to exhaust the mine in a comparatively few years.

The conclusions of the super-power survey will be announced next month. It is believed that a super-power system will be found feasible and that recommendations will be made as to how it may be made effective.

Coast Defense Revolutionized

Development during the World War of mobile artillery has revolutionized coast defense in the United States. Historic old forts are to be dismantled. In substitution, high power rifles mounted on railway carriages will be based at strategic points along the coast. The carrying out of this change of coast defense policy will necessitate a large amount of work of a mechanical nature in the preparation of the necessary guns and their mounts.

Ordnance Bureaus Work Together

In the discussion of the reorganization of the government departments, the statement frequently is made that there is a great amount of duplication of work on the part of the Bureaus of Ordnance in the War Department and in the Navy Department. This is denied by ordnance officials. The closest co-operation is maintained and neither bureau has secrets from the other. Some claim a positive advantage for separate bureaus predicated on the axiom that two heads are better than one. The same problem thus is approached from different angles with much resulting good.

Foreign News Notes

The German State Railway administration has just placed large orders with the German locomotive and car works. These orders call for 1,706 locomotives and 23,517 passenger and freight cars, the total value of these orders being 5.2 milliard marks. One-half of these orders has to be delivered during the summer and the other half during the winter of the present year. The railway administration intends introducing 50-ton freight cars and the car works have been asked to submit drawings for this new type of cars. It is expected that by the introduction of these large cars the freight traffic will be facilitated. The introduction of this type of cars will, of course, necessitate the re-construction of the overhead material which has seriously suffered during the war. Large orders are about to be placed for this material too.

Italian Engineering Works

The largest Italian engineering works, Gio, Ansaldo & Co., at Rome, Genoa and Sampierdarena, which are capitalized at 500 million lire, are not in the position to pay a dividend for the last year. The net earnings amounted to only 5,947,763 lire for 1920, which will be forwarded on new account. The second largest engineering works, however, the Terni Steel Works, declared a dividend of 9 per cent on the entire capital stock.

A Roumanian Market

American manufacturers of all kinds of oil well machinery, tools and supplies should find a good market in Roumania. Most of the old material is used up or has been destroyed in consequence of the war. The Roumanian petroleum companies are largely increasing their capital stocks and a good deal of money will be spent for the purchase of new machinery. The most prominent Roumanian oil company, the Steaua Romana, of Bucarest, has just increased its capital stock to 310 million Lei.

National Foreign Trade Council Holds Big Convention at Cleveland

"American Foreign Trade and Its Present Problems" was the general theme of the eighth convention called by the National Foreign Trade Council, and held in Cleveland, Ohio, May 4 to 7. The slogan of the convention was "Greater Prosperity Through Greater Foreign Trade." Between 1,800 and 2,000 delegates attended.

In calling the convention to order, James A. Farrell, president of the U. S. Steel Corporation and chairman of the National Foreign Trade Council, placed emphasis upon the fact that the United States has the capacity to produce and the raw material and labor required, but needs further organization of financial machinery for foreign trade. He said that everybody is affected by the world wide slowing down and that the welfare of all is linked up with the satisfactory solution of our foreign trade problems. His talk included mention of the effect of the slump in foreign trade upon our merchant marine, presenting a problem of what to do with our ships.

Convention Officers

Alexander Brown, president of the Brownhoist Co., of Cleveland, and president of the Cleveland Chamber of Commerce, was elected president of the convention. O. K. Davis, secretary of the National Foreign Trade Council, was elected secretary of the convention. Fred I. Kent, of the Bankers' Trust Co., of New York, addressed the first general session on "Financing Foreign Trade." He said in part: "It is no more possible for a country to be sufficient unto itself, than it is for a community, or a family, or any individual in it. There is always some point in human development beyond which progress cannot be made without the impetus of foreign stimulation. A man can go so far, a family can reach a little beyond, a community has still further powers, and a country can make much progress; but if any of these units are confined entirely within themselves, they will sooner or later reach a maximum of intelligence after which retrogression is certain to follow."

In speaking of the effect of corporations formed under the Edge Act, Mr. Kent lauded the aims and purposes of the Foreign Trade Financing Corporation. He urged a more thorough understanding and more co-operation on the part of American bankers and manufacturers, toward the building up of this new financial institution.

The first or morning session was closed by an address by W. E. G. Harding, governor of the Federal Reserve Board, Washington, D. C., on "Frozen Credits, What They Are and How To Thaw Them." The following extracts are taken from Mr. Harding's address:

"The present is the time for courage in the business world. Now is the time to do things . . . We stand on a firmer and saner financial basis than we did a year ago . . . We are now entering upon the last stage of the post-war period. As far as the banking world is concerned, our worst problems are passed . . . The Federal Reserve Banks are in an exceptionally strong position with 55 per cent gold reserves. This is a higher percentage than at any time since 1915. The Federal Reserve Banks are now able to take part safely in a movement to stimulate business with a view to thawing out frozen credits."

Long-Time Credits

The afternoon session was devoted to the topic "The Need for Long-Time Credits in Our Foreign Trade." In speaking on the value of long-time credits to the exporting manufacturer, George R. Meyercord, president of the Illinois Manufacturers' Association, Chicago, dwelt at some length on the Foreign Trade Financing Corporation. He said:

"As I view the Edge law foreign trade financing machinery, it offers the first step whereby the manufacturer gets some reasonable measure of relief toward creating that highly desirable, stabilized situation whereby his frozen inventory is rendered more liquid.

"Every day American manufacturers are being offered profitable European business that they reluctantly are obliged to decline because this country has lacked the foreign trade financial machinery that has been developed so successfully by Great Britain.

"The manufacturer who invests in the stock of the Foreign Trade Financing Corporation will be amply repaid. It will be a profitable investment. It will help every manufacturer and business man in the country. It will solve employment problems and restore the general prosperity to which progressive industry is entitled."

Frank H. Taylor, president of the S. S. White Dental Manufacturing Co., in his speech, made the statement that "this is the right time to exercise ourselves in foreign business."

Foreign Trade Policies

The topic for the third general session was "Foreign Trade Policies." D. R. Williams, of the American Chamber of Commerce, Manila, Philippine Islands, spoke on the effect of double taxation on our foreign trade. He said: "Americans are held liable to the exorbitant rates of the United States Act while Filipinos, Britishers, Germans, Japanese and other trade rivals of every race and color, go their way unmolested. As these latter pay no tax to their home governments upon their Philippine income, it results that in our dependency and under our own flag, we penalize our own countrymen in favor of foreigners."

"Government Service to Foreign Trade" was the title of an address by J. Walter Drake, of the Hupp Motor Car Co., Detroit. Mr. Drake urged the reorganization of the U. S. Foreign Service.

At this same session Lewis E. Pierson, of the Irving National Bank, N. Y., spoke on the settlement of our export balance, and Richard Spillane, of the *Philadelphia Public Ledger*, gave an address on the use and value of foreign news.

The fourth general session dealt with "The Merchant Marine." The speakers were James A. Farrell, president of the U. S. Steel Corporation, who spoke on "American Maritime Policy"; William D. Winter, of the Atlantic Mutual Insurance Co., New York, who spoke on "Practical Problems of Marine Insurance"; Furman D. Pearce, of Norton Lilly Co., New Orleans, whose address was on "Marine Operating Problems."

The last general session had as its topic "National Programs for Foreign Trade" and was concerned with reports of the group sessions and of the convention general committee, and with miscellaneous business. There was a total of eleven group sessions scattered over the first three days of the convention. They dealt with commercial education for foreign trade, foreign credits, special export problems of the manufacturer, the motion picture in foreign trade, the organization and location of the export department, foreign trade advertising, inter-American trade relations, interest of agriculture in foreign trade, banking service to foreign trade, the services of the export-commission house, and trade relations with the Far East.

Special Features

A feature of the convention was the Trade Advisor Service. The council assembled a body of men possessing technical information based on experience or practical observation and they were available to delegates as "trade advisors." A. E. Ashburner, of the American Multigraph Sales Co., Cleveland, was in charge of the service and was assisted by G. A. O'Reilly, of the Irving National Bank, New York.

The convention enjoyed the co-operation of the Bureau of Foreign and Domestic Commerce of the Department of Commerce; the Department of State; Post Office Department, and the Bureaus of Markets, Standards, and Education. The Pan-American Union also was represented. Dinners were held by the Export Managers' Club of New York and the Advisory Committee on Foreign Mails, and a luncheon was held by the American Manufacturers' Export Association. The convention was closed, with the exception of a Saturday morning general session, by a banquet held in the Statler Hotel at which Senator Walter E. Edge, of New Jersey, spoke on "Our Foreign Trade." An abstract of this address will appear in a later issue of the *American Machinist*.

C. A. Moffett Heads Steel Company

The election of Charles A. Moffett to the presidency of the Gulf States Steel Co., and the retirement of James Bowron, president, and his election to the chairmanship of the board of directors, came as a big surprise in industrial circles in the Birmingham district.

Mr. Bowron is one of the oldest and best informed iron and steel men in the South. He resigned from the presidency, a position he has held since the organization of the corporation in 1913, because of advancing years. The new president, who was vice-president and general manager, retains the latter position. He is also one of the best-known men in iron and steel circles in the South.

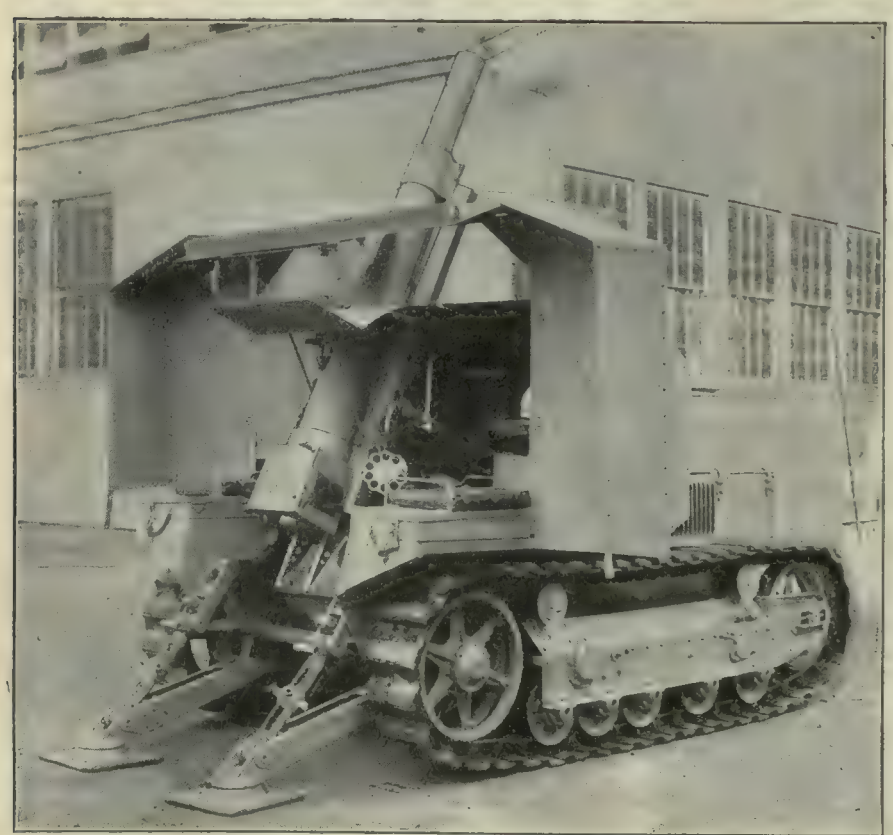
The properties of the Gulf State Steel Co. are located in Alabama.

The Truth About Austin Bros.

That a recent news story published in newspapers in the Southeast and originally emanating from New York to the effect that Austin Brothers, of Atlanta, Ga., would begin the erection within the next thirty days of a structural steel plant in Atlanta to cost $1,250,000 was unauthorized and greatly exaggerated, is the statement made by J. K. Barcroft, president of the company. The story stated the information was furnished by the New York headquarters of the corporation. As a matter of truth Austin Brothers' headquarters are in Atlanta and no permanent office is maintained elsewhere. As previously reported in *American Machinist* the company recently purchased a site near Fort McPherson, in Atlanta, where a structural steel plant will be erected, but it will not be on the extensive scale as was reported.

New Holt Tractor Gun Proves Success on First Official Tryout

The illustration shows a view of the latest development in U. S. Army artillery equipment. It is a 105-mm. howitzer mounted on a tractor which can travel over highways at a speed of 25 miles per hour. The gun and its mounting complete weighs 6½ tons. A caterpillar tread is used, the width of the track being 12 in. and the length of the ground contact 81 in. The driving mechanism is similar to that with which the army tanks were equipped, except that rubber is used on the sprockets and plates to reduce the vibration of high-speed travel. The new gun, which is reported to have made a very creditable showing in the tests at Fort Winfield Scott, San Francisco, Cal., was made by the Holt Manufacturing Co., of Stockton, Cal. Mount and gun together worked equally well. Shots were fired horizontally without budging the tractor, and other shots fired in the air at "65" elevation, considered anti-aircraft shots, were equally successful. It will be sent to Washington to be given a final ordnance test at the government testing grounds, Aberdeen, Md. The gun was designed by Pliny Holt.



"PLINY HOLT BOOSTER" TRACTOR GUN

France Suffers from Business Stagnation

BY A CORRESPONDENT IN PARIS

At the present moment France is going through a very severe crisis from an industrial point of view. Last July the automobile manufacturers commenced to note that business was going off at an alarming rate. This state of affairs continued and was even accentuated right on to the present moment. The consequence was that a panic occurred and most of the automobile manufacturers tried their utmost to cancel the material and machinery which they had on order. This caused the stocks of all the machine-tool merchants to be increased to very large amounts, as at that time they preferred to accept cancellation rather than risk their machines not being paid for, and also to preserve good business feeling with the automobile concerns. The crisis among the automobile firms spread to the general engineering trade, and at the present moment stagnation is prevalent all over France, Switzerland and Spain and other countries.

In addition to large stocks being held by all the machine tool merchants the French government has hundreds of machine tools which it took over from the American Expeditionary Force. These machines are lying in different depots all over France (there are 4,000 tons in one depot at Valenciennes) and are a constant source of trouble to us in our business. With a normal trade I consider that there are enough machine tools in this country at present to supply France's needs for the next few years. We are also having very strong competition with German manufacturers, who up to just recently have been offering machines at prices which are 50 per cent cheaper than those at which we can offer American-built machines. This is easily understandable when one compares the two rates of exchange. The latest political developments between the Allies and Germany will probably tend to cut out some of this German competition.

FINANCIAL DIFFICULTY

From a financial point of view France is in difficulties, as she has advanced large sums of money to industrial concerns in the devastated areas to allow them to rebuild their workshops and to provide them with new machinery. This financial help should have been met promptly by the reparation payment of Germany, but up to the present, as you know, Germany has practically paid nothing, which leaves France with the burden of her invaded districts' financial load, in addition to her pension obligations.

I cannot hold out any great hopes of a large flow of business in our territory for American machine tools in the near future. If it were possible for England and France to trade with Russia my opinion is that trade would recover much quicker than it shows any signs of doing at the moment.

Business Items

The Michigan Tool Co., Detroit, Mich., has moved into its own building at 147 Jos. Campeau St., at Atwater St. This company will have in its new quarters 15,000 sq.ft. of floor space.

Rome Iron Mills, Inc., announces that on and after April 20 the general offices will be located in the National City Building, 17 East 42d St., New York City.

The International Pulverized Fuel Corporation announces that on and after April 20 its general offices will be located in the National City Building, 17 East 42d St., New York City.

The Superheater Co. announces that after May 1 its general offices will be moved from 30 Church St. to 17 East 42d St., New York City.

The American Electric Fusion Corporation, Chicago, Ill., has recently been organized and incorporated with a capital of $50,000 to engage in the manufacture of electric welding machinery of the resistance type. The company has already developed the first series of a line of spot-welders and contemplates expanding to cover a complete line of apparatus. The officers of the company are: President, Edmund J. Henke; vice-president, Edgar Littman of St. Louis; secretary and treasurer, S. G. Taylor, Jr., and director of sales, Arthur B. Sonneborn. The plant of the company is temporarily located at 1906 N. Halsted St., Chicago, Ill., pending erection of a factory.

The Engineering Business Exchange conducted by Charles Whiting Baker announces the opening of a southeastern branch, with offices in Washington, D. C., which will be under the direction of Marshall O. Leighton, who during the past three years has rendered valuable service to the engineering profession as the chairman of the National Service Committee of Engineering Council. Associated with Mr. Leighton in carrying on the exchange will be A. C. Oliphant, who has also been active in the work of the National Service Committee. The southeastern branch will co-operate with the main office of the exchange in New York City but will have especial charge of the territory from Maryland to Alabama, inclusive. The former work of Messrs. Leighton and Oliphant in the Washington office of Engineering Council will be transferred to L. W. Wallace, secretary of the Federated American Engineering Societies. Mr. Wallace will probably be in the Washington office after April 15.

"The Peeves" variable speed transmission and the "Peeves" wood split pulley are now handled in the New York territory by the Standard Supply and Equipment Co., 71 Murray St., New York City. The "Peeves" products were formerly represented by Paterson, Gottfried & Hunter, Inc. A very complete stock of both of these products will be installed by the Standard Supply and Equipment Co., as well as a complete assortment of repair and replacement parts. W. L. Garcia, formerly head of the power transmission department of Patterson, Gottfried & Hunter, will continue in his relationship with "The Peeves" products with the Standard Supply and Equipment Co.

The Boston Gear Works announces the opening of a Cleveland branch office at 803 Superior Ave., N. W., with a complete line of standardized commercial gears.

The Keller Pneumatic Tool Co. announces the removal of its Chicago branch to larger and more up-to-date salesrooms and service station. After May 1 this branch will be located on the main floor in the Transportation Building, 624 South Dearborn St., Chicago, where a complete stock of tools and parts will be maintained. J. C. Campbell, district manager, will be in charge.

The National Auto Top Co., Inc., 808 West Broad St., Richmond, Va., contemplates the installation of machinery for the manufacture of metal automobile bodies, etc.

J. V. Hughes & Co., Johnstown, Pa., recently organized with a capital stock of $250,000, has purchased the four-story brick building on Vine St. and will begin at once the manufacture of toys, novelties and household articles of all kinds. New machinery is now being installed.

To establish a factory which will include a foundry and machine shop for the purpose of manufacturing a newly invented automobile rim, and other automobile parts and accessories, the Brown Manufacturnig Co. has been organized and incorporated with $100,000 capital, by a group of well known business men of Brunswick, Ga. Sam E. Brown, inventor of the new rim, heads the company, and associated with him as incorporators are J. E. Lambright, M. B. McKinnon, E. W. Butts, W. T. Grimes, W. S. Nathan and C. Z. Walker. It is announced by officials of the corporation that the new plant is to be immediately established at Brunswick.

A group of business men headed by W. H. Weatherly, president of the First National Bank of Anniston, Ala., and including interests at Memphis, Tenn., and Cincinnati, Ohio, recently organized the Anniston Electrical Steel Corporation and took over the Anniston Steel plant, comprising about 40 acres of buildings and three miles of standard gage railway. Mr. Weatherly is president of the new corporation. Other officers are G. G. Illingsworth of Cincinnati, vice-president and general manager; W. S. Hotchkiss of Memphis, treasurer. The steel foundry and shops and the forge department of the big plant are to be extensively improved and enlarged immediately, and the program of the new corporation calls for the enlargement of the whole plant during the next year or so. Operating at capacity the plant employs 1,500 workers.

The Merchants Shipbuilding Corporation, with a six-million dollar plant at Chester, Pa., is now engaged in general engineering lines, embracing steel construction work, manufacturing and power plant equipment, machinery and railroad work. A license has also been granted to build the Diesel engine. J. L. Ackerson is in charge of operations.

The Fosdick Machine Tool Co., of Cincinnati, Ohio, maker of high-grade heavy-duty radial and upright drills, has taken over all patents, drawings, patterns, jigs and fixtures covering the line of Pierle quick change high-speed ball bearing sensitive drill presses from the R. K. Le Blond Machine Tool Co. This acquisition by the Fosdick Company will give it a complete line of drilling machinery, consisting of heavy-duty radial drills, heavy-duty upright and gang drills, and high-speed sensitive single and multiple spindle drills.

The Consolidated Tool Works, Inc., of New York, announces the removal of its general offices and warehouse to 296 Broadway.

The Alvord Reamer and Tool Co., Millersburg, Pa., opened a branch office in Chicago at 546 W. Washington Boulevard, and will carry a complete stock of its manufactured articles. T. J. Davis, C. E. Block and C. B. Cole are identified with this branch office, Mr. Cole acting as manager.

Personals

J. ARTHUR DEAKIN announces that he is open to represent in New York or for export, a well-known American machinery company. Mr. Deakin is the American representative of Isbecque, Todd & Co., of Brussels, Belgium. The New York office is located at 150 Nassau St.

CLARENCE A. EARL, former general manager of the Corbin Screw Corporation, has been elected president and general manager of the Briscoe Motor Corporation, Jackson, Mich.

GOVERNOR JAMES HARTNESS, of Vermont, has been presented with the John Scott medal, in recognition of his invention of the flat turret lathe, used in making artillery. The award was made by the American Philosophical Society, at Philadelphia, Pa.

DR. ALBERT SAUVEUR, professor of metallurgy at Harvard University, has been elected to honorary membership in the American Society for Steel Treating. Dr. Sauveur, a native of Belgium, has been a pioneer in metallographic research, having edited and published several papers and books on this subject.

F. W. MCINTYRE has been appointed general sales manager of the Reed-

Prentice Co., Becker Milling Machine Co. and Whitcomb-Blaisdell Machine Tool Co., of Worcester, Mass., succeeding J. P. Ilsley, who has resigned to accept a position with the Taylor Steel Construction Co., of New York City. Direct sales offices of the three companies are maintained in New York, Detroit, Cleveland, Indianapolis and Worcester. The Dale Machinery Co. has been appointed sales agent in the Chicago territory. Normoyle & Lapp, 514 Liberty Building, Philadelphia, have been appointed sales agent in the Philadelphia territory. Under the direction of F. O. Hoagland, general manager, improvements in the present product and in new lines are being developed.

A. R. JACKSON, superintendent of the William Galloway Co., Waterloo, Iowa, has accepted the position of general superintendent with the George B. Miller & Son Co., manufacturer of farm implements at Waterloo, Iowa. Mr. Jackson will have complete charge of production.

HOWARD BRYAN of the educational department of the Hart-Parr Co., Charles City, Iowa, has returned from a three months' sojourn in the Philippine Islands in the interests of the Hart-Parr tractor.

RICHARD A. SCHULTZ, manufacturer of motor truck axles, Chicago, Ill., has recently incorporated under the state laws of Illinois and is operating under the name of the R. A. Schultz Manufacturing Co. The company also manufactures thrust and "Radax" ball bearings.

EDWARD C. MCSHEEHY has resigned as manager of the David A. Wright Machinery and Equipment Co., Chicago, Ill., effective May 1. After that date he will represent the Steel and Tube Co. of America, and the Mark Manufacturing Co. of Chicago, in the Colorado, Wyoming and Montana oil fields, having headquarters in Denver. He is well known to the oil operators in that section, having been connected with the Mine and Smelter Supply Co. of Denver for a number of years.

J. P. ILSLEY has resigned as general sales manager of the combined Reed-Prentice Co. of Worcester, Mass., the Whitcomb-Blaisdell Machine Tool Co. of Worcester, Mass., and the Becker Milling Machine Co. of Hyde Park, Mass. Mr. Ilsley has accepted a position with the Taylor Steel Construction Co. of New York City.

W. H. RASTALL, trade commissioner attached to the Department of Commerce, returned on May 1 from a three-year tour of the Far East. He investigated markets for American industrial machinery and has some interesting facts to present. Manufacturers interested in the Far East may communicate with Mr. Rastall at 307 Custom House, San Francisco, Cal.

RAYMOND C. FULLER, formerly with the Federal Shipbuilding Co., Kearney, N. J., is now attached to the engineering department of the Sperry Gyroscope Co., Brooklyn, N. Y.

Obituary

LORENZO G. SUSCIPJ, whose good fellowship and kindly cheer distinguished him among advertising men, succumbed to a short and unexpected attack of pneumonia on April 23 at his home in Mt. Vernon, N. Y. Mr. Suscipj was born in Rome, Italy, 45 years ago, of an old and prominent Italian family. In 1902 he came to the United States and began forthwith his advertising career. His training was received in newspaper work in Syracuse. After five years he went to Chicago to enter the employ of the Union Carbide Co. and later became assistant advertising manager. In 1917, when Murray, Howe & Co. secured the account of the interests with which Mr. Suscipj was affiliated, he saw the opportunity to enter an organization where he could give the benefit of his experience. He was appointed secretary and contract manager of the company, which post he occupied until his death. Mr. Suscipj was a member of the New York Advertising Club and the Mt. Vernon Country Club. Services were held at his home in Mt. Vernon on Sunday, April 24, his body being removed for interment to Cincinnati, the home of Mrs. Suscipj, his only surviving kin in America.

ALFRED L. LINCOLN, for many years president and general manager of the Lincoln Twist Drill Co., Taunton, Mass., died on Feb. 2. He had been interested all his life in the manufacture of twist drills. He retired from active business in 1917.

JOHN A. BAKER, formerly connected with the Mesta Machine Co., of Pittsburgh, as assistant general superintendent, has been appointed works manager for the Los Angeles plant of the Rich Steel Products Co.

Trade Catalogs

Porcelain Enameling. Chicago Flexible Shaft Co., Chicago, Ill., Catalog No. 80. This catalog describes porcelain enameling methods and furnace construction, both from the metallurgical and the practical shop standpoint, and is a compilation of exceptionally useful information.

Simonds Steel. Simonds Manufacturing Co., Lockport, N. Y. Catalog No. 121. Ninety-three 4½ x 7-in. pages, replete with halftone illustrations, charts, tables, specifications, and bound in leather covers. A well-presented description of the product of the Simonds company and the equipment used in its manufacture.

The Abbott Burnishing Process by Means of Steel Balls. The Abbott Ball Co., P. O. Box, 1233, Hartford, Conn., Catalog 104-T, 23 pages, 4 x 9 in., describes the Abbott burnishing process for all sorts of metal parts by means of special tumbling barrels in combination with steel balls.

Air Compressors. Sullivan Machinery Co., Chicago, Ill. Bulletins 77A and 77B, describing the Sullivan angle-compound power-driven air compressors and the portable mine-car air compressor. The bulletins are complete with illustrations and specifications.

Utility Tools. J. C. Glenzer Co., Detroit, Mich. Thirty-one 4 x 9-in. pages covering the line of cutting tools and fixtures put out by this company. Some of the tools described are counterbores, spot-facers, reamers, countersinks, core-drills, sleeves, etc. A special feature is the unique arrangement of pages in the center of the catalog which illustrates the interchangeability of the Utility system.

Drill Sharpeners. Sullivan Machinery Co., Chicago, Ill. A thirty-two page 6 x 9-in. catalog describing a line of drill sharpeners for hammer-forging drill bits and shanks.

Crane Cages. Pawling & Harnischfeger Co., Milwaukee, Wis. Describing the latest model of P & H crane cage, which embodies such new features as front lever operated controllers and all-enclosed switchboard and control.

Drop Hammers. Standard Machinery Co., Auburn, R. I. Represented by the Brownell Machinery Co., Providence, R. I. Twelfth edition of a 6 x 9-in. catalog describing and illustrating a complete line of presses of all kinds, rolling mills, wire drawing machinery, swaging machines, roller and ball bearings.

Oil and Gas Burners. W. S. Rockwell Co., 50 Church St., New York, N. Y. Bulletin No. 223, illustrating and describing various types of burners for use of oil and gas fuels for industrial heating.

Oil Hole Covers. W. W. & C. F. Tucker, Hartford, Conn. Catalog No. 6, twenty-one 4 x 6-in. pages, showing several new models of oil hole covers. Tables of sizes, specifications and price lists for all types are included.

Electric Hoists. Northern Engineering Works, Detroit, Mich. Bulletin No. 543, illustrating miscellaneous types of electric hoists.

"Reamers at Work." A booklet pubished by the Gisholt Machine Co., Madison, Wis., showing the solid-ajdustable Gisholt manufacturing reamer at work in the shop. Specifications and working data are included.

Rotary Pumps. Blackmer Rotary Pump Co., Petoskey, Mich. A four-page circular illustrating and describing several types of "Black-Mer-Maid" rotary pumps.

Forthcoming Meetings

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The spring meeting of the National Association of Manufacturers will be held in New York, May 16, 17 and 18 at the Waldorf-Astoria Hotel. The headquarters of the association is at 30 Church St., New York City.

The Taylor Society will hold its Spring Meeting at the Hotel Statler, Cleveland, Ohio, May 19 to 21.

The spring meeting of the American Society of Mechanical Engineers will be held at the Congress Hotel, Chicago, May 23-26. Calvin W. Rice, Engineering Societies Bldg., 29 West 39th St., New York, is secretary.

The Society of Automotive Engineers, 29 West 39th St., New York announces that its summer meeting will be held at West Baden, Ind., on May 24 to 28 inclusive.

The American Railway Master Mechanics Association will hold its Spring Meeting at the Drake Hotel, Chicago, Ill., on June 15 and 16.

The 1921 annual meeting of the American Society for Testing Materials will be held at Asbury Park, N. J., on June 20 to 24, with headquarters at the New Monterey Hotel. C. L. Warwick, Engineers Club, Philadelphia, Pa., is secretary.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Trailer Car, Scoop-Body

Easton Car and Construction Co., 50 Church St., New York, N. Y.

"American Machinist," Feb. 24, 1921



The body is mounted on a structural-steel turntable and may be dumped from any one of the four sides. The wheels are equipped with roller-bearings. The low height of the car makes it convenient for hand loading. The car can be used for handling such materials as sand, coal, castings, cinders and metal chips. It is equipped with flat-tread instead of narrow-gage-track wheels, not being confined to the limits of a track system. It can be handled by one man, where single cars, either hand-pushed or pulled, can be employed. The capacity of the car is 27 cu.ft.

Platform, Lift-Truck, Pressed Steel

Powell Pressed Steel Co., Hubbard, Ohio

"American Machinist," Feb. 24, 1921

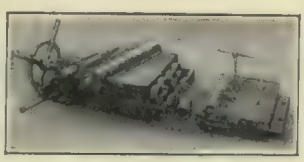


The platform is made of one piece of sheet steel and is formed by a cold process, which sets the material to the form required. The height, or inside clearance, of the platform is generally from 6½ to 12 in. The corrugations used to strengthen the platform are 1½ in. wide by ¾ in. deep and spaced at 6-in. centers. It is stated that a platform made of No. 9 gage steel will easily carry from 15,000 to 20,000 lb., and may be overloaded considerably, that the life of a platform is practically endless, and that no repairs are required. Racks or boxes may be built onto the platform, and to provide a large flat top a sheet-metal plate is spot-welded to the top of the platform.

Centers, Fluting, Multiple-Spindle, No. 2½

Miller & Crowningshield, Greenfield, Mass.

"American Machinist," Feb. 24, 1921



The device is intended for use on the table of a milling machine when fluting taps or reamers, and it consists of an indexing head and a tailstock. It can be furnished with either three or four spindles, the same range of work being handled in each case. The spindles can be turned simultaneously in the same direction by means of the crank. The indexing for any number of flutes up to 20 can be done by means of a single full turn of the indexing handle, change gears being provided to vary the ratio. The spindles are clamped simultaneously by means of one handle. The tailstock is separate from the head, being made either solid or with separate vertical adjustment for each center. Either round or square stock can be held.

Charger, Storage Battery, Automatic, for Electric Industrial Vehicles

Acme Electric and Manufacturing Co., Cleveland, Ohio

"American Machinist," Feb. 24, 1921



The device is intended to charge the battery at the rate recommended by the battery manufacturer. The charger takes up a little more than a square foot of floor space. Its motor is built for heavy service, and the generator is constructed to suit the battery. The shaft is one solid piece, rotating on ball bearings, the dynamically balanced armature and rotor both being mounted on it. The commutator has a large radiating surface and maintains a low operating temperature. Cool operation is afforded by a Sirocco-type fan, which ventilates the machine by drawing air through the windings. An automatic operating panel accompanies the charger. It is made of rubber-finished electrical slate mounted on an angle-iron frame, and contains the instruments and switches.

Block, Size, Adjustable

M. B. Hill, 10 Eden St., Worcester, Mass.

"American Machinist," Feb. 24, 1921

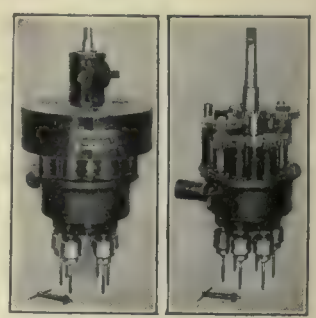


The block is adjustable in size and intended for use in setting cutting tools to height above a surface. It is made of carbon steel, hardened and ground all over, and the sliding surfaces are lapped. In the inclinded surface of the larger piece is a T-slot, in which slides a small T-head stud that extends up into the hollow sliding member. A tapered hole in the upper end of this stud receives the correspondingly pointed end of the knurled-head screw, a turn of which serves to clamp the sliding member in any position. The setting is, of course, measured by means of a micrometer over both members.

Head, Tapping, Multiple-Spindle

John H. Dorman & Son, 5148-52 Hudson Blvd. West, West New York, N. J.

"American Machinist," Feb. 24, 1921

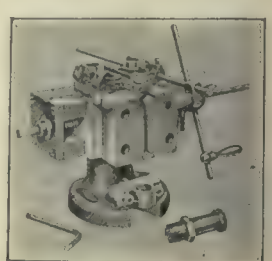


The device is intended for tapping simultaneously six holes grouped together, the holes not lying on the circumference of the same circle. The head at the left is completedly assembled, while the housing has been removed from the head in the view on the right. The gears driving the tapping spindles are compounded, the driving spindle carrying two gears of different sizes. In this way the taps can be given the same speed of rotation, although they are placed at different distances from the center line of the driving spindle. It is possible also, to vary the speeds of the different spindles by means of the gearing, so that taps of different pitch can be used at the same time. The direction of rotation reverses automatically when the head is raised.

Chuck, Universal, Drilling Machine

John Chuck Co., Milwaukee, Wis.

"American Machinist," Feb. 24, 1921

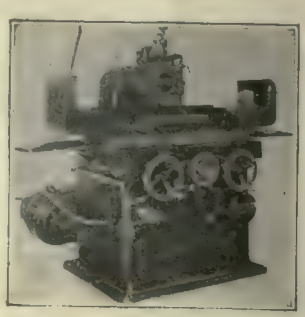


The device is intended to be used for holding work while performing such operations as drilling, milling, grinding and tapping, being employed chiefly on the tables of drilling machines. False jaws are made to conform to the work. An adjustable arm is furnished to hold the stop. The jaws are operated by means of a right- and left-hand screw, thus being self-centering. The screw is of high-grade steel and provision is made for takng the end thrust. A handle is provided, by which the screw can be operated from either end of the chuck. The body and crossheads of the chuck are made of cast iron. Provision is made for taking up the wear on crossheads. Extension bases can be furnished for long work.

Grinding Machine, Surface, High-Duty, Type C

Diamond Machine Co., 9 Codding St., Providence, R. I.

"American Machinist," Feb. 24, 1921



The machine is intended to do small work, although it can handle pieces up to 10 in. wide, 24 in. long and 8 in. high. It is made much heavier than the usual small surface-grinding machine, so that rigidity and freedom of vibration may be obtained. The machine has individual motor drive, the motor being a component part of the machine and standard in all respects. The wheelhead is cast integral with the vertical column, the combined column and head being adjusted vertically to suit the thickness of the work. The ways are completely covered by metal guards. The traverse is automatic, and adjustable from 0.001 to 0.020 in. per stroke.

Clip, paste on 3 x 5-in. cards and file as desired

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Threading Machine, Two-Spindle, ¾-In.
Geometric Tool Co., New Haven, Conn.
"American Machinist," March 3, 1921



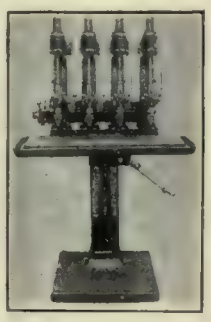
The bed of the machine carries two spindles, which are mounted in large bronze bearings. The spindles are driven by a single pulley, located at the rear of the machine, but may be operated and controlled independently by means of the change gear levers at both sides of the machine. The speeds are indexed according to the size of work being handled, but may be varied. Both spindles may be fitted with die heads for external threading, or may be fitted with taps for internal threading. Or, one spindle may carry a die head and the other may carry a tap. Each carriage is fitted with a two-jawed chuck operated by a hand-wheel. A single-geared pump forces oil through the spindle and die head against the work. The machine will cut U. S. Standard thread to ¾ in. in diameter.

Screw Machine, Automatic, Four-Spindle
Cone Automatic Machine Co., Windsor, Vt.
"American Machinist," March 3, 1921



Changes in the design have altered the appearance of the machine to a considerable extent, although the principle of the Cone automatic is retained in the present design. The frame carrying the camshaft rests upon uprights that are a part of the lower frame and that carry the spindle turret and driving mechanism. The upper frame furnishes the support for two auxiliary spindles, while two other spindles are carried upon the turning tool-slides, making four independently driven auxiliary spindles. The turning tools are supported by slides that have bearings directly upon the bed of the machine and travel in a direction parallel to the work. The machine is built in three sizes, the one shown handling bars up to 1½ in. in diameter and producing pieces 6 in. long. Floor space, about 6 by 8½ ft. Shipping weight, 8,000 lb.

Drilling Machines, Sensitive, High-Speed, "Pecorp"
Providence Engineering Corporation, Providence, R. I.
"American Machinist," March 3, 1921



The machine was formerly made by the A. C. Mason Co., Inc., Paterson, N. J. It is built in both bench (Model E) and floor (Model F) types and with either one, two, three, four or six spindles, the illustration showing a multiple-spindle floor-type machine. It is fully equipped with ball bearings, and the bearings and moving parts are covered, the only visible rotating parts being the driving pulley and the nose of the spindle. The spindle is provided with a device for retaining the lubricating oil, a reservoir being incorporated in the sleeve. Oil which has passed through the lower bearings on the spindle is caught, when thrown outward, by the interior surface of the non-rotating sleeve, and then drops downward from the bottom of the sleeve, thus protecting the operator. Holes ⅛ in. in diameter can be drilled in steel.

Shaper, Crank
Samson Works, Berlin, Germany
"American Machinist," March 3, 1921



The gear for the link drive and its journal are made in two separate parts, the journal being of steel, hardened and ground. The coupling of the link and ram is pivoted. The ram runs between two steel gibs. The adjustment of the table feed is made by means of a pawl. The feed during reversal of the ram is actuated by two cams fitted on the main drive gear, and is transformed into the reciprocating rotation of a vertical feed shaft by means of a completely encased train of spur and bevel gears. Forced lubrication is provided for all main parts, by means of a pump feeding a constant jet of lubricant.

Milling Machine Drive, Individual Motor, Cleveland
Clark Mesker Co., 18511 Euclid Ave., Cleveland, Ohio
"American Machinist," March 3, 1921



The motor bracket and drive mechanism are built in two sizes, to fit the Nos. 1 and 2 milling machines. It is claimed that this direct-connected motor drive obtains the advantages of belt-driving by the incorporation of a friction clutch between the lower sprocket and the main drive-shaft. The grip of the clutch can be adjusted by a nut at the back of the clutch housing. The drive can be applied to the present models of belt-driven machines. The bracket is designed to support the motor high enough, so that it be free from the dirt of the floor. The sprockets and chain run in a bath of oil. A 2-in. Morse chain is used on the No. 1 machine, and a 2½-in. chain on the No. 2. The motor has a constant speed and runs at 1,200 r.p.m.

Rivet-Heating Machine, Electric
Elektrische Schweissmaschinen Gesellschaft, Charlottenburg 4, Germany
"American Machinist," March 3, 1921



The machine is intended for use in the erection of steel structures, and for boiler shops, shipyards and other industrial plants. The transformer is placed on a cast-iron table resting on legs equipped with rollers. In the front of the transformer are the electrodes. The regulating switch has six steps and is encased and mounted in the rear. The switching on and off of the current, and the movement of the electrodes for feeding and removing the rivets are actuated by the treadle. The machine is fed by a weak medium-tension alternating current, which is converted into a very strong low-tension current. This latter current passes through the rivet, which is put between the electrodes and is heated in a few seconds. The machine is made in two sizes, for rivets up to ¾ and 1¼ in., respectively. The smaller size of machine heats 400 rivets per hour.

Boring Tool, Small
M. B. Hill, 10 Eden St., Worcester, Mass.
"American Machinist," March 3, 1921



The tool is suitable for use in small lathes. The toolbar is held to the shank by a swinging link that permits it to be raised and lowered, to accommodate various heights of center, without throwing it out of parallel. The link is simultaneously tightened upon the stud and upon the toolbar by means of a single screw. Three toolbars are provided with each holder. A split bushing is furnished to adapt the holder to a smaller size of toolbar. Extra bars can be made from drill rod.

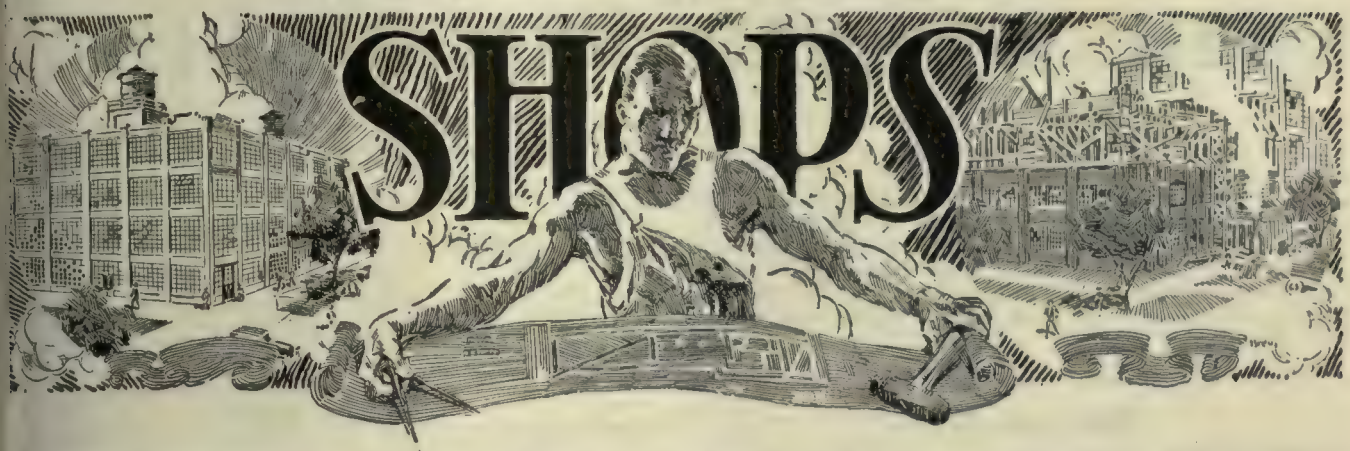
Tool and Holder, "Twisto"
John H. Monstream, Hartford, Conn.
"American Machinist," March 3, 1921



The device is intended for use on lathes, planers and shapers, being adapted to general machining work. The cutting tool or bit resembles a three-lipped twist drill, it being provided with three helical grooves. The cutting is done on the ends of the bit, one edge cutting at a time. The bits are regularly furnished in lengths of 2 in., it being stated that there are 6¾ in. of length of cutting lip available for wear on each bit. When sharpening the tool, only the ends of it are ground. The bit is clamped in the holder in a horizontal position, a long bearing being provided in the holder, so that the bit is securely held. The holder is adapted to the use of disk tools. The shank of the tool passes through the hole used for the "Twisto" tool, and a stud passed through the lower hole in the holder serves to steady the edge of the disk.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

R. I., Hillsgrove — The Providence Fittings Co., G. F. Bullard, Pres.—Six or eight in. single or double acting air cylinders, Garvin preferred but similar type would be considered, (new or second hand).

R. I., Providence — D. Marandola, 1275 Pleasant St. — repair equipment for proposed garage and service station.

Md., Baltimore — S. T. Williams, 223 North Calvert St., (mechanical engr.)—heavy engine lathe, to swing 18 to 20 n. over bed and take 6 to 8 ft. between centers, also suitable chuck with lathe, Lodge & Shipley, Amer. Tool Co. or similar make, preferred.

N. Y., Binghamton — E. H. Titchener & Co., manufacturer of wire goods—inclinable power press similar to Bliss No. 20.

N. Y., Buffalo—The Warner Jewelry Case Co., 648 Michigan Ave. — machinery for manufacturing jewelry cases including presses, etc.

N. Y., New York (Borough of Manhattan)—The Automatic Straight Air Brake Co., 210 11th Ave.—
Jones & Lamson turret lathe.
No. 2A Warner & Swasey turret lathe.
No. 4 Warner & Swasey turret lathe.
No. 2V O. & J. milling machine.
No. 2H Becker profiler.
No. 25 Becker milling machine.
Pratt & Witney multiple drill
Single spindle sensitive drill press.
Two spindle sensitive drill press.
Four spindle sensitive drill press.
Six spindle sensitive drill press.
2½ Garwin tapping machine.
No. 6 Heald grinder.
One 4 in. x 12 in. tool room lathe.
Bench lathe.

N. Y., New York (Borough of Manhattan)—The Florida East Coast Ry., 120 Bway.—foot power squaring shears.

N. Y., New York (Borough of Manhattan)—The Imperial Japanese Navy, 1 Madison Ave.—
One 12 ft. x 24 in. Rahn Larmon lathe, series "D" three step cone, double back gear, quick change gear, etc.
Six 24 in. x 10 ft. Rahn Larmon lathes, three step cone, double back gear, quick change gear, etc.
Two 14 in. x 6 ft. Greaves Klusman lathes, double back gear, three step cone, quick change gear, etc.
Two 14 in. x 6 ft. Porter lathes, double back gear, four step cone, quick change gear, etc.
Seven 16 in. x 6 ft. Greaves Klusman lathes.
Seven 16 in. x 6 ft. Porter lathes.
Two No. 7 Porter turret lathes.
One 2 spindle Allen sensitive ball bearing drill press.
One 4 ft. Carlton style "G" radial drill.
One 5 ft. Carlton new model ball bearing radial drill with speed box drive and plain table.
One 2 spindle 20 in. Washburn sensitive ball bearing drill press complete with countershaft.
Three 32 in. Rochford mechanics sliding head drill press.
One Capital internal grinder, capacity ⅛ in. to 2 in. x 2 in., table dimension 36 in. x 7 ft.

N. Y., New York (Borough of Manhattan)—The Machinery Engr. & Sales Co., 299 Bway.—one 6 ft. x 14 in. engine lathe and power presses, all sizes.

N. Y., New York (Borough of Manhattan)—The Standard Oil Co., 26 Bway.—one No. 2 Cleveland plain milling machine with arbor and regular equipment including plain, vise, belt guard, etc.

Pa., Beaver Falls—The Traver Eng Co., H. G. Traver, Pres.—small punches, large punch and shears.

Pa., Pittsburgh—W. C. Davison Gas Burner & Welding Co., 3145 Penn Ave., F. F. Davison, Mgr.—one 24 in. turret lathe and one No. 3 milling machine.

Pa., Pittsburgh—The Pittsburgh Gauge & Supply Co., 30th and Liberty Aves., manufacturers of electric household, mine and mill supplies, F. B. Lippincott, Purch. Agt.—No. 3 milling machine, automatic nailing machine and acetylene welder.

N. C., Wilmington—Carter's Production Wks., 210 South Water St., manufacturer of machinery, O. Carter, Mgr.—
One drop end, power driven plate roll, 17 ft. between housings.
One 8 to 10 ft. boring mill.
One 42 x 42 planer.
One rotary plate shear which will cut plate ¾ in. thick.
One bevel shear which will cut plate ¾ in. thick.

Miss., Kosciusko—The Planters Oil Mill & Gin Co., J. O. Ashworth, Supt.—one 18 in. x 14 ft. engine lathe, (used and in good condition), 20 in. x 24 in. drill press and small crank shaper.

Ill., Chicago—O. C. Harrington Co., 4134 Fillmore St., manufacturer of auto accessories—small punch press.

Ill., Chicago—The J. H. Smith & Sons Co., 3541 Cottage Grove Ave.—foot power squaring shear.

Mich., Detroit — F. J. Whitney, 5955 Grand River Ave.—equipment for proposed garage and service station.

O., Cleveland—The Machine School, 2122 Prospect Ave.—punch presses, No. 2 and No ", (used).

Wis., Cudahy — J. Wagner, 901 Layton Ave.—12 in. lathe, drill press to drill 1 in. hole and emery wheel for garage.

Wis., Milwaukee—J. J. Biedrzycki, 684 3d Ave.—lathe of size adaptable to auto repair work.

Wis., Milwaukee—M. D. Newald & Co., 201 Bway., manufacturer of motor trucks, M. D. Newald, Purch. Agt.—18 in. lathe, 20 in. drill press and small bench drill press.

Wis., Milwaukee — The Nordstrom Vulcanizer Co., 2706 St. Paul Ave., C. Nordstrom, Purch. Agt.—4 grinders equipped with buffers and 1 drill press to drill ½ in. hole.

Wis., Milwaukee—W. A. Stidemann, 1266 South Pierce St., manufacturer of metal specialties—punch press.

Wis., New Holstein—Meili-Blumberg Co.—drill press and emery wheel for garage.

Wis., Platteville—The Fiedler Motor Co., E. C. Fiedler, Secy.—drills, lathes, etc.

Wis., Sheboygan — The Globe Co., 824 Penn Ave. — end milling attachment for Cleveland open side planer, 30 in. x 30 in.

Wis., Waukesha — Kendall & Held, 312 Harrison St.—medium size lathe for repair department of garage.

Ia., Cedar Rapids—The Bd. Educ., 705 1st Ave., M. A. Motejl, Secy.—manual training equipment for proposed school here.

Ark., Helena—J. M. Biggs, Box 244, manufacturer of hall clock cases, clock movements and small electrical specialties — wood and metal working machinery including lathes, punch presses and special tools.

Kan., Topeka—J. E. Weekes, Genl. Mgr. of the Weekes Machine Shop, 506 East 4th St.—milling machine.

Ont., Goderich—The Natl. Shipbuilding Co., W. Hutchinson, Mgr.—metal working machinery.

Machinery Wanted

N. J., Woodstown — The South Jersey Farmers Exchange—grinding machine.

Pa., Wayne—W. McClellan—crusher rolls for crushing rock.

Fla., Arcadia—The Tropics Products Co., R. H. Daugherty, Pres.—labeling machines and pasteurizers.

La., New Orleans — J. P. Sutton, 2001 Rousseau St.—complete foundry equipment, cupulo, flasks, electric crane, machine for elevating castings, etc.

Ill., Chicago—The Great Western Laundry, 2125 Madison St.—laundry equipment.

Ind., Elkhart—The Amer. Coating Mills—machine equipment for its paper mill.

Mich., Detroit—The Utility Compressor Co., 1161 East Harper Ave.—miscellaneous equipment for making refrigerators for proposed plant at Adrian.

O., Columbus—The Federal Ice & Refrigerating Co., 20th and Whitcomb Sts.—special ice and refrigerating machinery.

Wis., Kenosha—S. Grotsky, 317 Orange St.—refrigerating and milk separating machinery.

Wis., Racine—The Fox Ice Co., Liberty St., C. Fox, Purch. Agt.—ice making and refrigerating machinery.

Wis., Racine—The New York Market Co., 132 Washington St. — meat handling machinery.

Wis., Rice Lake — The Rice Lake Mfg. Co., manufacturer of sash and doors — woodworking machinery, including mortiser, sticker, etc.

Mo., Springfield—The Forster Mfg. Co.—canning machinery.

Cal., San Bernardino—K. O. Stromee, 465 H St.—machine to turn out wood blocks ⅜ x 1¼ x 1¼ embossed pressed or printed.

THE WEEKLY PRICE GUIDE

This Week's Market

The metal market is practically unchanged from last week. We record a general lowering in pig iron prices. We present the new basing card of discounts on wrought pipe in Pittsburgh. Linseed oil is stronger in Chicago and New York. Cleveland reports steel sheets available at warehouses at prices 15c. less than the new schedule printed on this page.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$28.75
Northern Basic	26.52
Southern Ohio No. 2	27.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	34.26
BIRMINGHAM	
No. 2 Foundry	24.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	26.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	*25.00
CHICAGO	
No. 2 Foundry local	24.00
No. 2 Foundry, Southern, sil 2.25@2.75	30.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26.46
Basic	24.46
Bessemer	26.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.23	$3.33	$3.09	$3.23
Soft steel bars	3.13	3.23	2.99	3.13
Soft steel bar shapes	3.13	3.23	3.48	3.13
Soft steel bands	4.18	4.28	6.25	
Tank plates	3.23	3.33	3.78	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	4.25	4.00	4.13
No. 12	3.15	4.30	4.05	4.18
No. 14	3.20	4.35	4.10	4.23
No. 16	3.30	4.45	4.20	4.33
Black				
Nos. 17 and 21	3.75	4.95	4.80	5.20
Nos. 22 and 24	3.85	5.00	4.85	5.25
No. 25 and 26	3.90	5.05	4.90	5.30
No. 28	4.00	5.15	5.00	5.40
Galvanized				
No. 10 and 11	4.00	5.30	5.00	5.70
No. 12 to 14	4.10	5.40	5.10	5.80
Nos. 17 and 21	4.40	5.70	5.40	6.10
Nos. 22 and 24	4.55	5.85	5.55	6.25
No. 26	4.70	6.00	5.70	6.30
No. 28	5.00	6.25	6.00	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$4.73	$4.63	$4.25
Flats, squares and hexagons, per 100 lb	5.23	4.63	4.75

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	65%
Cleveland	50%
Chicago	50%

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	41
Electrolytic	43

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: ⅛, 8½c. per lb.; ⅛, 8c.; ⅛ to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.50	8.00	8.25
Spring steel (light)	8.00	7.00	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.20
Hoop steel	4.28	3.69	3.83
Cold rolled strip steel	6.00	8.25	7.90
Floor plates	5.30	3.09@3.40	5.78

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of April 13, 1921:

BUTT WELD

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
1 to 3	62½	50	¼	33½	18½
			1 to 1½	35½	20½

LAP WELD

2	54½	41	2	30½	16½
2½ to 6	58½	45	2½ to 4	34½	22½
7 to 12	54½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	60½	49	1 to 1½	35½	21½
2 to 3	61½	50			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	52½	41	2	31½	18½
2½ to 4	56½	45	2½ to 4	34½	22½
4½ to 6	55½	44	4½ to 6	33½	21½
7 to 8	50½	37	7 to 8	24½	12½
9 to 12	45½	32	9 to 12	19½	7½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13.62½
Tin in 5-ton lots	32.25
Lead	5.00
Zinc	5.[illegible]
ST. LOUIS	
Lead	4.60
Zinc	5.20

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.50	22.00	23.50
Copper wire (carload lots)	15.00	17.50	20.00
Brass sheets	17.25	24.00	24.50
Brass pipe	21.00	22.00	20.75
Solder (half and half) (case lots)	18.00	22.75	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier. add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	15.25
Cleveland	19.00
Chicago	18.75

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots..... 11.00

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	12.15	12.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.25
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	$9.50
Copper, heavy, and wire	9.00	9.50	8.50
Copper, light, and bottoms	8.00	9.00	7.75
Lead, heavy	3.25	3.50	3.50
Lead, tea	2.00	2.50	3.00
Brass, heavy	6.00	7.00	9.00
Brass, light	4.50	4.50	4.50
No. 1 yellow brass turnings	5.00	5.50	5.00
Zinc	3.00	3.00	3.00

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.4	25.50@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.00
Chicago	20.50
Cleveland	22.50

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	42.00	35.00
Commercial	30.00	15.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$2.00	1.60
Hot pressed hexagon	List	2.00	1.60
Cold punches hexagon	List	2.00	1.60
Cold punched square	List	2.00	1.60

Semi-finished nuts, ⅜ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	50%
Cleveland	75-10%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50-10%	60-10%	50%
1½ and 1¼ in. by 3 in. up to 12 in	50%	50-5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $4.00 Chicago..... $4.00
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $3.75 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅜ by 6 in. and smaller	40%	50-10%	40%
Larger and longer up to 1 in. by 30 in.	40%	50%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	50%	60%	45%
Tinned	45%	60%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.65 Cleveland...$4.60 Chicago....$4.88 Pittsburgh..$3.70

Boiler, same sizes:
New York...$4.75 Cleveland...$4.70 Chicago....$4.98 Pittsburgh..$3.80

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	25.50
Brass	21.00	24.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼-2 in., inclusive in rounds, and ¼-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$7.00 per 100 lb.; New York price is 8c.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	10.00@13.00	12.50	14.25
Colored mixed	7.00@11.50	9.50	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$3.50@$4.25
Prompt foundry	4.50@ 5.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.70	$0.66	$0.75
5-gal. cans	.73*	0.81	1.00

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

Ont., Durham—The Jackson Mfg. Co.—woodworking equipment and machinery.

Ont., Simcoe — The Osigrow Silk Co. — complete equipment for silk weaving plant.

Que., Montreal—The Canadian Consolidated Rubber Co., Inspector St.—additional machinery.

Metal Working

NEW ENGLAND STATES

Conn., Darien — L. Butler, Boston Post Rd., plans to build a 1 story garage on the Post Rd. Estimated cost, $10,000.

Conn., Hartford—J. P. Murphy, Garden St., has awarded the contract for the construction of a 1 story, 65 x 85 ft. garage on Congress St. Estimated cost, $10,000.

Conn., New Haven — E. Romano, 117 Cedar St., has awarded the contract for the construction of a 1 story, 40 x 65 ft. garage on Howard Ave. and Spring St. Estimated cost, $10,000.

Conn., Plainville—The Plainville Casting Co. has awarded the contract for the construction of a 1 story, 70 x 160 ft. foundry. Cost between $45,000 and $50,000.

Mass., Boston — P. McCue, 29 Speedwell St., has awarded the contract for the construction of a 1 story, 111 x 168 x 182 ft. triangular shape garage on Talbot Ave. Estimated cost, $35,000.

Mass., Cambridge—The city has awarded the contract for the construction of a 1 story, 32 x 155 ft. garage and a 27 x 152 ft. shop building on Hampshire St. Estimated cost, $40,000.

Mass., Chelsea—Pope & Cottle Co., 140 Carter St., has awarded the contract for the construction of a 1 story, 50 x 65 ft. garage. Estimated cost $20,000.

Mass., Gloucester — Perkins & Corliss, Inc., Middle St., have awarded the contract for rebuilding a 2 story garage on Main St. Estimated cost, $40,000.

Mass., Hyde Park (Boston P. O.)—J. S. Coveney, 1087 Hyde Park Ave., will build a 2 story garage. Estimated cost, $10,000.

Mass., Indian Orchard — The Chapman Valve Mfg. Co., Pine St., has awarded the contract for the construction of a 1 story, 50 x 275 ft. addition to its foundry. Estimated cost, $150,000. Noted April 7.

Mass., Springfield—H. G. Fisk, 111 Maple St., has awarded the contract for the construction of a 2 story, 100 x 100 ft. garage on Chestnut St. Estimated cost, $65,000.

Mass., Springfield—The Gulf Refining Co., Albany St., will soon award the contract for the construction of a 1 story garage. Estimated cost, $25,000. Private plans.

Mass., West Springfield (Springfield P. O.)—A. Ballotti, 9 Palmer St., has awarded the contract for the construction of a 1 story garage on School St. Estimated cost, $10,000.

Mass., West Springfield (Springfield P. O.)—The Smith-Springfield Body Co., Circuit Ave., has awarded the contract for the construction of a 1 story, 90 x 320 ft. addition to its automobile body plant, with an ell 30 x 110 ft. Estimated cost, $150,000.

R. I., Providence — D. Marandola, 1275 Pleasant St., plans to build a 1 story garage and service station on Hartford Ave. and Middleton St. Estimated cost, $20,000. Private plans.

MIDDLE ATLANTIC STATES

N. J., Newark—L. Capalone is having plans prepared for the construction of a 1 story garage on Elizabeth Ave. Estimated cost, $40,000. F. Grad, 245 Springfield Ave., Archt. and Engr.

N. J., Trenton Junction—The New Jersey Highway Dept., Broad St. Bank, Trenton, plans to build a large garage on Scotch Rd. near Trenton. T. J. Wasser, Broad St. Bank, Trenton, Engr.

N. Y., Buffalo—The Warner Jewelry Case Co., 648 Michigan Ave., plans to build a factory on Michigan Ave. Estimated cost, $75,000.

N. Y., New York (Borough of Brooklyn)—M. Kelly, c/o Seelig & Finkelstein, Archts. and Engrs., 44 Court St., is having plans prepared for the construction of a 2 story, 100 x 150 ft. garage on Kings Highway. Estimated cost, $120,000.

N. Y., New York (Borough of Brooklyn)—H. Kornbloom, 26 Court St., will build a story, 95 x 110 ft. garage on 40th St. Estimated cost, $50,000.

N. Y., New York (Borough of Brooklyn)—The Maylson Realty Co., c/o McCarthy & Kelly, Archts. and Engrs., 16 Court St., will alter its 1 story, 100 x 100 ft. garage at 218 Navy St. Estimated cost, $30,000.

N. Y., New York (Borough of Brooklyn)—The M. C. K. Constr. Co., 1438 Park Ave., will build a 1 story, 95 x 225 ft. garage on Meeker and Morgan Aves. Estimated cost, $125,000.

N. Y., New York (Borough of Manhattan)—G. R. and J. T. Smith, c/o N. J. Convery, Archt. and Engr., 767 Broad St., Newark, N. J., have awarded the contract for the construction of a 4 story garage on University Pl. and 12th St., here. Noted Feb. 17.

N. Y., New York (Borough of Manhattan)—H. I. Stitler Inc., 529 Washington St., has awarded the contract for the construction of a 2 story garage on Washington and Bethune Sts. Estimated cost, $250,000. Noted April 21.

Pa., Beaver Falls—The Traver Eng. Co. plans to build a 100 x 200 ft. addition to its plant, for the manufacture of special machinery. H. G. Traver, Pres.

SOUTHERN STATES

La., New Orleans — J. P. Sutton, 2001 Rousseau St., will rebuild his iron foundry on St. Andrew and Rousseau Sts. New building will be 1 story, 110 x 150 ft.

Va., Alexandria—The Bureau of Yards & Docks, Navy Dept., Wash., D. C., will soon award the contract for altering plating shop and cafeteria at the Naval Torpedo station here. Noted Feb. 24.

MIDDLE WEST STATES

Ill., Chicago — The Ludlow Typograph Co., 3032 Clybourne Ave., has awarded the contract for the construction of a 3 story, 50 x 120 ft. factory at 2040 Clybourne Ave., for the manufacture of type setting machinery. Estimated cost, $75,000.

Ill., Chicago—Whitney & Ford, 4325 Cottage Grove Ave., plan to install a machine shop to handle plumbing supplies on Western Ave. and 40th St.

Ind., Indianapolis — The Henry Furnace & Fdry. Co., 915 North Davidson St., plans to build a 2½ story storage and factory building to cover 25,000 sq.ft. of floor space. Estimated cost, $100,000.

Ind., Michigan City—The Weil McLain Co. plans to build a 1 story, 60 x 160 ft. metal pattern factory. Estimated cost, $50,000. Private plans.

Mich., Adrian — The Utility Compressor Co., 1161 East Harper Ave., Detroit, has had plans prepared for the construction of a 1 story, 73 x 240 ft. factory for the manufacture of iceless refrigerators. Estimated cost, $40,000. Baxter, O'Dell & Halpin, 1024 Hammond Bldg., Detroit, Archts.

Mich., Benton Harbor—C. C. Sweet will soon award the contract for the construction of a 1 story, 90 x 150 ft. garage. E. R. Austin, 31 J. M. S. Bldg., South Bend, Ind., Archt.

Mich., Detroit — F. J. Whitney, 5955 Grand River Ave., has awarded the contract for the construction of a 2 story, 100 x 190 ft. service station on Second and Cass Aves. Estimated cost, $100,000. Noted March 17.

Mich. Marysville—The Monarch Pattern Wks., 1426 Russell St., Detroit, plans to build a 2 story, 40 x 100 ft. pattern shop. Estimated cost, $40,000. Private plans.

O., Cleveland — A. J. Lukivinski, 7665 Bway., has awarded the contract for the construction of a 1 story, 60 x 130 ft. garage. Estimated cost, $40,000.

Wis., Manitowoc—H. Brandenburg, 1303 Washington St., is having plans prepared for the construction of a 1 story, 30 x 180 ft. garage, repair shop and sales room, on 13th and Washington Sts. Estimated cost, $75,000. H. V. Hertling, Dempsey Bldg., Archt.

Wis., Platteville—The Fiedler Motor Co. will soon award the contract for the construction of a 2 story, 100 x 136 ft. garage and office building on Water and Main Sts. Estimated cost, $75,000. E. C. Fiedler, Secy. H. Kleinhammer, Platteville, Archt. Noted May 5.

STATES WEST OF THE MISSISSIPPI

Mo., North Kansas City (Kansas City P. O.)—The Standard Steel Wks., 1722 Tracy St., Kansas City, has awarded the contract for the construction of a 1 and 2 story, 118 x 225 ft. factory and office building. Estimated cost, $75,000. Noted May 5.

Mo., Springfield—The Forster Mfg. Co. is having plans prepared for the construction of a 1 and 2 story canning factory. Estimated cost, $50,000.

WESTERN STATES

Cal., Bakersfield—The Natl. Supply Co. has purchased a 5 acre site here and plans to build machine shops and other buildings.

CANADA

Ont., Blenheim— T. W. Graham will soon award the contract for the construction of a 2 story, 35 x 70 ft. garage Estimated cost, $25,000.

Ont., Toronto — A. Clancy, c/o P. L. Davis, Archt., 157 Danforth Ave., will soon award the contract for the construction of a 2 story, 40 x 60 ft. garage on Danforth St. Estimated cost, $30,000.

FOREIGN

T. H., Pearl Harbor — The Bureau of Yards & Docks, Navy Dept., Wash., D. C., will receive bids until June 29 for footings for machine shop here.

General Manufacturing

NEW ENGLAND STATES

Conn., Essex — E. E. Dickenson & Co., manufacturer of witch hazel, has had plans prepared for the construction of a 2 story addition to its factory. Estimated cost, $40,000. Brown & Von Beren, 185 Church St., New Haven, Archts.

Mass., Newtonville—The Security Mills, Inc., West Newton, has awarded the contract for the construction of a textile mill including a 1 story, 75 x 250 ft. mill building, 1 story, 55 x 90 ft. dye-house and a 1 story, 30 x 25 ft. boiler house. Estimated cost, $125,000.

Mass. North Dighton — The Mt. Hope Finishing Co. has awarded the contract for the construction of a 1 and 4 story addition to its textile manufacturing plant and storage building, to cover 81,000 sq.ft. of floor space, on Spring St. Estimated cost, $250,000. Noted March 31.

Mass. South Weymouth (Boston P. O.)—The Stetson Shoe Co., Inc., will soon award the contract for the construction of a 4 story addition to its factory here. Estimated cost, $40,000. E. Nichols, 70 Kilby St., Boston Archt.

R. I. Arkwright (Fisherville P. O.)—The Interlaken Mills, Inc., has awarded the contract for the construction of a 1 and 3 story addition to its finishing plant and weave shed. Estimated cost, $125,000 Noted April 21.

MIDDLE ATLANTIC STATES

N. J., Newark—The New York Pie Co. 82 Sullivan St., New York City, will soon receive bids for the construction of a 1 story bakery here. Estimated cost, $200,000. Ballinger Co., 47 West 34th St., New York City, Archt. and Engr.

N. J., Woodstown—The Woodstown Coal & Ice Co. plans to build a 2 story, 20 x 10 ft. addition to its cold storage plant. Estimated cost, $25,000. Private plans.

American Machinist

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The Use of Paper in the Machine Shop

Precautions Taken by Skilled Mechanics—Besides Hindering Slippage, Paper Protects Machine Tables from Injury—Planer Kink Worth Noting—Paper Used as Feelers

By E. A. DIXIE

PAPER is an indispensable adjunct to many machine operations and yet it is seldom one sees mention in the technical press of even single instances of its use. Because of the lack of record of this important subject the writer here sets forth the uses and applications known to him in the hope that others, with wider experience than his, may come forward with their knowledge of the use of paper in machine shop practice, to the end that this most handy semi-precision shop appliance may be more widely known.

So far as the writer's experience goes there are but two fundamental uses for paper in machine work:

First, to increase frictional resistance.

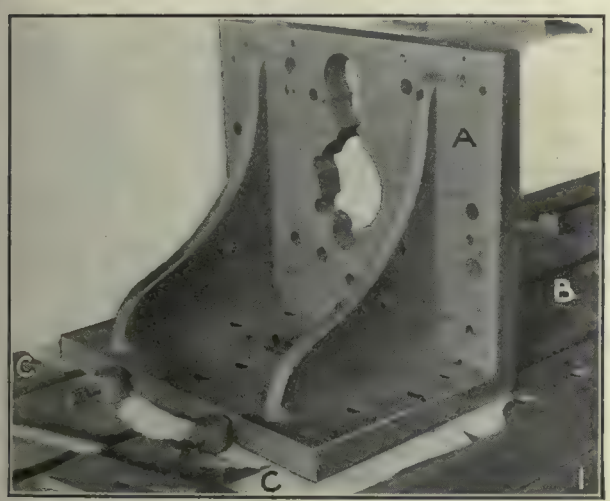
Second, as a spacer or shim.

Under the first heading the writer does not refer to such mechanisms as paper friction clutches (although these are most certainly mechanical devices) but he does refer to the use of paper to increase frictional resistance between surfaces to prevent one from sliding on the other.

An example of such use for paper is shown in Fig. 1, where the angle plate *A* is to be bolted to the table of a planer. The piece of work (not shown) secured to the angle plate projected beyond the side of the angle plate and the part of it to be planed was nearly a foot from the edge.

With these requirements and the angle plate bolted (without papering) direct to the table of the planer it was found that the thrust of the cut, after a few strokes of the planer, twisted the angle plate around out of square. But after the paper *C* was placed between the angle plate and the table the same bunters and bolts held it securely in place. In the example shown in Fig. 1 *A* is an angle plate, *B* the planer table and *C* pieces of soft white paper.

Very often castings or forgings are so slender that one must be very careful to avoid springing them when bolting or strapping them down, but they must be strapped down sufficiently to prevent their shifting under the thrust of the tool. In such cases soft paper placed between the work and the platen, especially under the points where the pressure of the straps comes, will usually prevent slipping. To further prevent slipping it is often advisable to place paper between the straps and the work and also between the straps and the blocking, when metal blocking is used under the "heel" of the strap.



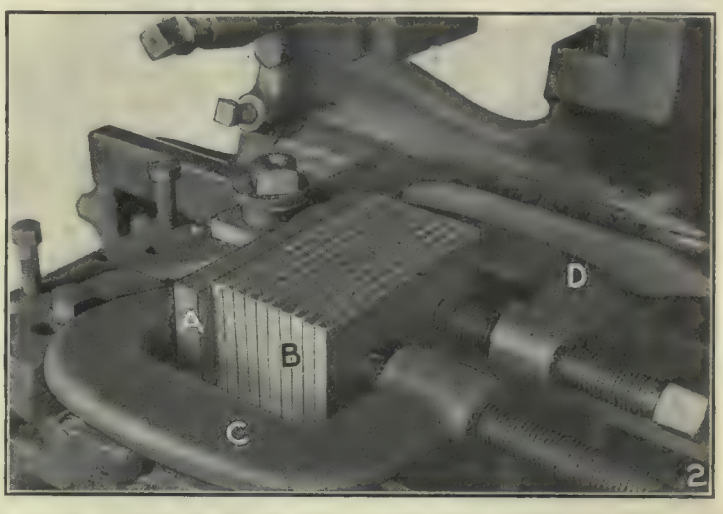
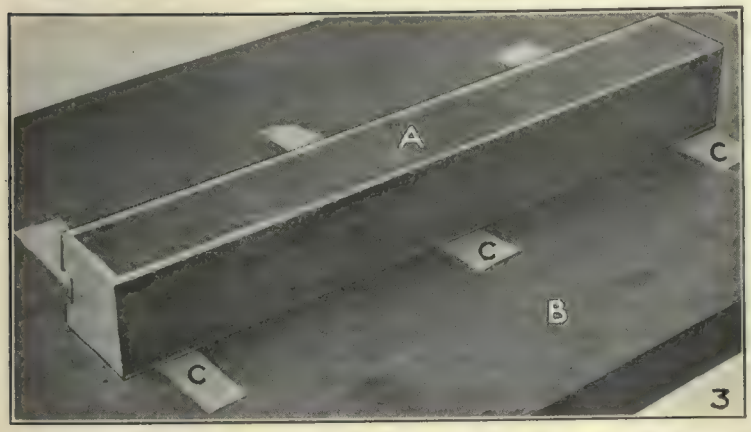


FIG. 1. ANGLE PLATE PAPERED TO PLANER TABLE. FIG. 2. THIN PLATES PAPERED TOGETHER TO PREVENT SHIFTING

The coefficient of friction between two planed metal surfaces is very low, even where one or both surfaces are rough castings. Even with castings just as they come from the foundry the friction is not materially greater, but place a piece of ordinary newspaper between the two surfaces before bolting or strapping them down and see what a difference it makes in resistance to the pressure of the cut.

Another application is shown in Fig. 2. The angle plate *A* is bolted to the table of the shaper. The ten ¼-in. pieces of machine steel *B* are to be planed on their edges. They are held to the angle plate by the two clamps *C* and *D*, but between each piece and between the angle plate and the first piece a piece of soft paper has been placed. With the paper thus placed the



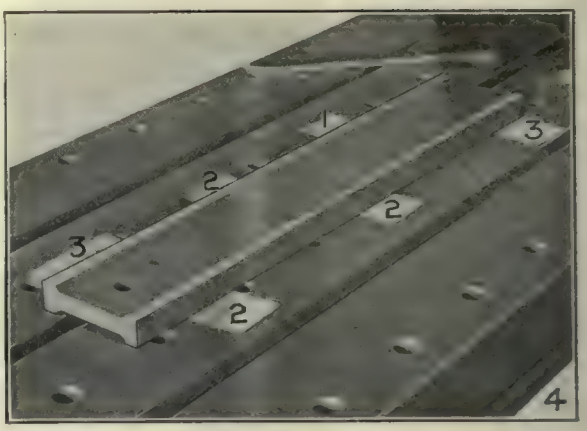


FIG. 3. TESTING A FLAT SURFACE. FIG. 4. IRREGULAR JOB PAPERED READY FOR CLAMPING

clamps need not be screwed up nearly as tight as they would have to be if the pieces of steel were clamped metal to metal.

While the use of paper under *slender* castings has been mentioned, its use also holds good with heavy, rugged castings where it is necessary to take extremely heavy cuts. No matter how carefuly one straps a piece of work to a machine table it is bound to be sprung, other conditions being equal, and the tighter it is strapped down the more it will be sprung. However, with newspaper between the surfaces the strapping need not be nearly so tight to obtain the same frictional resistance between them.

Besides the use of paper in connection with securing work to machines a similar application is found for it between machine parts which are subjected to shocks to prevent their shifting their relative positions under the influence of such shocks. A shim of thin preferably soft paper enormously increases the grip of machined surfaces one to another.

Under the second heading, "As a spacer or shim," there are endless examples from which one can draw.

An illustration is given in Fig. 3 which shows the testing of the truth of a machined surface by means of papers; *A* is a piece of square cold rolled steel which has been planed on one side; *B* is the surface plate, and at *C* are three strips of tissue paper. If the surface plate is true and the planed surface is flat the three papers will be gripped equally and the pull necessary to withdraw any one of them will be the same. If, however, either the work or the surface plate or both of them are out of true, then the errors and their approximate extent and locations can be noted by making this test at various parts of the surface plate and observing the way the papers are gripped. The application of this method of testing the truth of other machined surfaces such as the abutting parts of machines or to work held on machine tables or lathe faceplates and so forth will be at once apparent. Thus used the strips of paper are virtually very thin parallels which are much nearer to equality in thickness than are the usual run of metal parallels. When choosing paper for this application one should remember that a thin, hard paper will give by far the most dependable results. A soft paper is of no use for such tests. Because of its softness the weight of the metal part resting on it compresses it, and because of its high coefficient of friction we do not get a reliable indication when we pull the paper strips, for the slightly compressed strips will give almost the same "feel" as other strips which are bearing more of the weight. For work of this character I have obtained the most dependable results from a paper which is known by the trade name of "Frisket paper." This is a very thin, hard, transparent paper used by photo-engravers' retouchers. They, however, coat it with a thin film of rubber cement before use, while the machinist must use it without the rubber coat, *just as it comes from the paper maker.*

Another "shim" use for paper is in setting up work for machining. It is not the intention of this article to instruct *how* a job should be "papered" for machining. In the writer's estimation that would be an impossible task, for there are other elements which must be taken into consideration. A job may be correctly papered to prevent its moving or warping during the machining operation, but if the tools be incorrectly ground or the cuts be improperly taken the job will warp and crawl all over the machine table. This phase of papering must be learned by experience.

For this kind of work any kind of hard paper, cardboard or, if the work is very irregular, metal shims may be used to augment the papers.

In Fig. 4 a casting is shown set up and papered on the planer table. In this case the photograph was taken just after the planer hand had located and papered the irregularities in the casting. The figures shown on the pieces of paper indicate the numbers of pieces used at these locations. In this case hard cardboard, about 0.008 in. thick, was used. On this job six planer fingers will be used, one over each of the piles of time cards.

In the machining of accurate angle plates, straightedges, parallels, and so forth, paper is indispensable.

Fig. 5 shows the papering of a special parallel gib

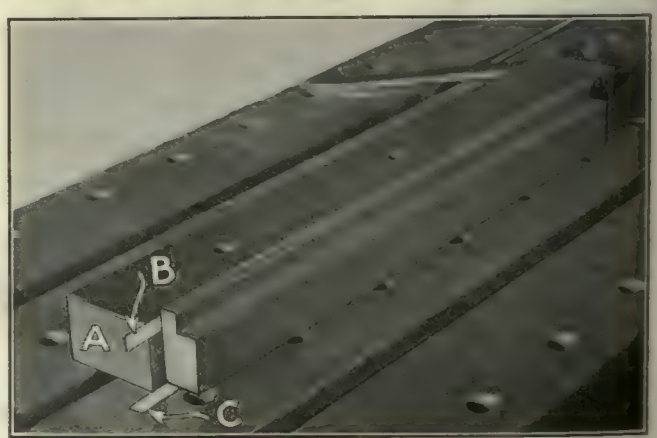


FIG. 5. PAPERING A GIB SO ITS EDGE WILL BE SQUARE WITH ITS SIDES

preparatory to planing. The two opposite faces have been planed and the operator is preparing to plane one of the edges. The planer shoe *A* may or may not be accurately square to the planer table; whether it is or not makes no difference, for if it is appoximately so he can pack out the bottom or the top of the parallel with papers, as shown at *B* and *C*, till the edge of the gib will finish truly square with its sides. With one edge square it is a simple matter to make the other one parallel to it.

On all classes of machine tool and other machine work size blocks and gages are almost indispensable to determine, with the degree of accuracy necessary to preclude excessive assembling costs, the relative locations or heights of different members. But accurate, expensive size blocks were never intended to be used as stops against the faces of which to set the cutting edges of hardened tools. With these combination size blocks any dimension can be set up and we can then place the requisite thickness of paper on top of the assembly of size blocks and the planer tool can be set down till it touches, not the expensive size block on the top of the assembly but an inexpensive piece of paper which is so soft that it cannot damage the block.

In Fig. 6 is again shown the special parallel gib shown in Fig. 5. The surface *A* has been finished square with the side *E*. It is now desired to finish the surface

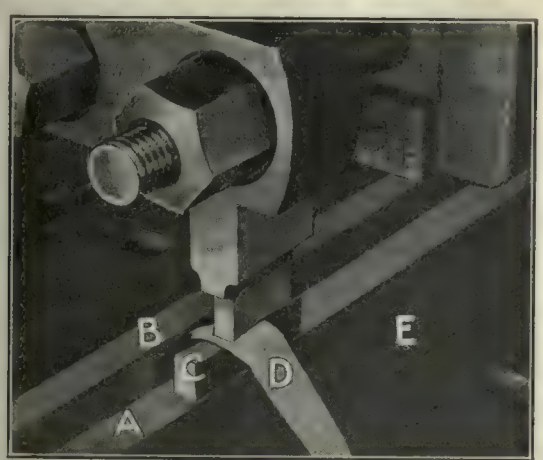
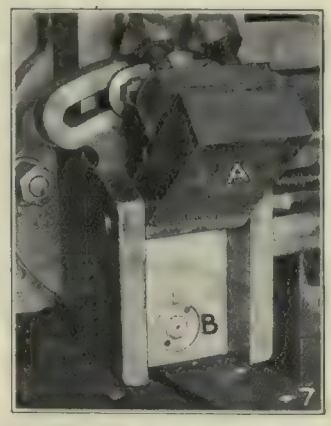


FIG. 6. PAPER USED TO SET THE FINAL FINISHING CUT

B parallel to *A* and ½ in. above it. In setting the tool for the cut the planer hand takes his ½-in. size block *C* and sets it on the surface *A*, and on top of it he places a thickness of paper *D* which his experience tells him will give the correct allowance for the operation (grinding or scraping) which is to follow the planing operation. Or it may be that the job is to be finished on the planer; in this case the thickness of paper used determines the depth of the final finishing cut to be taken.

The tool is brought down till it touches the paper and the planer hand tries the "feel" to determine the amount of finish which the tool at a certain setting will leave either for a subsequent finishing cut on the planer or for the grinder or scraper.

Another very little-known method of setting for both the final roughing and finishing cuts was developed by the late Mr. Smith, who had charge of the planer department at the Sigourney Tool Co., Hartford, Conn. It is commonly admitted that this concern does the finest metal planing in this country. At any rate if you want to hear a man's ability eulogized ask any planer hand



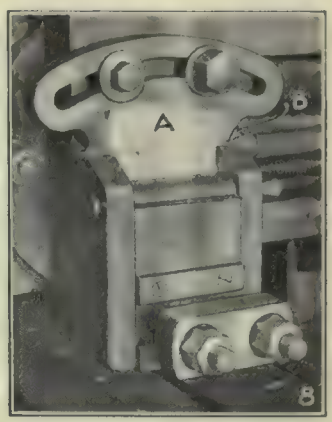


FIG. 7. CLAPPER BLOCK RAISED PREPARATORY TO PAPERING BEHIND THE CLAPPER. FIG. 8. CLAPPER BLOCK WITH PAPER BEHIND IT

who has worked under Mr. Smith: "Who is the best planer hand you ever knew?"

In Figs. 7 and 8 is shown this exceptionally clever application of papering. A piece of paper, *A* Fig. 8, of the desired thickness and a little narrower and longer than the clapper block, is threaded on a wire *B* or the needle of a surface gage. The clapper block is raised as shown in Fig. 7 and the surfaces *A* and *B* cleaned, thus insuring that those parts of the clapper block and head which take the thrust of the cut have no particles of dirt to give a false setting.

The paper is then slipped in from the top behind the clapper block and the clapper block lowered as shown in Fig. 8. The bottom of the paper thus comes between *A* and *B*, Fig. 7, and lifts the tool a fraction of the thickness of the paper above the position it would occupy were there no paper between the surfaces *A* and *B*.

The first finishing cut is then taken with a broad tool and wide feed. When this cut is finished the clapper block is raised slightly, the paper removed and the clapper block again lowered. With the paper removed the clapper block comes into direct contact with its seat in the head, the tool is lowered that small fraction of the thickness of the paper which it was formerly lifted and is now in position to take the final finishing cut without altering the position of the tool as it was set for the first finishing cut.

Recently the writer had some blocks of steel approximately 4 in. long by 2 in. wide and about ¾ in. thick. They were used as spacers in a certain machine, and were parallel. On assembling them in place it was found that the parts which they were to space had been machined incorrectly and that it was necessary either to remachine the large parts of the machine parallel or taper the spacers about 0.004 in. from end to end. The job of tapering was done on a surface grinding machine. The spacers were held on the magnetic chuck with a strip of paper 0.002 in. at the center of their length and two pieces of the same thickness at the end which was to be thinned. Two parallels slightly thinner than the spacers were placed on the magnetic chuck to prevent shifting sidewise and a bunter at the thick end to take the thrust of the cut. These latter precautions may not have been necessary but they insured the job staying put on the chuck, for there was theoretically only a *line* direct metal to metal contact between the spacers and the chuck at the thick end of the spacers and lifting the other end only 0.004 in. from the chuck greatly decreases its magnetic pull.

Special Equipment in a Railroad Boiler Shop

Heavy Forms Used for Flanging Sheets—Powerful Riveting Machine for Repairing Mud Rings—Special Equipment for Boiler Flue Work

By J. V. HUNTER
Western Editor, *American Machinist*

THE modern locomotive boiler shop has little opportunity to work on a manufacturing basis for few parts, outside of flue work, are made in lots of more than a few pieces at a time. Where the opportunities for duplication of parts exist the foremen frequently develop special facilities to reduce costs. A number of pieces of such equipment has been made in the shops of the Chicago & Alton Railroad at Bloomington.

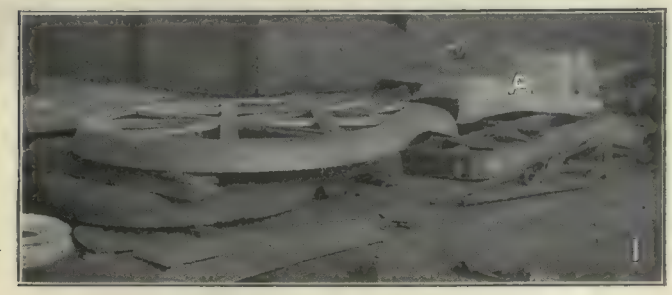


FIG. 1. CAST-IRON FORMS USED FOR FLANGING BOILER SHEETS



FIG. 2. SOME FLANGING FORMS AND OPEN FORGE FOR HEATING PLATES

A collection of heavy cast-iron forms shown in Figs. 1 and 2 has been made to aid in flanging flue sheets and kindred parts. An example of this work is shown lying on the forms at *A*, Fig. 1. A large open-top coke forge is used for heating sections of the plates preparatory to bending. The smoke hood over this fire with its exhaust pipe that connects with the underground exhaust system shows in the background of Fig. 2.

A pneumatically operated clamping device, Fig. 3, is used for holding the sheets on the form while flanging. The heavy base and sliding crossbeam are grey cast iron. The two 3-in. steel guide pins are approximately 12 ft. between centers so that there is plenty of side clearance for handling practically any job that will come into the shop. The top crossbeam is lifted by two 12-in. air cylinders, one bolted to each end of the base. The cylinders are fitted with double acting pistons and packing glands surround the rods so that air can be used for clamping as well as for lifting. As the travel of the pistons in the cylinders is limited the clamp is given additional range of capacity by providing means of adjustment on the piston rods. These rods are threaded for about 30 in. with adjusting nuts above and below the ends of the crossbeam. The power of this clamping press is so limited that it is impractical to use it directly to assist in the flanging work. All flanging and bending is done by sledging while the work is clamped down on the form.



FIG. 3. CLAMPING PRESS FOR HOLDING PLATES ON THE FORMS

The heavy riveter shown in Fig. 4 was built in the shop and is used for riveting mud rings. It was stated

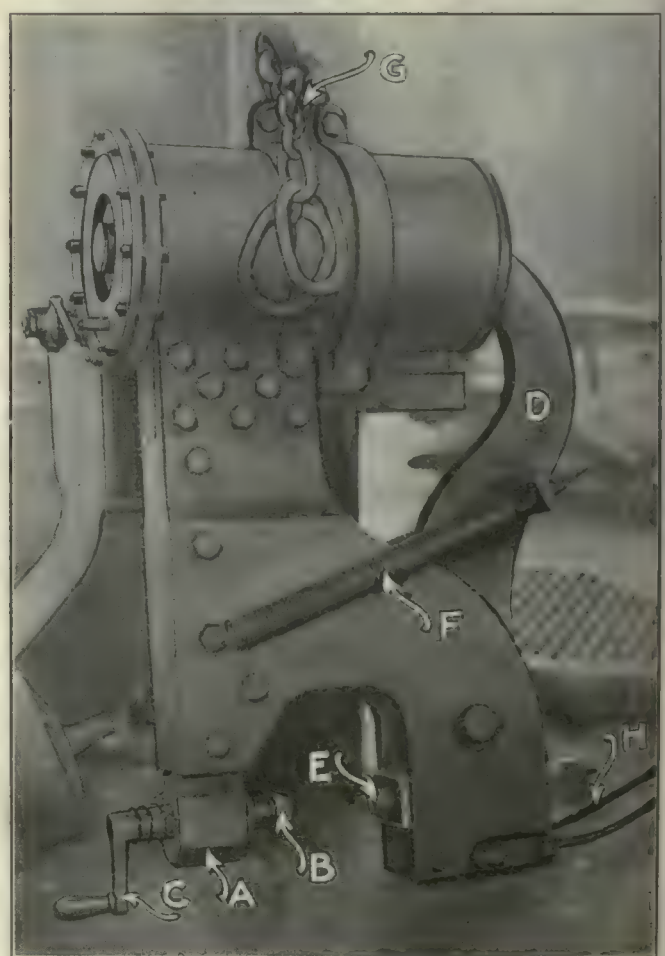


FIG. 4. LARGE POWER RIVETING PRESS FOR MUD RING WORK



FIG. 5. ROTARY SHEAR FOR CUTTING BOILER FLUES

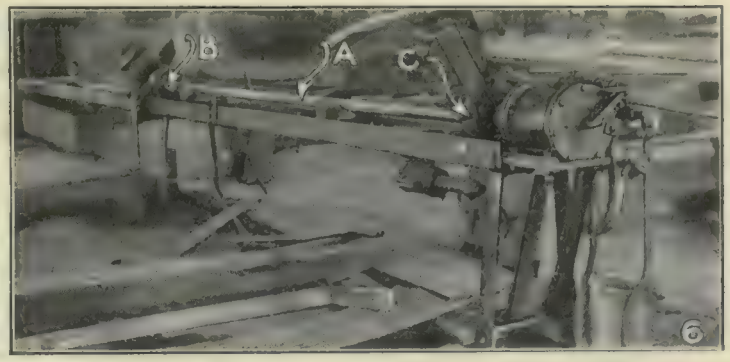


FIG. 6. HYDRAULIC TESTING DEVICE FOR BOILER FLUES

that its capacity is 75 tons riveting pressure. However it only figures out to a possible working pressure of 55 tons with 90 lb. air pressure, which is a high pressure for the end of a long air line. The air cylinder is 15 in. inside diameter and the ratio of the lower arms is seven to one.

The frame is made of two steel plates that have been forged on one end to form a semi-circular socket in which the cylinder is bolted. Spacing blocks bolted between the two plates separate them to permit the insertion of the levers of the working mechanism. The upper jaw *A* is a forging held in the frame by heavy bolts. It carries the stem for the adjustable riveting die *B*. This stem is adjustable to provide for various thicknesses of work. It has been cut with a heavy square thread and may be turned in or out by the crank *C*. The heavy lever *D* transmits the pressure from the piston to the heading die *E*. After each stroke the piston and lever are pulled back to the starting position by the pair of coil springs *F*. The chains *G* are for hanging the press from an overhead crane hook. The boss riveter uses the lever handle *H* to guide the press into position and line the dies over the rivet.

Cutting Boiler Flues to Length

Among the shop built tools found in the flue-welding department is the flue cutting machine shown in Fig. 5. The disk-shaped knife *A* is carried on the shaft *B* which has a bearing and pulley enclosed in the belt guard *C*. No speed reduction is used from the line-shaft drive and the speed of the cutter exceeds 200 r.p.m. The cutter rotates the pipe which is supported by rollers directly beneath the knife edge. One feature on this device that has not been found in other shops visited by the writer is the holding device *D* that is employed to enclose the loose end. In many cases this loose end has been observed to flop around loosely in an open V-block. This device in the Bloomington shop incloses the loose end by a pair of trigger-like fingers that permit the tube to slip down inside when it is laid on top. Moreover the tube once inclosed is safe, and can be readily slipped out endwise after the end has been cut off.

The hydraulic flue testing outfit shown in Fig. 6 probably exists in some form in most shops. However, this one has several features that simplify its operation and are well worth mentioning. Its frame is a length of 12-in. channel that lies with its flanges up, thus forming a trough that slopes to the far end carrying all the spilled water to a sump tank. From this tank the water flows through a check valve into a pressure storage tank and is ready for use again. The tube *A* in testing position lies between a stationary head *B* and the pneumatic clamping head *C*. The stationary head is adjustable for different lengths of tubes but need only be set once as all clamping is done from the other end. It is faced with rubber gasket material that seals that end while the tube is under the testing pressure.

A view of the working side of the operating end of the testing device is shown in Fig. 7. When the flue *A* is in position, the water inlet pipe *B* is inside. The end of the flue slips inside of the ring *C* and rests against a gasket on the inside of the recess. When the head *D* is set up the gasket forms a watertight seal during the test. The head *D* is carried on the end of the piston from the 8-in. air brake cylinder *E*.

When ready to test a tube, air is turned into the cylinder by the valve *F*. The head *D* moves up to the tube, clamping one end against the stationary end and sealing the other end by the gasket in the ring *C*. Opening the valve *G* permits water to flow from the storage reservoir through inlet *B*, thus filling the tube. Pressure is applied by opening the air valve *H* which acts on the storage reservoir and so directly through the water supply line to the tube being tested. The testing pressure is read on the gage. When the test is completed, valve *G* is closed cutting off the water supply, and the tube is released by shifting valve *F* to exhaust the air from the clamping cylinder. The air pressure need not be released from the storage reservoir until the water supply is nearly exhausted. Then when the pressure is relieved the water that has collected in the sump tank automatically flows in through the check valve, refilling the pressure reservoir.

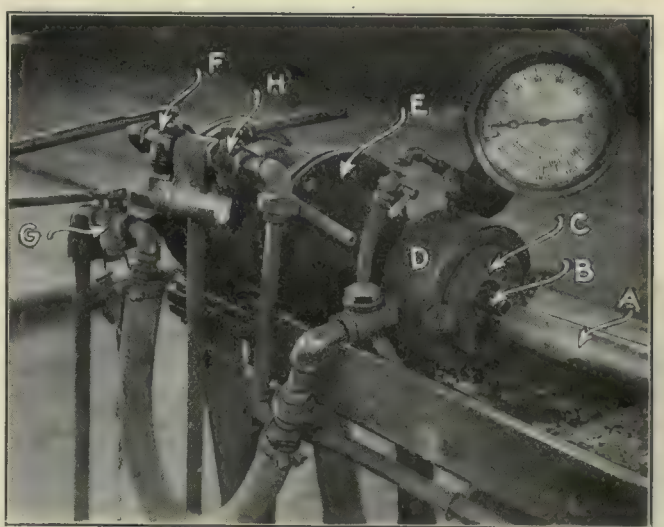


FIG. 7. CLAMPING HEAD AND GAGE ON FLUE TESTER

Design of Helical Springs

Controlling the Spring Criterion—Methods of Making Coil Springs—Sample Investigation of a Material for a Helical Spring

By JOSEPH KAYE WOOD
Engineer, Western Electric Co., Inc., A. T. & T. Co.

THE "Material Index" $\left(\frac{\pi S}{G}\right)$ was discussed in the previous article, in which it was shown that the value of this index might be as high as 0.030 where steel music wire of the highest quality is used. In this article it will be shown how the factors appearing in the "Spring Criterion," $\left(\frac{h-H}{H}\Big/\frac{D^2}{d^2}\right)$, may be controlled within satisfactory limits, in order that the value of this criterion may be less than the safe limit, i.e.,

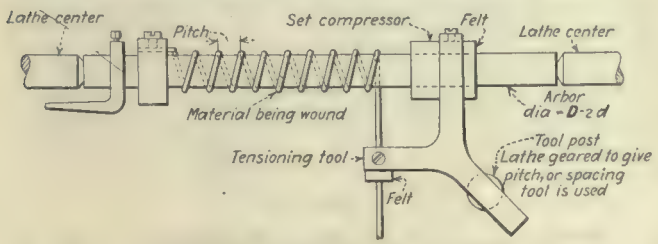


FIG. 1. WINDING A SPRING IN A SPEED LATHE

less than the material index. The present article will also include a sample investigation of a material from which helical springs were made and tested.

Spring Criterion $\left(\frac{h-H}{H}\Big/\frac{D^2}{d^2}\right)$

Consider first "d" the diameter of the wire. Material of "round" cross section, which is the only section being considered here, is never truly round in the practical sense, and if commercial bar or wire material is carefully measured, the diameter will be found to vary by about 1 to 5 per cent from minimum to maximum, the per cent of variation being the greatest for the smallest size wire. An average diameter of the material should always be used in the design of springs, because even then the variation will be magnified by the second power in the spring criterion and by the fifth power in the deflection formula. Then, the unavoidable error to be expected from this source is probably of the order of 3.0 per cent.

The other dimensions used in the above formula are: "D," the mean diameter of the spring; "H," the solid length of the spring; and "h," the maximum length of the spring. They are controlled mostly by the care taken in winding or coiling the spring. There are three general methods of making a helical spring, namely: (a) winding, (b) coiling, and (c) a combination of winding and coiling. The method used depends on the number of springs to be made.

Spring Making

(a) "Winding" a spring is understood to mean bending a certain length of wire or rod in the form of a helix *on* an arbor, the diameter of which is usually somewhat less than the inside diameter $(D-d)$ of the spring and equal to $D-2d$ approximately. The arrangement of the apparatus is shown in Fig. 1. Hence, the essentials of spring winding are: First, an arbor equal in diameter to approximately $D—2d$; second, means of rotating the arbor and feeding or spacing of the material at a uniform pitch, such as a speed or engine lathe, and even by hand (using a Hjorth spring winder), the method used depending on the diameter of the material; third, tension on the wire or rod equal in unit stress to less than 50 per cent of the elastic limit. Also, after a compression spring is formed it is compressed in order to make it "set." This method, which is used for making small quantities of springs has a disadvantage in that it is necessary to allow for the increase in spring diameter that occurs when the spring is removed from the arbor.

(b) "Coiling" a spring, Fig. 2, means bending the wire or bar into the form of a helix by using three rollers, which remain *outside* the spring being coiled, and a tensioning tool. The essentials of this method are: First, the adjustment of the rollers so that their guiding or tangent points are located in the circumference of a circle whose diameter is equal to the outside diameter $(D+d)$ of the spring; second, the adjustment of the pitch "pusher," which determines the pitch; and third, slight tension on the wire in the tensioning tool. The coiling of a spring is usually done in a machine designed especially to suit the existing conditions, and

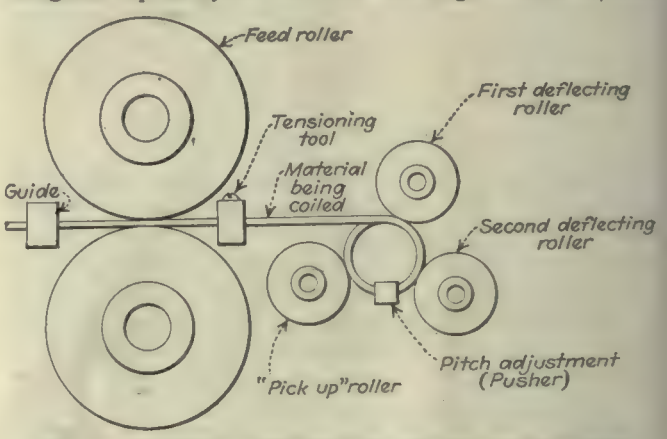


FIG. 2. COILING A SPRING BY MEANS OF ROLLERS

which ordinarily automatically controls the spring diameter and the pitch, and also cuts the springs at the proper length, which is "H" plus the length of the end loops for elongation springs and "h" for compression springs. Compression springs are also automatically compressed in order to make them "set." This method, which is suitable for production in large quantities, has the advantage of the "burnishing" operation, which will be explained more fully in the next paragraph.

(c) "Combination winding and coiling" consists in using an arbor set on the lathe centers as in "winding," the arbor being slightly less in diameter than the inside diameter $(D-d)$ of the spring. A tool called the "burnishing nose" and of the shape shown in Fig. 3, bends the material around the arbor in much the same way as in "coiling" a spring. Consequently, less tension need be applied to the material, which is the great

advantage both of this method and of the previous method over the heavy tensioning method used in "winding" a spring. A second advantage, also, is that

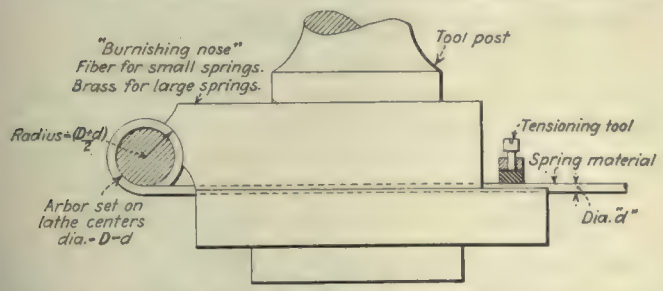


FIG. 3. COMBINATION OF SPRING WINDING AND COILING, OR "BURNISHING"

the spring takes a better "set," i.e., will not increase in diameter after being removed, which action had to be allowed for in the "winding" method.

Relative Fiber Stresses

The "burnishing nose" referred to performs an operation very similar to that of "coiling" in that it forms the material into a helical shape almost entirely by a bending stress plus a slight tensile stress, while in "winding" the forming is done mostly by a large tensile stress plus a bending stress. Now, consider the case where similar material and equal spring and wire diameters are used for both methods. Whether the spring coil be formed by winding or coiling, it will require very nearly equal stresses on the outside and inside fibers to produce the requisite "set." For the sake of illustration, let us assume that it requires a stress of 100,000 lb. per square inch.

The value of this stress may be shown graphically by *A'A* in Fig. 4, which fiber is in tension, or by *B'B*, which is in compression. The geometrical axis is coincident with the neutral stress axis. Now, when a spring is formed with considerable tension in the wire, the stress diagram will be as shown in Fig. 5, where the fiber stress *A'A* will be in the order of, say, 150,000 lb. per square inch and *B'B* considerable less, say, 50,000 lb. per square inch. Assume, then, that 70,000 lb. per square inch is the elastic limit for tension and 60,000 lb. per square inch the elastic limit for compression of this wire. It is obvious, therefore, that the compressive stress *B'B* (Fig. 4) in the first case will tend to hold the wire in the original form, while in the second case the compressive stress *B'B* (Fig. 5) has no holding power whatsoever. On the other hand, the tensile stress *A'A* in the second case exceeds the elastic limit more than *A'A* in the first case, and will produce a certain amount of permanent strain or holding power, but not as much as a compressive stress would, due to the lower elastic limit for compression. Therefore, in the second case the entire stress on the inside fiber *B'B* (Fig. 5) will be retroactive, tending to make the spring diameter increase after the removal of the tensile load.

Now in the case of "coiling" or "burnishing," a slight tensile load is applied to the wire, while the bending load is sufficient to produce the stresses shown in Fig. 4. The net result of this method is shown in Fig. 6, which shows that the neutral axis is but slightly removed from the geometrical axis. Assume *A'A* equal to 110,000 lb. per square inch and *B'B* equal to 90,000 lb. per square inch. This has the advantage over the first case (Fig. 4) of causing *A'A* to exceed the elastic limit for tension to a greater extent, while the stress *B'B* still exceeds the elastic limit for compression.

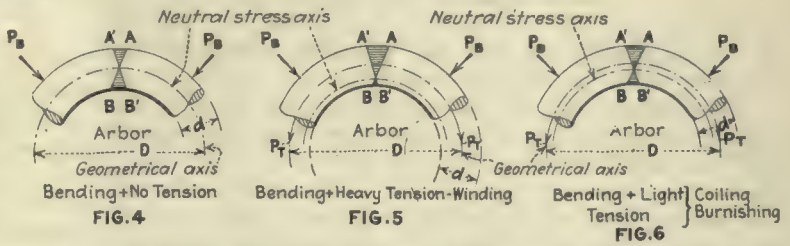


FIG. 4. STRESSES PRODUCED BY PURE BENDING, NO TENSION. FIG. 5. STRESSES PRODUCED BY BENDING AND HEAVY TENSION, AS IN WINDING. FIG. 6. STRESSES PRODUCED BY BENDING AND LIGHT TENSION, AS IN COILING OR BURNISHING

Therefore, from the foregoing discussion it is quite obvious that "coiling" and "burnishing" (Methods *b* and *c*) will produce a better or more permanent set in the forming of a helical spring, and are therefore recommended.

Very large springs may be formed by heating the bar to a temperature sufficient to enable winding it on an arbor easily, and then plunging the *entire* spring into an oil bath quickly, after which it is tempered.

Initial tension: Sometimes an elongation spring is required to have an initial tension, i.e., the application of a certain load before any deflection takes place. These springs are made by twisting the coils against each other, so that the initial tension is held in equilibrium by a close-wound spring equal in length to h_1." The method of forming these springs may be called the "double winding" method and is shown very briefly in Fig. 7(a). The size of the auxiliary arbor *A* and the angle its axis makes with the axis of the main arbor *M* determines the amount of initial tension and initial twist or deflection. This method may be used for making compression springs also, as shown in Fig. 7 (b), where the wire is fed from the opposite side of the auxiliary arbor. Here the amount of pitch or spacing between the coils is dependent on the size of the auxiliary arbor and the angle its axis makes with the main arbor axis. For accurate results, the "burnishing" tool should be used on both the main arbor and the auxiliary arbor.

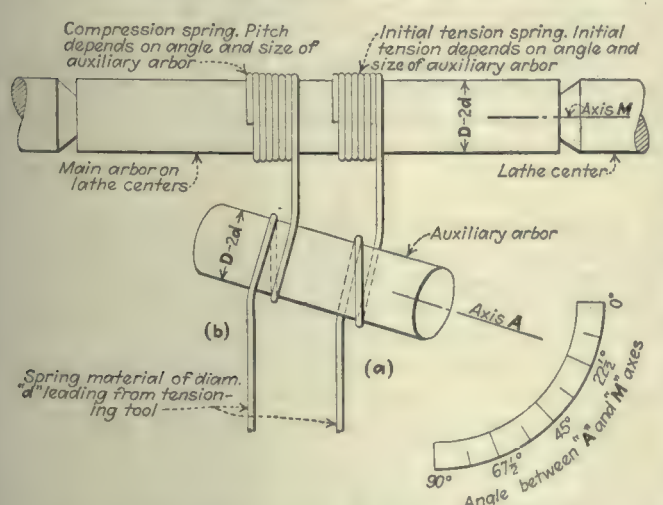


FIG. 7. "DOUBLE-WINDING" A SPRING, USING AN AUXILIARY ARBOR

In forming a helical spring, the diameter "D" should not be less than five times the diameter "d" of the wire or bar and preferably seven times. The reason for this is that the fiber stress "S" produced under these conditions is complicated and too near the rupture point for even materials of high strength.

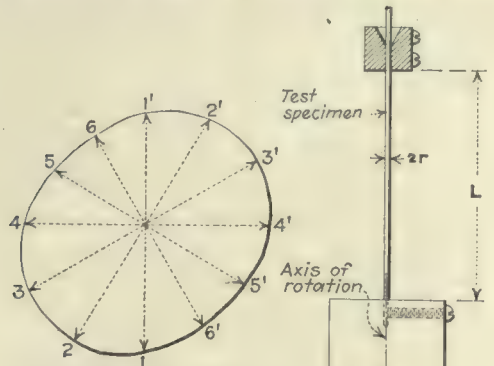


FIG. 8. MEASUREMENTS TAKEN TO DETERMINE THE MEAN DIAMETER OF A WIRE. FIG. 9. TORSIONAL PENDULUM FOR DETERMINING MODULUS OF ELASTICITY

When considering "H," elongation springs should have a slight inappreciable initial tension, so that the length "H" will give correct deflections and pressures. Annealing by means of the cold air blast method should not destroy this initial tension. The end loops should be made in such a way that the pull is along the axis of the spring. In compression springs the length "h" may change after the first compression, which gives it the "set," and may also change if the finished spring is subjected to heat treatment. For this reason, compression springs should not be cut to the length "h" until after given these two treatments.

Although a spring is safe if the percentage of elongation or depression and the spring index $\left(\frac{D}{d}\right)$ are within the limits prescribed by the material index, yet for elongations or depressions exceeding 300 per cent the deflections are not exactly proportional to the loads, due to the fact that the deflection formula becomes appreciably only approximate.

The number of turns "N" should be specified to conform with the length H, and should be specified only for turns in active use. Exact uniformity of pitch is not so important, provided an unsafe load is not thrown on any one coil.

Thus, the variations in the diameters D and d will cause the spring criterion to vary by about 6 or 7 per cent, provided that all factors are controlled as outlined in these articles; but the value of this criterion will usually be more than the true value, which is on the safe side. For the deflection formula, a variation of about 8 per cent may be expected in the required pressure at a certain point in the spring's travel, provided that all factors are controlled to within certain limits. More accurate springs may be made by testing them out and rejecting those which fail to meet the requirements.

Great care should always be taken not to damage by marking or scratching the wire material. Coarse tools should not be used, and the tensioning tool and burnishing tool should have a brass or fiber contact. Also, care should be taken when grinding or squaring the ends of compression springs.

Sample Investigation of Material for a Spring

Music wire of high quality, 0.020 in. in diameter and having the following chemical composition, was procured for the making of a spring:

	Per Cent
Carbon	0.85
Manganese	0.45–0.50
Sulphur	0.02
Phosphorus	0.025
Silicon	0.15

This steel, which is of eutectoid composition, or thereabouts, is evidently favorable for spring material, as it should have a very high elastic limit and ultimate strength. A study of the cross section of this wire through the microscope, using a magnificatian of 200, reveals the fact that this steel has a very fine and closely grained structure. Consequently, due to this homogeneous structure, we would expect a uniform value for the modulus of elasticity throughout the entire spring made from this material. The utmost precautions were taken to keep the wire and the springs made from it free from corrosion by packing them in chalk dust.

Test No. 1

Ten 8-in. samples of this wire were calipered and an average diameter for each determined. Tensile loads were then applied to each sample in increments of 10 lb. each until the wire ruptured, while an extensometer was used to measure the elongations. From the elongation curves plotted and the average diameter, the ultimate strength, the elastic limit, and the modulus of elasticity were computed for each sample. The figures thus obtained are quite consistent, so that the averages for the ten samples are considered sufficiently accurate for practical use. Therefore, the value of the modulus of elasticity E is found to be 33,300,000 lb. per square inch, the value of the elastic limit, 272,000 lb. per square inch and the ultimate strength equal to 338,000 lb. per square inch. It is quite evident, then, that the quality of this wire is high.

From the value of the elastic limit of 272,000 lb. per square inch for tension, the value of the elastic limit for torsion may be taken as 50 per cent of this or 136,000 lb. per square inch. Theoretically, this value should be slightly greater and may be computed from the following formula: $S_{Torsion} = \frac{1}{2} S_{Tension} - \gamma S_{Tension})$, which was derived in a previous article. However, as a safe maximum value rather than an exact value for "S" is required, we may reduce the value of the torsional elastic limit, as given above, to about 110,000 lb. per square inch and call it "S" for this particular material.

Test No. 2

Having secured the value of "S," the value of "G" the torsional modulus must be determined. Using one of the four methods described in the previous article, 10 8-in. samples of wire were each subjected to a tensile load of 70 pounds and the elongations noted. The diameter was measured just below fine black lacquer marks placed at every half-inch section on each wire, both before and after the application of the load. These measurements, in which an accurately adjusted micrometer was used, were taken at six different places at any one mark, as shown in Fig. 8, and the mean of these six measurements considered as the diameter of the wire at that mark.

The average of the differences in these diameters before and after the application of the load for the ten samples is 0.00005 in. The average elongation is 0.060 in. and the average diameter 0.0194 in. Therefore, the factor of lateral contraction λ may be determined by the following formula:

$$\lambda = \frac{d_1 - d_2}{\epsilon \times d_1}$$

Where d_1 = diameter before load is applied,
d_2 = diameter after load is applied,
ϵ = unit elongation,

$$\therefore \lambda = \frac{0.00005 \pm}{0.007 \times 0.0194} = 0.375 \pm$$

Now from formula (5) derived in a previous article,

$$G = \frac{E}{2(1 + \lambda)} \qquad (5)$$

Hence by substitution we get,

$$G = \frac{33{,}300{,}000}{2(1 + 0.375)} = 12{,}000{,}000 \text{ lb. per sq.in. } \pm 5\%.$$

As the results of the foregoing experiment were not accurate, nor consistent enough (due to the wire being so small), it was decided to determine "G" by another method. This method was not recommended for small wire in the previous article.

Test No. 3

Method No. 3 which was outlined in the previous article was used in this test. Formula (4), used in connection with this method, is as follows:

$$G = \frac{2\pi IL}{t^2 r^4} \qquad (4)$$

One end of a sample of wire was pinched between two brass plates having the wedge shape shown in Fig. 9. From the other end, a solid brass cylinder 1.53 in. in radius and weighing 8.59 lb. was suspended. The moment of inertia of a solid cylinder "I" with respect to its axis of rotation is equal to $\frac{MR^2}{2}$, where M is the mass and R the radius. But $M = \frac{W}{g}$, where "g" equals the acceleration of gravity, which if substituted gives $I = \frac{WR^2}{2g}$. Now, substituting this value in (4) we get

$$G = \frac{\pi W R^2 L}{12 g t^2 r^4}$$

or, $$G = \frac{0.163693\, L}{t^2 r^4}$$ for the cylinder used.

By varying the length L for each of the five different samples of wire tested and noting the time of oscillation when the weight was turned through various amplitudes about the vertical axis, the following results were obtained:

(1.) The value of $\frac{L}{t^2}$ was very close to 0.625 for over 100 measurements made of L and t.

(2.) The average value of the radius r of the five samples of wire was 0.0096 in.

Therefore, by substituting these values in the above formula, we get

$$G = \frac{0.163693 \times 0.625}{(0.0096)^4} = 12{,}100{,}000 \text{ lb. per square inch.}$$

as the value of the torsional modulus.

Comparing this value of "G" with the value determined by the previous method we find a very small difference, which, however, does not mean that the former results were accurate, but that they serve to give better confidence in the good results obtained in this test.

Test No 4

Having determined the value of "S" equal to 110,000 and "G" equal to 12,100,000 lb. per square inch, which makes the material index $\frac{(\pi S)}{G}$ equal to 0.0285, a spring was designed and made up in order to verify these figures. A compression spring of the following dimensions was deflected by varying pressures, and a curve then plotted:

Average diameter "d" of wire	=	0.0194 in.
Mean " "D" " spring	=	0.1310 in.
Free length of spring "h"	=	1.41 in.
Number of turns "N"	=	32.0

The spring criterion $\left(\frac{h - H}{H} \times \frac{d^2}{D^2}\right)$ for this spring is equal to 0.0274, which is just less than the material index.

The curve plotted resulted in a straight line. Measurements of the deflections were very carefully made by loading the spring until a certain electrical contact was made, which indicated a definite length of travel. By selecting any pressure and corresponding deflection from the curve, say 0.555 for the deflection and 26.456 ounces for the pressure, and substituting in the ordinary deflection formula

$$G = \frac{P D^3 N}{2 F d^4}$$

or, $$G = \frac{26.456 \times (0.131)^3 \times 32}{2 \times 0.555 \times (0.0194)^4} =$$

11,900,000 lb. per square inch. Four other springs, tested in a similar manner, gave an average value of "G" equal to 11,800,000 lb. per square inch. "G" computed from this formula is low, due to the approximation made in deriving the above formula, and to difficulties in making measurements on small springs. However, the per cent difference is very small.

Test No. 5

Twenty-four springs similar in size to the springs used in test No. 4 were made up, particular precautions being taken to protect the wire from moisture by covering the hands with chalk dust. Twelve of the springs were copper plated, as outlined in the previous article, i.e., by plating with nickel previous to copper plating.

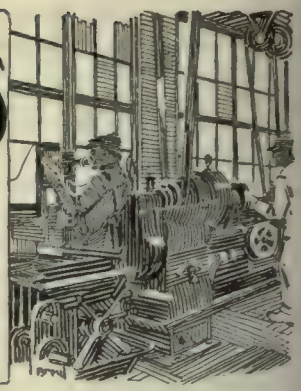
The twenty-four springs were then submitted to a fatigue test, being operated at the rate of once per second through the maximum deflection. After 2,000,000 operations three failures occurred, which is quite negligible, considering that the failures occurred after the 800,000th operation. If the unloading line had been plotted on the elongation chart for this wire, it probably would have very nearly coincided with the loading curve, showing 100 per cent recoverance, or ability of the material to withstand fatigue.

This test then shows that the material index as determined by the previous tests was a correct maximum limit for the spring criterion, which was very close to it in value. It shows, further, that because of the precautions taken to protect the wire from corrosion and embrittling due to plating, the treatment did not materially affect the value of the material index, thereby not decreasing the useful and safe working range of the spring.



MODERN PRODUCTION METHODS

By
W P. Basset
of
Miller, Franklin, Basset & Co



XVI—Getting the Overhead into the Finished Product

Methods of Checking Costs—Distribution of Various Charges to the Proper Departments—Machine Hour Rates

IT WAS once the practice to keep cost accounting entirely separated from the general accounting of a business, with the result that the information derived from the two sources was more apt than not to differ widely. Since correct costs depend upon charging every expenditure shown by the general books to each item of the product in the proper proportion, I have throughout this series shown how each item of costs is handled, not only in the cost system but in the general books.

Unless the cost system ties in frequently with the general books of account we have no check on the accuracy of the costs and the system would be in effect the inaccurate and old-fashioned single entry system.

Fig. 77 is a trial balance taken from the books after consideration has been given to the balances which existed in the inventories when the books were opened at the beginning of the year. These balances were purposely omitted in the ledger pages which have appeared so far, in order to prevent confusion as subsequent items were entered. This trial balance shows that the manufacturing expense account has a debit balance of $14,582.86, which is the controlling figure. When all of the contributory department expenses have been distributed, the total expenses of the productive departments must balance with this figure after it has been modified by journal entries. The journal entries will be discussed as the need for making them appears. A complete list of them with the amounts of each is given in Fig. 78.

In Part XIII, I discussed theoretically the bases on which the various contributory departments' expense can be distributed to the productive departments, choosing those methods best adapted to the needs of this particular shop. I shall now describe the actual clerical steps by which all of the overhead is gotten into the product.

On the expense analysis of the boiler department, shown in Fig. 79, the total direct expense is seen to be $791.05. To this amount have been added $3.29 for lighting and $142.27 for fixed charges, making a total boiler expense of $936.61. It seems well to explain here that for each department the direct expense is totalled separately from the fixed charges and the shares of the expense of other departments. The direct items—sometimes called the controllable expense—are those which are under the control of the one in charge of the department, and for which he can be held responsible. He cannot, however, be held responsible for a rise in the other items which are allocated to him by higher authorities.

Experience having shown us that in a plant of this kind about 90 per cent of the steam goes for power and 10 per cent for heating the buildings, we make the distribution in this proportion at the bottom of the boiler

TRIAL BALANCES
as of
January 31

	Dr.	Cr.
Material purchased finished	$25,232.02	
Lumber packing material	923.80	
Forgings and castings	54,274.62	
General stores	6,126.30	
Goods finished and in process	245,463.56	
Buildings	452,601.78	
Bar stock	27,341.13	
Hardening and carbonizing material	4,300.56	
Fuel	5,371.29	
Machinery	372,380.42	
Accounts payable		324,136.77
Iron and steel	25,137.47	
Cash	95,127.30	
Accounts receivable	275,129.30	
Real estate	50,000.00	
Surplus		325,966.52
Capital stock		1,000,000.00
Manufacturing expense	14,582.86	
Reserve for dep. buildings		3,711.17
Machinery insurance		112.50
Tax machinery		81.58
Building insurance	1,387.80	
Tax buildings		101.75
Selling expense	49.55	1,319.47
Reserve for dep. machinery		1,319.47
	$1,655,429.76	$1,655,429.76

FIG. 77. TRIAL BALANCE SHEET

department expense analysis. The 90 per cent is at once added to the power department expense analysis, while the correct proportion of the heating charge for each department in the plant is worked out on the basis of floor space, on the sheet shown in Fig. 80 for "heat distribution." The total of these amounts must of course be $93.66, which is 10 per cent of the total boiler department expense. These amounts are posted to the expense analysis of the various departments, absorbing all of the $93.66.

On the power department expense analysis you will find the $842.95 which is the 90 per cent of boiler expense carried forward to the power department. The "power distribution" sheet in Fig. 90 analyzes the power consumption of all departments and gives the amount to be charged against each department. The total of these amounts must be $1,198.76 to check with the total expense developed for the power department.

The expense analysis of the office department shows a total charge of $1,304.02 which has benefited both the manufacturing and the selling ends of the business. We decided to charge 60 per cent of the total office expense to general factory and 40 per cent to selling, inasmuch as a study of the activities of the clerks and executives showed that their time was divided roughly in that proportion. The distribution is shown at the bottom of the office department expense analysis.

Here it becomes necessary to make the first journal entry which consists of debiting the "selling expense" ledger account with $521.61 and crediting the "manufacturing expense" ledger account with $521.61; this being the share that the selling end of the business has to bear of the total office charge.

In Part XIII, we explained that the "general factory" department is simply the gathering ground for those items of overhead expense which benefit the shop as a whole rather than any specific department. The total of these items gathered on the general factory expense analysis is $2,826.37. We decided in Part XIII that for this shop the productive hour would give the fairest basis on which to charge this expense to the productive departments. So we divide the total general factory expense by the total productive hours of the plant, giving us a charge of 12.09 cents per productive hour, which will absorb the general factory charge.

Sometimes it is desirable to spread this expense as a percentage of the productive labor. Therefore, on the expense analysis we have worked out this ratio as 25.91 per cent.

Perhaps at this point it is well to call attention to the fact that in this series of articles dealing with costs we have purposely made our figure ridiculous so far as ratios, rates and amounts are concerned. This is so that there will be no liklihood of our chancing to assume figures close to those of some client who might feel that we were giving away confidential information. Therefore, it is unsafe for any reader to assume that the actual figures used in these articles can be used as a standard by which to check the performance of his own shop.

In Fig. 80 is shown a sheet called "distribution general factory," listing the department and showing for each the number of productive man hours in that department. Now, the productive man hours in any department, multiplied by the 12.09 cent rate for the general factory gives, in the last column, the share of the general factory charge which each department must bear. These are now carried forward to the expense analyses of each department. This absorbs all of the expense of the contributory departments—except for the toolroom—into the productive departments.

The toolroom expense is often perplexing. To get the widest application I have chosen to consider the medium size shop in which the toolroom takes care of the machine repair work and may, in emergency, do productive work upon the product that is sold. Its expense analysis is worked up in the usual way and we find that it shows a total expense of $881.78. The labor in the toolroom can be charged out to the other departments on the basis of the work actually performed for them, just as the labor of a productive department is charged to the product. In fact, we may properly look upon the toolroom as an outside concern which we employ to manufacture tools and do miscellaneous repair work for us. I think that if we get this point of view, the point which we seek to bring out will become clear.

So we find that in this month the toolroom put in 978 hours which should be charged to other departments as shown on the "toolroom distribution," Fig. 80. This gives us a complication, for the general factory department had service from the toolroom to the extent of 85 hours. But on the toolroom expense analysis there is a share of general factory amounting to $118.24. Without

SUMMARY OF JOURNAL ENTRIES
UP TO THE MAKING UP OF EXPENSE ANALYSIS

	Dr.	Cr.
Manufacturing expense	$5,463.97	
Machine depreciation		3,711.17
Building depreciation		1,319.47
Machine taxes		81.58
Building taxes		101.75
Machine insurance		112.50
Building insurance		137.50
Monthly charge for the above; see fixed charge sheet.		
Selling expense	1.92	
Manufacturing expense		1.92
Amount of light for the month charged on entry to Manufacturing Expense, but on distribution found to belong to Selling Expense.		
Selling expense	21.82	
Manufacturing expense		21.82
Amount of Fixed Charges belonging to Selling Expense; see Fixed Charge Sheet.		
Manufacturing expense	5,307.53	
Goods finished and in process	10,615.06	
Payroll		15,992.59
To transfer respectively the non-productive labor and the productive labor to the above accounts.		
Manufacturing expense	525.00	
Fuel		525.00
Coal used during the month.		
Manufacturing expense	1,456.73	
Hardening and carbonizing material		124.65
Lumber and packing materials		371.80
General stores		960.28
Materials used for expense purposes during the month.		
Selling expense	20.25	
Lumber and packing materials		10.20
General stores		10.05
Materials used for Selling Expense during the month.		
Goods finished and in process	46,765.80	
Castings and forgings		21,781.38
Bar stock		13,613.85
Iron and steel		9,885.03
Lumber and packing materials		2.50
Material purchased finished		1,348.18
General stores		134.86
Above being the withdrawals from the inventories and put into process during the month.		
Buildings	210.11	
Bar stock		35.01
Iron and steel		175.10
Amounts withdrawn from above inventories during the month for the benefit of the buildings.		
Machinery	409.15	
Bar stock		215.15
General stores		193.99
Amounts withdrawn from above inventories during the month for the benefit of the machinery.		
Selling expense	521.61	
Manufacturing expense		521.61
Share of office chargeable to Selling Expense.		
Manufacturing expense	8.36	
Profit and loss due to abnormal expense		8.36
Difference between the actual toolroom rate and normal rate on toolroom charge to General Factory.		
Buildings	27.33	
Manufacturing expense		27.33
Toolroom labor and expense charged to buildings.		
Machinery	244.22	
Manufacturing expense		244.22
Toolroom labor and expense charged to machinery.		
Selling expense	450.00	
Goods finished and in process		450.00
Shipping Room labor that was posted to Goods Finished and in Process, to charge it to Selling Expense.		
Selling expense	853.55	
Manufacturing expense		853.55
To transfer the shipping expense to selling expense.		

FIG. 78. SUMMARY OF JOURNAL ENTRIES UP TO THE MAKING UP OF EXPENSE ANALYSIS

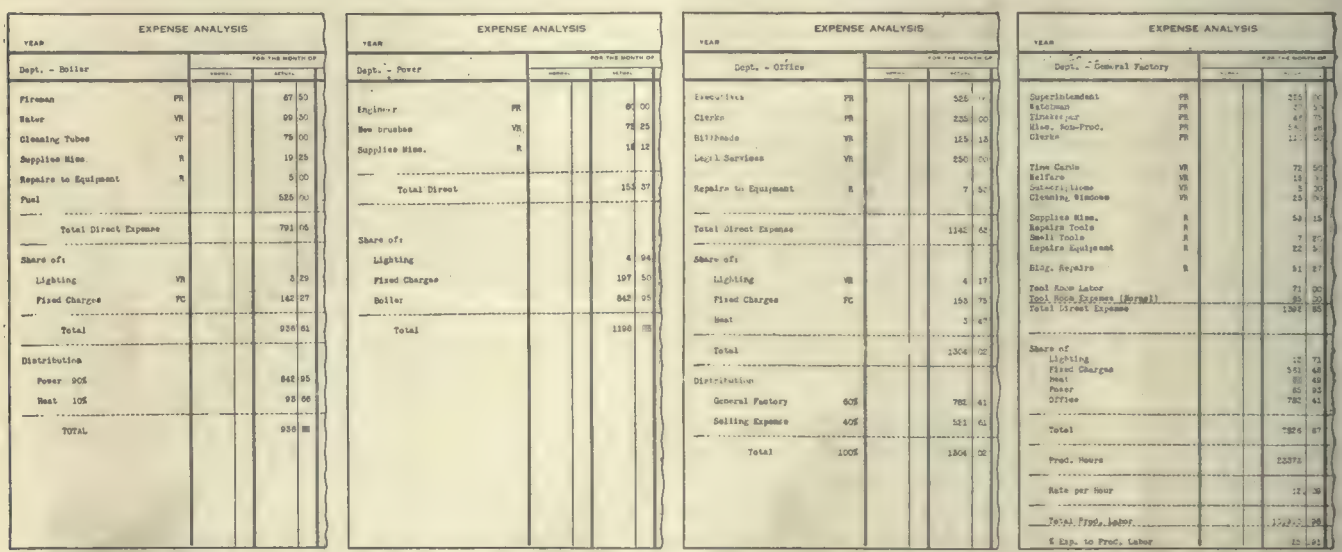
recourse to higher mathematics, it is obviously impossible to close either one of these departments until the total expense of both has been ascertained. As we maintain a cost system to get us commercial results and not as a gymnasium for mental acrobatics, we use a method which gives us sufficiently accurate results at little effort. We assume a standard or normal rate per hour, which in this case is $1. On the general factory expense analysis is a charge of $71 covering 85 hours time of a toolroom workman which was made from the service cards of the toolroom workmen. The item of "toolroom expense (normal)" is the charge for 85 hours work done by the toolroom and charged for at the normal rate of $1 per hour.

As soon as the general factory rate has been developed and the toolroom's share charged to it on this basis, the actual rate for the toolroom is developed. This gives an actual hourly rate for the toolroom of $0.90 16/100.

On the toolroom distribution sheet, Fig. 80, the toolroom expense charge for each department is worked out by multiplying this actual hourly rate by the number of chargeable hours. For general factory this gives rise to a discrepancy, for on the distribution sheet the general factory's share of the toolroom expense is $76.64, while on the general factory's expense analysis it was charged with $85 at the normal rate. Now, were we to leave things in this condition we would be out of balance with the controlling ledger account by the difference between $76.64 and $85, which is $8.36. This is corrected with a journal entry debiting manufacturing expense and crediting "profit and loss due to abnormal expense" with $8.36. In the next article, we will discuss this question of normal and abnormal expense in detail.

The toolroom distribution sheet shows 17 hours charged to the buildings, and 140 hours to machinery. These are not expenses of operating, but are rather asset items, being additions to existing buildings and machines. We, therefore, relieve the manufacturing expense account by means of journal entries debiting buildings with $27.33 the sum of toolroom labor and expense, and machinery in the same way with $244.22 and crediting manufacturing expense with similar amounts. The toolroom charges to other departments together with these charges to assets absorb all of the $881.78 toolroom expense except the $551.78 covering the 612 hours put in as productive labor on the concern's regular product. This $551.78 will be released in the final cost of our product, just as is the expense of any other productive department.

The expense of all contributory departments now rests in the productive departments, each of which has taken its fair share. The next step is to get the expense of the productive departments into the product.



EXPENSE ANALYSIS

YEAR

Dept. - Boiler

Fireman	FR		67 50
Water	VR		99 30
Cleaning Tubes	VR		75 00
Supplies Misc.	R		19 25
Repairs to Equipment	R		5 00
Fuel			525 60
Total Direct Expense			791 65
Share of:			
Lighting	VR		8 29
Fixed Charges	FC		142 27
Total			936 61
Distribution			
Power 90%			842 95
Heat 10%			93 66
TOTAL			936 61

EXPENSE ANALYSIS

YEAR

Dept. - Power

Engineer	FR		97 00
Wee brushes	VR		75 25
Supplies Misc.	R		16 12
Total Direct			188 37
Share of:			
Lighting			4 94
Fixed Charges			197 50
Boiler			842 95
Total			1190 76

EXPENSE ANALYSIS

YEAR

Dept. - Office

Executive	FR		526 [illegible]
Clerks	FR		235 00
Bill Reade	VR		125 18
Legal Services	VR		250 00
Repairs to Equipment	R		7 50
Total Direct Expense			1142 68
Share of:			
Lighting	VR		4 17
Fixed Charges	FC		155 75
Heat			3 47
Total			1304 07
Distribution			
General Factory	60%		782 41
Selling Expense	40%		521 66
Total	100%		1304 07

EXPENSE ANALYSIS

YEAR

Dept. - General Factory

Superintendent	FR		375 [illegible]
Watchman	FR		[illegible]
Elevator	FR		47 [illegible]
Misc. Non-Prod.	FR		54 [illegible]
Clerks	FR		11 50
Time Cards	VR		72 50
Welfare	VR		13 [illegible]
Sanitation	VR		5 30
Cleaning Windows	VR		23 [illegible]
Supplies Misc.	R		59 15
Repairs Tools	R		[illegible]
Small Tools	R		7 [illegible]
Repairs Equipment	R		22 [illegible]
Bldg. Repairs	R		51 87
Tool Room Labor			71 00
Tool Room Expense (Normal)			85 00
Total Direct Expense			1362 85
Share of			
Lighting			12 73
Fixed Charges			551 48
Heat			80 49
Power			85 93
Office			782 41
Total			7826 87
Prod. Hours			22375
Rate per Hour			17 [illegible]
Total Prod. Labor			17[illegible] 96
% Exp. to Prod. Labor			15 [illegible]

EXPENSE ANALYSIS

YEAR

Dept. - Tool Room.

		MONTH	FROM TO DATE	
Foreman	FR		45 00	
Timekeeper	FR		21 50	
Misc. Non-Prod. Labor	FR		109 07	
Clerks	FR		21 00	
Supplies Misc.	R		38 40	
Repairs Tools	R		25 30	
Small Tools	R		65 20	
Mach. Repairs	R		32 24	
Total Direct Expense			367 71	
Share of				
Lighting	VR		6 59	
Fixed Charges	FC		297 91	
Heat			5 45	
Power			95 90	
General Factory			118 24	
Total			881 78	
Chargeable Hours			978	
Rate per Hour		1 00	.9018	
Chargeable Labor			777 08	
% Expense to Labor			112 64	

EXPENSE ANALYSIS

YEAR

Dept. - Automatic

		MONTH	FROM TO DATE	
Foreman	FR		50 00	
Repairs to Mach.	FR		115 00	
Truckers	FR		18 19	
Timekeepers	FR		11 50	
Misc. Non-Prod.	FR		102 83	
Clerks	FR		10 00	
Inspectors	FR		18 00	
Overtime	FR		210 00	
Repairs to Machines	VR		931 00	
Supplies Misc.	R		37 12	
Repairs Tools	R		20 10	
Small Tools	R		50 40	
Repairs Equipment	R			
Machine Repairs	R		206 10	
Belting	R		50 90	
Tool Room Labor			38 40	
Tool Room Expense			45 58	
Total Direct Expense			1,910 02	
Share of				
Lighting	VR		18 53	
Fixed Charges	FC		952 [illegible]	
Heat			15 [illegible]	
Power			569 60	
General Factory			541 [illegible]	
Total Expense			3,524 63	
Machine Hours			750	
Rate per Mach. Hour			4 [illegible]	
Productive Labor			1,088 17	
% Expense to Labor			329 96	

EXPENSE ANALYSIS

YEAR

Dept. - Milling.

		MONTH	FROM TO DATE	
Foreman	FR		42 50	
Repairs to Mach.	FR		15 20	
Truckers	FR		16 42	
Timekeepers	FR		11 50	
Misc. Non-Prod. Labor	FR		175 20	
Clerks	FR		10 00	
Inspectors	FR		30 00	
Overtime	FR		76 82	
Supplies Misc.	R		24 18	
Repairs Tools	R		[illegible]	
Small Tools	R		19 20	
Repairs Equipment	R		[illegible]	
Mach. Repairs	R		93 50	
Belting	R		38 90	
Tool Room Labor			10 80	
Tool Room Expense			[illegible] 52	
Total Direct Expense			568 84	
Share of				
Lighting	VR		2 75	
Fixed Charges	FC		379 97	
Heat			2 75	
Power			161 62	
General Factory			808 58	
Total			1,730 52	
Mach. Hours			1,080	
Rate per Mach. Hour			1 [illegible]	
Prod. Labor			2,495 18	
%Expense to Labor			69 [illegible]	

FIG. 79. EXPENSE ANALYSES

So let us now consider the expense analysis of the automatic department. In earlier articles we have described the items marked V.R., P.R., and R. The toolroom labor and expense have just been discussed. Under the heading of "shares," you will note light, heat, power, fixed charges and general factory, the origin of which we have discussed in this article. The total expense is thus seen to be $3,524.63, and a total of 750 machine hours have been put in by the department. By dividing the total expense, $3,425.63 by the 750, we get a rate per machine hour of $4.69. This, then, furnishes a basis on which the product processed in the automatic department can be justly charged with the department's expense. From a factory report, we learn the number of hours that have been charged against each order, part or job and to get the actual cost for that month multiply them by the $4.69 rate. Old-fashioned cost systems would use that as the cost; the best modern practice is to use instead of the $4.69, a normal rate and carry the difference between the normal and actual to profit and loss. This will be explained in detail in a later article.

This is a good place to warn the reader that the machine hours of a department are not necessarily the same as the hours reported on the workman's service card. It is, therefore, necessary that the correct method of keeping time be used in the automatic department. The method to choose will depend upon whether the work is continuous and whether it is possible to keep the same men regularly on the same groups of machines. If, as is usually true, the work is not continuous, it is best to use a time card for each machine, on which is reported the number of machine hours that the work took from the beginning of the set-up time until the machine stopped running on that part. The men in the automatic department then report their time as operators or set-up men but not against any individual job. A labor cost per machine hour is thus developed and handled as an over-all labor charge. For the automatic department, this plan will do, as the operators differ but slightly in skill and rate. Skill enters mostly in making the set-ups.

The need for charging time in this way is due to the peculiar conditions which exist in the automatic department. The man who ordinarily runs say four machines may find some morning only three machines set up and ready to run. Half an hour later, one of these machines may finish and the fourth be ready for him to start. During the week he may run anywhere from one to four machines at a time. It would entail needless clerical effort to report his time and to get the labor rate. If in a special case it seems advisable to report the man's time exactly against any part, it can be done accurately. If he normally runs four machines, his time is applied

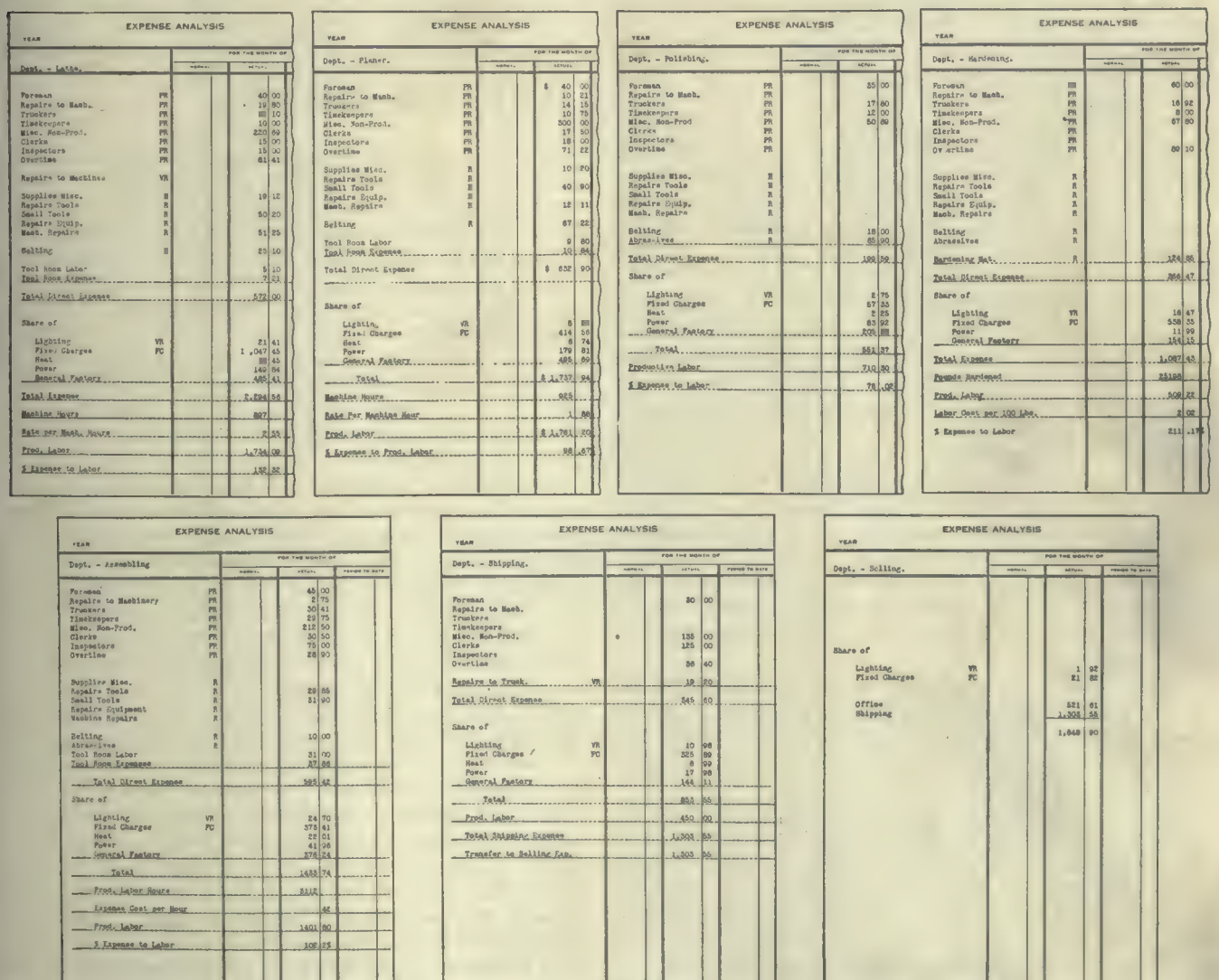


FIG. 79. EXPENSE ANALYSES (CONTINUATION OF)

one-fourth to each. Then when one of his machines is down a time card is turned in for that machine as being idle and the labor cost at one-fourth the man's rate is thrown into the department's expense. It would be obviously wrong to divide the man's rate among the machines he actually happens to be running at any time. Suppose for example, a man gets 60 cents an hour and normally runs four machines each of which is charged with a labor cost of 15 cents an hour. If, however, two machines went down, the parts on the two machines which are still operating would be charged at 30 cents an hour, thus penalizing a part for a fault of management. The better way, where labor cost must be charged to the product direct is to throw 30 cents into the overhead of the department and charge each of the machines which are operating with the customary 15 cents per hour for labor.

Either of these two plans can be adopted, although I believe it is best to use the labor cost per machine hour, as first described. So much for the method of accounting for time and arriving at the total machine hours in the automatic department. We also show on the expense analysis the productive labor dollars amounting to $1,068.17. This figure has been taken from the report described in Part XIV on labor. We are thus able to develop, for comparison but not for purposes of costing, a ratio of expense to productive labor of 329.96 per cent, as this is a figure that interests some executives.

YEAR

Dept. - Tool Room Distribution

	Hours	Labor	Expense
General Factory	85	71 00	76 64
Automatic	47	39 40	42 38
Milling	15	10 80	15 [illegible]
Lathe	8	6 12	7 21
Planer	12	9 80	10 84
Polishing			
Hardening			
Assembling	42	31 00	37 86
Shipping			
Buildings	17	12 00	15 53
Machinery	140	118 00	126 22
Productive Labor	612	481 10	551 78
Total	978	777 02	881 78

YEAR

Dept. - Heat Distribution.

	Floor Space	%	
Office	4580	3.7	3 47
Tool Room	7200	5.8	5 45
General Factory	13890	11.2	10 49
Automatic	17860	14.5	13 58
Milling	3000	2.4	2 23
Lathe	23400	19.7	18 45
Planer	9000	7.2	6 74
Polishing	3000	2.4	2 25
Assembling	29000	23.6	22 01
Shipping	12000	9.6	8 99
Total	122900	100%	93 86

YEAR

Dept. - Power Distribution

	%	
Tool Room	8.	95 90
General Factory	5.5	65 [illegible]
Automatic	32.5	389 60
Milling	13.5	161 85
Lathe	12.5	149 84
Planer	15.	179 81
Hardening	1.	11 99
Polishing	7.	83 92
Assembling	3.5	41 96
Shipping	1.5	17 98
Total	100%	1198 76

YEAR

Dept. - Distribution General Factory

Department	Hours	Expense
Tool Room	979	118 24
Automatic	2001	241 62
Milling	5000	605 [illegible]
Lathe	4015	485 41
Planer	4100	495 [illegible]
Polishing	1700	205 53
Hardening	1275	154 15
Assembling	3112	376 24
Shipping	1192	144 11
Total	22373	2826 87

FIG. 80. DISTRIBUTION SHEETS

Before leaving the discussion of the machine hour rates as used in the automatic department it may be well to point out the fallacy of trying to make the machine hour rate include the labor of the machine's attendant. Perhaps where the true machine hour rate is very high, the charge for labor low and uniform throughout the department, the error may be negligible if the operator runs an unvarying number of machines. But I do not believe the practice advisable; for by combining the labor and expense into one rate, we are never able to analyze the cost into its elements. It is only by having these elements separate in the final costs that we can correct any deviation from the normal. When figures are lumped they are hard to separate; they might as well be buried.

The reason some cost departments include the workman's wage in the machine hour rate is, as a rule, to make it easier for them to estimate on new work; but like most short cuts of a lazy man the result is usually incorrect.

The expense of the milling department and of the lathe department is handled in exactly the same way as for the automatic. While in the automatic department the machine hours were greater than the man hours it would be well to note that the opposite condition sometimes exists in the planer department, for there a man and a helper may operate a single machine.

For several reasons the expense of the polishing department is not released on the machine hour basis. First, it is difficult to secure reports of the machine activity; second, the work to be performed is not so much a question of machine time as it is man time; and third, the polishing equipment is an aid to hand work rather than productive machine tools. We therefore release the expense of the polishing department upon the basis of the percentage of expense to productive labor. The labor cost in dollars and cents is accumulated against each order or part and the proper percentage, in this case 76.2 per cent, is added to absorb the overhead. Thus, a part on which $5 has been spent for polishing labor would absorb 76.2 per cent of $5 or $3.81 for expense.

Applying the expense of the hardening department to the product presents a problem different from any of the foregoing, although its expenses are gathered in exactly the same way. But it is impossible to charge the number of men or machine hours against each part or piece, for in one receptacle many different kinds of work may be packed and treated at the same time. To determine as nearly as we can the cost per piece for hardening, we get a report of the number of pieces which have gone through, together with their weight. In this month, 25,198 pieces were hardened at a productive labor cost of $509.22, which is a labor cost of $2.02 per hundred pounds.

If the hardening department is called upon to give several different treatments to different materials, a set of ratios may be set up based upon the number of pieces that could be treated by a furnace were the furnace assigned to that particular piece. This ratio would also consider the length of time that the pieces have to remain in the furnaces. These ratios are applied to the weight of the pieces that have been treated during the month and the number of unit pounds produced is

figured. So, if a piece has a unit value of 0.5, and a thousand of these pieces have gone through during the month, there would be 500 unit pounds and the general cost for the unit pounds for the hardening department is arrived at. Then, by multiplying the unit for the particular piece by its weight, the cost for that piece per pound is determined.

In the assembling department, because little of the work is done with machine tools, we release the expense by taking the percentage of expense to the productive labor dollar in the same way as in the polishing department.

Some cost accountants believe that it is more accurate to release the assembly department expense on the productive hour instead of on the labor dollar. While theoretically that may be true in some plants we must remember that we seek to develop our costs only so that they may serve us. When they are developed to an impractical and expensive degree of accuracy, the business becomes the slave of the cost system. Since experience shows that in the assembly department the hourly wage rate differs very little between man and man, the difference in the final result, by using either basis, is negligible. The productive payroll total is easy to get. So when we use that figure instead of the

Debit		Credit	
Charge register	$1,829.63	Lights to S. E.	$1.92
Expense requisition	1,456.73	Fix. chg. to S. E.	21.82
N. P. labor	5,307.53	Selling from office	521.61
Fuel	525.00	Tool room chg. to bldgs.	27.33
Fixed charges	5,463.97	Tool room chg. to mach.	244.22
Abn. toolroom exp.	8.36	Shipping to selling exp.	853.55
			$1,670.45
		Balance	12,920.77
	$14,591.22		$14,591.22

Expense by Departments

Tool room	$551.78
Automatic	3,524.63
Milling	1,739.32
Lathe	2,294.56
Planer	1,737.94
Polishing	551.37
Hardening	1,087.43
Assembling	1,433.74
	$12,920.77

FIG. 81. MANUFACTURING EXPENSE LEDGER ACCOUNT

productive hours we leave the cost department free to devote its time to other and more useful work.

The total expense of the shipping department—$1,303.55—is charged in a lump to selling expense by means of a journal entry debiting selling expense and crediting shipping. The correctness of considering shipping as a selling expense is apparent when we realize that once the goods have been moved from the assembly floor, they are manufactured and the factory has ceased to be interested in them.

The Dividing Line

There has been no little discussion as to the dividing line between manufacturing costs and selling costs. To me it seems apparent that if the product of the factory can be taken directly from the assembly floor and installed in the plant of a next-door neighbor, the manufacturing cost is complete with assembly. We recall one order on which there was no crating cost or shipping cost, the finished product being placed directly upon the purchaser's trucks, uncrated, and carried away. But some of this concern's product was crated and shipped to other cities. Sometimes the sales department chose to sell other orders for export which required heavier crating and consequently a heavier shipping charge. There is no reason why the manufacturing department should be saddled with costs due solely to the territory in which the sales department chose to sell.

The Manufacturing Expense Ledger Account

In Fig. 81 is shown the appearance of the manufacturing expense ledger account as it appears after all of the journal entries shown on Fig. 78 have been made. Each debit and credit entry shows its source. The difference—$12,920.77—has presumably been charged ultimately to some productive department and so has found its way into the product. This amount is therefore credited to manufacturing expense and debited to "goods finished and in process." To prove this figure, we list below the ledger account in Fig. 81 the productive departments with the total expense for each one as shown by the expense analysis. The total of these figures is $12,920.77, checking with the balance in the manufacturing expense account and so proving the correctness of our accounting for expense. Thus we know that every item of expense appears somewhere on the expense analysis and that finished product will absorb it all.

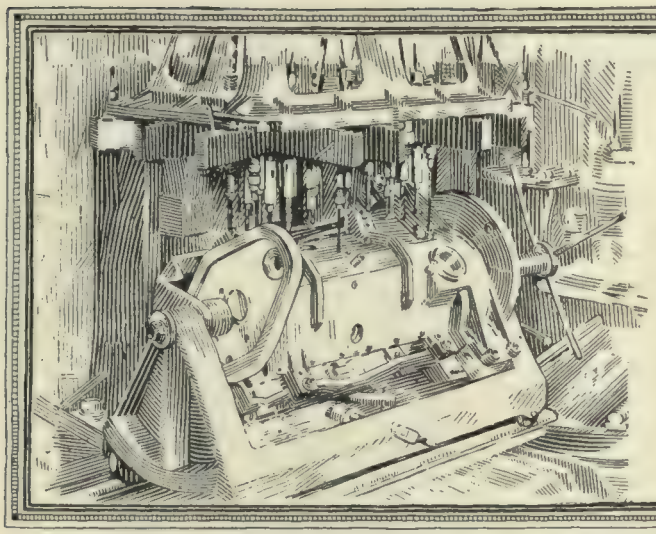
Knowing Why You Do Things

By Foster G. Jones

Referring to the third paragraph under the title "Know Why You Do Things," on page 565 of the *American Machinist*, wherein John Brent states that a machinist's job "is to make chips and that he does not need to know or understand the art of making drawings or figuring pulley or gear diameters," Mr. Brent is in my estimation absolutely wrong. The progressive machinist of today is getting a technical education, or is striving for more knowledge in the mechanical field, of which the machinist trade is such a minute part; and in this way he becomes a bigger asset to his employer and at the same time his capacity for making chips is not lessened.

About two years after I had started my apprenticeship my employers opened a trade school, giving the apprentices four hours a week out of the regular working hours to study mathematics, shop problems and mechanical drawing. This technical training of only four hours a week gave us the desire and aroused our ambition to go farther into the study of the subjects; with the result that we boys enrolled in night schools or correspondence schools and in this way received a liberal technical education which, combined with the practical experience, produces better machinists, better workmen and men better equipped to assume the duties of management. I have the highest regard for the industrial trade school and the company that gave me the opportunity to attend one.

My advice to the apprentice who is learning the machinist trade is to get all the knowledge he can of the different divisions that are in line with his trade; for the machinist trade is one of the starting points in the mechanical field. The machinist with a technical education has the foundation for making a better designer, engineer, or executive than the man who has only the technical side. So get busy—throw over the shifter and start making chips but do not forget to do a little diligent studying as you go along. It leads to bigger things.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
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Drill Jig Design Continued—Plain Clamps—Multiple Clamps—Hook Bolt and Wedge Clamps—Equalizing Clamps—Spring Plungers and Jacks

IN LOCATING a piece of work in a jig there are several points which must be looked after very carefully, in order that the piece may seat itself properly, may locate against portions of the casting which are not likely to vary and may be clamped securely without any danger of distortion. We have gone very thoroughly into the principles of locating the work in a previous article and we have taken up the various points which influence the design of a satisfactory jig. It must be borne in mind that there are numberless varieties of clamps which are used for various conditions

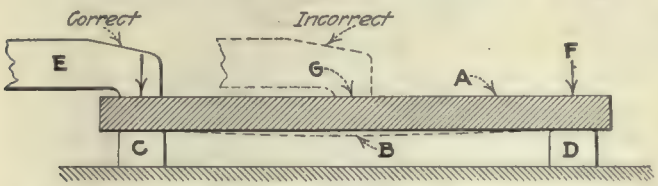


FIG. 36. CORRECT AND INCORRECT METHODS OF CLAMPING WORK

found in jig work in many factories throughout the country and that it is the selection of the proper type of clamp which shows the skill of the designer.

It is of primary importance that the clamp should not tend to force the work away from the locating points when pressure is applied to it. It very frequently happens that the bearing which the clamp obtains on the work is not quite what it should be and as a consequence the work is forced away from its bearing and locating points so that inaccuracy is the result. In handling delicate work it is important that the clamp should not be applied to any portion which is likely to spring out of shape or to be distorted, making the finished product inaccurate. Great care must be exercised when several clamps are applied on different portions of a piece of work. When a condition of this kind arises the clamps must be designed in such a way that they will equalize and distribute the pressure so that the work will not be tilted out of its true position.

In Fig. 36 are shown both correct and incorrect methods of clamping. With the work *A* set up on lugs at *C* and *D*, the clamping action should be directly over these points as shown at *E* and *F*. Pressure should never be applied at point *G* for the reason that it would be apt to distort the work so that it might take the position *B*. This is a principle in designing but it does not apply to every case. We might easily imagine a heavy piece of work which could be clamped at *G* without causing any trouble. On light work the principle mentioned must be very carefully adhered to.

Several types of plain clamps which are commonly used in jig design are shown in Fig. 37. These clamps may be varied to suit particular conditions; that is they may be bent into different shapes and they may be operated by means of a screw in the middle or at the end, or they may be pivoted. They may be shaped to conform to a peculiar casting and they may have a very narrow bearing point where they come in contact with the work. In fact they may be changed to suit an infinite number of conditions. There is shown at *A* a clamp commonly called a U-clamp which is made of a single piece of steel bent into a U-shape. This type of clamp is frequently used in faceplate work, and on milling machines or boring mills, using a T-bolt as indicated. The clamp shown at *B* has a guide and support at *C* which prevents it from turning and getting out of position with the work when it is not used. The slot at *D* allows the clamp to be pulled back away from the work after the piece has been machined. This type of clamp is in common use for many varieties of jig work.

The clamp shown at *E* is similar to *B* but it is operated and guided in a different manner. The operator applies pressure to the clamp by means of the thumb-knob *F* on the end of the screw *G*. When releasing the work the screw slides along in the groove at *H*. This groove also serves to keep the clamp in alignment with the work when clamping.

Hook-Bolt and Wedge Clamps

At *A* in Fig. 38 is shown a hook-bolt clamp, frequently found very convenient for work not easily reached with the ordinary form of clamp, or when there is not room enough to permit the use of a plain clamp. In using a hook-bolt the heel *B* of the hook-bolt should be "backed-up" so as to take the pressure resulting when the clamp is tightened. Unless provision is made for taking up

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pressure there is a possibility that after continued use the hook-bolt may become bent so as to be practically useless. There is a tendency on the part of tool engineers to avoid the use of hook-bolts for this reason. We consider however that a hook-bolt is too useful an adjunct to be cast away. There is no objection whatever to a hook-bolt when it is backed up as shown by the upper view at *C*, as the strains of clamping are taken by this backing up lug so as to prevent any bending of the hook-bolt. When used in this way it will be found that many problems in clamping are simplified.

A wedge clamp is shown at *D* and although this form of clamp is not recommened for all work there are certain cases where it can be applied to advantage. The wedge is likely to distort the work for the jig, but in certain cases suitable provision can be made to counteract this distortion in the fixture and when this is properly done no difficulty should be experienced in its use. There are certain factories in the country which use jigs with wedges to a considerable extent. Sometimes a wedge is hung by a piece of closet chain and fastened to the jig so that it will not be lost. At other times the wedge is made extra long and pins are inserted at each end to prevent its being lost or falling out of the jig.

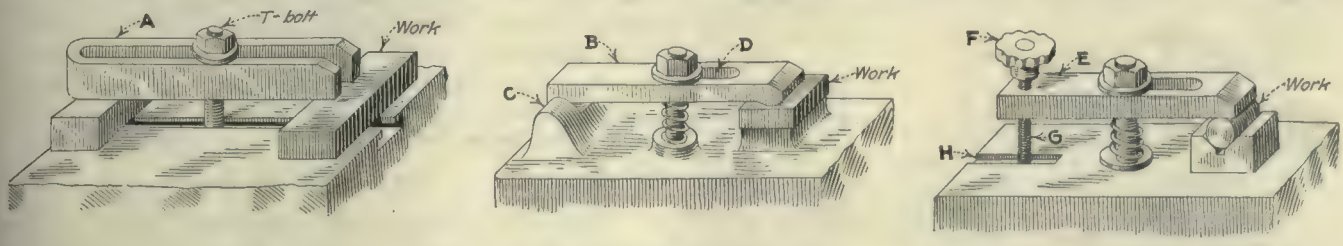


FIG. 37. TYPES OF PLAIN CLAMPS

A somewhat similar arrangement is shown in the clamp *G*. It is somewhat more elaborate but has the advantage of being made up in unit form so that it can, if necessary, be standardized and made up in quantities when the occasion warrants. The section *A-A* shows another view of the block with the sliding clamp in position in the block *H*. In operation the clamp is slid forward until it comes to rest over the pin *J*, after which pressure is applied by means of the thumbscrew. It is an excellent clamp which is easily operated and a form similar to it is used in great quantities by one very large manufacturing concern in the Middle West.

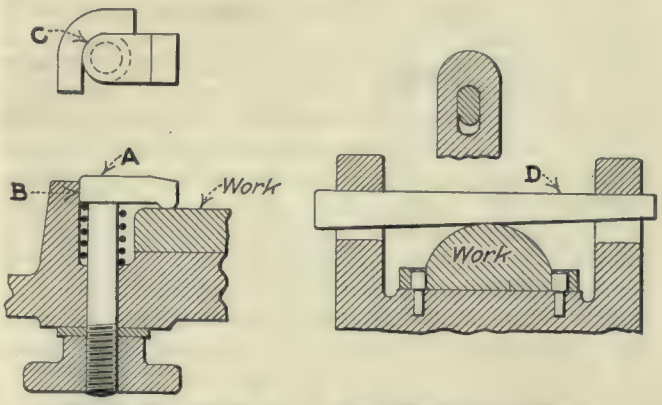


FIG. 38. HOOK-BOLT AND WEDGE CLAMPS

Suggestion for Clamping

Fig. 39 shows a group of representative clamps which can be applied to many varieties of work. These illustrations are diagrammatic and serve to show principles rather than careful details. The clamp *B* should not be used except when the work is located over pins or in some other way which prevents it from moving when the clamp is applied. This particular clamp is operated by a lever *C* and slides forward on the work as the stud *D* rides up on the angular hardened block *E*. A pin or nut on the end of the stud *F* takes the pressure of the clamp.

In order to avoid throwing a piece of work out of alignment when clamping, the scheme shown at *K* can be used. The work locates in a V-block and the pin *K* is adjusted by means of the collar screw *L*. This type of clamp applies the pressure directly to the work without any turning action.

The clamp shown at *M* is not used frequently, but there are occasions when a piece of work like that shown

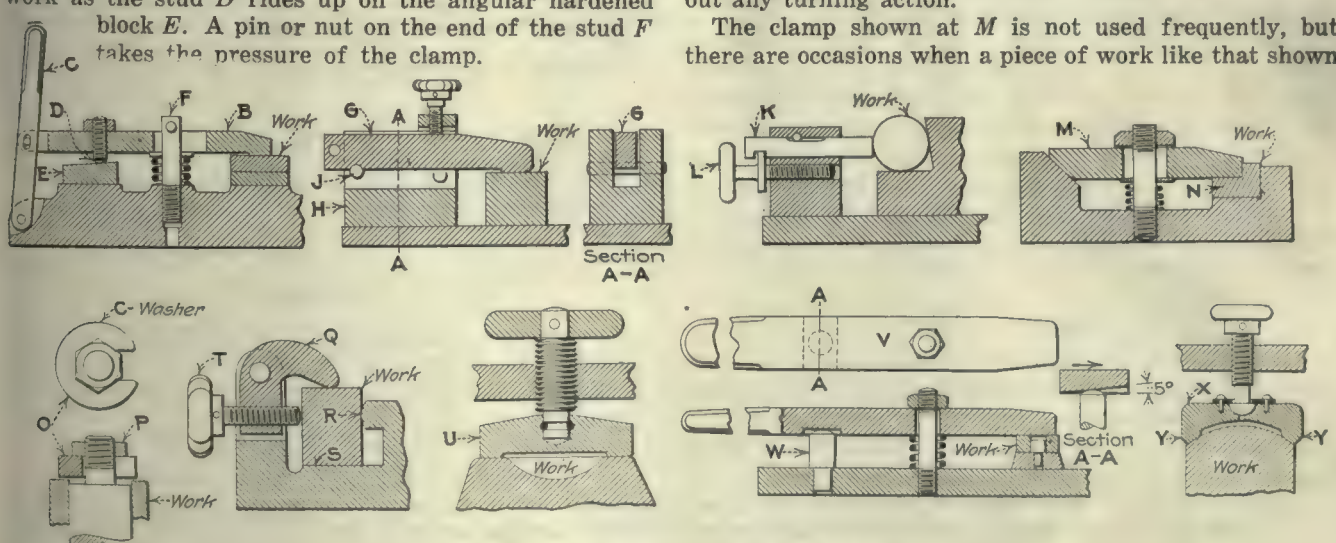


FIG. 39. GROUP OF REPRESENTATIVE CLAMPS

at *N* can be held to advantage by this type of clamp. The objection to it is that it must be loosened considerably in order to remove the work unless it is possible to slide the piece out of the jig end-wise.

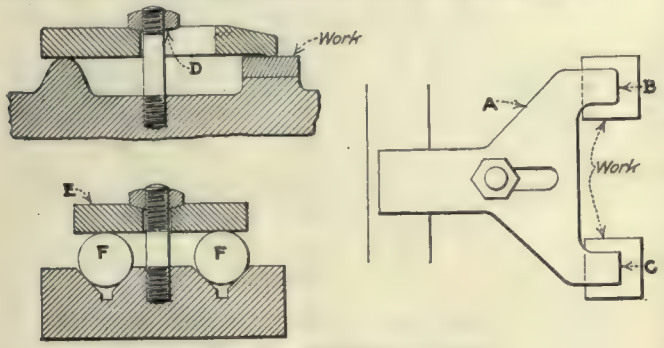


FIG. 40. MULTIPLE CLAMPS

The C-washer clamp shown at *O* is too common to need much description. In its simplest form it is a washer, cut out on one side so that when the nut *P* is loosened it can be slipped out readily. After this the work can be removed without difficulty and without removing the nut.

The clamp shown at *Q* is very useful on small light work. It is rapid in its action and serves to clamp the work at *R* and *S* at the same time. When the thumb-screw *T* is operated equal pressure is brought to bear in the directions indicated by the arrows. Particular attention must be paid to the position of the points of contact in relation to the pivot pin or more pressure will probably be applied in one direction than in the other.

The clamp shown at *U* is commonly called a "button" clamp. It is useful for small work and is so made that the portion *U* does not revolve but is hung loosely on the end of the screw so that when pressure is applied it adjusts itself to the work. The button may be made large or small according to conditions. It is a useful clamp and is found in many varieties of light jig construction.

A somewhat peculiar type of clamp is shown at *V* whose use is limited to finished work. Furthermore the work must be positively located in order that it may not be forced out of position by the action of the clamp. The operation in clamping is a swinging one as indicated by the arrow and the clamp is so made at the point shown in section *AA*, that a wedging action takes place between the clamp and the top of the pin *W*.

Another type of clamp, with a "button" end as shown at *X*, is similar to that shown at *U* except that the screw which operates it has a ball-end as indicated, in addition to which the clamp itself is made with three points *Y* separated 120 deg. so that the three points will bear with uniform pressure on a regular surface. A clamp of this kind is frequently used for holding the round end of a piston in automobile work, but other applications may frequently be found in the general run of jig work.

Multiple Clamps

It is frequently necessary in clamping a piece of work to apply pressure simultaneously at two points which are widely separated. Sometimes the clamp is applied to two pieces at the same time while at others it may be at two points on the same piece of work. The example *A* shown in Fig. 40 is of a plain clamp spread out at the end so that the points *B* and *C* bear on the work. If the work has been machined it is unnecessary to provide anything more than a plain nut for clamping, but when the work is "in the rough" it is advisable to provide for inequalities by making the portion *D* in the form of a ball so as to permit the clamp to float enough to take care of the inequalities in the casting. The clamp *E* is commonly used to hold two pieces of work at the same time as indicated at *F*. It can be swung around side-wise after the work is machined to allow the pieces to be removed.

Equalizing Clamps

When it is necessary to hold several pieces at the same time or to apply pressure equally to three or four pieces at the same time, an equalizing clamp must be used. It is difficult to illustrate all of the various types of equalizing clamps which are used in jig work, but the principles underlying the design can be simply shown as in Fig. 4. In the first part of the illustration, the work consists of two pieces set up and clamped uniformly with the same screw at the same time. When pressure is applied by means of the screw *B*, there is a reaction through the lever *C* on the end of the pin *D* so as to force the clamp *E* down on the work. At the same time the re-action of the screw forces the clamp *F* down on to the work on that side of the jig with an equal amount of pressure.

In clamping four pieces of work a similar principle can be applied as shown at *G*. An equalizing lever is provided at *H*, pivoted at *J* where the leverage is applied. The pressure will be equal on the rods *K* and *L* and also on the clamp *M* and *N* so that the four pieces of work will be held with uniform pressure. The piece *Q* is clamped at both ends at the same time by means of the clamps *R* and *S* when pressure is applied at *T*. By the addition of various levers which must be properly pivoted it is possible to hold a number of pieces at the same time with equal pressure. It must always be remembered however that the power which is applied must be in direct proportion to the number of pieces which are to be clamped. An odd number of pieces is more difficult to clamp than an even number. In order to clamp three pieces at *G* instead of four, it is necessary only to provide a fulcrum at *X* in place of the work

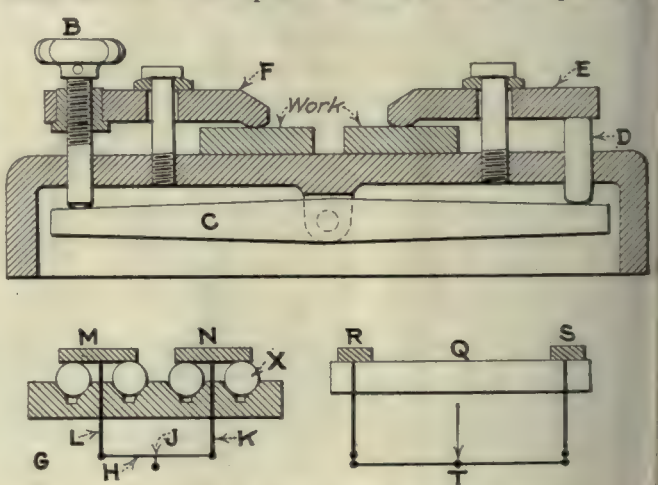


FIG. 41. EQUALIZING CLAMPS

Spring Plungers and Jacks

In supporting a piece of work in a drill jig or a milling fixture some of the points of support must be made adjustable when the work is a rough casting. There are also a number of cases where jacks and spring

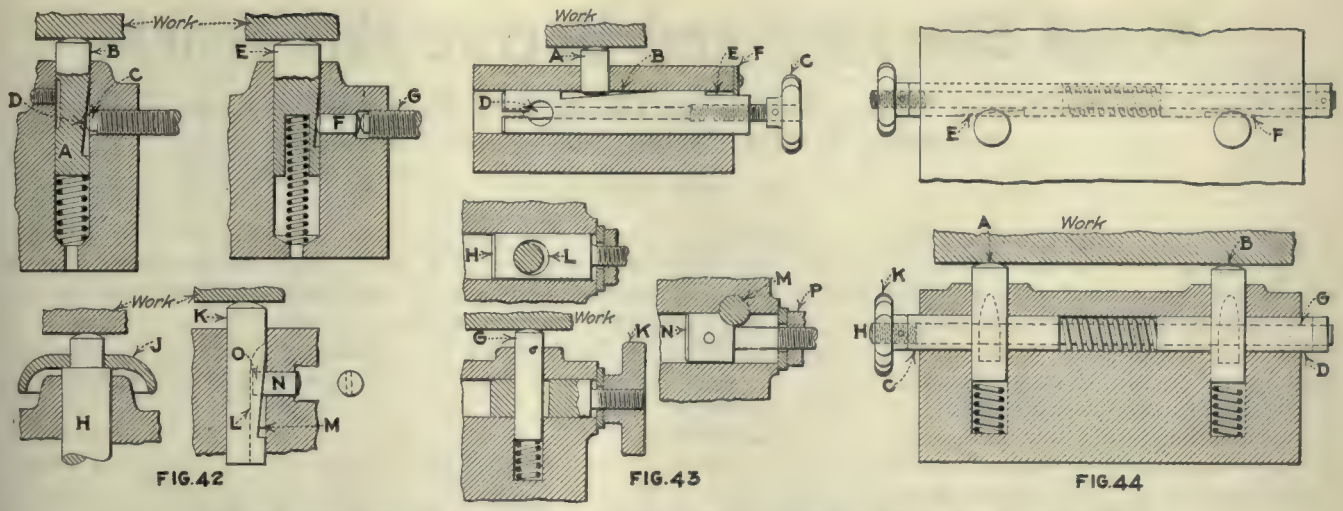


FIG. 42. SPRING PLUNGERS AND JACKS. FIG. 43. SPRING PLUNGERS AND JACKS.
FIG. 44. LOCKING TWO SPRING JACKS AT ONE TIME

plungers are used not only as a support but also to throw a piece of work over into a certain position. As a general thing spring jacks are made in such a way that they can be positively locked after they have reached a given position, so that there will be no chance of their moving under the pressure of a drill or milling cutter. The locking device used to hold the jack in position is of primary importance. Whatever method of locking is employed it must be such that there is no tendency to produce in the jack a hole or depression that might make it likely to assume after a time one position regardless of the position of the work against which it acts. Many ingenuous arrangements are used.

There is shown at *A* in Fig. 42 a common type of spring jack. Common as this type is, it is open to some objections. The plunger or jack *B* is usually pack-hardened so that it has a soft core. Therefore the action of the round end screw *C* has a tendency, after considerable use, to make a depression or pocket as indicated by the dotted lines at *D*. It is important that the angular surface against which the screw acts should not be too great. As a general thing about 5 deg. is sufficient. Speaking generally, we do not favor this type of jack on account of the objection mentioned.

The jack shown at *E* is very similar in general construction except that it has a pocket for the spring, so that it can be used in more confined fixtures. There is an added improvement also in that the locking pressure is applied through the soft brass member *F* acted upon by means of the screw *G*. There is no turning movement to the plug *F* as it comes against the jack, therefore, it is not likely to wear a perceptible depression.

The jack shown at *H* is practically the same in construction but it is provided with a shield *J* in order to guard against chips and dirt working down into the bearing and causing it to become loose. A protecting cover can be applied to almost any type of jack, but it is necessary only where the jacks are to be used for a very great number of pieces.

Another type of jack, shown at *K*, is milled on one side to form a support as shown at *L* and is also provided with angular surface *M* against which the plug *N* acts. The plug is made with a tongue so that it enters the slot *L* and prevents the jack from turning. The plug *Y* is also cut so that its angular surface bears against the angularity of the jack. There are cases when a jack of this kind may be found very useful.

In Fig. 43 an entirely different type of jack is shown at *A*. Such jacks are used extensively on light work such as typewriter and cash register parts. In the hands of a careful workman they will give good results but they can be made to distort the work considerably unless properly used. The jack is operated by pushing the plunger *B* forward by means of the knob *C*. The workman must know by the "feeling" that he has applied all the pressure necessary after which he turns the knob *C* slightly which causes the taper pin *D* to expand the end of the plunger *B* so that it locates firmly. The end of the plunger *B* is flatted off at *E* and a plate *F* is provided to prevent it from turning.

An excellent type of jack is shown at *G*. The binding or locating action is produced by drawing up on the plunger *H* by means of the knob *K*. The hole *L* shown in the upper view is usually made about $\frac{1}{32}$ in. larger than the jack. A jack of this kind will exert a great deal more pressure, but it is somewhat more expensive to make than some of the others mentioned. It is apparent that when considerable pressure is required the knob *K* can be replaced by a nut that can be tightened by a wrench.

Another type of jack is shown at *M*. It is similar in general construction to the one just described, but the location action is somewhat different. The plunger *N* is concave at *O* to the same radius as the jack so that when pressure is applied by means of a nut at *P* the friction against the jack is sufficient to keep it from slipping. There are other designs which can be used for spring plungers and jacks but the ones illustrated are more commonly used in jig work.

Fig. 44 shows a method of clamping two jacks simultaneously. Assuming that the jacks are bearing on the work at *A* and *B* in such a way that it is necessary to lug them at the same time in one operation, the method shown can be used to advantage in many cases and other developments can be made to suit particular conditions. In the case shown the locking devices consist of two sleeves at *C* and *D*. These sleeves are tapered slightly on one side at the points *E* and *F* to engage with the tapered portions of the jacks *A* and *B*. Rod *G* extends through both of the sleeves and is threaded at the end *H* so that when the knob *K* is turned the two sleeves approach each other and bring equal pressures to bear on the angular portions of the jacks. A nut can be used in place of the knob.

Wood Blocking and Boring-Bar Work

Use of Wood in Holding Work—Boring and Facing With Bars Held on Lathe Centers—Threading With a Boring Bar—Wood Parallels

By JOHN SLOCUMB

ABOUT forty years ago in a jobbing shop in Bangor, Maine, I remember that the wood pile was very prominent. Probably it was too prominent, and too much used, but there are certain uses for wood in some set-ups on a lathe, a planer, or a milling machine, and I want to call attention to some of them.

In the average machine shop today there seems to be a prevailing belief that any set-up on wooden blocks is unmechanical and sloppy. I have used the lathe largely in boring with boring bar on centers and consider this way, for many kinds of work, equal, if not superior, to any other.

In setting up some jobs in the lathe it is of course difficult to get the work central and in alignment, for the reason that it is bolted to the lathe carriage and there is no cross or vertical adjustment. I have seen a great deal of time wasted in setting up jobs on the carriage of the lathe by using parallels, V-blocks, knees and shims.

Suppose the piece to be machined is an iron casting

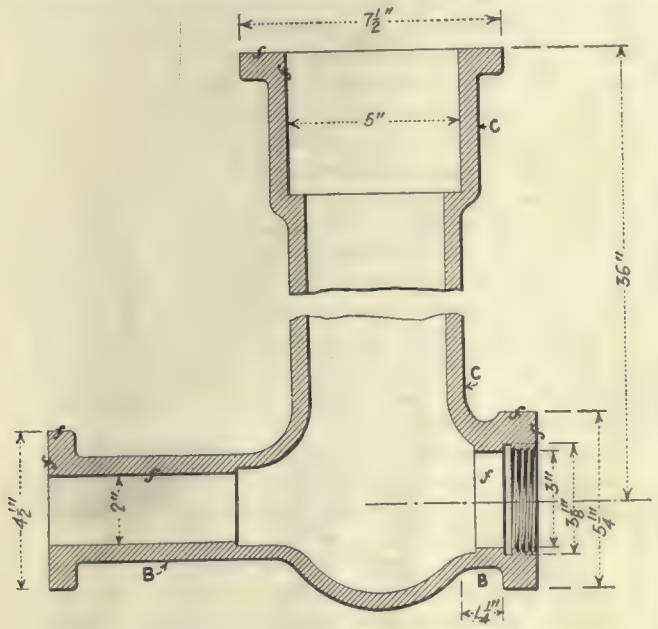


FIG. 1. CASTING TO BE BORED AND THREADED

as illustrated in Fig. 1. The left flange is to be faced and turned on the edge and the center hole bored. The right end is faced on the flange, edge of flange turned, center hole bored, and outer end threaded. The side extension is too long to swing in a small lathe. This job might be handled on the boring mill if it were not for the threading. It is very easily handled in the lathe using the wooden set-up as illustrated in Fig. 2.

In using an ordinary 16- or 18-in. lathe on a casting of this kind I use hard pine or spruce, planed all over 5¾ x 2¾ in. and bolt two pieces across the carriage as shown. If the tool block is in the way it must be removed. I bore out the wood, using a wood-cutting fly tool in a boring bar to fit the circle of casting at points *B* and *B*. Then I clamp the casting down in these recesses which align and center it at once, and hold it very firmly. A slight roughness of the surface will imbed itself in the wood making it hold better than when holding on iron.

Where there are a number of similar pieces to be done, this way is especially advantageous for the reason

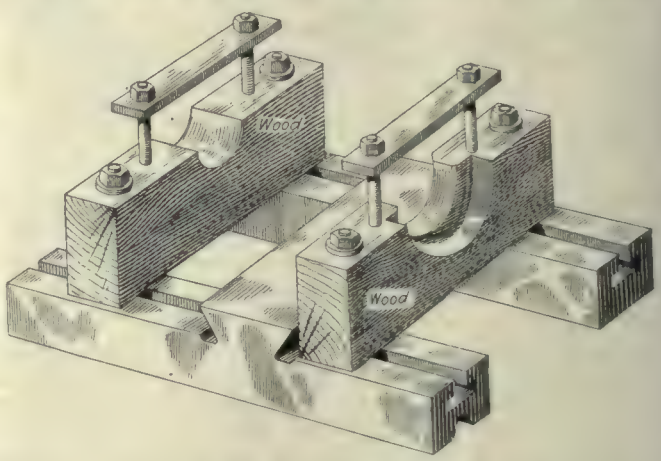


FIG. 2. WOOD BLOCKING FOR HOLDING THE CASTING

that once the wooden foundation is made the change from one piece to another can be made very quickly. Sometimes castings from the same pattern will vary as much as ⅛ in. in diameter, and so I first caliper all the castings and bore the wood to suit the smallest, then a light cut is taken through again when I come to the large ones. I do not make the wood come quite up to the center of the casting, so that the bore in wood is not quite a half circle. For this reason I cannot caliper the bore, but if it is desired to do so, small pieces of wood can be nailed on to increase the height, so as to cut somewhat more than a half circle and allow calipering.

I have no difficulty in boring to the proper sizes by merely setting the fly tool out of the boring bar the proper distance. Have the boring bar run true at the point where the cutter is located and measure its diameter at that point. Then subtract this diameter from the size you propose to bore in the wood and one-half of the remainder is the amount to make the tool project from the bar. For this purpose I have no difficulty in using a common steel scale with sufficient accuracy.

Before bolting the timbers down on the lathe I strike a rough circle with a pencil on their faces and saw and chisel out a rough notch which helps in the boring.

It will be noticed by this method that it is easy to

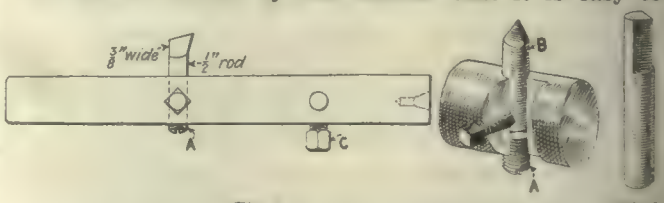


FIG. 3 FIG. 4

FIG. 3. BORING BAR WITH FACING AND THREADING TOOLS. FIG. 4. CUTTER FOR FINISH-FACING

bore the two different diameters to suit the two ends of the casting, and in this case where the right end is only 1 in. wide where it is set into wood, the wood is easily narrowed up to suit with the fly tool, or a round corner can be cut. In fact, the wood can be shaped to the casting whatever it may be.

In facing the left flange it is of course best to have a facing head on the boring bar with a tool block actuated by screw and star wheel, but in the absence of this I use a tool for roughing as shown at the left in Fig. 3. For the work shown this tool would be made of ½-in. drill rod with the top face flattened to about ⅜ in.; then use a ⅜-in., 16-pitch adjusting screw and set out one turn of the screw at each revolution of the bar. This is for roughing, and to keep under the hard scale of the casting I use a small cold chisel ⅛-in. wide, and at each turn I set out the cutter and chip a little niche in the casting to admit it. For finishing I use a cutter as shown in Fig. 4, and then where the flange is too wide to scrape clear across, set out the cutter, and face by suitable stages. In cutting the internal thread use

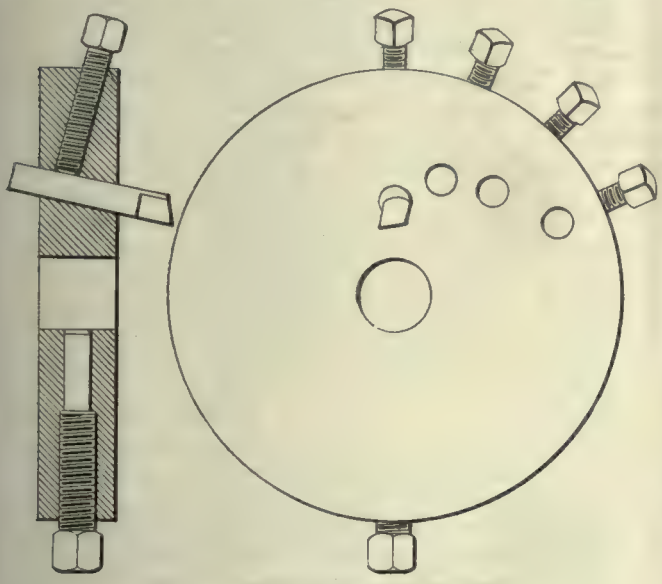


FIG. 5. SHORT BAR FOR FACING

a cutter as shown at *B*, Fig. 3. This cutter is made of ⅜-in. drill rod flattened on top about ¼ in. for a setscrew. Use a ⅜-in. 16-pitch headless adjusting screw and set out about one-quarter turn to each cut. As in facing, the lathe must be stopped to adjust the tool and the tool must be locked fast by the setscrew *C* each time.

To run the carriage back I drop the back center of the bar slightly off the lathe center with the cutter in the up position. This lets the cutter down enough to clear the thread, when the apron nut can be dropped out and carriage run back by hand.

To cut the recess I use a flat-end cutter in the same hole that I use for the threading cutter and use the same setscrew and adjusting screw. I use a stop clamped to the ways of lathe to locate carriage.

To adjust the tool, slack off back center slightly and run carriage ahead so the adjusting screw can be gotten at. Move tool out sufficient for cut and tighten the setscrew. Then run carriage back against stop, tightening back center enough to bring the cutter up in contact with work, and start up the lathe, then, by tightening the back center, the cutter is moved up for its cut. Repeat this process until the recess is sufficiently deep.

To turn the edge of the flange a good way is to use a collar on the boring bar as shown in Fig. 5. In this collar there are four holes for the cutter at different

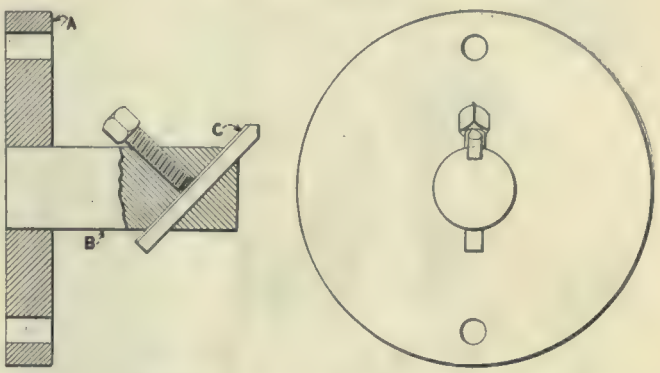


FIG. 6. BORING BAR MOUNTED ON FACEPLATE

distances from the center, and each hole is drilled and reamed at a sufficient angle to allow for some radical adjustment, which is made by adjusting the cutter endwise.

In finishing the long side or projection on the casting, it is fitted into wooden timbers the same as before, resting in bored out recesses in the wood at points *C* and *C*. In this case, as the boring bar cannot pass through the work as it did in the first operation, I use the tool as illustrated in Fig. 6 in which *A* is a cast-iron plate bolted to the small faceplate; *B* is a short boring bar shrunk in the cast plate and carrying the cutter *C*, and has binding and adjusting screws in its end.

Where the hole to be bored is small in diameter, the bar can be simply an arbor fitted to the center hole in the spindle, but for heavy work the center hole is usually too small. In order to accurately square the face of the projection with the first flange, it is only necessary to carefully line the first machined flange with the ways of the lathe by adjusting the timbers on the lathe carriage after the work is in place for the second operation.

In the old shop at Bangor, Maine, we used to bore a lot of cast-iron bevel gears in small sizes, say 18 in. and under. Where there were a number of same kind to do, we used to bolt some hard wood (usually maple) to the faceplate of lathe and bore it out to suit bevel of face of gear and to such depth that inner ends of teeth would bottom. See Fig. 7.

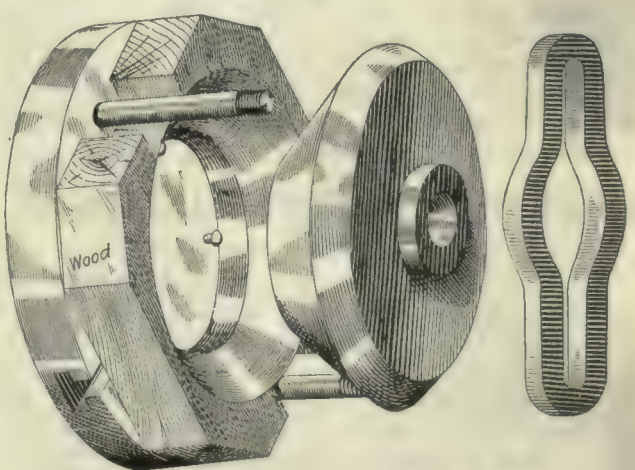


FIG. 7. WOOD CHUCK FOR BEVEL GEAR

When the gear is clamped in, as shown, it holds very firmly, and, of course, always trues itself nicely. When a great many pieces are to be done this is a rapid way of chucking.

I remember one job in the old shop where there was a large number of 2-in. malleable elbows to be rebored

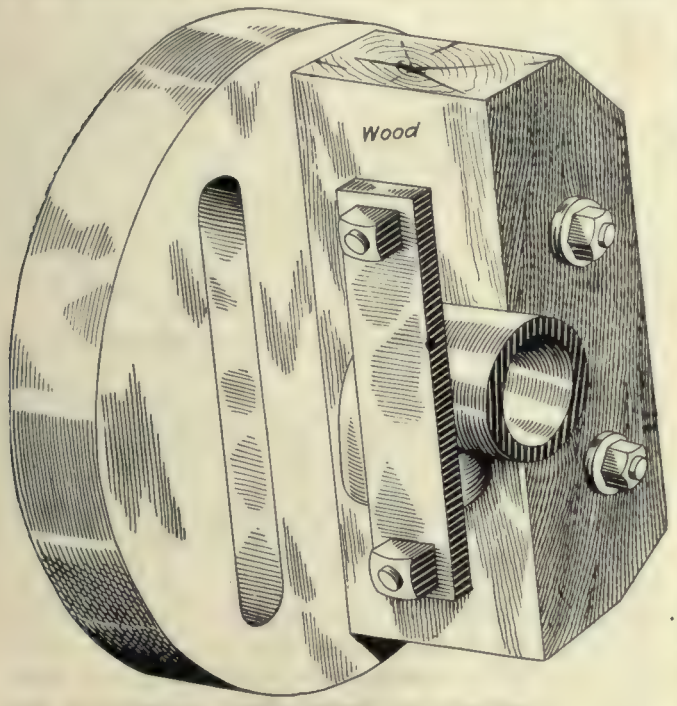


FIG. 8. WOOD CHUCK FOR ELBOW

and threaded for thin tubing. For this work a piece of hard maple was bolted to the faceplate of lathe as shown in Fig. 8, with a recess carefully made to make one-half of the elbow as shown, and bolts and straps were used to hold the piece down. Where it is desired to square the threads accurately it can be done by facing each end of the elbow at the same setting in which the thread is cut. When they are turned about, square the first side with the faceplate by planing off the block or by shimming up where it rests on the face-plate

I have used hard maple parallels on the planer to good advantage to support rough castings. The rough surface of the iron imbeds itself in the wood and has great holding power. Wood is better than iron because of its yielding ability, guarding somewhat against springing the work in clamping if care is used in the placing of supports and in the clamping.

In our old shop the pattern and carpenter shop were very conspicuous and considerably used by the machinist. Today the wood working department is most conspicuous by its absence and sometimes a little lumber for blocking is hard to find.

Purchasing Technical School Equipment

By J. R. Camm

Whenever the question of supplying machine tools for any kind of an educational institution arises, those in authority for the contemplated purchases almost invariably ask for a discount from the prevailing price. Sometimes, however, because of a relatively low first cost, they purchase cheap, inferior and sometimes obsolete types of machines. Such procedure is erroneously thought to be administrative economy. With little reflection upon this practice, any fair-minded citizen with a slight knowledge of the kind, character and essential qualifications of machine tools suited for educational institutions will readily see that it is not only bad practice and poor judgment, but unsound economy.

In selecting machines for so important an institution as a vocational, trade, or technical school, it is eminently out of place to make the elements of price, discounts or bids the principal consideration. First-class machine tool manufacturers endeavor to give the highest type of machines for the price. They are not in a position to make discounts, and it is inequitable to ask for discounts. Something cannot be had for nothing, and if a manufacturer is justified in cutting his price for one institution, he should do it for another. This, of course, would be impracticable because it would soon be impossible for such a manufacturer to stay in business, for when goods are sold below the cost of production, or with a margin insufficient to maintain business, the manufacturer must withdraw his machine from the market.

American parents, with their characteristic ideals for the attainments of their children, unquestionably do not hesitate to furnish the finest equipment the market affords. These parents do not listen to the man who says another machine is "just as good," or to the over-enthusiastic salesman who tells them they will "save money" by purchasing this particular machine merely because of its low first cost. Moreover, they do not want their children to be trained upon the products of the manufacturer who fails to change the style of his machine to conform to the best present-day scientific methods of production, neither are they impressed by the money saving arguments of the second-hand dealer who makes no contribution to the advancement of the machine-tool industry.

Young men graduating from a trade or technical school are presumed to possess a knowledge of the best, most practical, and up-to-date methods of machine shop practice. This they obviously cannot possess if their knowledge and practice is acquired by work or training on machines of inferior design and manufacture. The industry of the future will depend upon the type of students that we train in this generation. A great obligation rests upon the faculties of our training schools to supply high-grade mechanics and engineers. In fact, morally, school administrators have no other choice except to provide the best and most scientific models of machines.

It is reasonable to assume that a great injustice is done to any body of students by expecting them to maintain high standards of efficiency on anything except the best equipment that money can buy.

Our Boards of Education and faculties of trade and technical schools are made up of high-minded and broad-gaged citizens, and the writer has no conscious thought of criticism. He merely wishes to call attention to the fact that the best interests of the coming generation of mechanics and leaders in industry, the best consideration for the taxpayer, and the surest possible means of receiving large returns on our educational investments, is to get such equipment as will do the job intended, and do it well. Most people can readily understand that in a training institution, anything less than what is absolutely essential means money thrown away. It is far better to spend no money whatsoever on equipment unless that equipment is of the right kind.

Magnetic Chucks



DESIGN, DEVELOPMENT, CONSTRUCTION

Ellsworth Sheldon
ASSOCIATE EDITOR AMERICAN MACHINIST

VII. The Simmons Chuck

The Independent-Magnet Chuck Is Composed of "Units" and May Be Made of Any Size Without Altering Detail Construction

THE independent-magnet type is to date the youngest of the magnetic chuck family, and incorporates some of the features of both of its progenitors, the single-magnet and multiple-magnet chucks. Like the former, its entire top surface is magnetic; there being no neutral points except the soft metal dividers. Like the latter, it has several pairs of poles, each with its own pair of energizing coils. Unlike either, its magnets are entirely separate from the chuck body, a certain number of pairs forming "units" of which large or small chucks are built up.

The magnetic chuck made by the Taft-Peirce Manufacturing Co., Woonsocket, R. I., called by them the "unit pole," belongs to the class which we have designated "independent-magnet" for the reason that its

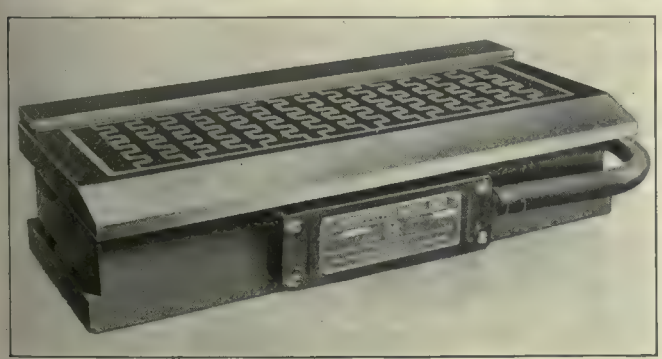


FIG. 112. FACE OF RECTANGULAR CHUCK

groups of magnets are in themselves complete units, each with its own poles and energizing coils, independent of any other group or of the chuck body.

The size of the magnetic group and the number of poles in a group differ somewhat according to the size and weight of the chuck, but a long chuck differs from a short one only in the length of the body and number of units contained therein. Wider chucks are made by placing two rows of units side by side.

In the rotary form of chuck the units necessarily vary in size with the increase in diameter of the chucks, for each unit is cast in the form of a ring of the size required to fill the space inside the chuck.

As the magnets are entirely separate from and independent of the body, the latter may be made of brass, aluminum, or any other suitable material. Cast iron is used in most of the rectangular chucks because it is easy to work, is strong and capable of withstanding rough usage. As the rectangular chuck does not require as much handling as the rotary chuck, the weight is not so important a factor. Rotary chucks that become permanently a part of a grinding machine are also made of cast iron for the same reason. Rotary chucks for use on lathes and for cylindrical and internal grinding are, however, usually made with an aluminum body for the purpose of reducing the weight to be handled by the workman in mounting and demounting them.

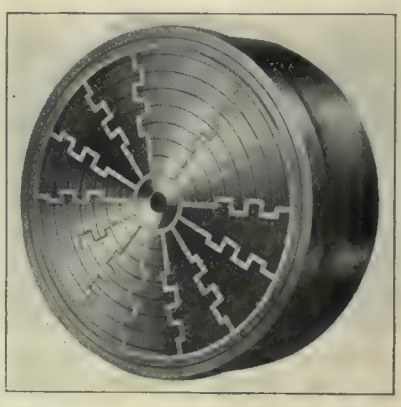


FIG. 113. FACE OF ROTARY CHUCK

The characteristic interlocking polepiece of the Simmons chuck may be clearly seen in Figs. 112 and 113, which show the rectangular and the rotary chucks respectively, and by this feature the chuck may be instantly recognized. There are many chucks whose polepieces interlock but not in just this same pattern.

The inventor of this chuck is Frank L. Simmons of Millbury, Mass., to whom a patent was granted in January, 1918, covering the independent-magnet feature and other constructional details. The patent was immediately assigned to the Taft-Peirce Co., in whose shop the chucks are now built under the supervision of the inventor. Mr. Simmons was not a newcomer to the magnetic chuck game, he having been connected with its manufacture for several years prior to his application for a patent. The original Simmons chuck was built by him at his home in Millbury, the work being done evenings and during such odd moments as could be

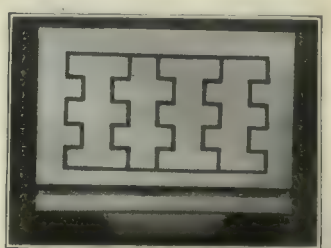


FIG. 114. THE ORIGINAL SIMMONS CHUCK

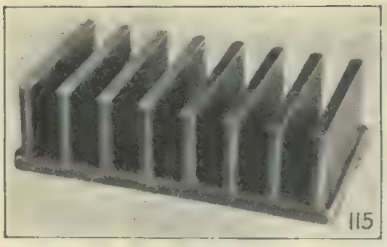




FIG. 115. CORE OF MAGNETIC UNIT FOR RECTANGULAR CHUCK. FIG. 116. CORE OF MAGNETIC UNIT FOR ROTARY CHUCK



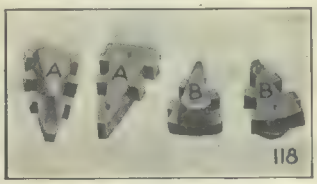


FIG. 117. POLEPIECES FOR RECTANGULAR CHUCK FIG. 118. POLEPIECES FOR ROTARY CHUCK

spared from the daily routine. When finished it was put into service where its capabilities could be tested to the utmost. A picture of this chuck appears in Fig. 114.

It may be noted that the pattern of the original chuck does not conform exactly to that of the standard chuck shown in Fig. 112. There are projections on the end bars of the frame, and there are three differently shaped polepieces. Though there are in the standard pattern four polepieces of different shape, two of them are end pieces that make the projections from the frame unnecessary.



FIG. 119. FACE, OR TOP-PLATE, FOR LARGE RECTANGULAR CHUCK

Magnetic Units of Cast Steel

The magnetic units of the Simmons chuck consist primarily of steel castings which form the back-bar and cores for a definite number of complete magnets. A unit may have any even number of cores, but for convenience in handling the number is limited to eight for the rectangular chucks. Smaller sizes of chucks may have units of six or even of four cores. The units for the rotary chucks are cast in a complete ring and of course vary in size with the diameter of the chuck. Unit cores for rectangular and for rotary chucks are shown in Figs. 115 and 116 respectively.

Very little machine work is required on the core castings. They are ground upon both back and front surfaces and the holes for the holding screws drilled and countersunk and that is all. They are coated with insulating varnish to minimize the possibility of a "ground."

The shape of the polepieces is such as to render these parts readily susceptible to the drop-forging process and they are, therefore, so made from a grade of soft iron selected because of its high magnetic permeability. There are but four differently shaped pieces used in the rectangular, and but two in the rotary forms of chuck; shown respectively in Figs. 117 and 118. In the latter picture each piece is shown in two positions to display the difference between the upper and under surfaces.

Different lengths of each of these pieces containing a greater or fewer number of the lateral projections are made to conform to the width or diameter of the chucks, but other shapes are not required. In the large top plate shown in Fig. 119 there is one each of the pieces *A* and *D* (Fig. 117), and about thirty each of the parts *B* and *C*. The plate in Fig. 119 is 6 ft. long.

Top Plate Is a Frame

The top plate of a Simmons chuck is not a plate at all until the polepieces are set, but a rabbetted frame, rectangular or circular as the case may be. The polepieces are machined on the bottom where they make contact with the cores, and in a later operation the contour is finished by a gang of cutters while held in special fixtures so that each piece is made to fit a standard gage. Two small studs may be seen in Figs. 117 and 118, projecting from the upper surface of the pieces, and the first machining operation is the finishing of these studs by means of a hollow mill so that they may act as locating points in subsequent operations. They are swept off in the final finishing of the top plate after it has become a unit.

The non-magnetic filler used to separate the polepieces, and at the same time hold them in place with respect to the frame and to each other, is babbitt-metal. A frame to be filled is laid face down upon a large cast-iron bench plate where it is located by adjustable gage pieces held by clamps. The polepieces are now set in their respective places; the small studs entering holes in the plate to locate and hold in place each piece during the pouring and staking operation. Because of the milling to exact size and shape of each piece and the exact location made possible by the studs—by which the pieces have already been located in the milling fixture—there is no uncertainty about the thickness of the non-magnetic dividers; the distance between pieces has been carefully calculated and can be positively maintained.



FIG. 120. STAKING IN THE NON-MAGNETIC FILLER

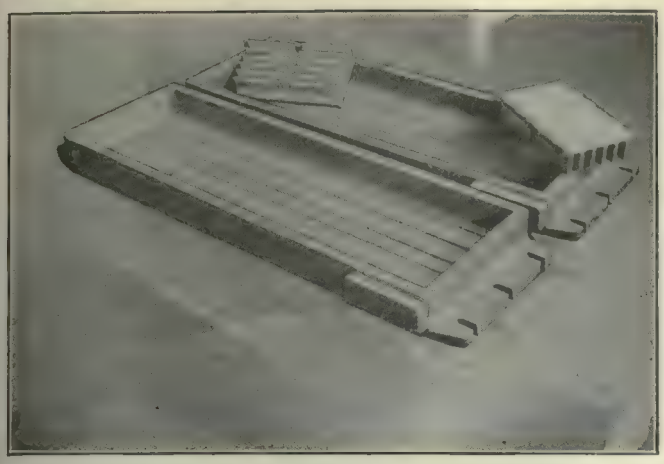


FIG. 121. CAST-IRON SHELLS FOR LARGE RECTANGULAR CHUCKS

The shape of the under surface is such that there is a broad channel between all the polepieces, the depth of which is about one-quarter of the finished thickness of the top plate. Below this channel and extending down to the iron of the bench plate is the narrow sinuous crevice that separates the polepieces from each other and the equally narrow but straight channel that separates them all from the frame. The broad, shallow channels act as runners to lead the molten metal to all open spaces within the frame and thus insure complete filling of all interstices with little likelihood of cold-shuts, imperfect casting, or bubbles. The staking operation, shown in Fig. 120, follows the pouring. The bench plate is large enough so that the pouring and staking operations may be continuous, making it unnecessary—as it would be undesirable—to lift a filled top plate and have to put it back again for staking. The staking is done by means of a pneumatic hammer. On the bench plate shown in Fig. 120 will be seen several of the frames, in which the polepieces have not yet been set, with round-sectioned rods running transversely across them. These rods are of hard brass or bronze, and were laid on the molds in the foundry and the frames cast around them. They thus become permanently a part of the frame; acting as tie-rods to prevent the frame from bulging or spreading in the center from any cause, and being of non-magnetic metal, they do not interfere with the magnetic currents.

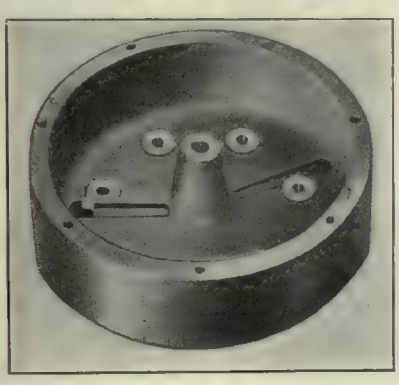


FIG. 122. SHELL OF ROTARY CHUCK

After the soft metal filler has been staked in, the top-plates are rough-milled over the upper surface and are finished by milling and grinding the under surface, which must make a watertight joint with the edges of the shell and at the same time make firm contact with the finished upper ends of the cores.

Rectangular shells or chuck bodies may be seen in Fig. 121. These shells are usually made of cast iron for the reason that this metal combines ease of working with mechanical strength and comparatively low cost, while lightness of weight in this form of chuck is not a serious consideration. They are not, however, allowed to come in contact with the magnetic parts and do not therefore, carry magnetic currents to any extent.

Machine Work Reduced to a Minimum

The rectangular chuck bodies are planed upon the under surface, which is ribbed; milled on the upper surface of the ribs that may be seen in Fig. 121 at the bottom of each shell; milled and ground upon the upper edge of the shell; and milled or planed upon the vertical face of the rectangular boss to be seen near one end. This boss is for the terminal box attachment through which the magnet coils connect to the current supply.

Top plates are held on by fillister-head screws passing up through the sides of the shell, entering tapped blind holes on the under side of the top-plate; the holes for the screws by which the terminal box is attached do not go through the iron; the magnet cores are attached to the bottom of the shell from the inside by brass screws tapped into blind holes. Thus it may be seen there is no opening to the interior of the closed chuck except the one by which the leading-in wires enter, and this is finally covered by the terminal box; the joint between box and shell being sealed by a rubber gasket.

In Fig. 121 may also be seen two of the core units which in this particular chuck (a special large size) are cast in sections of three pairs each; each of the cores being interrupted midway of its length to allow the use of two shorter coils on each core instead of one long one. The units are attached by brass fillister-head screws to the ribs at the bottom of the shell, but are separated from these ribs by strips of bakelite.

In Fig. 122 may be seen the body or shell of a rotary chuck in which the magnetic unit—in this case a ring—rests upon round washers of fiber, or bakelite, being attached by brass screws to the circular bosses shown



FIG. 123. COIL WINDING MACHINE

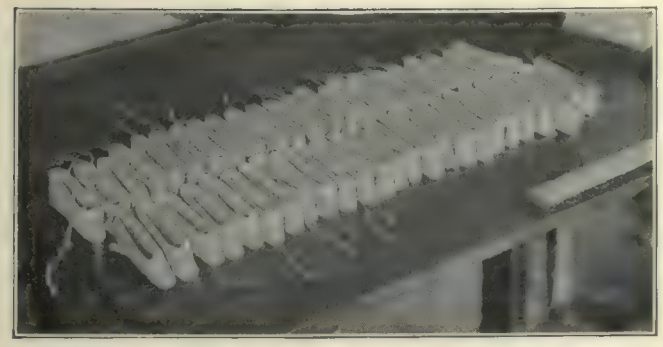


FIG. 124. A BATCH OF COILS READY FOR IMPREGNATING

at the bottom of the shell. If the shell is made of non-magnetic material, as many of the rotary chucks are, the bakelite or fiber insulators are unnecessary.

In preparing the magnet coils for the Simmons chuck, no previously treated fabrics are used; the insulation of the magnet wire is cotton, and ordinary cotton tape is used for binding the coil. This apparent disregard of precautionary measures against grounding is, however, not without reason, as the reader will observe in following out the after-treatment of the coil.

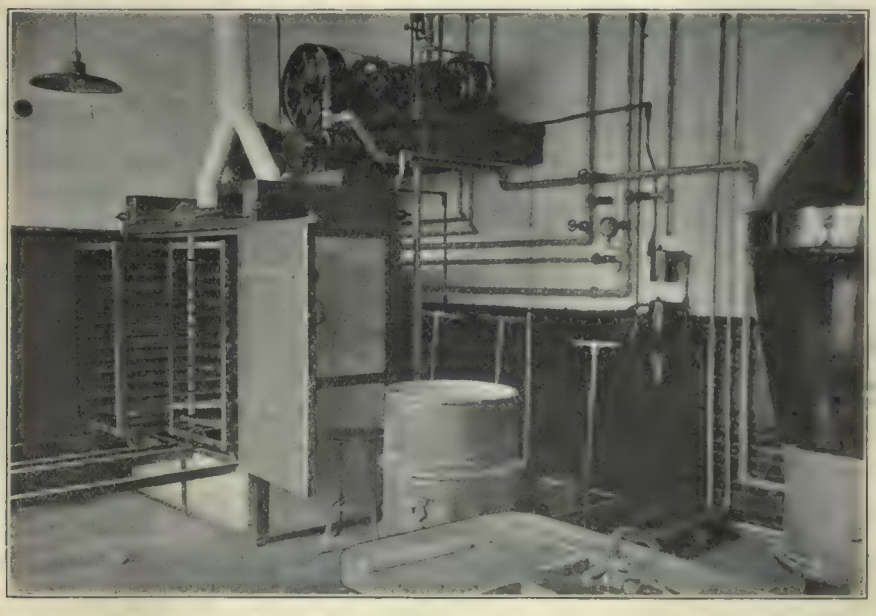


FIG. 125. THE IMPREGNATING AND BAKING MACHINERY

The winding of the coils, shown in Fig. 123, is a job for two girls, one of whom operates the winding machine while the other prepares the bobbins on the small hand-operated device seen at the left in the picture.

The bobbins are of steel or aluminum, according to their size, separable along a diagonal line leading across the body so that a slight pull upon the respective heads of a bobbin will release it from a tightly wound coil and allow the latter to be removed without difficulty.

To prepare a bobbin for winding the operator sets the two halves together, dowel pins locating the parts with respect to each other and a latch upon one of the parts holding them together. Slipping the complete bobbin onto the spindle of the device she lays several strips of cotton tape lengthwise upon it and binds them to the body of the bobbin with a strip of fabric the width of which is equal to the length of the coil. This serves to hold the binders in place and also to hold the magnet wires after the bobbin is removed. The ends of the binding strips are caught under clips to keep them from flying about in the winding machine and the bobbin is ready for the machine.

The machine operator solders a terminal wire to the end of the magnet wire on her reel, slips it through a hole in the head of the bobbin, sets the measuring dials, to the required number of turns and starts the machine. Each revolution counts off one digit on the dials until zero is reached, when the machine stops automatically. The operator slips the filled bobbin off the machine spindle and exchanges it with her companion for a newly prepared one; the other operator then solders on the second terminal wire, ties the binding tape and takes out the bobbin which she proceeds, to set up ready for the next coil. The coils at this stage appear as at Fig. 124.

The reason for the porous cotton insulation will be seen when the impregnating process is considered. The machinery for this purpose is partly shown in Fig. 125, and is somewhat elaborate.

The varnish used for impregnating the coil is quite hard when baked, is impervious to moisture and of a chemically inert nature. The impregnating tanks cannot be seen in the picture for the reason that they are located in a fireproof vault just beyond the brick wall back of the oven. The machinery on the shelf over the oven is for the purpose of exhausting the air from the tanks.

The varnish is melted by steam coils within the tanks and held almost at the boiling point. A basket arrangement in the upper part of each tank can be moved up and down by means of an outside lever after the tank is closed. Each batch of coils is thoroughly baked before impregnating to expel any trace of moisture, and while hot, is immediately transferred from oven to impregnating tank, the cover of the latter closed, and the air exhausted. After remaining in vacuum for several minutes the basket of coils is lowered into the hot varnish and air re-admitted to the tank. Thus it will be seen that the fibrous material with which the wires are primarily insulated is not depended upon for the real insulation; it merely serves to hold all metal parts out of contact with each other during the preliminary construction. Its porous nature permits it readily to give up its moisture while in the oven, to release whatever air may be in the coil while it is in the vacuum chamber, and as readily to absorb the molten varnish which will, when the air pressure is restored, penetrate to and fill all the minute interstices.

After removing the coils from the varnish and drain-

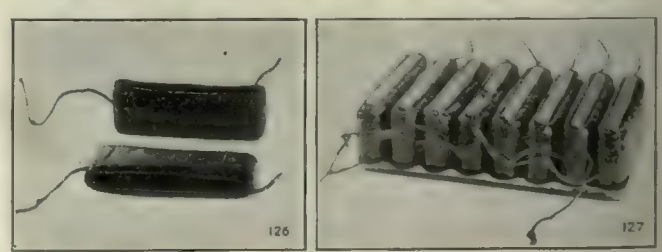


FIG. 126. COILS READY TO BE PLACED ON A CORE
FIG. 127. A MAGNETIC UNIT

ing them they are returned to the oven and subjected to a baking heat for several hours, after which they are shellacked, wound with prepared tape and again shellacked.

Connecting the Coils

A pair of coils ready to take their place in a chuck are shown in Fig. 126. It will be noted that one terminal wire in each coil leads from the edge at one end while the other terminal is taken from about the center, widthwise, of the coil at the other end. This is standard practice in the winding room, and this unvarying position of the terminal makes a mistake in connecting the coils very unlikely. A magnetic unit with its coils ready to be connected is shown in Fig. 127.

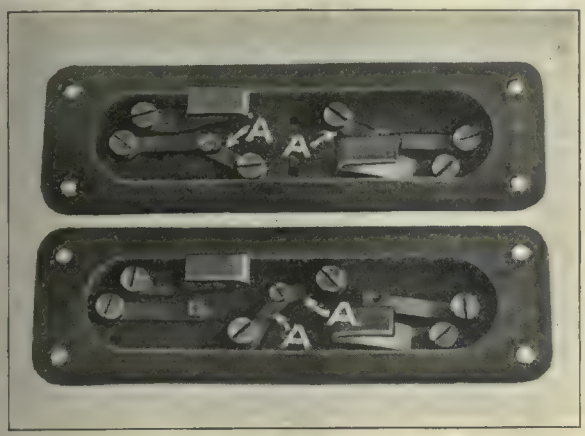


FIG. 128. THE TERMINAL BOX

The Simmons chuck, like nearly all others, is designed to be used in connection with either 110 or 220-volt current. To facilitate changing the connections that adapt it to one or other of these currents the terminal box, the inner part of which is shown in Fig. 128, is made in two parts. The two views in this picture are of the same piece; one connected for 110 and the other for 220 volts. The change is effected by loosening the binding screws that hold the two parts of the swinging connector bar *A A* to the outer terminals, bringing them together and joining them at the center. The only tool necessary to do the work is a screwdriver.

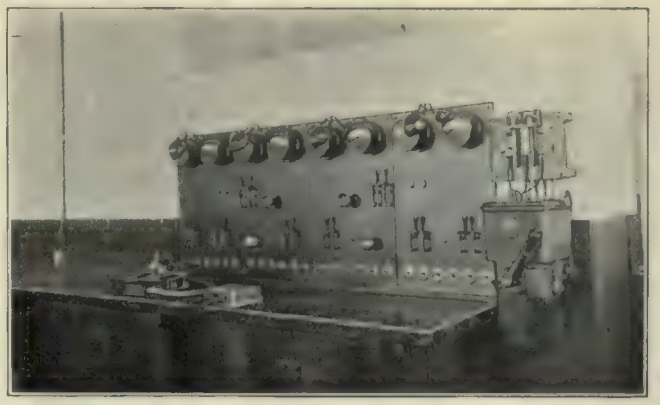


FIG. 129. THE TESTING PANEL

All chucks are tested under service conditions before shipping them out of the factory. They are also given a "ground" test with a high-voltage current. The testing panel is shown in Fig. 129, where there is provision for the attachment of 24 chucks simultaneously. Back of the board is a motor generator set adapted to deliver to the terminals either 110- or 220-volt current as may be desired.

Final Declaration of the Foreign Trade Convention

Immediate Creation of Financial Institutions Under Edge Law Urged — Costs of Railroad Transportation Must Be Reduced — Foreign Service of U. S. Should Be Reorganized

THE eighth National Foreign Trade Convention, composed of upward of 1,500 delegates, representing every part of the United States and every factor of our international commerce, met in Cleveland from May 4 to 7, 1921, to study the problems confronting our foreign trade as a result of present world-wide conditions. As a brief statement of the conclusions reached from consideration of the addresses and discussions at its various sessions, it submits its final declaration and commends these opinions and recommendations to the thoughtful attention of the Government and the people of the country.

The world is suffering today from unbalanced exchanges. Notwithstanding the position of the United States as a creditor nation, the present unstable financial condition of a large part of the world, especially of Europe, is the fundamental cause for our own business depression. A return to normal conditions in our own country depends in large part upon an improvement of our foreign trade. The present retrogression is clearly evidenced by the maximum of the country's export trade $928,000,000 in June, 1920, decreasing in October to $751,000,000 and in March, 1921, to $384,000,000.

Foreign nations whose imports exceed their exports have been compelled to curtail purchases because of inability to pay by exports. The result of this would be eventual restoration of more normal exchange, but the requirements of international commerce and domestic prosperity in each country demand immediate relief from present stagnation.

The United States must continue to increase its imports of raw material and merchandise not detrimental to existing industry in order to receive pay for the exports necessary to stable employment of labor in agriculture and industry; and to permit of the liquidation of the obligations of the debtor nations. Continued liquidation in gold of foreign obligations to us will tend to renew inflation and arrest the beneficial readjustment of values on the basis required by present conditions throughout the world.

Long-Term Credits

It is generally agreed that the solution depends upon our ability to create adequate facilities for the purpose of drawing upon surplus American investment funds in order that the long-term credits so badly needed by the disorganized countries of Eurpose may be furnished. Most of the countries of Europe are unable to pay us now and for some time to come in gold or merchandise, and unless they are enabled to obtain credits to purchase the raw materials which they need, their business and ours will continue to stagnate.

We urge the immediate creation of financial institutions under the Edge law, whose machinery will facilitate extension of long-term credits to promote free exchange of exports and imports. We commend efforts to acquaint our investing public with the necessity of purchasing debentures issued by such institutions against approved foreign securities for this purpose, so that eventually every community will serve its own vital interest in furthering our foreign commerce as a necessary component of domestic prosperity.

Financial Condition Strong

The reduction of loans and accumulation of banking reserves now permit, and the lower prices of many commodities justify, the extension of credits sufficient to accelerate recovery in certain lines. This should gradually thaw frozen credits and end stagnation. It will further provide increasing export and import cargoes for our now partially idle merchant marine and contribute to restoration of economic equilibrium in countries suffering from war debts and inflated currencies and to a proper distribution of commerce in neutral markets.

The increased confidence prevailing in the American business world denotes the disappearance of danger of financial panic. As liquidations progress and reconstruction in Europe proceeds, normal conditions will be restored. Nevertheless, after so great a disturbance in business and financial conditions, it is prudent to recognize that equilibrium will be restored and commerce resumed only by gradual processes. Months may elapse before necessary liquidation will have been accomplished. It will continue to be the part of prudent commercial and financial interests to refrain from hasty and ill-advised expansion, tending through renewed inflation to nullify quickly the present fruitful efforts of conservative business men to lead the country back into paths of safety and sanity.

It is manifest that while many products of our soil have been reduced in value to pre-war levels, a number of manufactured products remain too high in cost of production to compete in neutral markets with foreign goods. It is essential that the substantial reduction in cost of living, which has already occurred in food products and other basic commodities, shall be followed by economies in cost of production until a stable balance of values of all commodities and productive effort is established. No readjustment, however, can be complete without reduction of costs of railroad transportation both for domestic and export shipment. Continuance of our present cost of finished merchandise would maintain unreasonable expense of living and put our products in a non-competitive position in markets of depleted purchasing power.

American Maritime Policy

Congress has declared in favor of private ownership of our merchant marine as soon as practicable, but under present conditions it is impracticable to dispose of any considerable proportion of our merchant marine to private owners at fair prices.

So much of the fleet as can not be chartered on a bare boat basis or time charter to private operators should be laid up pending the revival of world commerce, meanwhile the fleet will serve our national security as a naval auxiliary, in case of necessity.

The plan should be abandoned of allocating ships to load at ports and for trade routes irrespective of the tonnage of cargo offering or of the losses to the Government attendant on this policy.

While it is obvious that the ultimate sale price will be measured by the world market for similar ships, such parity of price and successful operation can be obtained only if the operating costs are approximately equal to those of our foreign competitors.

Present shipping laws requiring larger crews subject American vessels to a disadvantage estimated at 5 per cent on the capital investment, while the compulsory advance of half wages in any foreign port of call adds a further burden of cost by involving excessive delays.

As continued maintenance of the American merchant marine is of vital interest to American producers, exporters and importers, they should require the employment of American vessels in the carrying of their shipment of exports and imports to such extent as they are able to exercise preference or control and in any case they should prevent discrimination against American ships in such transportation.

It is believed that the adoption of these recommendations will save the Government its present large loss in carrying on the existing plan of operation and will insure ultimately the retirement of the Government from the shipping business through the sale to private owners of the fleet at reasonable prices.

Between the United States and its possessions and foreign ports, rapid, regular combined passenger and freight service should be maintained for the prompt and regular carriage of the mails, express freight and merchandise.

The State and Federal governments are urged to remove those disabilities caused by non-uniformity of state laws and excessive taxation which place American insurance at a disadvantage with the foreign insurance market in which they must compete. We urge the enactment of the marine insurance measure now pending in Congress, a model upon which uniform state legislation may be based.

Excessive governmental expenditure in all countries imposes upon the commerce of the world a burden, the further increase of which can end only in disaster. Provision of facilities for commerce is futile if every business activity continues to be oppressed by a multiplication of taxes. For the recovery of normal prosperity the utmost economy in governmental expenditures should be accompanied by unremitting frugality in private business.

Contractual Obligations

Throughout the world the stress of readjustment has been attended by deplorable violations of the sanctity of contracts, emphasizing the absence of adequate international machinery for the enforcement of awards of commercial arbitration. This deficiency should be promptly remedied. In many instances all parties affected by breaches of contracts sincerely believe themselves in the right, as numerous commodities in foreign trade are not standardized. Standardization of the grain, cotton, iron ore and other stable trades has protected them from the defaults so numerous with merchandise to which standardization should, so far as practicable, be applied. Business interests should cooperate with the United States Government to this end.

Through the initiative of the National Foreign Trade Council standard definitions of shipping terms (F.O.B., C.I.F., etc.) in foreign trade have been generally adopted

in the United States. The concurrence therein of commercial organizations abroad should be sought by the council. Revision and uniformity of ocean bills of lading is greatly to be desired now that the hazards of war are removed.

Export Trade and Tariff

We commend the efforts of the American Bankers' Association and other organizations to adopt uniform standards of Letters of Credit.

American export business has been injured in the past by lack of persistent effort to hold markets already gained. American producers are urged not to abandon or lose interest in their foreign trade because it shows no profit for the moment and to remember that in many cases it will cost much more to regain in the future a business lost now through lack of courage and foresight.

The vast market which the United States offers to other nations on a basis of equality, and the supplies of American raw material exported without taxation or discrimination, entitle the American export and import trade to equality of treatment in all foreign markets.

To insure such equality of treatment, the American tariff, whatever its underlying principle, should provide for additional duties on imports from nations discriminating, by tariffs or administrative practices, against the trade of the United States.

Foreign Service

The Foreign Service of the United States should be reorganized and established under a unified supervision which will promote its efficiency, both in diplomatic representation and in the collection and dissemination of commercial information. This reorganization should provide for a permanent career through the establishment of a national training academy for the Foreign Service, which will attract competent and ambitious young men into a life work of constructive effort in their country's service.

Scientific educational training is as essential for our business agents as for our official representatives. It should equip them with accurate and practical knowledge of foreign markets and languages, as well as of the economic social and political conditions prevailing in other lands. The exchange of scholarships, already established with several countries, is a most helpful means to this end, and should be widely encouraged.

Legislative Assistance

The convention urges upon Congress the vital importance of prompt action upon measures affecting our foreign trade now pending before it. Chief among those calling for immediate enactment are the increases of appropriations that will provide for much needed expansion and improvement in the Bureau of Foreign and Domestic Commerce in the Bureau of Standards in the Department of Commerce.

We urge the earliest possible enactment of the China Trade Act, which will permit the formation of American companies to trade in China on a plane of tax equality with their competitors of other nationalities.

We submit that the policy of taxing Americans abroad upon income derived from within the country of residence is fundamentally uneconomic; is really restrictive rather than productive of revenue, and is a handicap upon the promotion of American commerce dangerous to the success of American enterprise abroad and bound to react disadvantageously upon industry at home. The United States is the only great commercial nation which pursues this policy, and we urge Congress to abandon it in the forthcoming revision of the revenue laws.

The steady maintenance of a prosperous foreign trade is as vital to the successful operation of government as to the welfare and contentment of all our people, and we submit that the time has come when the two houses of Congress may well consider the establishment of separate standing committees on foreign commerce as a means of insuring more prompt and effective handling of measures affecting foreign trade.

We commend the improvement of foreign postal communications and the extension of international parcel post service recently accomplished and urge upon Congress the revision of the revenue law necessary to permit the negotiation of a parcel post convention with Cuba, so that our manufacturers and exporters may be enabled to enjoy the same means of access to that market now available to their European competitors.

Waterways and Telegraph

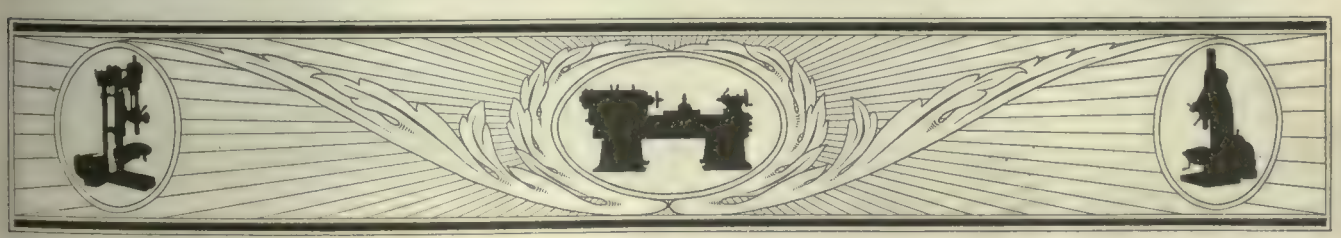
It is essential to the best development of the trade and commerce, both domestic and foreign, of the United States, and for defensive purposes in time of need that our national waterways should be developed adequately and fully utilized.

The popularization of overseas trade by those news and trade publications and press associations which have given valuable space and journalistic skill to the gathering and dissemination of accurate foreign news is recognized and appreciated. In certain sections of the country the supply of foreign news is inadequate for the needs of their industries, and this condition retards public understanding of foreign trade policy, and of the true relation of foreign trade to the welfare and prosperity of our people.

Expansion of the systems of international telegraphic communication, under American control and operation is essential to proper development of our foreign trade.

In the international conventions necessary to establish equal opportunity of all nations in the development of their communications we urge the importance of separate treatment of the two chief methods of communication on radio and cable.

This convention, representing every section of the United States, and without regard to politics, approves the policy of the State Department regarding mandates as expressed in its recent note to the principal powers, and pledges thereto its full support.



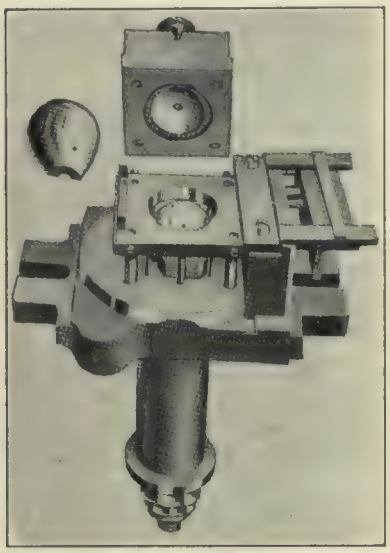
Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Blanking, Forming, Trimming and Piercing in One Operation

By Leonard H. Anderson

The press-tools shown in the accompanying cut were designed to blank, form, trim, and pierce the shell shown at the left of the tools; all in one stroke of the press. The shell is a deflector, used in connection with small electric lamps. The tools were used in a single-acting, inclinable power press of 3½-in. stroke, the stock being fed by hand through the guide attached to the right-hand side of the lower tools. The material used was soft brass of 0.017-in. gage and 4½ in. wide. The upper surface of the lower tool is a pressure pad, backed up by a stiff rubber bumper in the tube below the die and supported in the usual manner upon four pillars that pass through the die-bed and rest upon a pressure ring on top of the bumper. The pressure pad stands normally at a level that just clears the forming punch; which in this case is a part of the lower tool. The piercing punch is in the upper tool and projects just far enough from the surface of the drawing die to allow it to pierce the shell at the instant the drawing is completed.



TOOLS FOR BLANKING, FORMING, TRIMMING AND PIERCING A SHELL IN A SINGLE ACTION PRESS

The trimming punch is at the bottom with the drawing punch mounted on top of it, and is an exact fit for the trimming die; which is the lowest part of the upper tool. The forming die, which is also at the top, does not conform exactly to the drawing punch, but is enough deeper than necessary to complete the form to allow for the slight additional movement necessary to trim and pierce the shell.

In action, the stock is cut off by the right-hand edge of the tool as it passes the stationary shear blade, leaving a square blank that is immediately gripped between the upper punch and the pressure pad. Continuing the movement, the stock is drawn down over the forming punch, the pressure pad serving to keep out the wrinkles, until the trimming die reaches the punch; at which moment the drawing is complete. By reason of the extra depth of the drawing die, however, the press gate is able to continue its movement by an amount sufficient to trim the flange and pierce the shell.

The completed shell is carried up by the returning tools and is stripped by a knockout rod at the top of the stroke, from whence it falls clear of the tools by reason of the inclined position of the press. The scrap is carried up by the pressure pad and is blown clear by a jet of compressed air. The scrap from the piercing punch passes out through the hollow rod in the center of the rubber bumper.

The tools were designed and built by the Phœnix Tool Works, 2 Remer St., Bridgeport, Conn.

Safety Features for Grinding Machines

By J. H. Vincent

In the Decatur shops of the Wabash Railway all belts that are near enough the floor to endanger the workmen are encased in sheet metal guards similar to

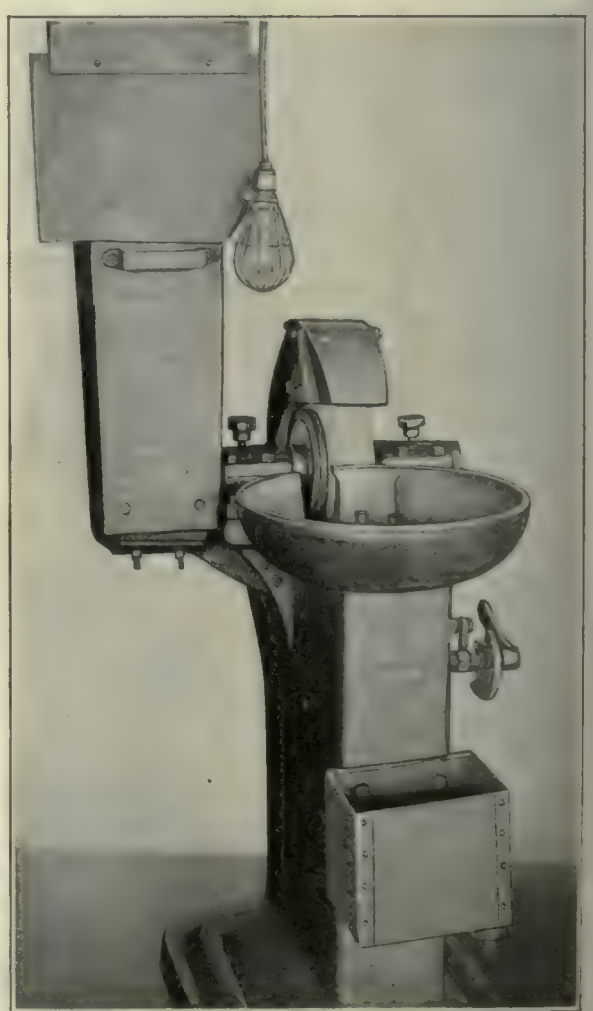


FIG. 1. BELT GUARD ON A GRINDING MACHINE

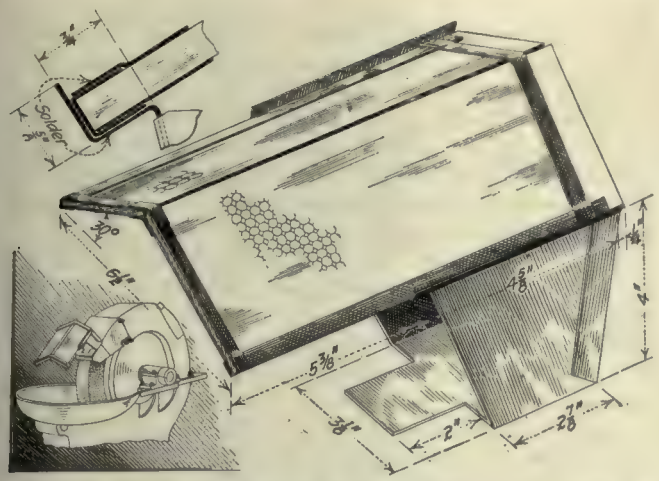


FIG. 2. TYPE OF SPARK GUARD INSTALLED OVER GRINDING WHEELS

that shown in Fig. 1. The guards are so attached that they may be readily removed when it is necessary to repair the belts. They are also used for the prominent display of safety warnings, as witness the one shown.

The guards mentioned on the warning are now being installed on all grinding wheels in the shop. The details are shown in Fig. 2. The guard is readily adjusted so that all sparks and grit particles are prevented from flying up into the workman's face. Wire glass is used in the frame of the guard, as shown.

Countersinking Attachment for the Drilling Machine

By E. A. Dixie

The illustrations show an exceptionally handy little attachment for use where there is a lot of countersinking or counterboring to be done, especially on rough and irregular castings.

The body *A* is of machine steel although cast iron would be quite satisfactory. It is bored to be an easy sliding fit on the drilling machine quill *B*. At the back it is slotted out to clear the feed rack on the quill and a crosshole is drilled for the clamping bolt which is tightened by the lever nut *C*.

A vertical hole accommodates the spring plunger *D*, the bottom end of which is simply a round button head, the other end being threaded for the two check nuts *E* that serve to adjust its movement in the body *A*.

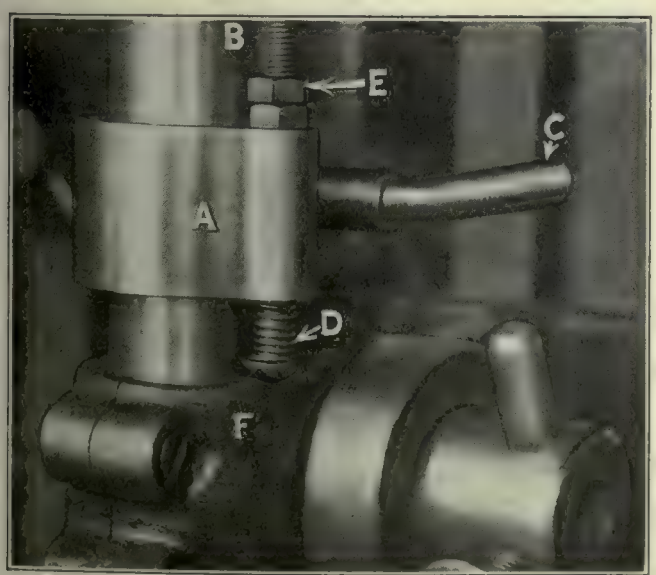


FIG. 1. THE ATTACHMENT WITH STOP EXTENDED

When the clamping lever *C* is loose the quill can be moved up or down without compressing the spring plunger *D*. But when the clamping lever *C* is tightened the attachment becomes virtually a part of the quill and the quill can only be moved downward till the top of the button head on *D* is brought into contact with the face of the body of the attachment by the quill bracket *F*.

A half a turn of the clamping lever *C* serves to release the attachment and for this reason it is very handy for countersinking castings or work of irregular height. The attachment is first set by bringing the point of the countersink down on top of the work near the hole that it is desired to countersink. The stop *D* is then set by adjusting the nuts until the required depth of countersink is obtained, at which time the spring will be compressed as shown in Fig. 2. Obviously a setting once obtained in this way will be correct for any part of the work no matter what its height.

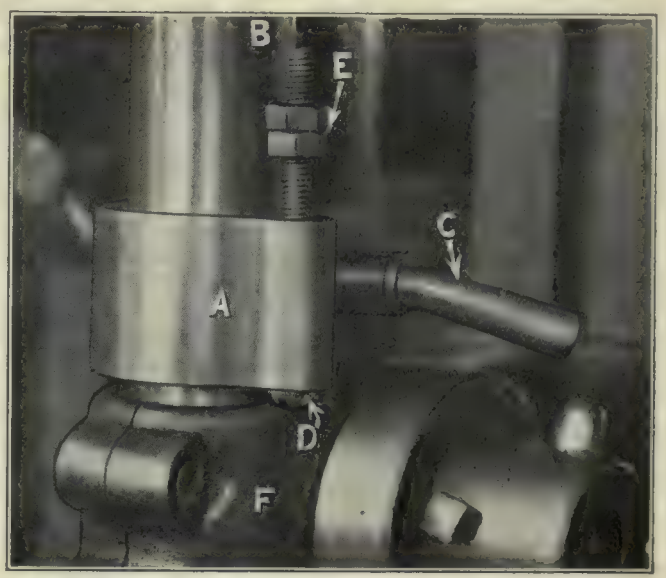


FIG. 2. THE ATTACHMENT WITH STOP COMPRESSED

The different holes in the work are now moved under the countersink and all the operator has to do is to see that the point of the countersink touches the surface of the work at the edge of the hole to be countersunk *before* he clamps the attachment tight to the quill.

In operation the attachment is much more rapid than it might seem to be from the description.

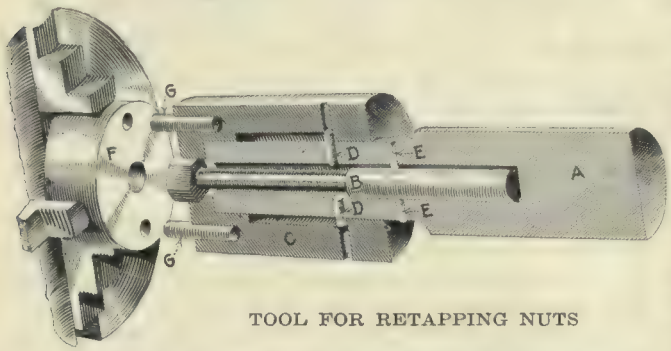
Tool for Retapping Nuts

By Harry Moore

A large quantity of brass nuts was required to be retapped and the fixture shown herewith was made to do the job.

The nuts were retapped in a hand-screw machine and the object of the fixture was to enable the boy to complete the operation without stopping the machine. The tap holder *A* was turned to fit the turret hole and drilled for the tap *B*. Sleeve *C* is a running fit on the turned down portion of *A*, and is recessed to form a lighter bearing and also to clear the pins *DD*, driven into *A*, which prevent the two parts from coming apart. An opening in the front of the sleeve *C* is filed

hexagon to fit the nut. Two pins *EE* driven into *A* engage two slots in the shank of the tap, allowing the latter to slide back and forth but preventing it



TOOL FOR RETAPPING NUTS

from rotating. Piece *F* is gripped in the chuck and has a clearance hole for the tap and two holes in line with pins *GG*. In operation the nut is placed in the sleeve *C*, the holder advanced until pons *GG* enter the holes in *F*. The sleeve revolves, and further advancement of the holder presses the nut against face of *F* and on the tap. Running at a fast speed the machine is reversed immediately the nut reaches the face of *F*.

Know Why You Do Things

By M. H. Ayrbn

With reference to L. S. Watson's query on page 883, Vol. 53, of the *American Machinist* as to why a tool should be set below center, might I be allowed to offer an explanation and also make a few remarks on the setting of tools in relation to the center. There are two shapes of tools that practical experience on a medium and a heavy class of lathe work compel the machinist, if he is observant, to set below center. These are the set-back stiff scraper, Fig. 1, and the swan-neck spring scraper, Fig. 2.

The set-back scraper is used on steel shafting for dry finishing before wet finishing. This tool requires to be ground with very little front clearance but with plenty of top rake, and with a little honing after grinding it will cut very cleanly. A feed of $\frac{1}{8}$ to $\frac{3}{8}$ in. can be used according to diameter and rigidity of work. This tool, if correctly hardened and ground, will remove 0.025 in. from the diameter of a steel shaft 12 in. in diameter, using a $\frac{3}{8}$-in. feed and will carry its cutting edge during a cut 15 to 20 ft. in length. To use this tool, grip as

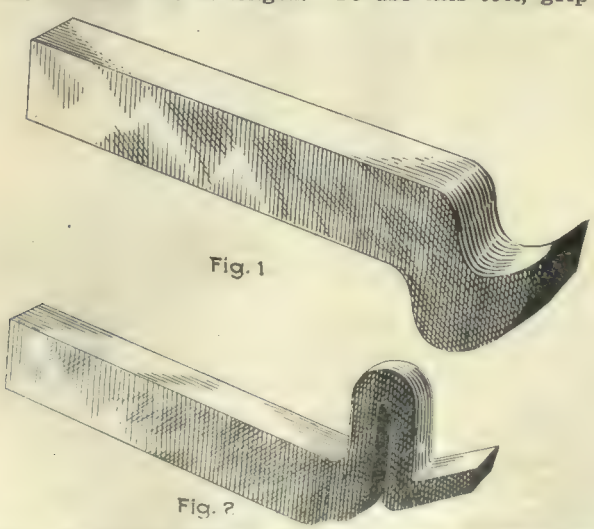


FIG. 1. SET-BACK STIFF SCRAPER. FIG. 2. SWAN-NECK SPRING SCRAPER

closely as possible to the neck of tool, set $\frac{1}{4}$ in. below center; adjust cutting face of tool on work according to width of feed to be used.

There are two reasons for setting the tool below center: the first is that the pressure of the cut is in an angular direction toward the center of the lathe bed. This pressure enables the tool to hold the cut securely and turn the shaft parallel.

The second reason is that should this tool dip or dig in, it will spring downward and away from the shaft, thus reducing the amount of damage. The path of spring of the tool is indicated by an arrow as shown in Fig 3. The same reasons apply to the swan-neck, spring scraper—the only difference is that 0.006 to 0.01 in. is all that it is advisable to remove from the diameter of a shaft when wet finishing with this tool. The lathe slide-rest must be carefully adjusted before using either of these tools.

In practice on heavy lathe work roughing tools are set at the height of lathe centers. Roughing tools have an increased front rake and decreased top rake which throw the weight of the cut on lathe carriage and bed.

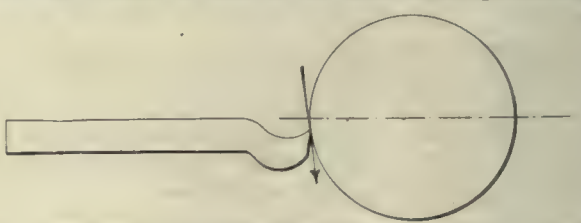


FIG. 3. DIRECTION OF PRESSURE WITH SET-BACK STIFF SCRAPER SET BELOW CENTER

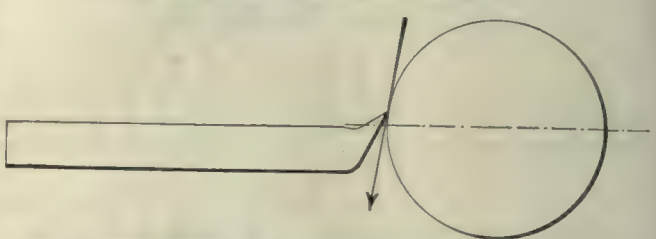


FIG. 4. DIRECTION OF PRESSURE WITH ROUGHING TOOL SET ABOVE CENTER

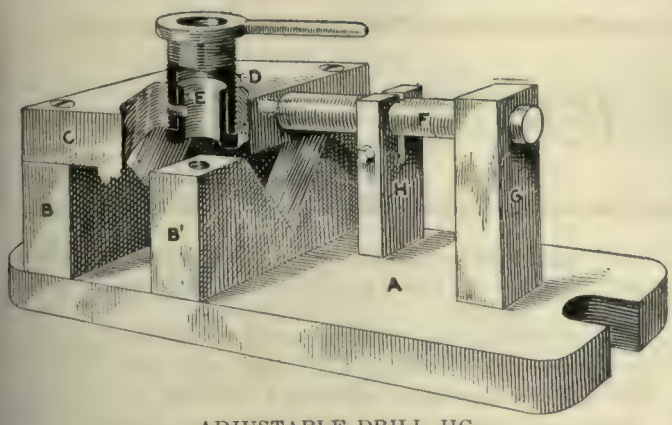
V-threading tools should also be set at the height of the lathe centers, for if this rule is ignored the correct depth and form of the thread will not be cut. When medium or light lathe work is being roughed, particularly work that requires a steadyrest for finishing, it is best to set the roughing tool above center and use a fine feed and a quick speed. The front rake of the tool must be increased. The raising of the tool above center decreases the spring of the work and removes chatter. The force of the cut in this case is away from the work and against the screw of the lathe slide, as shown in Fig. 4.

Jig for Drilling Nipples

By K. Saldiz

A quantity of nipples from $\frac{3}{8}$ to 1 in. in diameter, inclusive, had to be drilled in one place radially. The size of the drills differed for each size of pipe; also the holes were spaced from the end of the nipples differently on nearly every order, so a jig was built as illustrated and described here.

A baseplate *A* was provided with two slots by which it was clamped to the table of the drill press, and two V-blocks *B* and *B*^{1} were fastened to it, big enough to accommodate the largest nipple. On the ends of



ADJUSTABLE DRILL JIG

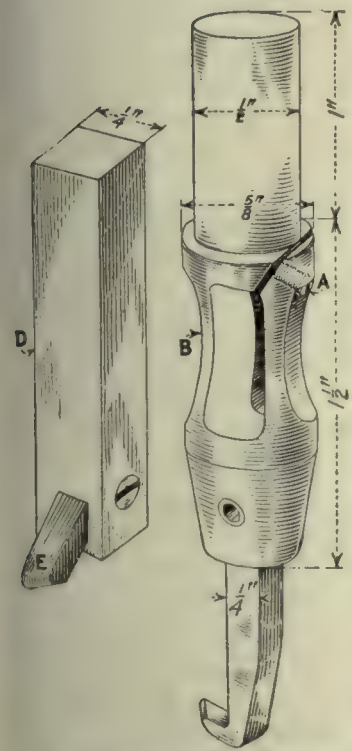
the two V-blocks a plate *C* was fastened, with a threaded hole in the center, to take the threaded bushing *D*. This bushing had a handle by which it could be screwed down tight on the nipple. The hole in the bushing was big enough to take the largest drill bushing *E*, held in by a small setscrew. The bushings for the different sizes of drills were all of the same outside diameter. A rod *F* was screwed in the top plate, the other end resting in the pillar *G*, that was set in the baseplate. On rod *F* was a sliding arm *H* made tight with a clamping screw. The setting of this arm gave the desired center distance, which could be changed to suit.

Every part of this jig was made of cold-rolled steel, cyanide hardened, except the drill bushings.

Formerly every nipple had to be centerpunch marked individually, clamped and drilled; a production of 10 to 20 per hour being reached. With this jib the production is from 30 to 50 per hour according to size of pipe and drill. The size of the drills ranges from $\frac{5}{16}$ to $\frac{5}{8}$ in.

An Adjustable Boring Tool

BY CHARLES SEHL



AN ADJUSTABLE BORING TOOL

The sketch shows an adjustable boring tool-holder for small work. The screw *A* adjusts the cutting tool, by causing the holder to spring at *B*. For larger holes than can be taken with the solid boring tool, a boring tool set in a holder as shown at *D* can be used and the cutter *E* set-out to the diameter of the hole when starting to bore. At the end of the screw *A* the holder can be opened at least $\frac{1}{16}$ in. without any danger; this will move the boring tool about three times that distance. Since there is seldom more than $\frac{3}{32}$ in. to be bored out of small holes this range of adjustment will be ample to cover nearly all cases in ordinary practice.

What Comes of Running a Lathe Backward

BY JOHN J. HILL

Some time ago I read in the *American Machinist* that a good way to prevent chatter in using a long boring tool is to turn the tool upside down and run the lathe backwards. Having the usual trouble in boring out a brass cylinder 10 in. in diameter by 12 in. long, I suddenly remembered this sovereign remedy and determined to apply it.

I turned the tool over and started the finishing cut. I was delighted with the result; the lathe ran quietly and the finish was a smooth glass-like surface. Figuring that the job would take care of itself for quite a while, as it was running so nicely, I decided to go over across the shop and "visit" with a shopmate who was running the planer.

As I stood talking with my friend, with my back turned to my own job, I was startled by a sudden commotion culminating in a grand smash, and I looked around to see my lathe surrounded by an excited crowd (which included the boss) all trying to do something at once.

I made the distance back to the wreck in two jumps and as soon as I could wedge my way to the front row of spectators, found that the faceplate had unscrewed and dropped the whole "works" on the shears, breaking the boring tool, wrenching the casting free from its holding straps and otherwise injuring the appearance of the job and the feelings of the boss who directed to me several sarcastic remarks about "going to bed nights," "staying on my job in the day time," "learning which way a lathe ought to run," et cetera.

Thus ended my first practical lesson in chatter prevention. Now, when I have trouble from this source I turn the tool upside down, but I put the cut on the backside of the work and run the lathe forward. I find that it works just as well and I do not expect to see the faceplate fall off.

[We think the boss was right.—EDITOR.]

Support Your Cutting-Off Tool Solidly

BY JOHN P. WHEELER

I have often noticed the difficulty the average toolmaker has in using a cutting-off tool in the lathe and offer my experience as a remedy.

I served my time in an old English shop and many years ago got my first introduction to an American lathe, a "Davis & Egan," and was charmed with it until I had to use a cutting-off tool. It took me about a month to discover why I had trouble but once I did find out the cause all my troubles disappeared.

The main difficulty is caused by the rocker. If any lathe hand will take the rocker out, reverse the plate, and pack the cutting-off tool level with the center by means of solid packing, having the tool flat on top and with very little clearance on the cutting edge he will be delighted with the result.

I have shown this scheme to hundreds of lathe hands at different times but I still find in every shop I go into the new crop of mechanics having the same trouble with cutting-off tools. The rocker is not solid enough and easily slips down under strain causing the well-known "dig." I generally use the same means for holding forming tools. The extra trouble of packing the tool up is well repaid.

IN THIS ISSUE

DIXIE in the first article in this issue goes very much into detail concerning the use of paper in the machine shop. He tells of the assistance that paper affords the skilled mechanic in taking his many precautions to insure accuracy; how it hinders slippage and prevents injury to machine tables, and how it is used as feelers. The proper use of paper is commendable and the practice of using it is so universal that we are glad indeed that Dixie has set down the facts contained in his article.

In the next article, which begins on page 852, Western Editor Hunter describes special equipment used in a railway boiler shop. There is a great deal that may be learned from boiler shop work and Hunter has bent his energies to selecting for description machines and devices certain to be of universal interest.

We go deeper into the design of helical springs this week in Joseph Kaye Wood's third article beginning on page 854. It will be remembered that in a previous article Wood devised special formulas for helical spring design and introduced the terms "material index" and "spring criterion." This week he takes up the method of controlling the spring criterion and analyses the actions that take place when coiling a spring by means of rollers or by means of burnishing, which is a combination of spring winding and coiling. One of his conclusions is that coiling and burnishing will produce a better or more permanent set in the forming of a helical spring, and are therefore recommended.

The matter of cost accounting has not kept pace with development in many other lines. Though we suppose that in some fields it has reached a very high degree of development, in the machinery industry it has not progressed nearly so far as possible. In this installment of "Modern Production Methods," under the title "Getting the Overhead Into the Finished Product," W. R. Basset deals with the methods of checking costs and the distribution of various charges to the proper departments. In referring to the old system of keeping cost accounting entirely separate from the general accounting of a business, Mr. Basset says, "Unless the cost system ties in frequently with the general items of account, we have no check on the accuracy of the costs and the system in effect would be the inaccurate, old-fashioned, single-entry system. As usual the article includes many sample forms." Page 858.

We hope that many of our readers are following the series on "Tool Engineering." We have promised that this is to be a great series and we believe that the first three installments have borne out our statement. The fourth installment, page 864, continues the treatment of drill jig design. Clamps are featured and part of the article is devoted to spring plungers and jacks.

It so happens that we are able to run in the same issue with the story of the use of paper an article by John Slocumb dealing with the use of wood in the machine shop, particularly wood blocking and bar work. It tells of the use of wood in holding work, in the construction of boring and facing bars that are held on lathe centers, of threading with a boring bar, and of parallels made of wood. An interesting statement that Slocumb makes is this: "In the average machine shop today there seems to be a prevailing belief that to set up a wooden block is unmechanical and sloppy. I have used the lathe largely in boring with boring bar on centers and consider this way for many kinds of work equal if not superior to any other." This interesting article begins on page 868.

Ellsworth Sheldon's seventh magnetic chuck article, page 871, goes into the details of the Simmons chuck which was invented by Frank L. Simmons of Millbury, Mass., to whom a patent was granted in 1918. This patent was immediately assigned to the Taft-Peirce Company in whose shop the chucks are now built, under the supervision of the inventor.

It was a very earnest and broad minded group of men who met at Cleveland earlier in the month in response to the call of the National Foreign Trade Council, to consider the important problems relative to foreign trade and general business, now pressing. After the many addresses of merit had been delivered and full discussion held the convention drew up the final declarations which we publish on page 875. If the suggestions embodied therein can be followed out not only will foreign traders benefit but the good effects will be felt by all those engaged exclusively in domestic commerce.

Coming Features

Next week we will have an article on "Planning and Controlling Production in a French Shop," by E. Jullien of Savy Jeanjean et Cie., Courbevoie, France. The author has been generous indeed with his information and has included in his article examples of stores requisitions, record cards, routing cards, schedules and tool sheets. He describes a very interesting device known as a revolving calendar, which is a part of the production scheme.

Of series articles there will be the fifth of "Tool Engineering," the tenth of "The Foreman and His Job," and the tenth of "Metal Cutting Tools."

Hunter will have an article on testing equipment for pneumatic motors that should be of universal interest because pneumatic motors are used everywhere.

We shall begin the fourth of A. B. Cox's gear articles dealing with the slipping of involute gear teeth. The article is so long that it will have to be continued the following week.

View points of some of the foreign trade experts who took part in the convention at Cleveland will be found in the abstracts of addresses which will appear in th next issue.

EDITORIALS

We Must Finance Foreign Trade

PROBABLY the most lasting conviction carried away from the Foreign Trade Convention was that foreign trade has become a necessity for the United States and that it is not confined to export, but includes sufficient proper import.

There isn't a great deal of foreign trade enjoyed by the United States right now, little export because of commonly known and very obvious causes, and little import because the nation hasn't come to know it as a necessary reaction to export.

The convention did more than decry conditions. It made many constructive suggestions and went on record in its final declaration as backing up a program that is going to mean business if carried through. Of particular significance was its stand and the stand of individual speakers on the advisability, actually the necessity, of doing something definite to finance foreign trade. Former Secretary of Commerce Redfield, president of the American Manufacturers' Export Association, in urging the development of the Foreign Trade Financing Corporation, said, "I know personally of orders from other countries available to the United States at the present time, of more than $20,000,000 which can be closed just as soon as the corporation operates.

"It is not a question of whether this company ought to be formed and put into operation, but one of our standing at the parting of the ways and deciding whether we shall go down, though possibly not out, or whether we shall go up and stay in the game. Those of you who have had experience with competitors in Europe have no illusions as to the quality of the competition we have to meet, or doubts about our ability to compete with them, but we are without the tools. We have reached the end of our financial power with the tools which we have, and unless new tools are created speedily we have reached the end of our useful activities in export trade."

The Convention in its final declaration includes the following: "We urge the immediate creation of financial institutions under the Edge Law, whose machinery will facilitate extension of long-term credits to promote free exchange of exports and imports. We commend efforts to acquaint our investing public with the necessity of purchasing debentures issued by such institutions against approved foreign securities for this purpose, so that eventually every community will serve its own vital interest in furthering our foreign commerce as a necessary component of domestic prosperity."

We could give many other quotations and they all point the same way. There is no room left for doubt as to the advisability of getting this machinery going. The plan has been O.K.'d by the business group more immediately, but probably no more intimately, affected by foreign trade. Just now the thing that must be done is to overcome the existing spirit of apathy. Unfortunately "let George do it" seems to be the accepted, if unexpressed, slogan of many who should be right on the firing line.

No Place to Economize

RESOLUTION number ten, adopted by the Chamber of Commerce of the United States, reads in part:

"The Department of Commerce is now charged with the primary duty of rendering the fullest possible service to American commerce, both foreign and domestic. It has no inquisitorial or regulatory powers and is accordingly free from the equivocal duty of restraining business with one hand while it attempts to offer service with the other.

"This Department is in a peculiarly favorable position to obtain, co-ordinate and distribute vital commercial information, carefully safeguarding all confidential facts. It can render invaluable service through the development of commercial standards and specifications, the absence of which is costing the American people at the present time hundreds of millions of dollars.

"The Chamber strongly recommends that the facilities of the Department of Commerce be broadened to meet the actual and economically proper demands of the business of this great nation. It recommends further that those federal bureaus and divisions, the duties of which upon study are found to fall within the scope of the Department, be included in the Department.

"The Chamber believes that the prompt consummation of this plan will give a decided impetus to the revival of business both domestic and foreign at a time when such revival is proving a slow and arduous process; and that the service thus made available to American business will contribute substantially to reducing the suddenness and intensity of future business depressions through establishing a more accurate and reliable basis of available facts . . . ."

This invaluable and vitally necessary work cannot be carried on without funds. On first glance it might seem that a large sum of money would be required to make even a start on the task. The amounts asked from Congress by Mr. Hoover are $250,000 for the collection, handling and dissemination of commercial information, and $350,000 for the study of standardization and elimination of waste problems at the Bureau of Standards.

The sum of these two appropriations would be just enough to support a battalion of troops for one year. The comparison is significant.

Incidentally, the money so spent would be productive of actual savings considerably in excess of the expenditure, aside from any other consideration.

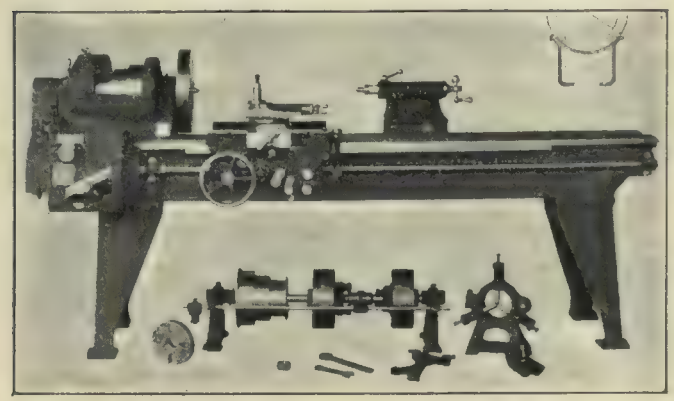
This appropriation will not be obtained without a fight and it must have the weight of public opinion behind it to get it across. Resolutions like the one quoted are all very well, but the average Congressman needs to hear from the folks back home before he is ready to take action that will bring down the wrath of the demagogs upon his head. It is the duty of every manufacturer and business man in the country to sit down and write to his representative telling him what he wants him to do.

Here is a chance to do something tangible to assist the man who has undertaken to make the Department of Commerce a real aid to business and industry.

Shop Equipment News

Carroll 14-Inch Quick-Change Lathe

The accompanying illustration shows the 14-in. quick-change-gear lathe recently placed on the market by the A. V. Carroll Machine Tool Co., Norwood, Cincinnati, Ohio. The chief feature to which the maker calls attention is a gap by which the swing over the ways is increased to 19 in. for chuck and face-plate work. The gap in the bed is not visible from the front or the back of the machine, since only the inner ways are broken, the outer or carriage ways remaining. The small sketch at the upper right-hand corner of the illustration shows the construction used for the gap bed, the section shown extending for a distance of 9 in. in front of the headstock. It is said that the feature adds greatly to the adaptability of the machine, and does not weaken the strength of the bed.



CARROLL 14-IN. QUICK-CHANGE LATHE WITH INVISIBLE BED GAP

Specifications: Swing; over bed, 16½ in.; over bed with gap, 19 in.; over carriage, 11 in. Spindle bearings; front, 2½ x 4 in.; back, 2 x 3 in. Diameter of spindle nose, 2 7/8 in. Hole in spindle; through, 1 5/8 in.; taper, No. 3 Morse. Back-gear ratio; single, 9 to 1; double, 9 and 3 to 1. Diameter of tail stock sleeve, 1¾ in. Length along ways; carriage, 22 in.; steady rest, 4 in. Countershaft; pulley, 10 in.; speed, 225 r.p.m. Distance between centers with 6-ft. bed, 40 in. Weight with 6-ft. bed; net, 1,650 lb.; boxed for export, 1,950 lb.; weight per additional foot of length, 90 lb. Export box, 29 x 29 x 84 in.

The drive is by belt on cone pulleys, either three- or four-step pulleys being provided. Either double or single back gears can be furnished. The headstock is of bowl shape, all gears being covered. The gears in the head are steel, and the bearings are of bronze. The spindle is of 50-point carbon steel and ground to size. It is constructed with a large opening throughout its entire length for bar work. The spindle is said to be in line with the bed and carriage with an error not exceeding one-thousandth of an inch in 16 in. The head and gear box can be elevated by means of raising blocks so as to increase the swing of the lathe to 20 in. It is said that it is not necessary to alter the intermediate gearing when making this change, which can be quickly performed.

The quick-change gear box for obtaining feeds is equipped with steel gears. By the positioning of one knob and handle, 24 changes of feed, either right or left, can be obtained. The lead screw has a four-pitch thread, and is adjusted by means of a threaded collar.

The carriage is fitted with gibs at both the front and back. It is arranged to receive a taper attachment when desired.

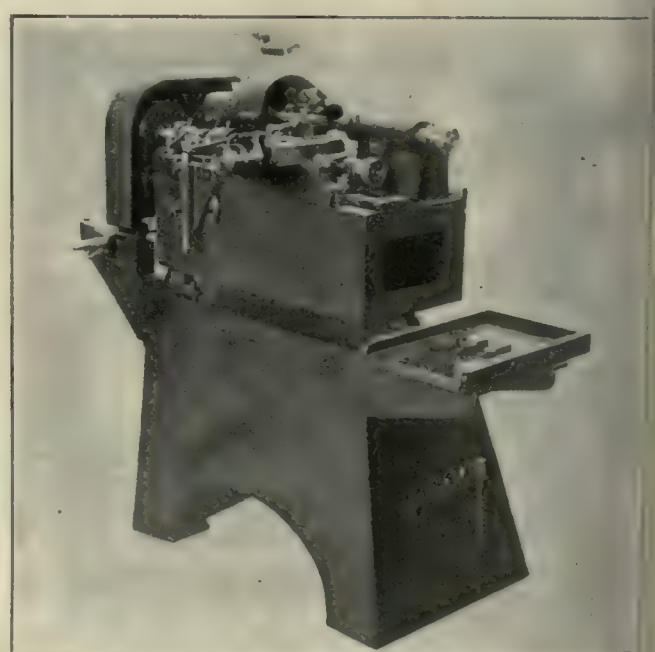
The gears and studs in the apron are of steel and bronze. An interlocking device is provided, so as to prevent breakage, making it impossible to engage both the screw and the feed at the same time. A reversing mechanism permits of either right- or left-hand feed. The compound rest is provided with taper gibs, and its bottom is graduated so that it can be swiveled. The tailstock can be set over for taper turning. The centers are self-discharging.

The machine can be furnished in lengths of bed of 6, 8, 10 and 12 feet. The equipment consists of large and small faceplates, a follow rest, steadyrest, centers, wrenches, thread indicator and a countershaft provided with double friction clutches.

Herbert Precision Screw Lathe

The accompanying illustration shows a precision lathe intended for the cutting of accurate threads, as on gages, and recently introduced to the American market by Alfred Herbert, Ltd., Coventry, England, through offices at 50 Church St., New York, N. Y.

The bed of the machine is of box section and rests on three balls so secured to the base as to allow free expansion or contraction with temperature changes. The headstock is fitted with a three-step cone pulley, driving the spindle through gears with a speed reduction of 4 to 1. The lead screw is, in turn, geared to the spindle. The work center does not revolve. The tailstock has a fine adjustment across the bed. The saddle carries two



HERBERT PRECISION SCREW LATHE

Specifications: Capacity; maximum diameter, 2½ in.; adm between centers, 3 to 6 in.; maximum length threaded, 3 Number of spindle speeds; forward, 3; reverse, 3. Spindle spee forward, 80, 40 and 20 r.p.h.; reverse, 110, 55 and 22.5 r.p Countershaft pulleys, 8x1¾ in. Horsepower required, 1. Fl space, 4 ft. 10 in. x 2 ft. 8 in. Weight; net, 1,596 lb.; gr 2,239 lb.

slides, the top one having an eccentric bushing which permits adjustment of the height of the tool. By means of a micrometer stop reading to 0.0001 in., the correct depth of cut can be obtained by the top slide. The intermediate slide has a micrometer adjustment lengthwise for side cutting.

The lead screw has a square thread, there being eight threads per inch. It is placed between the V's of the bottom slide. A solid nut is used. The shank of the tool is ¾ in. in diameter. A pitch-varying attachment is provided, so that the proper allowance for the change in length of the work during hardening may be quickly made. By means of a grinding and lapping fixture, the thread-cutting tools can be finished to the exact angle required.

Langelier Special Automatic Multiple-Spindle Drilling Machine

A six-spindle machine of the dial type for drilling the tumbler holes in pin-tumbler lock cylinders has recently been completed by the Langelier Manufacturing Co., Providence, R. I., and is shown in the accompanying illustration. At the top of the illustration are shown the cylinders, with the holes for the small pins or "tumblers" that prevent the plug of the lock from turning, except when the proper key is applied. Jig drilling is, of course, a necessity, but the holes are so closely spaced that a multiple-spindle, single-position machine would be impracticable. This machine operates upon the progressive principle.

Seven positions are provided, one for each of the six holes and one for unloading and reloading. The jigs are equidistantly spaced upon a large horizontal dial and so arranged as to open and close automatically at the proper time. A slide at each position carries a short, horizontally projecting arbor fitting the plug-hole in the cylinders to be drilled. A bushing plate guides the drills. As the jig closes, the slide advances until the end of the arbor enters a closely fitting bushing in the fixed part of the jig, thus clamping and locating the cylinder.

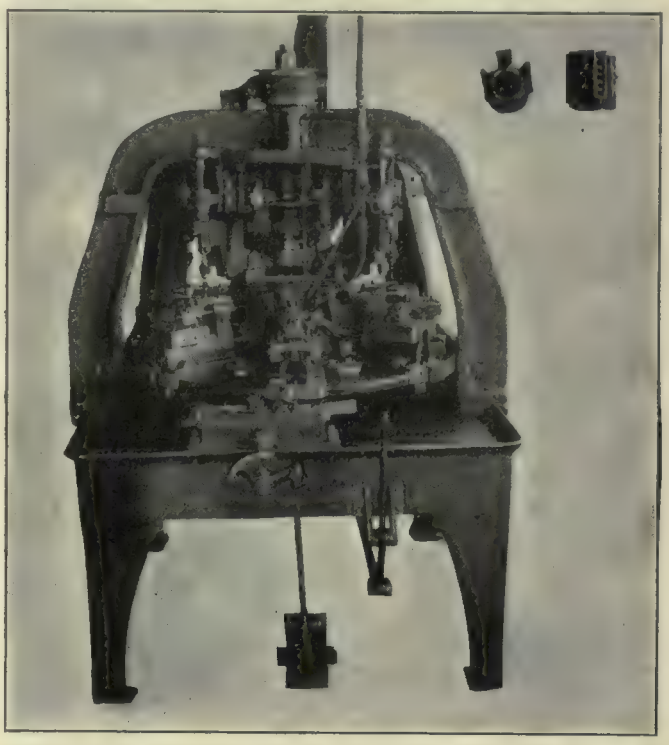
A roller, projecting below the slide, engages the stationary cam upon the table as the jig comes to the loading position, drawing back the slide and allowing the operator to change the piece of work. The jig may be closed at any time by the pressure of the operator's foot upon the treadle; but ordinarily there is no reason for doing this, as the closing movement takes place automatically when the dial carries the jig forward.

The main drive of the machine is by belt to the pulley at the upper end of the vertical, central shaft, from which all the movements are derived. A spur gear upon this shaft drives six short vertical countershafts, from which the drill spindles are driven by web belts, each provided with an independently adjustable idler to take care of the belt tension. The spindles run at 5,000 r.p.m., and are mounted upon ball bearings.

The cams for moving the dial and for advancing the drills to the work are located under the machine table, out of the way of chips. The dial rests upon an annular bearing surrounding the central shaft, and the movement of the drill spindles is taken from a sleeve that slides upon the hollow boss, projecting upward from the stationary table in which the central shaft has its lower bearing. The spindles are all connected by toggles to this sleeve, which, in turn, receives its movement from a cam under the machine.

The dial is moved by a modified form of the "Geneva" gear, the single toothed member of which is keyed to the camshaft beneath the table of the machine. The locking bolt that locates the positions of the dial is near the periphery of the dial and has its bearing below the table. Independent vertical adjustment of the drill spindles to compensate for wear of the drills is provided by the knurled head screw above each spindle.

Because of the nature of the material, no lubricant is used, but the machine is piped to deliver a jet of air



LANGELIER SPECIAL AUTOMATIC MACHINE FOR DRILLING TUMBLER HOLES IN LOCK CYLINDERS

upon the drills and thus keep down their temperature while at the same time keeping the work clear of chips. The machine will deliver eleven completed cylinders per minute, it is said.

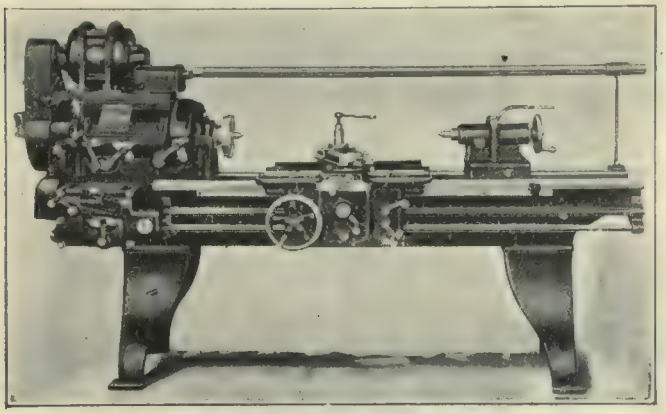
Morris Geared-Head Lathe

The Morris Machine Tool Co., Court and Harriet Sts., Cincinnati, Ohio, has fitted with a geared head and single-pulley drive its quick-change lathe of the type previously described on page 478, Vol. 52, of the *American Machinist*. As shown in the illustration, the machine is driven by an individual motor mounted on top of the headstock. The lathe is made in swings of 16, 18 and 22 inches.

The head provides twelve spindle speeds, and by using a double-clutch countershaft either twenty-four speeds or twelve forward and twelve reverse speeds can be obtained. The speed range for the 16-in. lathe is 12 to 347 r.p.m., while it is 10 to 297 r.p.m. for the 18- and 22-in. lathes. All the gears are of steel, heat-treated and hardened. The headstock is partly filled with oil, permitting the gears to dip enough to thoroughly lubricate them.

All speeds are secured through sliding gears and one positive back-gear clutch. The only friction clutch used is in the pulley at the initial drive, the clutch being of large diameter and controlled by a shifter rod run-

ning the full length of the lathe, thus permitting the operator to start and stop the lathe from any working position. When releasing the friction clutch in the



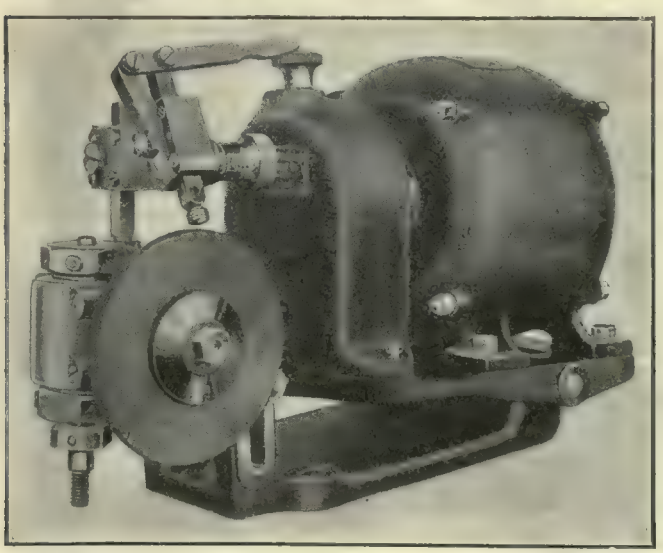
MORRIS GEARED-HEAD LATHE

pulley a brake can be applied by the same pull to stop the idle rotation of the spindle. This action is of use both when shifting gears and when turning work partly around for inspection at different points on the diameter. Speed changes are made by means of the levers in front of the head. When the direct-drive clutch is engaged the back-gear pinion is put out of mesh, preventing the back gears from running idle. The pulley is protected by a guard which can be swiveled to suit the angle of the belt.

The geared head is interchangeable with the cone head and arranged to receive the motor-drive unit at any time. The motor is mounted on a plate bolted to the head and drives the clutch pulley by an endless belt. An idler pulley adjusts the tension of the belt by means of the star handle at the front of the motor plate. The idler pulley and bracket are mounted on the motor plate, making the motor-drive unit self-contained.

"Universal" Thread-Milling and Grinding Attachment

The Automatic Machinery and Equipment Co., 1110 Land Title Bldg., Philadelphia, Pa., has recently placed on the market a machine for attachment on the tool-



"UNIVERSAL" THREAD-MILLING AND GRINDING ATTACHMENT

block of a lathe, for use in milling and grinding threads and worms. It is known as the "Universal" because of its wide range of adaptability, and it is adapted to production work of different sorts. The machine will mill, flute and grind a tap in one setting, besides milling worms and cutting gears and ratchets. It can be used for drilling jigs and fixtures, splining shafts, and doing both internal and external grinding.

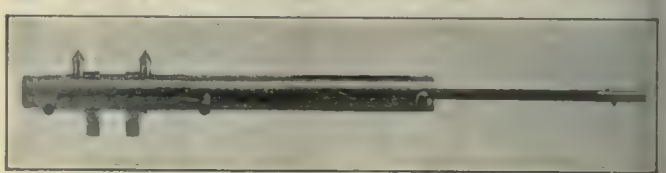
The illustration shows the Size "A" machine, fitted for grinding. There is a spindle, shown at the bottom of the spindle head, for holding the milling cutter. The head can be swung to bring the spindle in the desired position, it being graduated for the full 360 deg. to facilitate setting.

The driving motor is mounted on a base hinged on the main base, so that the spindle can be raised or lowered. The motor base carries a quick-change gear box, which is interposed between the motor and the spindle head. The spindles are fitted with ball thrust bearings, and run in oil in adjustable bronze bearings. The spindles and gears are made of heat-treated alloy steel.

A diamond truing device is furnished for dressing the grinding wheel to any desired angle. The equipment includes a diamond, an internal adapter, grinding wheels and wrenches. The motor can be furnished to suit the current available. The length of the machine is 14½ in,, the width 6 in., and the height 8 in. The weight is about 45 lb.

Van Keuren Micro-Gage Holder

A set of accessory measuring tools, for use with the combination micro-gage blocks manufactured by the Van Keuren Co., 361 Cambridge St., Allston, Boston,



VAN KEUREN MICRO-GAGE HOLDER

Mass., has recently been placed on the market by the same concern. The device, shown in the accompanying illustration, is a holder for the gage blocks and the measuring points, forming a caliper. The micro-gages, which are round in shape, permit the use of a light steel tubing for the frame or clamp to hold the micro-gages and the jaws. The micro-gages are inserted in the lower or open end of the tube, and the jaws are inserted in ¼-in. slots.

The three sets of staggered slots, instead of one long slot, retain the rigidity of the steel tube. Pressure on the clamp screw release button at the top of the tube permits the clamp screw to be moved quickly to accommodate any combination of gages or jaws. The clamp has a range up to 7 in. Small dimensions are secured with the jaws in the central slot. For long combinations the two end slots are used.

The measuring jaws include two flat jaws 0.300 in in thickness, two plain 0.250-in. plugs and two 60-deg 0.250-in. scribing plugs. A base block 1 in. in thickness held in place by one of the 0.250-in. plain plugs, permits measurements to be established at a definite height above a surface plate. The two flat jaws being of a definite thickness may, when separated by the desired combination of gages, be used for either inside or out

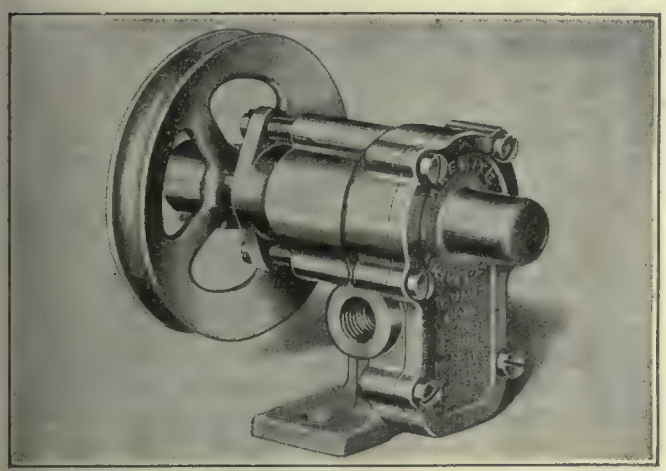
side measurements. The plain plugs are likewise used for measurement of the diameters of holes or the smallest or largest distance between parallel holes. The 60-deg. plugs are used for trammel points, for checking the lead of threads, for scribing lines and for locating height dimensions.

All of the measuring parts, being of simple construction embodying plain flat or cylindrical surfaces, are said to be as accurate as the micro-gages themselves.

Alemite Universal Pump

The Alemite Die Casting and Manufacturing Co., 2640 Belmont Ave., Chicago, Ill., makes a line of pumps of the type shown in the illustration. The pumps are made in five sizes with a range of capacity from ½ to 10 gallons per minute, when run at their rated speed of 300 r.p.m. They are adapted to the handling of differnt sorts of coolants, oils and heavy fluids.

The parts are made of die castings chiefly, by the



ALEMITE UNIVERSAL COOLANT PUMP

Specifications: Made in five sizes, Nos. ¼, 1, 3, 5 and 10. Respective capacities, gallons per minute at 300 r.p.m., ½, 1, 3, 5 and 10. Size of inlet and discharge openings, ¼, ⅜, ½, ¾ and 1 in. Net weight, plain type, 2, 4½, 6¾, 9¼ and 15¼ lb.

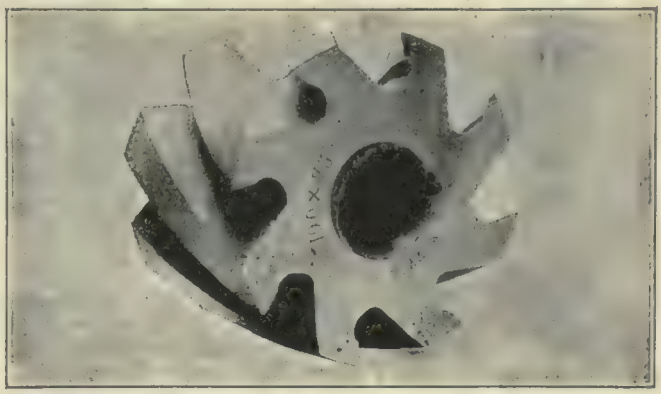
methods which the company has developed in its die-casting business. The casing and cover are bolted together by means of capscrews, only a light coat of shellac being used to prevent leakage, therefore avoiding the use of gaskets. The bearing on the drive shaft is provided with a large gland with a take-up to prevent leakage. The drive shaft can be extended to receive any desired type of power transmission. There are only four moving parts, the crankhead, rotor, oscillator, and the extension.

The rotor is constantly kept in contact with the casing by means of a spring placed between the shaft and crankhead, which construction allows for the passage of any foreign substance such as dirt or grit through the pump, thus preventing clogging. The pumps are made of a hard, high-tensile-strength metal, especially adapted for this purpose.

Savy Helical Milling Cutter

The type of milling cutter shown in the accompanying illustration is made by A. Savy, Jeanjean & Co., Courbevoie, near Paris, France. The mill can be furnished in various sizes and numbers of teeth. The helix angle is 30 deg. The wide-spaced teeth are undercut, and have a rake of 10 deg. To sharpen, they are ground on the front faces only.

Besides the high metal-removing capacity of the cutters, the following advantages are claimed for the tool: First, the 30-deg. helix angle eliminates the chatter,



SAVY, JEANJEAN & CO. MILLING CUTTER

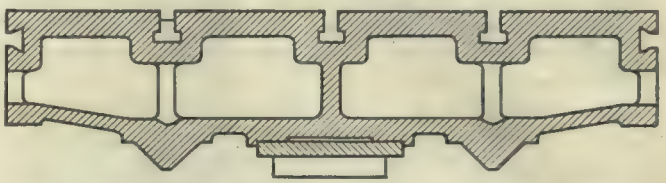
particularly with a deep cut; second, no chip breakers are required; third, the tooth is very much stronger than in a standard cutter; and fourth, the sharpening of the cutter does not decrease the chip space, but on the contrary, it increases it.

It is stated that a 4-in. diameter cutter of the type shown when under test took a cut 2½ in. wide and ½ in. deep in medium-hard cast iron at a speed of 62 r.p.m. and a feed of 20 in. per minute. The cutting speed was 65 ft. per minute, and 25 cu.in. of metal was removed per minute, only 12½ hp. being absorbed by the milling machine. The cutter was in perfect condition after one hour of such service.

Box-Form Table for Gray Planer

The illustration shows the box type of construction used for the tables of the planers recently made by the G. A. Gray Co., Cincinnati, Ohio. The objects which this design seeks to attain include ease in cleaning, freedom of the V's from chips and dirt, and a greater degree of rigidity. In order to further stiffen the table, the top and bottom surfaces are firmly tied together by a heavy, uninterrupted vertical wall of metal running the entire length of the table on its center line. On each side posts of metal serve the same purpose, while permitting the operator to clean the chips from the cored portion of the table. The cored openings in the outside walls are designed to leave a sufficient amount of metal while still permitting access to the interior. Heavy transverse walls at two-foot intervals provide against arching under the strains imposed by the clamps and stop-pins.

The stop-pin holes pass entirely through the table top, thus permitting the chips to fall through and leaving the holes clear. The cleaning is done from the side



SECTION THROUGH GRAY BOX-FORM PLANER TABLE

of the table, lessening the danger of pushing chips into the V's. Wide and deep chip pockets are provided at the ends of the table, to safeguard the V's and the gearing against chips.

Johnson Gets Ready for Business

Discarding Wornout Equipment—Getting Ready for Competition—Rearranging the Shop, Putting Machines in First Class Shape—Painting the Shop and the Machines

BY JOHN R. GODFREY

I'VE been having several confabs with Johnson during the winter but as he asked me not to spill it all over the map, I just naturally had to sit tight. He has his plans fairly well worked out now and he's so dead sure he's got it all doped out right he gave me the Admiral Dewey high sign of "You can fire when you are ready, Godfrey." So here goes.

"We're in for a slump Godfrey—can't be helped. You can't tear the world up by the tail for five years and keep on picking watermelons all the time. We've danced and now we must pay the fiddler, and the deuce of it is a lot of wall flowers who never even got a bid to trip the light fantastic, have to chip in just the same.

"There's no use fooling ourselves about either profits or losses. Most of us made more than any real patriot should and we ought to bear our loss like a soldier. I'm going to charge off my losses as due to the drop in materials p.d.q. or sooner, and take business at the present price of cast iron, not what it was a year ago.

"I figure out that the country has a surplus capacity for manufacturing most things mechanical, which means that some shops are going to be partially idle a long time unless they find something new to manufacture. A lot of the weaker motor builders must just naturally go broke. They haven't production capacity enough to turn out motors at a price to meet the big shops that are well equipped. And some of the big plants are likely to get fed up with dollars on the wrong side of the ledger too.

SAVED HIS PROFITS

"Now I figure to stay in the game. I tucked away my extra profits where I can get them and I'm going to use a wad of that easy money within the next few months. I didn't blow my cash on twenty-thousand dollar limousines like some of my friends. Just now they are cussing out the workman who bought a silk shirt and a victrola as not being thrifty. Don't seem to see that they come in the same class.

"As I said before I figure to stay in business, but all the figuring in the world won't do it unless I can produce motors as economically as the rest of them. So I've been going over my shop with a fine tooth comb to see what machines ought to be replaced. And believe me there's a bunch of 'em.

"We've been charging off 10 to 15 per cent depreciation on machines until we owe them money. We've kidded ourselves into believing we were putting it over on the tax collector by using machines that had been charged off long ago. We've been loosing money on most of 'em.

"Now I'm ordering the best machines I can buy to replace these lame ducks. I propose to have gear cutting machines that will cut time to the bone on those timing gears. The old grinding machines are going out and newer ones coming in. The same with cylinder boring machines. I may pay a little more for them than I would later but I'll have them ready for business while the other fellow is thinking about ordering.

"We're going to have real competition, Godfrey, such as we never had before. And the chap who thinks he is saving money by hanging on to his old machine equipment is licked before the show starts. He won't even hear the band. And he's the calamity howler who will raise his melodious voice in protest about unfair competition and ruinous prices for motors, when the aforesaid competition gets into action. Prices will be ruinous all right to the man who thinks a fifteen-year old milling machine is good enough for crankcases and the like. But the shops with real machine equipment will get the business at a fair margin, if they are at all well managed.

"Then there's the wage question. The alleged manager who don't realize the need for new machinery or hasn't the nerve to buy it if he does, will probably try to reduce his costs by cutting wages. And even if he gets away with it, which he can of course, if his men get hungry enough, he'll find many disappointments in the game. A man may take a big cut because he has to eat once in a while. But you can just imagine the joy he'll put into his work and how hard he'll try to make every move count for the boss—*not*. It isn't human nature on one side any more than on the other.

"Wages must probably come down in many lines. They were shot out of sight because the workmen could club the employers into paying them and passing it on to the consumer. They took lessons from our sugar philanthropists and others. They both blame it all on old supply and demand—when they get the benefit. But its downright outrageous and unpatriotic when an unskilled laborer wants a 10 per cent boost.

MACHINISTS WAGES WERE TOO LOW

"Mahcinists' wages have always been too low considering the skill and training they had to have. When a bricklayer can get more money than a skilled toolmaker, there's something wrong somewhere, and especially when we consider that the bricklayer doesn't have to have as much real skill and knowledge as a first year apprentice. I'm hoping to keep machinists' wages up where they are now. But we've got to have more production, both from the men and the machines. We all slumped after the war stopped and we've got to spit on our hands and get busy in a hurry.

"I've had a few talks with our men and I believe they see the light. We've discussed the new machines and what they ought to do. We've laid the cards on the table, face up, and I'm counting on the men to help me put things over as soon as the consumer gets up his courage enough to order. In the meantime we are rearranging the shop, putting every machine in as good condition as possible, painting machinery green and the walls white, and investing a lot of time and money against future business."

If more managers had Johnson's genuine optimism instead of the kind that talks good business and doesn't spend a dollar for needed equipment, we'd have started on the up grade long before this. Johnson's plan isn't especially new, but I'll gamble on his making it go when there is a chance at getting orders.



NEWS SECTION

Machine Tool Builders Hold Regional Meetings

E. F. Du Brul, general manager of the National Machine Tool Builders' Association, has announced a second series of regional conferences following the lines of the successful ones recently held on cost accounting practice. Meetings in this series have been held at Dayton, Indianapolis, Rockford, Milwaukee and Grand Rapids. Others will be held in the near future at Cleveland, Cincinnati, Rochester, Boston, Worcester, Hartford and New York.

American C. of C. Organized in Egypt

The American Chamber of Commerce of Egypt, with headquarters at Alexandria, has been formed by business men of Alexandria and Cairo, according to information received by the Foreign Commerce Department of the Chamber of Commerce of the United States. The officers of the new chamber are: President, P. N. Macdonald, general manager, Vacuum Oil Co., Cairo; first vice-president, R. Chesbrough, manager, American Foreign Trade Corporation, Alexandria; second vice-president, William Yale, H. Gill & Co., Alexandria; secretary, Henry Gill, H. Gill & Co., Alexandria; treasurer, M. Kallman, Livermore, Rojas & Co., Cairo; directors, T. Khayat, Charles Barnett Co., Alexandria and P. Sasso, Alexandria.

The American Consul at Alexandria was elected honorary president of the chamber.

With seven steamship companies operating direct steamship service to Alexandria from the United States and with many American houses interested in the extension of their trade through Alexandria as the distributing point, not only for Egypt, but also for Syria, Palestine and the Sudan, the establishment of an American Chamber of Commerce in Egypt had become a matter of urgent need. American business concerns interested in the services of the American Chamber of Commerce of Egypt can communicate with the secretary, Mr. Gill care of the Chamber at Elexandria, Egypt.

Importers and Traders Elect Officers

After two preliminary meetings at which an organization was started and perfected, the National Council of American Importers and Traders met at the Hotel Pennsylvania, on May 6, and after adopting a constitution and by-laws, elected the following officers for this year: President, N. E. Franklin, of Kny-Scheerer Corp. of America; first vice-president, Peter Fletcher, of Lamb, Finlay & Co.; second vice-president, William S. Pitcairn, of William S. Pitcairn Corp.; third vice-president, F. Bode, of Gage Bros.; fourth vice-president, A. B. C. Dohrmann, of the Dohrmann Commercial Co.; treasurer, H. O. Lloyd, of Julius Kayser & Co.; secretary, Franklin Van Leer, Jr.

A board of directors, comprising many of the largest importing houses in the country, was also elected. They were chosen so as to have, as far as possible, every commodity represented.

The object of the council is to unite American importers for the purpose of promoting the general welfare of all import interests; to render such assistance by advice and counsel as may be necessary from time to time; to obtain and render such counsel to importers and customs authorities as may be necessary to further the extension of import trade and commerce; to make a careful and unprejudiced study of all new governmental measures proposed for the welfare of our country and its commerce, so that every phase may be considered, and not to make either objections or recommendations on any proposed law or regulation until such study shall have been completed.

The council, though only in its infancy, has a membership of 150 of the most prominent trading houses in the country. It was reported at the meeting that there are over two hundred applications on file and inquiries are coming in every day. A vigorous campaign in behalf of the council and its aims will be undertaken at once by the officers just elected. The council has already made itself felt as the champion of American import trade by its fearless stand on the tariff question before the Ways and Means and Finance Committees at Washington.

Awards Made in Simonds Essay Contest on Economics

The prizes offered by Alvan T. Simonds, president of the Simonds Saw Manufacturing Co., of Fitchburg, Mass., to encourage the study of economics in high schools and normal schools, have been awarded. The prizes consisted of $1,000 and $500 for the two best essays on the subject "Present Economic Conditions and the Teachings of Adam Smith in the Wealth of Nations."

The first prize of $1,000 was won by David Koch, of the High School of Commerce, New York City. Second prize of $500 went to Aloysius Thiemann, Reedsburg High School, Reedsburg, Wis.

Essays were submitted from every section of the United States and from Canada. Practically every state was represented. A very large proportion came from New York City, where the study of economics is required of all seniors in the high schools.

The judges were Wallace B. Donham, dean of the Harvard School of Business Administration, Cambridge, Mass., and John G. Thompson, principal of the State Normal School, Fitchburg, Mass.

Census Statistics on Manufacture of Aircraft

A preliminary statement of the general results of the 1920 census of manufactures with reference to aircraft has been issued by the Bureau of the Census, Department of Commerce, furnishing a detailed statement of the quantities and values of the different types of aircraft manufactured during the year 1919.

Reports were received from 31 establishments engaged in the industry during 1919 showing products for the year valued at $14,372,643, as compared with 16 establishments in 1914 with products valued at $789,872. Of the 31 establishments reporting for the year 1919, 10 were located in New York; 4 in Ohio; 2 each in California, Massachusetts and Missouri; and 1 each in Connecticut, Indiana, Illinois, Louisiana, Maryland, Nebraska, New Jersey, Pennsylvania, Rhode Island, Washington and West Virginia.

Business Conditions as the Big Banks of the Country See Them

National City Bank of Chicago on Prices

The country is engaged in the task of trying to secure for the ultimate consumer the benefits resulting from the drastic reductions in wholesale prices. This is of great importance since the figures given out by the United States Labor Board reflect a decline of 38 per cent in wholesale prices since last July and an average level now only 62 per cent above that of prewar period as against a 118 per cent increase shown at one time last year. There is abundant basis for the statement made to the President by the Federal Trade Commission that retail prices were not being reduced in proper ratio to the decline in wholesale prices. The official figures covering the decline in foodstuffs indicates a falling off of 22 per cent for the year ending March 15 last. It is apparent that the decline in some of the other commodities such as cotton and copper has gone about as far as it is likely to go, for the low level recently touched by both commodities was actually below the cost of production.

Industry Fighting Hard

The expense of converting raw materials into manufactured products is still greater than it should be and there is no doubt that it will be reduced, not because great corporations are trying to impose upon labor, but because industrial managers are fighting hard to make both ends meet. For this reason the developments in the labor market will be worth watching as the liquidation or reduction of wages is one of the most difficult, yet urgent, problems connected with the after war readjustment. The position of the railroads will be helped by the abandonment on July 1 of the national wage agreements as it is a great injustice to burden the public with higher operating charges, which means higher shipping charges, than the average traffic will bear. The Railroad Labor Board together with other government agencies may be depended upon to ascertain the exact facts and to deal justly with both the employers and the employed. There is reason to believe that an amicable settlement will be arrived at, for the situation is perfectly clear and the sensational decline in traffic emphasizes the folly of continuing wage scales and working hour agreements which make it possible for labor to consume more than 60 per cent of the gross incomes of the railroads.

Price readjustment in other lines is proceeding satisfactorily and manufacturers and merchants everywhere are operating cautiously, and trying to at least break even. In some lines this is a difficult task and there have been many instances where manufacturers and industrial managers have kept their plants in operation, not for the profit in the business at prevailing prices, but in order to give their operatives something to do. Federal, state and municipal officials are trying to start up road-building campaigns and other public enterprises so that the large unemployed classes might be given something to do and their families saved from suffering. Labor leaders in some cases have recognized these conditions and have advised the men to accept reduced pay without question. The unemployed problem is not as serious in all lines as it was a month ago and the hope is that with the resumption of spring work, it will be possible to launch more undertakings calling for the employment of a large number of idle men.

Spring Revival Here—National City Bank of New York

The general situation as to trade and industry has shown some further improvement during the past month, although the fundamental difficulty, which is the disruption of the price level between raw products and manufactured goods, is yet far from overcome. According to government reports, the level of the principal farm products declined 5.6 per cent in March, whereas the normal movement in March is upward, and over the last ten years has averaged 3.4 per cent. On April 1 the index figure of farm products was 58.3 per cent lower than a year ago, 48.6 per cent lower than two years ago and 27.6 per cent lower than the average on April 1 of the past ten years. Other primary products, such as lumber and the metals, as yet have made no recovery, while on the other hand manufactured products, especially at retail, freight charges and personal services generally, have made no corresponding decline. Naturally the sale of manufactures has fallen off, railway traffic has declined and there is a large amount of unemployment. A description of the situation is enough to explain it, for agricultural products and raw materials represent the purchasing power of about one-half the population.

Nevertheless, there is bound to be more doing in the spring than in midwinter, and the industries are going much better than they were three months ago. The automobile industry naturally is stimulated by spring and good weather, and has come back strong. The tire industry has revived, and one of the biggest tire companies, the Goodyear, which was in financial difficulties as a result of the sudden falling of business in the face of big inventories, has been successfully refinanced and started on its way. The tire industry is an important factor in the cotton-spinning industry, and the mills that are getting busy again on tire materials are no longer competing upon other cotton fabrics.

Iron and Steel

The iron and steel situation is quiet, with demand light, and no developments of importance since the United States Steel Corporation announced its reductions. The smaller producers are making practically no profit from present operations, and are not disposed to cut prices further at a time when they see little prospect of stimulating the demand. The big corporation is very deliberate in its policies, and especially desirous of avoiding criticism in its relations with labor. It is responsible for no wage reductions as yet, although with operations curtailed approximately one-half it is evident that wage payments are very much lower than they were. This, however, does not excite criticism like wage rate reductions, and the management probably is of the same opinion expressed by others, that price reductions at this time would not create new business. The reduction of prices in any one line usually seems to the people in that line to be not enough to change the general situation.

The Railroad Situation

The Railroad Labor Board made short work of the national wage agreements, after hearing the evidence. It dispensed with arguments and ordered the agreements abrogated as of July 1, next, directing that in the meantime agreements be negotiated between the individual roads and their employees. This is the action contended for by the railroad companies, with a view to attacking the burdensome classifications and other conditions which they inherited from Government control. A notable feature of the Board's decision was a draft of general principles which it laid down for the purpose of indicating to the contracting parties the conditions which the Board will require. They are generally regarded as excellent and if the Board is successful in establishing them as the standard of conduct in the operation of the railroads it will be one distinct achievement to the credit of the Esch-Cummins law.

A. S. M. E. Confers Honorary Membership

The American Society of Mechanical Engineers announced, on May 12, the election to honorary membership of Henry R. Towne, head of the Yale & Towne Manufacturing Co. and Nathaniel Greene Herreshoff, naval architect and yacht designer. The honor, which recognizes distinctive achievement in engineering and scientific endeavor, will be formally conferred at the next annual meeting.

Railroad Activities in Russia and Roumania

The Czecho-Slovakian paper *Vecer*, of Prague, publishes an interview with the Russian Railway Commissioner Lomansow, who has been in Prague for the last few weeks. According to this interview the Soviet government is about to place the following orders for locomotives: 300 each with Czecho-Slovakia, Switzerland and Italy, while 2,000 engines will be ordered in England, Germany, Denmark and Sweden, and 2,700 in the United States. Lomansow furthermore declared that the Soviet government will dispose of 2½ milliards in gold and jewelry to pay for the locomotive orders.

The Roumanian ministry of public works has just published a report, according to which 331 kilometers of new railways are now under construction in Greater Roumania, involving the expenditure of 100 million lei. The construction of other new lines will soon be started and the government has granted quite a number of concessions for private lines. The demand for all kinds of railway material is steadily increasing in the country.

An Appeal for Machine Tools from Korea

An unusual opportunity is offered to members of the machine-tool industry to come in contact with the future industrial leaders of Korea.

An established college is now installing a model machine shop for training efficient Korean young men in toolmaking and modern machine practice. These young men will be the future mechanical engineers and teachers in their land. This college is known as the "Chosen Christian College" and is operated by a board composed of members of nearly all of the missions working in Korea and is inter-denominational in its character.

This machine shop will give the Korean young men practical experience in a line of work with which they are only very slightly familiar and for which a rapidly growing demand is developing.

This is an exceptional opportunity to introduce high-grade American machine making tools to these young men and should result in opening Korea as a market to American manufacturers.

The headquarters of the college is at 150 Fifth Ave., New York City.

Indian Trade Notes

The *Indian Textile Journal* states that according to reports geological investigations have been made of the recently discovered iron ore deposits in the southern parts of Singhbum in the province of Behar. It is found that the ore occurs usually at or near the tops of the hills, the most important deposit being in the range running from about three miles southwest of Gua to the Kolhan-Keonjhar boundary east of Naogaon, a distance of about 10 miles. The applications made for prospecting licenses and mining leases have been numerous.

Figures given in *Finance and Commerce* show that 1,041 motor cars were imported into British India during September, 1920, of which 723 cars were from the United States and 247 from the United Kingdom. During the previous six months the number of cars imported was 7,948 valued at 308 lakhs (1 lakh equals 100,000) of rupees, compared with 2,553 cars valued at 74 lakhs of rupees in the corresponding period of 1919. Of these the United States sent 5,654, the United Kingdom 1,002, Canada 542, France 49, and Italy 43. Bombay imported 2,775 cars, Bengal 2,694, Madras 908, Land 590, and Burma 531.

Metal Trades in China

There are more than twenty machine shops in the city of Harbin. The smaller shops, which are in the majority, produce printing presses and flour milling machines, while the larger plants are equipped to build machinery of all kinds and several are connected with shipyards.

A large iron works, Shwang Hou Shen, is to be established near the Great River this spring. Many Chinese and foreign engineers have already been engaged for construction of the plant.

A large deposit of iron ore 11 miles from the Yangtze River in North China was recently investigated, with the result that it was found to contain about 4,000,000 tons of workable ore of high grade, and that conditions for working this deposit are generally satisfactory. Plans are now being prepared for the establishment of an ironworks at the port of Chinwangtao.

Steamship Operators Readjust Ocean Freight Rates

Ocean freight rates on commodities contingent to and moving through North Atlantic, South Atlantic and Gulf Coast ports were rearranged and readjusted at a recent conference of steamship operators held in Atlanta. The readjustment was brought about to obtain, through the adoption of new tariff schedules, an equitable distribution of products through the ports represented at the conference, as encouraged by the federal shipping act of 1920.

The rate agreement met with the unanimous approval of the operators present. It also accords to Southern ports competitive equities that have heretofore been denied them. It is understood that the South Atlantic and Gulf Coast ports were given everything they requested in the general readjustment.

Steamship operators attended the conference from the Northern ports of New York, Boston, Philadelphia, Baltimore and Norfolk, and from all of the South Atlantic and Gulf Coast ports.

Swiss Machinery Market Overstocked

Consul A. W. Donegan reports from Zurich, under date of Feb. 14, that local stocks of agricultural machinery and farm implements are claimed to be sufficiently large to cover the entire demand of Switzerland for years. The border warehouses, too, are stocked, and what sales are made from time to time are at very low prices.

Swiss manufacturers during the war increased their output considerably, as the warring countries, with the exception of the United States, were unable to export machinery of this type. Since the armistice the rate of exchange in Switzerland has been favorable to neighboring countries and has had the effect of overcrowding the Swiss market with farm machinery. Last year the imports from Germany alone were about three times the size of the imports from that country in normal years.

Swiss import figures for the first six months of 1920 give the total value of $898,825 for agricultural machinery and farm implements, while the United States is credited with $208,491 of this amount and Germany with $632,451.

Austrian Auto Builders to Merge

Austria's automobile industry is doing really much better than might be expected, in view of the general industrial depression throughout the country. This is largely due to the absence of foreign competition, since with the present low value of the crown it is next to impossible for American, British, French, Italian, or German manufacturers to sell their cars in Austria. A first-class German car would now cost more than twice as much as a similar car of Austrian make. At the same time the low value of their crown enables the Austrians to sell their products abroad at prices with which the home manufacturers in those countries cannot compete.

Taking advantage of these conditions, three of the largest Austrian automobile concerns, the Austrian Daimler, Austrian Fiat, and Puch Works in Gratz, are about to complete an amalgamation, the preliminaries for which were begun a long time ago.

Japanese Steel Merger

The combination of the six large private iron and steel companies in Japan is proposed by the government's financial and economic investigation committee as a remedy for the present financial difficulties of the industry of Japan. It is suggested that the government should give substantial aid to the combined companies, which would have an output about equal to that of the Wakamatsu State Steel Works, while these private factories and the government works together would control about 90 per cent of the country's total production.

Bellis Heat-Treating Demonstrated at Geometric Tool Co.

At the plant of the Geometric Tool Co., Blake and Valley Sts., New Haven, Conn., the Bellis equipment and process of heat-treating high-speed steel was demonstrated before the New Haven Chapter of the Steel Treaters Association and invited guests from the city and adjacent territory on the evening of Thursday, April 14.

The Bellis furnace is a rectangular structure with provision for three open crucibles, so constructed that only the central chamber and crucible need be fired after the furnace has reached working temperature. Gas is the fuel used, and the burners are arranged tangentially in a circular chamber so that the flame does not impinge upon the crucible.

The central chamber is connected by flues to the adjoining chambers on either side, so proportioned and controlled by dampers as to maintain correct relative temperatures in the secondary crucibles. Auxiliary burners in the supplementary chambers are used when starting with a cold furnace; to be shut off when the required temperatures have been established.

For hardening the standard high-speed steels a temperature of 2,200 deg. F. is maintained in the central crucible; approximately 1,400 deg. F. in the preheating crucible, and 1,100 deg. F. in the quenching crucible.

The high-heat crucible is composite, consisting of an outer shell of a special refractory material with a ¼-in. lining of steel. The other two crucibles are of steel, or may be of any other of the refractory alloys commonly used for this purpose. The heating medium used in the first two crucibles is a compound of salts patented by the Bellis Heat Treating Co., while the quenching medium, not being subjected to the extreme temperatures attained in the preheat and high-heat crucibles, is a compound of lower melting point. The features claimed for the Bellis compound are homogeneity, fluidity, and the ability to withstand high temperatures indefinitely without breaking down and forming compounds that will attack the steel.

The pieces upon which the demonstration was conducted were high-speed steel chasers of various sizes, the regular product of the Geometric Tool Co. Sets of two, four, or six of the chasers, according to size, were wired together and suspended in the molten compound contained in the first crucible, where they were allowed to remain for a period of three minutes. They were then transferred to the high-heat crucible for the same length of time and then immersed in the quenching compound.

The length of time the work remains in each bath is determined by the time required in the high heat crucible to make certain that each piece is uniformly heated to the temperature of the bath; and this time may vary somewhat according to the size and nature of the piece. The time of immersion in the other two baths is not so essential, beyond making certain that the work has reached the temperature of the bath before it is removed; but as a matter of convenience all the shifting from one bath to another is done at the same time; thus there is a fresh batch of work entering the preheating compound and one batch leaving the quenching bath at the expiration of each three-minute interval.

The work, though still red hot, is properly hardened when it leaves the quenching bath, and may be allowed to cool in air. It is, however, further cooled in oil to a degree that allows it to be handled, for the sake of expediting its progress through the hardening room.

After witnessing the demonstration, which was conducted in the regular hardening room of the plant, the party adjourned to the lecture room, where they were addressed by Major Bellis, the originator of the process. The speaker directed the attention of his audience to the benefits to be derived from the labors of large scale organizations; briefly outlined his connection with the research work carried on during the war by the United States Army in relation to the handling and heat-treating of high-speed steels, and told the results of tests that had been made of the various methods of heat-treatment.

He called attention also to the advantages of a liquid medium by means of which the heat would be rapidly and evenly conducted to all parts of the work without danger of overheating the corners or smaller sections; the difficulty of securing an even heat by the pack-hardening method, and the liability to oxidation and scaling attendant upon any method of heating in an open fire.

The Geometric Tool Co., through its president, Howard E. Adt, extended an invitation to the guests to submit their hardening problems for solution and to bring in samples of work with which they had experienced difficulty to be put through the process under the direction of the company's experts.

Machinery Used at Ford Sawmill

Machinery and other equipment which will eventually handle 100,000 ft. of timber a day is in process of installation at the Ford plant, Iron Mountain, Michigan. About 20 per cent of the complete equipment for the sawmill is already in place, consisting largely of live rolls, edgers, band mills and crimmers. Four 300-hp. Wick's boilers are being placed in position in the powerhouse east of the mill. A steam turbine capable of 750 hp. will furnish power for the huge mill saws.

A distinct feature of the mill is that every machine within it will be operated by an individual motor, with power furnished by the huge Wick's turbine. The mill will open about July 1.

Effect of Price Reduction on Steel Trade in South

That the new scale of reduced prices, announced recently by the United States Steel Corporation, will tend to make jobbers feel that they need hesitate no longer in placing their orders and that the new prices will have a sobering effect on the trade is the opinion expressed by prominent men of the iron, steel and metal trades industries in the Birmingham district. The steel price reductions are believed to be one of the best things that has happened for business in several months. No immediate purchasing movement is looked for because general conditions are not such that there is any great demand for steel products, but the jobbers will doubtless feel that the bottom has been reached and that they can now replenish their depleted stocks, with the virtual assurance that steel prices are now on a uniform and generally firm basis.

It is noted that steel mill operations are experiencing steady improvement in the Birmingham district. The Gulf States Steel Corporation is planning to relight its iron furnace at Gadsden on May 1, and will also resume operations in the open hearth furnace of the steel plant at Alabama City. The plate mill at the Fairfield works of the Tennessee Coal, Iron and Railroad Co. is operating double time, with enough orders in hand and being received to merit it. The bar mill of the Bessemer Rolling Mills and the rail and blooming mills at Ensley are operating steadily. About half of the open hearth steel mills in the district are now producing, while there are now five blast furnaces making basic iron at Ensley, one making ferromanganese, and one making foundry iron at Bessemer. This is considerable improvement in that regard and gives excellent promise of an early return to normal in this district. Within another week or two the car plant at Fairfield will also resume operations on a full-time schedule.

Mention of the name of George Gordon Crawford for the presidency of the United States Steel Corporation, to succeed James H. Farrell in the event the latter accepts the appointment tendered him some time ago by President Harding as chairman of the United States Shipping Board, has created considerable interest among men connected with the iron, steel and metal trades industries of the Birmingham district, for Mr. Crawford is well known in that section. He has been president of the Tennessee Coal, Iron and Railroad Co., of Birmingham, since 1908, and prior to that time was president of the National Tube Co., a subsidiary organization of the steel corporation. As a director of big affairs and a manufacturer Mr. Crawford has proven his ability in the excellent record he has made while in Birmingham. Men of the iron and steel industries throughout the country concede that he is well fitted for the presidency of the steel corporation.

French and Dutch Air Services Supplanting English Control of Air Lines in Europe

SPECIAL CORRESPONDENCE

Those interested in the development of commercial air-service in Great Britain are greatly perturbed over the adverse turn conditions have lately taken. In spite of British government assistance the air buses of continental Europe seem to be driving the English interests from the field.

Mr. Winston Churchill, Secretary of State for the British Colonies, has consented to retain temporarily the secretaryship of the air. Referring to this a writer in the *London Times* recently made statements which are significantly applicable to conditions in the United States. They are in part as follows:

"Were the Colonial Office a Ministry of Imperial affairs, there would be something to be said in favor of charging it with the development of British Aviation. *Our Empire requires aircraft even more urgently than any other power. We require it for defense, for linking our scattered commonwealth and for internal communications.* The small area of the British Islands may afford insufficient scope for aërial transport and our uncertain climate may be unpropitious, but Canada and Australia, Africa and India *present the wide spaces which give air craft full opportunity* while their climates are less subject to unpredicted changes. If the production of aircraft is not developed in Great Britain, our Dominions, Colonies and Crown Territories will get what they need from France, Germany or America. *Civil aviation is stagnating here.* The London terminus of commercial flying (which was to be the Charing Cross of the Air) is almost idle except for the visits of foreign competitors. There is a superficial attraction therefore in the idea that Mr. Winston Churchill with his constructive imagination and his restless energy should at the same time encourage the constituent parts of the Empire to demand aircraft and stimulate British manufacturers to supply the demand. *We have often urged it is the commercial application which must form the basis of swift and economical development, aircraft is not the least important of the three branches of the services. It must have behind it the full authority of a Minister of State who can concert measures for the defense of the country on equal terms with the Admiralty or War Office.*"

BRITAIN FALLING BEHIND

In support of the statement above regarding the comings and goings of "foreign competitors" at the London air terminus, the following will throw some light on the seriousness of this situation: "During the period from Feb. 7 to Feb. 13, 1921, there were 13 arrivals and departures from the official air-port at London to or from the continent with passengers, mails and merchandise. Of the thirteen machines, *five* were operated by the *Syndicat National pour l'etude des Transports Aeriens; five* by the *Massageries Aeriennes;* and *three* by the *Compagnie des Grands Express Aeriens.* Not one machine was operated by a British air-transport company."

During the war Great Britain performed wonders in her airplane development work but for some reason the advantage she then gained seems to be slipping from her. Immediately after the war the International Air Traffic Association was formed at a meeting at the Hague, with Major General Sir W. S. Brancker as chairman. It is a significant fact that this association, which at its inception was practically controlled by British interests, held its last meeting at Berlin

The British technical press, especially that branch of it which is intimately associated with aëronautics, is extremely pessimistic regarding the future of commercial air service in Great Britain. The Dutch and French are, however, preparing for a great boom in the industry during the coming season.

A VALUABLE TRAFFIC

Last year the French companies carried over 5,000 passengers and French air experts assert that this season the number of passengers will easily reach 20,000. The traffic is valuable and France is determined to carry it. Last year the French government spent $500,000 in the encouragement of commercial aviation. It is said that France is prepared this year to spend $2,000,000 for this purpose. Relying on government assistance the French commercial companies have cut the price of the Paris to London air trip to 300 f. (about 21 dollars). By making this cut the French expect to divert from the railways a large number of first-class passengers and it is reasonable to believe that they will.

The land and sea trip from London to Paris involves two train trips, viz., London to Dover, Boulogne to Paris, and one boat trip, Dover to Boulogne. If one takes into consideration the incidental expenses of these three trips (which are avoided by the air passage) under the new tariff it will be almost as cheap to travel by airplane as by land and sea. If time is of moment then all the advantage is in favor of the airway for by it there is a saving of about six hours.

The British air transport industry has been so hard hit by the recent hard times that even if an attempt is made to "buck" the French by cutting fares it is doubtful if the trade could be made to pay. The present British fare from London to Paris by air bus is £10 10s., say $40, if this is cut to £5 5s. (about $20) to meet the French tariff, and to it is added the British subsidy, the total amount received per passenger will amount to only a little over £6 10s., about $26.

The British air program for 1921 is badly disorganized. Orders for new and improved passenger aircraft have been cancelled. It is therefore considered impossible for the British air companies to handle sufficient volume of business to make a profit at the reduced price.

The French and Dutch made their plans last fall and have consistently adhered to and wherever possible improved them. It is therefore to be expected that they will be the nations who will most benefit from the coming air boom.

The Dutch are principally interested in the routes covering northern Europe.

Brill Co. Produces Gas Railway Engine

A gasoline-propelled passenger coach and trailer for use on steam or electric railroads, which eventually may revolutionize city and interurban passenger transportation, has been completed by the J. G. Brill Co., Philadelphia, Pa.

It is a development of an idea on which railway and motor engineers have been working in recent years. One point in this effort has been to get a simpler and less expensive means of transportation.

The government has become a sponsor for this new type of passenger vehicle. This Philadelphia car will be shipped to Camp Allen A. Humphreys, at Belvoir, Va., where the government will put it in use in place of steam equipment. Army engineers in Philadelphia on orders from Washington have inspected and approved the car. Its performance on the camp railway will be closely watched by railway leaders as well as the government representatives.

Circular on Physical Properties of Materials

Circular No. 101, issued by the Bureau of Standards, aims to present in readily accessible form the best available data on the strength and related properties of materials. Among those treated are iron, carbon steel, alloy steels, wire and wire rope, semi-steel, aluminum, copper, miscellaneous metals and other alloys, rope, rubber, leather, and wood. The tensile strength, proportional limit, percentage elongation in 2 in., percentage reduction of area, Brinell and scleroscope hardness corresponding to a certain composition, density, and method of preparation are shown in most cases for the metals and alloys. In addition, figures are given in many instances for the compressive and shearing strengths, moduli of rupture, and Erichsen values. The circular also includes definitions of the properties treated and references to sources.

Wallace Speaks Before Milwaukee Engineers

Condemning the "eternal triangle" which makes up the daily schedule of the average workshop as deadly to industry, and commending the doctrines of Theodore Roosevelt as a safe guide for the nation's industrial leaders, L. W. Wallace, executive secretary of the American Engineering Council of the Federated American Engineering Societies, declared that the most important task of capital was to give the economic facts governing world industry to the masses of industrial workers.

Addressing the conference of the Society of Industrial Engineers, at Milwaukee, Wis., on April 27, Mr. Wallace asserted that industry of every kind was saddled with enormous waste and that more co-operation and less competition was a vital national need. Mr. Wallace pledged the support of the new engineering federation, which is pushing its organization into every industrial center of the country, to Congress in the work of government reorganization.

He called upon the legislators not to be disturbed by propaganda in behalf of those who will lose their jobs when business principles prevail in Washington, saying that to bring about a reorganization that will mean most to the nation will require the application of the Rooseveltian principles of honesty, courage and common sense. Impossible conditions prevail in the conduct of the public business, said Mr. Wallace, citing Secretary Hoover's statement of absurdities which exist in the Department of Commerce. Mr. Wallace added:

"Today as never before in the history of industry there is a necessity for candor and absolute honesty. More information and less hearsay is the need of the hour. We can conceive of no more important task for the industrial leader to perform than just this: Give the economic facts governing world industry to the masses of industrial workers.

"With such a background formed, then take them into your confidence as regards your business. Show them the books of the company, inform them of the financial condition of the company and as to the probable business for the year. If this be done much hearsay and the restlessness and disturbance resulting therefrom will be eradicated.

"The industrial leader needs to be more than purely an industrialist, just as Herbert Hoover, an engineer, is more than purely an engineer. Unfortunately the daily schedule of too many industrial leaders reads as follows: Home to plant—plant to lunch—lunch to plant—plant to home. An eternal triangle, almost as deadening as that other eternal triangle that we so frequently hear of. The industrial leader, by virtue of the fact that he has within his control the destinies of hundreds or thousands of workers and their families has a peculiarly significant responsibility to meet as a citizen. He cannot shut his eyes to the condition of the schools, of the streets, of the public utilities of the community in which his workers reside. If he fails to make his executive ability felt in all matters of community concern then he has failed to meet his responsibility as an industrial leader."

Mr. Wallace said that the national assay of waste being conducted by American Engineering Council had demonstrated the necessity of standardization of production and that new policies of distribution must be adopted if costs were to be lowered and normalcy attained.

How Dusty Is Your Plant?

All industrial plants are dusty. But how dusty is the air in any particular plant? Knowledge as to the degree and composition of such dust is important, for certain amounts and sorts of air dust seriously affect the lungs and predispose those who breathe them to tuberculosis and other diseases.

Dr. O. M. Spencer, of the U. S. Public Health Service, discusses the matter in a recent report of the Service. He shows that neither the fact that the exhaust pipes, etc., required by law appear to be properly functioning nor the use of wet instead of dry processes in grinding, polishing, and the like make it at all certain that the dustiness in a given plant is what it should theoretically be. He finds that many exhaust pipes do not in fact exhaust as they are supposed to do; and that under certain conditions some wet processes create much more dust than dry ones. Only actual "dust counts" show the real dustiness of the air that the workmen must breathe; and such counts should be made periodically to check the theoretical conditions.

To determine how unhealthful the dustiness of any particular plant process may be the composition of its dust should be ascertained and its effects interpreted by standard tables, which Dr. Spencer urges should be worked out for the various industries. Different industrial processes produce dusts which differ greatly in injurious properties.

To Organize Association of Employees' Clubs

On May 25 a conference will be held in New York City to effect organization of an association of the employees' clubs of America. Active membership will consist of clubs, associations or societies of employees of industrial, financial, mercantile or other organizations, having for their main purposes social, athletic, educational, thrift and savings, health, safety or other similar mutual benefit activities; companies having "clubs" holding active membership will be associate members.

Plans for the organization have been under way for several months by a temporary committee with headquarters on the 22d floor, Times Building, New York City.

Steel Industry Operating at 40 Per Cent Capacity

The feature of the iron and steel industry during the month is of course, the 20 per cent reduction in wages announced by the United States Steel Corporation, effective May 16. The immediate result of this reduction has been to arouse hope in the breast of the consumer that lower prices would follow. As far as the corporation is concerned, it has been figured out that the cut in wages did not offset the reduction in prices of April 13. Last year the labor cost alone on each ton of steel sold by the leading interest amounted to $40.80, as against $15.03 a ton in 1915, and the recent cut will bring the labor cost to about $32.64, which is still more than 100 per cent greater than the pre-war figure. The independents have been struggling along at prices which show little or no profit, anticipating that a revival in buying and consequent increase in operations would increase the profit and enable them to maintain the present price schedule and labor wage level. There is no prospect of an early buying movement, however, and there is a growing conviction that the independents contemplate a further reduction in wages so as to accomplish a lower price level. The wage reduction by the corporation is most severely felt in and around Pittsburgh as a great number of the mills of the leading interest are situated in this district. Union leaders and representatives of the independent steel interests will meet in Atlantic City late in the month to confer over the wage agreement.

The operations of the steel mills throughout the country are estimated at approximately 35 or possibly 40 per cent of capacity. This week, as was the case during the two preceding weeks, the increased demand for steel sheets, bars, etc., from the automobile manufacturers has been the bright spot in the market. There is a surprisingly small amount of price cutting from the level lately established by the independents and the corporation and virtually none by the larger independent interests. There is some shading being done by the steel warehouse interests, and jobbers in different parts of the country, and the fact has been brought out lately that not all of the surplus stocks bought at high prices during the boom times last year have been liquidated.

The daily pig iron output is down to the lowest level it has touched since the year 1908, and the April production amounted to only 1,193,041, as compared with 1,595,522 tons in March. Fifteen furnaces were either banked or blown out during April, and but nine blown in, and the month of May started with but 96 furnaces producing, as against 319 Oct. 1, 1920. W. P. Snyder & Co. estimates the average price for basic iron during April at $22.50, as against $24.50 in March, and that of bessemer at $25, as compared with $26.20 during March.

Business Conditions in Germany

By Our Berlin Correspondent

The decline of business is still progressing. In fact the political crisis, initiated by the London conference, is taking effect in business life only by degrees, and a further aggravation of the situation must be expected. The slight revival of demand, stimulated by efforts to obtain supplies before the sanctions and the customs barrier in the Rhineland came into effect, has subsided. Business between England, France and Belgium on the one hand, and Germany on the other, has come to a complete standstill.

On the other hand, the supply of raw material for the machine building industry has further improved. It appears that the production of the steel works during the last months widely exceeded the demand, and that the works are overstocked. The steel mills are now from 50 to 70 per cent working for stock. Their situation is rather serious, it being reported that many large orders have been suspended, and very few new orders received. This is ascribed to the expected reduction of prices, but is obviously due to a large extent to the general business depression. Nearly all mills are, in defiance of the price convention, selling below the official prices without being able to stimulate the market. The extent of current underbidding can be seen from the following figures:

	Official Prices of Iron Society	Actual Market Prices per Ton
Bars	M2,440	M2,000
Sections	2,340	2,100
Plates	3,000	2,700
Sheets	3,360 to 3,775	2,800
Wire	2,720	2,300

The prices of bars were, in May, 1920, M5,800 per metric ton, and the drop since then is, therefore, more than 60 per cent. More important still to the machine building industry is the decline in the prices of castings. These prices have lately been fixed as follows:

Castings from	Marks
2 to 10 lb.	2.80 to 3.60 per lb.
20 to 100 lb.	2.40 to 2.60 per lb.
200 to 1,000 lb.	2.20 to 2.35 per lb.
1,000 to 2,000 lb.	2.10 per lb.
2,000 to 6,000 lb.	2.07 per lb.
Over 6,000 lb.	2.00 per lb.

These prices are, however, purely nominal, the works having received permission to give discounts up to 40 per cent in order to meet the present market conditions.

Such reductions are affording the machine building industry some relief, especially as a decrease of wages cannot be expected, and their maintenance at the present level is all that can be hoped for. They are, however, only of a temporary character, and it is very doubtful whether the lower prices will last out to a period of brisk business, when the machine building industry could really enjoy them. Moreover, they are largely counteracted by the general increase of freight rates, which in the case of coal and raw material amounts to 65 per cent. In the case of factories removed from the coal and iron districts, the increased freight charges more than balance the present or any possible future decrease of prices.

The degree of the employment of the machine building industry in the various branches still shows the same variations. To the most favored branches—the locomotive and railroad car industry—has lately been added the shipbuilding industry, large orders having been placed, or are being placed, on the strength of the huge indemnity awarded the shipping concerns. The locomotive and car factories have in hand very voluminous orders amounting to M2,830,000,000 from the German State Railroads for 900 locomotives, 1,344 passenger cars, and over 12,000 trucks. Besides these orders, large orders have come from abroad for locomotives and cars. The employment of the agricultural machinery industry has remained stationary. With these sole exceptions, a continuous decline of business is noticeable in all other lines.

The large aeronautical industry of the country, which has tried to find employment in other lines, has so far had very little success in this direction, and is in a most distressing state, most works having been shut down.

The electrical industry, which entered into the current year with great expectations for large orders from electrification schemes, and has made preparations for increased output, laying in huge supplies of foreign copper and other material, and making provisions for increased manufacturing space, has so far been entirely disappointed. The extensive program of hydro-electric and other power plants, which for a long time had the interest not only of the electrical industry, but of the whole population, has been withdrawn for the time being, evidently due to the changed aspect of the world's coal situation. This not only applies to Germany, but also to surrounding countries, like Switzerland and Sweden, where the enthusiasm for electrification also has cooled down completely. The German electrical industry, which was figuring on having a share in foreign electric developments, appears therefore to be balked in this direction also.

The only branch of the industry which so far enjoys fairly good employment is the telephone and telegraph.

In the machine-tool industry, the decline has assumed larger proportions than ever before since the London conference. Only small factories making specialties are adequately employed. The main business in hand is mostly for railroad cars and locomotive factories. The shipbuilding industry has so far withheld large orders, and none are expected to be forthcoming, as the existing plant is more than adequate for all present requirements. The factories in the occupied Rhineland have practically come to a standstill. Their situation is a very precarious one indeed, as they find themselves locked in entirely on all sides, and separated from their markets. The limited market left them within the narrow confines of the present customs barriers is of course insufficient to support these industries.

As the manufacturers in this district are confronted by higher cost of raw material also, and by a possible rise of wages, caused by increased living expenses due to the isolation from the interior of Germany, it is difficult to see how they will be able to compete with their rivals across the customs frontier. The views in this respect are exceedingly gloomy. Alfred H. Schütte, of Cologne, has shipped the greater part of its stock to the Berlin branch, and has left only samples of each type of machinery at headquarters. This is significant of the expectations entertained in these parts. Schütte's shops are now working only four days a week, with a reduced number of workmen. They present, however, rather a picture of desolation, on account of the small amount of machinery now in operation.

In consequence of this situation, prices are weakening along the whole line, and the elaborate organization which the machine-tool industry has established for the maintenance of standard prices, seems tottering. This organization comprises committees formed out of manufacturers of the various types of machinery, which are an integral part of the Machine Tool Builders' Association. The committees lay down rules for minimum prices, which have, during times of good business, very often been exceeded, sometimes by more than 100 per cent, but are now silently disregarded. Discounts are being given of from 15 to 30 per cent of the prevailing standards. The following figures, representing the prices of the Lathes Convention, demonstrate the movement since last year. For a lathe of the most up-to-date type with single pulley drive and change gear box, the following minimum prices have been, or are now, in force:

	Jan., 1920	May, 1920	Present Prices
16″ x 3½′, weight 1,400 kg.	M 28,000	46,000	32,000
18″ x 3½′, weight 1,700 kg.	35,000	57,000	40,000
22″ x 3½′, weight 2,600 kg.	45,000	75,000	57,000
27″ x 3½′, weight 3,900 kg.	62,000	102,000	72,000

It should be noted that the prices reached their culmination point in May

of last year. Shapers of modern type registered the following prices:

	May-August, 1920	Present Prices
16-in. shapers..	M 25,000	M 22,000
20-in. shapers..	29,000	25,000
24-in. shapers..	36,000	27,500

MILLING MACHINE

28" x 7", weight 800 kg.. M 21,000 M 18,000

UNIVERSAL MILLING MACHINES

30" x 9", weight 1,000 kg. M 44,000 M 36,000

Ten per cent discount is being given to the trade, and for export trade, 10 per cent, as a rule, is added. Numerous cuts in quotations are, however, now becoming quite the rule, as the control of export prices has considerably relaxed. A movement is now on foot to discard the whole organization for the adjustment of prices, manufacturers desiring a free hand. The export control will be maintained only nominally, to interfere solely in the case of ruinous underbidding.

As the majority of manufacturers are now mostly working for stock, and the latter is accumulating at an alarming rate, the production will have to be reduced, unless an outlet can be found for the industry. According to authentic information, the present convention prices contain—in the case of well-equipped factories—a net profit of 25 per cent. This percentage represents the limit to which manufacturers can go in reducing their prices without actually selling below cost. The actual practice in quotations has already arrived at this limit without any material results as to improvement of business, which seems to prove that against all theories it is not solely the price question which is at the root of the present business crisis.

Business Items

The Victor Tool Co., of Waynesboro, Pa., has opened a branch office in New York City, located at 131 West 39th St. F. W. Curtis is manager and W. J. Boe, sales engineer. All matters pertaining to the New York territory will be handled at this office.

The Philadelphia Gear Works, Inc., 1120-1128 Pine St., Philadelphia, Pa., has opened a new factory to be known as Plant No. 2, which is expected to be in full operation in a few weeks. The plant is equipped with a 15-ton electric crane, enlarged railroad facilities and much additional floor space. A full complement of modern machinery has been installed.

The Hamilton Car Co., Ltd., of Hamilton, Ont., Can., has been organized for the purpose of carrying on the business heretofore conducted under the name of the National Steel Car Corporation.

The Tinius Olsen Testing Machine Co., 500 North 12th St., Philadelphia, Pa., has taken over the manufacture of balancing machines formerly made by the Carlson-Wenstrom Co. and the Lippincott-Carwen Co. of that city.

The Cadillac Tool Co., Detroit, Mich., announces the removal of its machine-tool sales division to the new quarters at 38 Hendrie St., Detroit.

The Air Reduction Sales Co., manufacturer of Airco oxygen, acetylene and welding and cutting apparatus, will move its executive offices to 342 Madison Ave., New York City. It is also announced that the district office will now be located at 191 Pacific Ave., Jersey City, N. J.

The Simpson-Peck Manufacturing Co., of New Haven, Conn., was recently organized and incorporated with a capital stock of $50,000 to engage in the manufacture of tools, hardware, etc. The incorporators are W. A. Peck and A. A. Twitchell, of New Haven, and W. H. Simpson, of New York City.

The Buckeye Machine Shop, Canton, Ohio, has added an engineering department, in charge of A. B. Wiser, who until recently was production manager of the Union Metal Manufacturing Co. Increasing business made the addition expedient.

The Lee Manufacturing Co., of New Haven, Conn., has recently been organized to manufacture machinery, machines, tools, etc. The capital stock of the new company is $25,000, and the incorporators are Robert E. Hyman, C. L. Buslee, and Attorney Michael J. Quinn, all of New Haven, Conn.

The Cowan Truck Co. has moved its Chicago office from the Fisher Building to 659 West Lake St. In the new location they will open a store and carry a stock of various products. The office will be under the management of T. S. MacEwan.

Announcement has just been received of the removal of Establissments Moerch & Roumet from 120 Boulevard Richard Lenoir, Paris, France, to a building recently constructed at 47 rue de Cambrai, Paris. This building will provide 3,250 sq.ft. of floor space and considerable show window facilities, making it one of the most magnificent machine-tool display buildings in France. The firm also announces that in view of the increased import tariff on German made machine tools, recently imposed by the French government, a greater volume of business with American firms will be possible. Moerch & Roumet is the representative of several American machine tool builders. L. S. Devos, Grand Central Palace, New York City, is the American representative of Moerch & Roumet. E. Bonnamy is the technical director.

The Cincinnati Grinder Co. has recently placed the sale of its line of grinding machines on an exclusive basis with the Marshall & Huschart Machinery Co., in the Chicago district; Motch & Merryweather Machinery Co., in the Cleveland, Cincinnati, Pittsburgh and Detroit district; Henry Prentiss & Co. in the New York and New England district, and will also maintain its own grinding specialists in the respective territories.

Personals

GORDON AHLGREN, connected with the Buettner & Shelburne Machine Co., at Terre Haute, Ind., is making a vigorous fight for the nomination on the republican ticket as councilman from the first ward of his city.

ELWOOD HAYNES, of Kokomo, Ind., was elected a member of the board of directors of the Stevenson Gear Manufacturing Co., Indianapolis, at the annual meeting of the stockholders held there recently. Members of the board who were re-elected follow: G. E. Stevenson, G. R. Stevenson, E. C. Jones, of Indianapolis, T. J. Stevenson, of Anderson; Simeon McQuiston, of Kokomo, and R. T. Wingo, of Detroit. The directors decided at the meeting to build a subsidiary plant at Detroit. The company has perfected a machine for multiple gear cutting, by which all the gears on any given piece may be cut at once.

JOHN MCKAY, assistant superintendent of the McDonald mills of the Carnegie Steel Co., Youngstown, Ohio, tendered his resignation on May 1. His successor has not yet been named. Mr. McKay came to McDonald more than a year ago, after fifteen years' experience as a superintendent of the Carnegie plant in Greenville, Pa. He will return to Greenville where he will retire from active service.

E. D. SHEARMAN, one of the founders of the Salisbury Wheel and Axle Co., Jamestown, N. Y., and its general manager until the company was sold in 1919, has been elected secretary and a director of the Collier Motor Truck Co., Bellevue, Ohio.

C. F. HERRINGTON, who for the past five years has been identified with the Bonnot Co. of Canton, Ohio, as mechanical engineer and district sales manager in Chicago, Ill., resigned on May 1 to accept a position as vice-president of the Holbeck Engineering Co. Cleveland, Ohio.

A. L. DELEEUW, consulting engineer has moved his offices from the Singer Building to 30 Church St., New York N. Y.

C. EARLE SMITH of the National Twist Drill & Tool Co., Detroit, Mich. has recently been elected a member of the board of directors and is now secretary and sales manager of the firm.

Erratum

We regret that due to an error in our issue of May 12 the following personal was inserted in the obituary column instead of in the Personals column:

JOHN A. BAKER, formerly connected with the Mesta Machine Co. of Pittsburgh as assistant general superintendent, has been appointed works manager for the Los Angeles plant of the Rich Steel Products Co.

Washington Notes

By Paul Wooton
Washington Correspondent

Congress and the Army, as well as the Navy, are face to face with the problem of what shall constitute an adequate reserve of material. While such a reserve applies to a limited extent to quartermaster stores and explosives, the main problem is the maintenance of adequate supplies of artillery, rifles, machine guns, shell and other ordnance material. Involved in this question also is the matter of inducing machine shops and other industrial establishments to make preparation for prompt conversion for the manufacture of munitions. It carries with it also the necessity of training machinists and other workers in the specific tasks required in the manufacture of war machinery and other equipment.

Ordnance officials are a unit in the opinion that steps should be taken to maintain a reserve of material. Just at this time, as a heritage from the late war, there are ample supplies of practically all types of munitions. Depreciation, of course, takes place at a rapid rate. The hope is that a replacement fund can be established to take care of this depreciation on an annual basis, thus providing for its renewal without waiting until the whole reserve must be replaced at a formidable expense. Representative Kahn, of California, who is chairman of the Committee on Military Affairs of the House of Representatives, has favored ever since he has been a member of Congress—Nearly 22 years—the appropriation of $50,000,000 annually for a preparedness fund.

Dollar-a-Year Insurance

In a recent address before the officers of the Chemical Warfare Service, Mr. Kahn pointed out that the $25,000,000,000 expended by the United States during the World War would have provided annual payments of $50,000,000 for more than 400 years. Had the American people demanded a preparedness fund of $50,000,000 each year, the saving during the recent war would have been several billion dollars, Mr. Kahn declared. The question now is, will the American people expend $1 per capita per year for a preparedness fund? It is pointed out that such insurance could be bought by the sacrifice of a picture show or a few soft drinks per year. It may be said, however, that there is grave doubt, both among the lawmakers and among Army officers, as to whether the needless losses of the recent war have constituted a sufficient lesson to the public to cause them to demand the appropriation for some such replacement fund. Such a policy would follow that of any well regulated manufacturing plant which builds up each year a replacement fund to take care of renewals.

Despite the feeling that there will be much opposition to the creation of any such annual preparedness fund, an effort will be made to put such an appropriation through Congress. If the effort is successful, the idea is to distribute, as widely as possible, the contracts for guns, shell and other equipment, so that industrial plants may become familiar with this type of work and that the necessary skilled personnel among workmen may be built up. This applies particularly to that part of work on ordnance material, which is the product of machine shops.

Want Mobile Machine Shops

That the mobile machine shops built during the war for the ordnance department are much in demand is indicated by the strenuous efforts being made by the state highway departments to secure some of these units for use in connection with the upkeep of their highway automotive fleets. The War Department is particularly anxious not to give up that type of equipment. Several unsuccessful efforts were made during the last session of Congress to pass legislation directing the Secretary of War to turn over several hundred of these mobile machine shops to the Department of Agriculture for distribution among the several states. Bills again have been introduced at this session providing for such transfer, with the prospects somewhat brighter for their enactment into law.

New Publications

Pyrometric Practice. Technologic Paper No. 170. By Paul D. Foote, C. O. Fairchild and T. R. Harrison, all of the Bureau. Paper covers, 326 pages, 7 x 10 in., 185 illustrations. Published by the Bureau of Standards, Department of Commerce, Washington, D. C.

This volume is a complete treatise of the practical phases and applications of pyrometry, as well as its theory. All general methods of measurement, instruments, use and standardization of pyrometric apparatus are discussed. The paper is illustrated with diagrams and photographs of modern American instruments. Many tables of data are included and the treatise contains an index for ready reference. The volume is quite comprehensive and should serve as an admirable reference book. The principle divisions of the book are: high temperature thermometry, thermo-electric pyrometry, optical pyrometry, radiation pyrometry, resistance thermometry, recording pyrometry, high-temperature control, melting-point methods at high temperatures, standardization of pyrometers and industrial applications of pyrometry.

Descriptive Geometry Problems. By F. G. Higbee, M. E. professor and head of the Department of Descriptive Geometry and Drawing, University of Iowa. Cloth covers, 12 x 9 in., 77 plates, 218 problems. Published by John Wiley & Son, Inc., New York, N. Y.

The book contains only problems and is intended to be used as a supplement to any standard text on descriptive geometry. The problems are well selected to cover the general and special cases, and they provide considerable variety, although dealing with the fundamental principles of the subject.

The arrangement is such that only one proposition appears on a page, although several problems are usually shown on each. The pages can be removed from the book because of the type of binding used. This enables them to be posted up for the use of the students and prevents the assumption of an incorrect problem. The solutions to the problems in practically all cases do not extend beyond the sheets. The paper used will permit of inking.

Electric Welding. By Ethan Viall, formerly Editor *American Machinist*. Four hundred and seventeen 6 x 9-in. pages; three hundred and twenty-nine illustrations and thirty-one tables. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City.

This book is a pioneer of its class and thoroughly deals with the subject of electric welding. It covers a wide range; from the use of the two known types of welding electrodes, through the gamut to the physical properties and metallography of arc-fused steel, automatic arc-, butt- and spot-welding. Nearly every class and make of welding machine is described and illustrated. Some of the chapters are: The History of Electric Welding; Arc Welding Equipment; Training Arc Welders; Carbon Electrode Welding and Cutting; Arc Welding Terms and Symbols; Physical Properties of Arc-Fused Steel; Automatic Arc Welding; Electric Welding High-Speed Steel and Stellite; The Strength of Welds.

The book covers the subject well and a copy should be in the hands of every shop executive.

Turret Lathe Practice. By Joseph G. Horner, A. M. I. Mech. E. Two hundred seventy-six 5 x 8-in. pages; 246 line drawings. Published by Emmott & Co., Ltd., 65 King St., Manchester, England.

A comprehensive treatise devoted to the turret lathe and its use, written in a clear, concise manner which, while dealing with practically every phase and problem of turret lathe operation, especially recommends itself to the practical shopman. The book contains descriptions of both machines and tools, illustrated with line drawings, including tools for various operations as recommended by both American and English engineers and tool designers.

Chapter headings are: Introduction (The Turret Lathe); Turning and Allied Operations; Drilling; Reaming; Boring and Allied Operations; Screw-Cutting; Work Done From the Cross-Slide; Examples of Tool Equipments; Capstan and Turret Details; The Headstocks; Collet Chucks and Wire Feeds. The contents are well arranged, and the material is handled in a manner that indicates a thorough knowledge of the subject.

Gas Torch and Thermit Welding. By Ethan Viall, formerly Editor *American Machinist*. Four hundred and forty-two 6 x 9-in. pages; three hundred and forty-two illustrations and twenty-four tables. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City.

This book thoroughly discusses all phases of welding practice by both the gas torch and the use of thermit. A description is given of nearly all the ordinary types of welds, and practically every type of gas torch of American manufacture is described and illustrated. Among the chapters are: The History and Uses of the Gas Torch; The Production of Gases Used in Welding; Medium and Low Pressure Generators; Pressure Regulators; Making Allowances For Expansion and Contraction; Welding the Various Metals and the Fluxes Used; Welding Jigs and Fixtures; Welding Machines; Thermit Welding; History, Nature and Uses of Thermit; Plastic Process Welds; Fusion Welds of Heavy Sections.

The author appears to have covered about all that is known of the subject, and welders and those having to do with welding and cutting will find this book a veritable encyclopedia of information.

National Electrical Safety Code: Handbook No. 3, Bureau of Standards, Department of Commerce, Washington, D. C. Third edition, 366 pp., 5 x 7½ in., buckram covers. Obtainable from Superintendent of Documents, Government Printing Office, Washington, D. C.

The National Electrical Safety Code has been developed with the co-operation of representatives of all branches of the industry, and the previous edition has become widely known as Circular No. 54. The rules have been adopted in whole or in part by a number of state commissions, and they constitute a recognized standard for the prevention of accidents in the electrical industry. The code consists of four main parts dealing, respectively, with (1) the installation and maintenance of electrical supply stations and sub-stations; (2) the installation and maintenance of overhead and underground supply and signal lines; (3) the installation and maintenance of utilization equipment; (4) rules for the operation of equipment and lines; and supplementary sections which include rules for protective grounding of equipment and circuits.

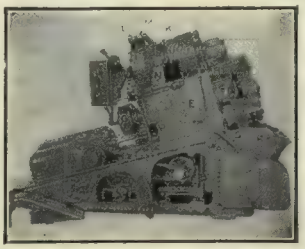
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Lathe, Automatic, Inclined-Bed, Hartness

Jones & Lamson Machine Co., Springfield, Vt.

"American Machinist," Feb. 17, 1921



The machine is intended for production work on the turning of pieces that can be held in a chuck. The motor is mounted in the base, and drives to the change-gear box at the left by means of a silent chain. The head is driven from the gear box through flexible connections. The work is held in a chuck placed over the dumping chip pan at the right. Because of the inclination of the machine the work rests in the proper position in the chuck while tightening. Two sets of tools are carried on round bars, one above and one below the spindle. These bars move endwise for axial feed and turn in order to secure the proper depth of cut, to face or crossfeed, and to present new tools to the work. One large cam drum at the top of the machine controls all of the movements. The tool-carrying heads can be readily removed without disturbing the set up.

Shear, Slitting, Steel, Bench, Chicago

Dries & Krump Manufacturing Co., 2917 South Halsted St., Chicago, Ill.

"American Machinist," March 3, 1921



The shear is intended for use in machine shops, tin and sheet-metal shops, garages and factories. It will cut steel bars up to $\frac{3}{16}$ x 2 in. and will slit steel sheets up to No. 10 gage. The shear weighs 22 lb., the light weight being made possible by an all-steel construction. The frame is pressed from a steel section, and is offset in order to allow sheets of any length to be slit. An adjustable hold-down is provided to keep the material from bending up while being cut. The leverage is obtained by means of a geared lever, the teeth of which mesh with those on the frame. The frame is 9 in. long and 6 in. high. The upper blade is $6\frac{3}{4}$ in. long x $\frac{3}{8}$ in. thick, and the lower blade is $4\frac{1}{2}$ in. long x $\frac{3}{16}$ in. thick. The blades are made of crucible steel. The handle is made of pipe and is shrunk onto the casting forming the gear.

Indicator, Test, Lathe

M. B. Hill, 10 Eden St., Worcester, Mass.

"American Machinist," March 3, 1921

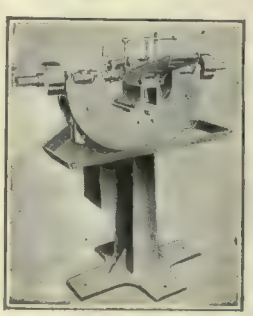


The indicator is attached to the shank by a universal joint, so that when in the lathe it may be turned to any angle. Two sensitive points are provided, one of which may be removed by unscrewing the sleeve without interfering with the action of the other. A rabbetted slide covers the amplification movement, allowing easy access for repair or readjustment. A similar device, not attached to a shank, is made for general use.

Chamfering and Threading Machine, Opposed-Spindle, Automatic, No. 183

Grant Manufacturing and Machine Co., Bridgeport, Conn.

"American Machinist," March 10, 1921



The principal parts of the machine are two cutter spindles, the magazine, and the work-holding and feeding table. The spindle bushings have a lateral adjustment of approximately 2 in., and are fed to the work by levers situated below them and operated by face cams within the body of the machine. The automatic movements are controlled by a small hand lever at the front of the machine, the operating mechanism being located at the rear. The work is placed in the inclined hopper, from which it is fed, clamped, machined and ejected automatically. With slight modification the machine can be adapted for threading both ends of small rods automatically, or for drilling, counterboring or countersinking.

Truck, Warehouse, Self-Loading

Lewis-Shepard Co., 568 E. First St., Boston 27, Mass.

"American Machinist," March 3, 1921



The truck is made in two sizes. It is of all-metal construction, and is equipped with Hyatt roller bearings. It can be handled by one man. The hook is adjustable in two directions and may be placed in ten positions vertically and twenty-eight horizontally. It has no interfering projection back of the truck. It is stated that the handles are of such shape that the truck can be easily controlled. Specifications: Model A. Capacity, 800 lb. Extreme width, 23 in. Overall length, 57 in. Wheels, 8 x $2\frac{1}{4}$ in. Weight 72 lb. Model B. Capacity, 1,200 lb. Extreme width, 23 in. Overall length, 63 in. Wheels, 8 x $2\frac{1}{4}$ in. Weight, 76 lb.

Chuck, Tapping, Reversing

John Chuck Co., Milwaukee, Wis.

"American Machinist," March 3, 1921

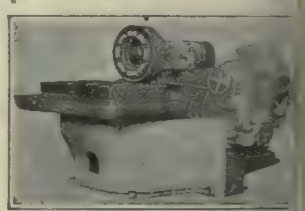


The chuck drives the tap by means of a device driving equally on each side of the tap shank. It is equipped with a five-point, positive clutch. It is stated that the clutch is capable of disengaging within a limit of 0.001 in. when the tap reaches the predetermined depth. It has a balanced drive concentric with the spindle, reversing with a two-to-one speed ratio. The gears all run in oil. The chuck is provided with an oiling device to give a copious flow of oil directly on the tap and work. The device is adaptable to any drilling machine, no special counterweight being required on the drilling machine spindle. It is stated that, owing to the construction, the sensitive clutch and the oiling device, the life of taps is greatly prolonged and breakage is reduced. Made in three sizes: No. 1, 0 to $\frac{3}{8}$ in.; No. 2, 0 to $\frac{5}{8}$ in.; No. 3, $\frac{1}{4}$ to 1 in. Equipped with Morse taper shanks. Aluminum body. All wearing parts hardened alloy steel.

Grinding Machine, Surface, Oscillating, Lumsden, No. 86

Alfred Herbert, Ltd., Coventry, England, and 50 Church St., New York, N. Y.

"American Machinist," March 10, 1921

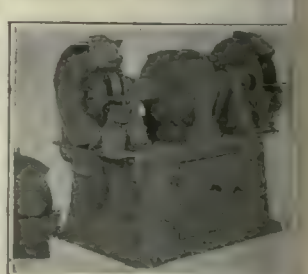


The machine is especially adapted to locomotive, ship-building and general engineering shops, where products such as steel railway buffers, axle boxes and covers, and similar parts having plane surfaces require grinding. It is stated that the output is rapid, surfaces up to 24 x 10 in. being handled. The grinding wheel is mounted on an arm that can be swung about the center of the driving shaft. The grinding-wheel head consists of a 16-in. segmental cupped wheel, mounted on a ball-bearing spindle carried in a ram which has an adjustment parallel with the axis of the spindle. There are three speeds of oscillation of the wheel. An ample supply of water can be provided by a pump driven from the countershaft. Horsepower required, 20. Floor space, 9 ft. 6 in. x 6 ft. 9 in. Approximate net weight, 8,100 lb.

Grinding Machine, Floor, Motor-Driven, No. 18

Marschke Manufacturing Co., Indianapolis, Ind.

"American Machinist," March 10, 1921



The machine is designed for heavy duty and the arbor is mounted on four Hess-Bright ball bearings. The motor-starting mechanism is placed in the pedestal, and is controlled by the lever extending through the door at the front. The wheel hoods are adjustable and can be set so that the wheel is always at the front of the hood. The machine can be furnished with or without an exhaust fan. Specifications: Motor: a.c. 2 or 3 phase, 60 cycle, 220 or 440 volt; d.c., 110 or 220 volt; size, continuous service. 5 hp., intermittent, $7\frac{1}{2}$ hp. Speed; no load, 1,200 r.p.m.; full load, 1,160 r.p.m. Carries two wheels, 18 x 3 in. Arbor length, 54 in. Floor to center of arbor, 34 in. Floor space, 32 x 64 in. Weight with a.c. motor, 2,200 lb.; with d.c. motor, 2,300 lb.

Clip, paste on 3 x 5-in. cards and file as desired

The greatest changes made in the third edition of the Code are in Part 2. The loading specification, upon which are based the requirements for strength of construction, has been simplified, and has been applied to signal lines crossing railways, for which arbitrary rules were formerly used. The rules have been rearranged in more convenient order, and an index has been added. The sag tables have been extended to cover iron and steel conductors. The new edition of the rules is in pocket size and has been entirely separated from the discussion of the rules which accompanied them in the second edition. This discussion has been considerably amplified and will be published separately as Handbook No. 4, which is now in press. The discussion contitutes a companion volume to the Code itself, and should be secured by those who have occasion to use the rules.

Kinematics and Kinetics of Machinery. By John A. Dent, M.E., and Arthur C. Harper, M.E.; 383 pp. 6 x 9 in. Illustrated with numerous diagrams. Published by John Wiley & Sons, Inc., New York City.

This work is an outgrowth of the notes prepared by Prof. G. A. Goodenough for the students at the University of Illinois. The notes were revised and rewritten by the authors in the present form as a textbook for engineering schools.

The book should have a wide range of usefulness as it is comprehensive enough to suit the needs of the graduate student and at the same time so arranged that material for an elementary course can easily be selected.

Many of the methods are graphical because of the complicated mathematical equations encountered in analyzing any but the simplest machines. A chapter on the mechanics of the gyroscope, written by Prof. F. B. Seely, is included and there are also several valuable "notes" at the end of the book. One of these is a complete investigation of the forces in a gasoline automobile engine of conventional type.

The twelve chapter headings are: I, Machine Motions, Pairs, Links, Chains, Mechanisms; II, Motion of Rigid Bodies; III, Velocities of Mechanisms; IV, Accelerations in Mechanisms; V, Inertia Forces of Machine Parts; VI, Balancing of Engines; VII, Governors; VIII, The Mechanics of the Gyroscope; IX, Critical Speeds and Vibrations; X, Toothed Wheels; XI, Cams; XII, Wrapping Connectors.

Labor Terminology. Issued as Bulletin No. 25 of the Harvard Bureau of Business Research under date of March 1. 108 pp. 5½ x 7¾, unillustrated.

The object of this bulletin is to provide a means of lessening the verbal misunderstandings which often cause or prolong disputes between employers and employees. It contains definitions from the labor standpoint of several hundred terms many of which, such as "open shop," "collective bargaining" and "union shop," are frequently used with different meanings by parties to labor controversies.

This effort to define what labor men mean when they use terms has been made for the purpose of enabling manufacturers and employers to secure a better understanding of the point of view of their men.

Professor Melvin T. Copeland, director of the Bureau of Business Research, states that the bulletin will be used at the Harvard Graduate School of Business Administration in the courses which deal with labor relations, and also will be put on public sale at a price designed to pay in part the cost of compilation.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A mercantile firm in India desires to purchase and secure an agency for everything electrical, textile machinery, electric passenger and freight elevators, screws and nails, corrugated-iron sheets and galvanized buckets, workshop tools, steel furniture, etc. Quotations should be given c.i.f. Bombay or Calcutta. Terms: Part advance through bank; balance against delivery of documents through bank. Reference, No. 34,632.

A commission merchant in Cuba wishes to represent manufacturers and exporters for the sale on commission of large quantities of iron, steel and general hardware. Reference, No. 34,617.

A firm of engineers in Sumatra desires to secure an agency for the sale of lightweight caterpillar tractors, suitable for use on rubber, tobacco, oil-palm, and rice estates; and also plows and cultivators for use with tractors. Quotations should be given c.i.f. Belawan. Payment: Cash against documents. Reference, No. 34,646.

An American commercial agent, who has sales and office connections in France, is in the United States and desires to be placed in communication with firms with a view to securing an agency for the sale of mechanics' tools, nails, tacks, bolts, screws, locks, padlocks, door checks, door plates, saws of various types, electrical supplies, belting, chains in all metals, and weighing machines. Quotations should be given c.i.f. Havre, France, or f.a.s. N. Y. No. 34,592.

A mining company in Victoria, Australia, desires to purchase machinery for the manufacture of salt and plaster of Paris. Quotations should be given f.o.b. American port. Reference No. 34808.

A mercantile company in Brazil desires to secure an agency for the sale of machinery. Quotations should be given f.o.b. New York. Payment to be in cash. Correspondence should be in Portuguese or French. Reference No. 34713.

A firm of importers in Cuba desires to be placed in communication with manufacturers of locomotive cranes, hoists and machinery of all kinds. Reference No. 34815.

A merchant in Syria desires to purchase hardware, wood and iron working tools and machinery, hand and motor pumps, agricultural machinery, construction material, bar and rod iron, tin plate, cotton and woolen goods, etc. Quotations should be given c. i. f. Beirut, Alexandretta, and Tripoli. Reference No. 34812.

Moens & Beck, Amsterdam, Holland, would like to take over an agency in that country for American firms dealing in iron and steel products and machinery of various kinds.

Trade Catalogs

Electric Hoists. Sprague Electric Works, of General Electric Co., New York, N. Y. Bulletin No. 48967, illustrative and descriptive of several types of electric hoists including bucket, winch, trolley, monorail and crane.

Reilly Evaporator. Griscom-Russell Co., New York, N. Y. Bulletin No. 330, 6 x 9 in., twenty-three pages, describing the latest model of Reilly self-sealing submerged type evaporator. Charts and tables are included.

Vanadium. Vanadium Corporation of America, 120 Broadway, New York City. A forty-nine page 8 x 11-in. catalog covering the use of this "master alloy" in the manufacture of locomotives, automobiles and airplanes.

Electric Cranes. Northern Engineering Works, Detroit, Mich. Bulletin No. 508, illustrating the type "E" standard electric traveling crane.

Lubrication. The Texas Company, New York, N. Y. Volume VII of a monthly magazine taking up problems of lubrication. This number is devoted to turbine lubrication, touching on the effect of high pressure on the viscosity and density of lubricating oils.

Grinding Machines. Norton Company, Worcester, Mass. A thirty-two page 5 x 7-in. catalog describing and illustrating a complete line of grinding machines, grinding wheel stands and fixtures.

Steel and Iron. Thirteenth edition of a comprehensive stock list published in booklet form by Horace T. Potts & Co., Philadelphia, Pa. It shows what the company carries for prompt shipment with weights, price lists and other valuable information.

The Cutler-Hammer System. Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Booklet, pp. 16, 8½ x 11 in. This booklet illustrates and explains the new line of control apparatus, which has recently been developed by this firm for use with high-speed newspaper presses.

Production Lathe. The Porter-Cable Machine Co., Syracuse, N. Y. A well-prepared catalog, sixteen 8½ x 11-in. pages, illustrating and describing the latest model Porter-Cable lathe for intensive manufacturing and rapid production of duplicate parts. Each important feature of the machine is treated separately, with complete illustrations and specifications.

Root Counters. The Root Co., Bristol, Conn. Catalog No. 31, covering a complete line of "Census takers of industry." Many types of counting machines are illustrated and described.

Waugholst. The Denver Rock Drill Manufacturing Co., Denver, Co. Illustrating and describing the many deversified uses of the latest Model-250 Waughoist lifting machine.

Bath Internal Micrometer. John Bath & Co., Inc., Worcester, Mass. Booklet No. 10 describing the Bath internal micrometer and master reference ring, a new tool for the rapid measurement of hobs in production work and for the accurate inspection of gages.

"Commercial" Annular Ball Bearings. The Schatz Manufacturing Co., Poughkeepsie, N. Y. Catalog No. 6, giving a wealth of information regarding the use of the less expensive grades of ball bearings.

Pamphlets Received

Co-operation and Cost Control: National Association of Cost Accountants. The May number of the official publication of this association is devoted to a discussion of an important aspect of cost control—the human side. It brings out the necessity of co-operation between cost and operating departments if the business of obtaining dependable cost figures is to be carried on effectively. The text of the pamphlet is taken from a paper read before the New York Chapter of the Association.

How Business with Foreign Countries is Financed: Guaranty Trust Co., New York, N. Y. A valuable booklet issued by this company outlining the services and facilities offered by its banking machinery in financing foreign trade and explaining the methods and forms generally used. A wealth of valuable information for the exporter and importer is contained in its pages.

Catalogs Wanted

The Engineering School of Drawing, 457 Main St., Springfield, Mass., would be pleased to receive catalogs and other literature on various production machines and tools that are now on the market.

The Hyde Engineering Works, Ltd., Montreal, Canada, would be pleased to receive catalogs from builders of all kinds of machinery, both jobbers and contractors.

Forthcoming Meetings

The Taylor Society will hold its Spring Meeting at the Hotel Statler, Cleveland, Ohio, May 19 to 21.

The spring meeting of the American Society of Mechanical Engineers will be held at the Congress Hotel, Chicago, May 23-26. Calvin W. Rice, Engineering Societies Bldg., 29 West 39th St., New York, is secretary.

The Society of Automotive Engineers, 29 West 39th St., New York announces that its summer meeting will be held at West Baden, Ind., on May 24 to 28 inclusive.

The American Railway Association will hold the Spring meeting of its Purchases and Stores Section at the Blackstone Hotel, Chicago, June 9 to 11, and the Spring meeting of its Mechanical Section at the Drake Hotel, Chicago, June 15 and 16.

The 1921 annual meeting of the American Society for Testing Materials will be held at Asbury Park, N. J., on June 20 to 24, with headquarters at the New Monterey Hotel. C. L. Warwick, Engineers Club, Philadelphia, Pa., is secretary.

Condensed-Clipping Index of Equipment

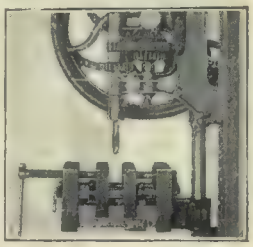
Patented Aug. 20, 1918

Vise, Drilling Machine

Joyce Drill Vise Co., P. O. Box 704, Amarillo, Texas

"American Machinist," March 10, 1921





The vise is made in two sizes, opening 5½ in. and 11 in., respectively. Both jaws are movable, which permits different sizes of work to be held without changing the position of the vise on the drilling machine. The rear jaw is moved by means of a thumbscrew. The front jaw is moved and the work clamped by the screw which is actuated by the vise handle. The jaws are held in alignment by and slide upon two rods. False jaws are furnished with the 11-in. vise, for holding pipe, pulleys or round articles up to 9 in. in diameter. It is stated that the vise saves time, drills and labor, and that it is substantially and durably made. It can be attached to any make of drilling machine, the illustration showing one method of attaching it. For fastening it on the table of a drilling machine, a set of special clamps is furnished.

Hammer, Drop, Steam

Massillon Foundry and Machine Co., Massillon, Ohio

"American Machinist," March 10, 1921



The housings are annealed steel castings of I section, machined to fit in deep pockets in the hammer base, which is likewise a steel casting. The cylinder is a semi-steel casting reinforced over the valve. It interlocks in the tops of the housings, so that no tie-plate is required. A safety cylinder is provided to protect the hammer in case the piston rod breaks, it being so made that the piston ascends against a cushion of live steam. The ram guides adjust back into the side frames for the removal of the ram horizontally. The guide-adjusting screws are threaded through nuts set in open pockets in the side frame, thus permitting damaged screws to be removed by cutting out the nut with an acetylene torch without distributing the ram or guides. The ram guides are rectangular in section and of forged steel. The hammers are built in sizes ranging from 800 to 20,000 lb. capacity.

Crane, Industrial, Crawler-Type

Northwest Engineering Works, 28 E. Jackson Blvd., Chicago, Ill.

"American Machinist," March 10, 1921



The crane is rated at 10-ton capacity with the load at a radius of 12 ft. It is self-contained, being driven by a four-cylinder, 60-hp. engine. This engine also drives a generating set for the operation of an electric lift magnet, when the latter is required. One advantage claimed for this type of crane is that it can travel anywhere in a storage yard and is not limited in its field to the points that can be reached from tracks. The steering is accomplished by a single control lever. The crawlers are made of manganese steel castings. All bearings are either self-aligning ball bearings or bronze bushings. The crane can also be used to operate a one-cubic-yard clamshell bucket, a pile-driver or a wood grapple. Its capacity at its maximum radius of 30 ft. is 5,200 lb.

Magnet, Electro, Universal

Liberty Engineering Co., Danbury, Conn.

"American Machinist," March 10, 1921

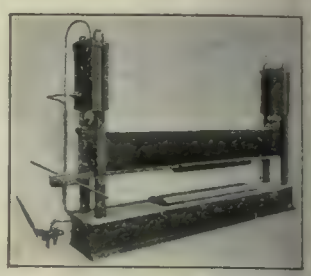


It is stated that the magnet will work equally well on large or small pieces, either a large block of steel or a watch being totally demagnetized by its use. The magnet operates on either a 110 or 220 volt alternating current for demagnetizing; and by the use of a quick-acting safety switch, iron and steel may be magnetized to a strong degree by the same current. Should it be desired to make the work a powerful magnet, a direct-current circuit of 110 volts is employed. As a magnetizer, it may be used in connection with deep-hole drilling, assembling work of various kinds, and to hold screws or articles while inspecting. The magnet is 6 in. in diameter by 1⅞ in. high. It weighs 3 lb. The switch and plugs and 5 ft. of cord are furnished.

Press, Plate-Bending

Houston, Stanwood & Gamble Co., Cincinnati, Ohio

"American Machinist," March 10, 1921



The press is especially intended for use in boiler or tank shops, or in any plant doing plate or structural-steel work. The machine consists of a crossbeam, connected to vertical rams at each end by means of hinged bearings, which give flexibility and allow the beam to adjust itself to any unevenness of the work. Either short, long, or sectional dies can be used, flat dies being provided for straightening plates and curved ones for such work as bending boiler plate. The machine does not require an auxiliary ram for returning the crossbeam to its upper position. It is built in various sizes and capacities to suit different classes of work, and it can be furnished to operate either on compressed air or on hydraulic pressure, obtained from city water mains or provided by means of a pump.

Locomotive, Industrial, Gasoline, American

Hadfield-Penfield Steel Co., Bucyrus, Ohio

"American Machinist," March 10, 1921



The machine is intended for light haulage purposes where steel rails are provided, as in industrial and construction work. It is built in several gages and sizes from 4 to 7 tons, and can be furnished either in the standard or in the low-built design suitable for mine use. The locomotive is driven by a heavy-duty Hercules, 4-cylinder, 4-cycle, gasoline engine. The engine used for the 4-ton machine has a piston displacement of 226.42 cu.in. and develops 23 hp. at 1,000 r.p.m. The drive from the motor is through friction disks, by means of which the speed can be varied and the direction of travel reversed. The disk shafts are supported on New Departure double-row ball bearings and Hyatt roller bearings, ball thrust bearings being used. The frame of the machine is built up of four cast-iron sections bolted together. The various units are so placed upon the frame as to make a compact arrangement, the operator's position being covered by means of a cab, which can be completely enclosed.

Fixture, Grinding, Rotary

Diamond Machine Co., 9 Codding St., Providence, R. I.

"American Machinist," March 10, 1921



The device is intended for holding circular work while the periphery is being finished. The fixture consists of two units, a plate mounted on a vertical spindle for holding the work, and an electric motor with reduction gearing for revolving it. The illustration shows the fixture used for the grinding of the periphery of a malleable-iron brake shoe, although such things as rollers for conveyors, wheels for small trucks and pulleys can be finished. The crowning of pulleys is accomplished at one setting of the work, it being unnecessary to tilt the work to obtain the necessary slant on the face. By placing the work toward the center of the cupped wheel, so that it makes contact with the inside edge of it, a crown is formed on the periphery, the amount of the curvature depending upon the relative positions of the work and the wheel. Widths of face as high as 10 in. can be handled.

Attachment, Punch Press, Paper-Feeding, Automatic

F. J. Littell Machine Co., 4125 Ravenswood Ave., Chicago, Ill.

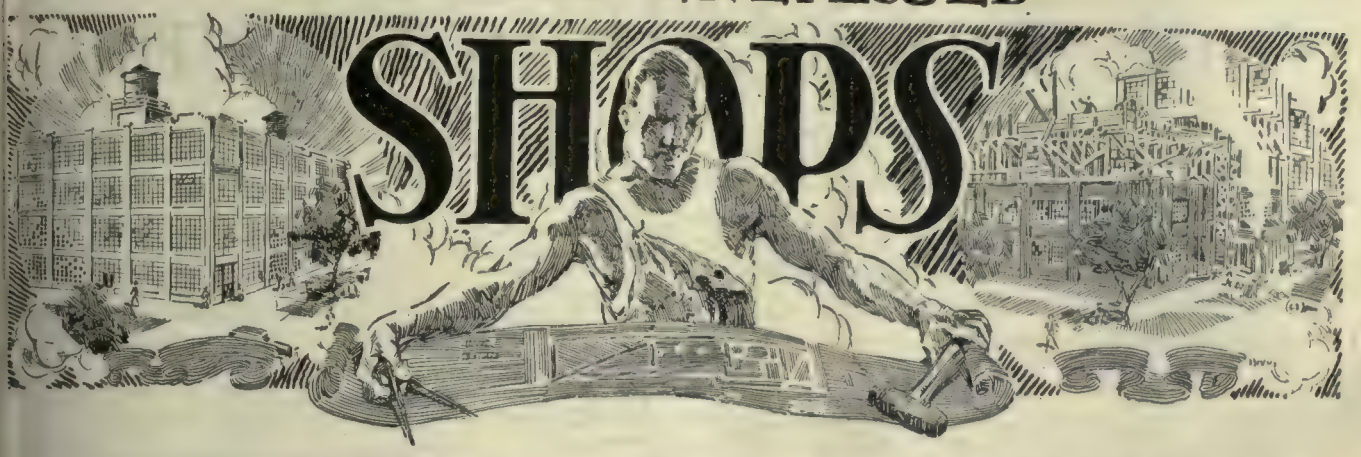
"American Machinist," March 10, 1921



The roll of paper stock is mounted on a mandrel supported by brackets on the legs. The strip of paper passes over an adjustable tensioning roller at the extreme left of the attachment and is led through a pair of adjustable angle-iron guides. It then passes under the series of three rollers that are mounted on the top of the extension, and that serve to cause the paper to rest with the necessary pressure on the two blocks of paraffin wax located between the rollers. The arrangement gives to the paper strip a thin coating of paraffin as it passes to the dies, and the paraffin there acts as a lubricant to permit the punching to be drawn into cup-like form without cracking the paper. The automatic feeding rolls can be adjusted for feeding the proper lengths of stock for each stroke of the die.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Mass., Boston—The G. W. Bent Co., 101 Causeway St., Manufacturer of brass and steel bedsteads—power angle iron or bar shears with capacity to cut 3 in. x 3 in. x in. steel angles.

Mass., Springfield — The Hannan Finton Co., 39 Sharon St.—No. 2 Colburn drill press for its machine shop.

R. I., Providence—Kelman & Lagovitz, 2 Ash St.—repair equipment for garage.

Md., Baltimore—The Amer. Coal Loading Machine Corp., P. O. Box No. 1479, M. R. Martin, Purch. Agt.—complete shop equipment to include castings, etc.

N. J., Elizabeth—The Amer. Stamping Co., 38 3d St., Manufacturer of metal toys—back gear double acting power press, preferrably with a 5 in. stroke.

N. J., Newark — The Cook Electric Co., 60-364 Jelliff Ave.—metal working tools.

N. Y., Hastings-on-the-Hudson — The Hastings Pavement Co.—spindle with No. Morse taper for 3½ ft. Fosdick heavy radial drill.

Special spindle with No. 5 Morse taper for 3½ ft. Fosdick heavy radial drill.

N. Y., New York—(Borough of Manhattan) The Argonne Motor Co., 120 West 31st St.—

11 in. x 5 ft. style "E" lathe with compound rest, etc.

No. 1 C Fox hand miller with plain vise, arbor and countershaft.

No. 1 Cincinnati universal miller with vise, arbor, dividing head, countershaft and in. x 6 in. angle plate.

10 in. Buffalo bench drill.

N. Y., New York—(Borough of Manhattan, The Monsoon Cooling System, 70 West 45th St.—

Small gap lathe, compound rest, countershaft and complete standard equipment.

No. 52 Beloit combined power punch and shear.

Pa., Philadelphia — The C. and A. Mfg. Co., 1851 Germantown Ave., manufacturers of sheet metal specialties, G. F. Cills, Purch. Agt.—one 37 in. sq. shears, ⅛ ft. cornice brake, one 37 in. slip rolls and one adjusting folder and turning machine.

Pa., Scranton—The Delaware, Lackawanna & Western R.R., Coal Mining Dept.—lathes, drill presses, planer and boring machine for its forge and machine shop at Forty Fort, Pa.

Ala., Birmingham—The Iron City Pipe & Supply Co., 2129 3d Ave.—18 in. jointer, No. trimmer, wood turning lathe with 12 in. swing between centers.

Va., Alexander—The Herfurth Engine & Machinery Co., Duke St., R. W. Herfurth, Purch Agt.—16 in. x 16 in. or 18 in. x 8 in. screw cutting lathe. (Used.)

W. Va., Logan—The Logan Machine & Electric Co., Inc., D. B. Browning, Secy.—machine shop eqiupment, insulating materials and magnet wire.

Ill., Aurora—The Divekey Bros. Mfg. Co. (Plumbers)—1 pipe machine to cut and thread from ⅜ to 4 in. diameter pipe, motor drive (new).

Ill., Aurora—The Durabilt Steel Locker Co., 65 South Bway.—10 ft. power squaring shear, 16 gage or ⅛ in. capacity.

30 in. ft. squaring shear, 18 gage capacity.

Open back inclinable press; No. 2 consolidated or equivalent.

Back geared, open back, inclinable press; No. 30 or No. 100 consolidated or No. 107 or No. 108 Niagara, or similar.

8 ft. O. H. L. power brake with ⅛ in. capacity, or equivalent.

Double head light tool grinder with one adjustable table.

Single spindle 14 in. sensitive floor drill press.

10 kw. electric spot welder with approximately 18 in. horn.

18 in. swing cut-off saw. (All used.)

Ill., La Salle—The Appolo Metal Wks.—Weisbecker grinding and polishing machine for polishing copper, steel, etc.

Mich., Detroit—The Quick Change Auto Rim Co., 439 East Fort St.—miscellaneous equipment for making rims for automobile wheels.

O., Columbus—The Jaeger Machine Co., 520 Dublin Ave.—one small power punch, maximum capacity 1/16 in. hole in ⅜ in. plate. (Used.)

O., Galion—The Galion Iron Wks. & Mfg. Co.—one Williams White Bulldozer, No. 6 or No. 7. (New.)

O., Madison—The Lyon King Implement Co., W. E. Arnold, Pres.—drill presses, punch presses, lathes, bending rolls, grinding stands, etc.

Wis., Fond du Lac—J. F. Ahern Co., 70 South Portland St., manufacturer of heating supplies, etc., J. Ahern, Purch. Agt.—pipe cutting machine.

Wis., Kaukauna—The Molock Co., manufacturers of stokers—one Adams gear hopper or automatic gear cutter, capacity from 2 in. to 6 in diameter, 10 pitch. (Used.)

Wis., Milwaukee—The Babcock Automobile Spring Co., 641 Jefferson St., C. Babcock, Purch. Agt. ½ to ⅜ in. stencil cutting machine.

Wis., Necedah—The Necedah Mfg. Co., manufacturer of row boat motors, Ford timers, etc.—screw machines and lathes.

Wis., Oshkosh—The Oshkosh Tractor Co., 172 Mt. Vernon St., J. Casey, Purch. Agt.—lathes, drill presses, shapes and other machinery for the manufacture of motors.

Wis., Slinger—The Wickert Sheet Metal Wks.—necessary machinery for repairing auto radiators.

Wis., Oshkosh—The Oshkosh Tractor Co.—equipment.

Ia., Grinnell—The Bd. Educ., F. P. Marvin, Pres.—manual training equipment for school.

Ia., Ottumwa—The Bd. Educ., J. A. Wagner, Clk.—manual training equipment for school.

Kan., Hutchinson—The Superior Welding Shop, 114 South Washington St.—one 24 to 30 in. lathe and one universal milling machine.

Mo., Kirkwood—The Bd. Educ., W. F. Knowlton, Pres.—manual training equipment for school.

Wash., Seattle—The School Bd., Central Bldg.—equipment for shop in high school.

Ont., Kingsville — A. Conklin & Son — modern garage equipment.

Tex., Dallas—The Texas Boiler Wks., 2321 Live Oak St., H. H. Sharp, Vice Pres. and Gen. Mgr.—bending rolls, sizes 8 to 12 ft. to handle ½ in. plate. (Used.)

Machinery Wanted

Ga., Atlanta—The Capital City Laundry—laundry, dyeing and rug cleaning machinery.

Ala., Ethelville—The J. H. Holmes Lumber Co., R. F. D. No. 2, J. H. Holmes, Purch. Agt.—Edgers and trimmers and other woodworking machinery.

Fla., Bartow—The Florida Mill & Planing Mill, T. Junear, Purch. Agt.—machinery for saw mill, etc.

Fla., St. Petersburg—The H. and A. Wood Products Co., Furniture and Toy Manufacturers, H. J. Albright, Secy. and Treas.—quick action woodworkers' vises and iron clamps used in connection with wooden bar for woodworkers in glueing table tops, etc.

N. C., Rutherfordton—J. L. Taylor—complete bottling plant machinery, etc.

W. Va., Welch—The Ward Pocahontas Coal Co., T. A. Lambert, Pres. — aérial tramway.

O., Cleveland—The Interstate Products Co., 1781 Winter St.—paint mills. (All sizes.)

Wis., Chippewa Falls—The Chippewa Valley Produce Co., Putnam St., manufacturer of dairy products—refrigerating machinery.

Wis., Hawkins—The Northern Sash & Door Co., O. L. Holtz, Purch Agt.—woodworking machinery.

Wis., Kewaunee—The Slovan Co-operative Cheese Co., Route 7, F. Sisel, Secy.—cheese making machinery.

Wis., Milwaukee—The E. & W. Mfg. Co., 325 Oregon St.—woodworking machine.

Wis., Milwaukee—The Nu-Wood Corp., 22d and Forest Home Aves., manufacturer of exterior stucco plaster for houses, H. Dorn, Purch. Agt.—special straw-weaving machinery.

Okla., Okmulgee—The Burdsall Paint & Glass Co., 203 North Morton St., J. Birdsall, Purch. Agt.—roughing and emery wheel with sand box, roughing plate and sand hopper for bevelling plate glass, and upright smoother, complete.

Ont., Toronto — The Provincial Government, Dept. of Pub. Hwy.—machinery for cement plant.

Metal Working

NEW ENGLAND STATES

Conn., Hartford — R. L. Fox, Asiyum Ave., plans to build a 1 story garage and service station on Asiyum Ave. and Hopkins St. Estimated cost, $80,000.

Conn., Hartford — Fuller Brushes Inc., Spruce St., has awarded the contract for the construction of a 2 story addition to brush factory. Estimated cost, $20,000.

Conn., New Haven—The Ratner Constr. Co., 425 George St., will build a 1 story, 70 x 140 ft. garage on Grand Ave. Estimated cost between $35,000 and $40,000.

THE WEEKLY PRICE GUIDE

This Week's Market

The metal market is slightly firmer than a week ago. Copper and zinc are up ¼c. Practically no changes in iron and steel. Old metals still dead. Stagnation true for Cleveland and Chicago, as well as for New York.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$28.75
Northern Basic	26.52
Southern Ohio No. 2	27.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	34.26
BIRMINGHAM	
No. 2 Foundry	24.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	26.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	*25.00
CHICAGO	
No. 2 Foundry local	24.00
No. 2 Foundry, Southern, sil 2.25@2.75	30.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26.46
Basic	24.46
Bessemer	26.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.23	$3.33	$3.09	$3.23
Soft steel bars	3.13	3.23	2.99	3.13
Soft steel bar shapes	3.13	3.23	3.48	3.13
Soft steel bands	4.18	4.28	6.25	
Tank plates	3.23	3.33	3.78	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	4.25	4.00	4.13
No. 12	3.15	4.30	4.05	4.18
No. 14	3.20	4.35	4.10	4.23
No. 16	3.30	4.45	4.20	4.33
Black				
Nos. 17 and 21	3.75	4.95	4.80	5.20
Nos. 22 and 24	3.85	5.00	4.85	5.25
No. 25 and 26	3.90	5.05	4.90	5.30
No. 28	4.00	5.15	5.00	5.40
Galvanized				
No. 10 and 11	4.00	5.30	5.00	5.70
No. 12 to 14	4.10	5.40	5.10	5.80
Nos. 17 and 21	4.40	5.70	5.40	6.10
Nos. 22 and 24	4.55	5.85	5.55	6.25
No. 26	4.70	6.00	5.70	6.30
No. 28	5.00	6.25	6.00	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$4.73	$4.63	$4.25
Flats, squares and hexagons, per 100 lb	5.23	4.63	4.75

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	65%
Cleveland	50%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b New York: 3/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per lb

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.50	8.00	8.25
Spring steel (light)	8.00	7.00	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.20
Hoop steel	3.64	3.69	3.8
Cold rolled strip steel	6.00	8.25	7.90
Floor plates	5.30	3.09@3.40	5.7

WROUGHT PIPE—The following discounts are to jobbers for carload lo on the Pittsburgh basing card of April 13, 1921:

BUTT WELD

Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
1 to 3	62½	50	⅜	33½	18½
			½ to 1¼	35½	20½

LAP WELD

2	54½	41	2	30½	16½
2½ to 6	58½	45	2½ to 4	34½	22½
7 to 12	54½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1¼	60½	49	1 to 1½	35½	21½
2 to 3	61½	50			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	52½	41	2	31½	18½
2½ to 4	56½	45	2½ to 4	34½	22½
4½ to 6	55½	44	4½ to 6	33½	21½
7 to 8	50½	37	7 to 8	24½	12½
9 to 12	45½	32	9 to 12	19½	7½

Malleable fittings. Classes B and C, Banded, from New York stock sell net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13.87½
Tin in 5-ton lots	33.62½
Lead	5.62½
Zinc	5.87½

ST. LOUIS

Lead	5.22½
Zinc	5.47½

At the places named, the following prices in cents per pound prevail, for 1 t or more:

	New York	Cleveland	Chica
Copper sheets, base	20.50	22.00	23
Copper wire (carload lots)	15.00	17.50	20.
Brass sheets	17.25	24.00	24
Brass pipe	21.00	22.00	20
Solder (half and half) (case lots)	24.00	22.75	17

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavi add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over in., 7½c.

BRASS RODS—The following quotations are in cents per pound at wa house:

New York	15.2
Cleveland	19.0
Chicago	18.7

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel

Ingots and hot	
Electrolytic	

Monel Metal

Shot and blocks	35	Hot rolled rods (base)	
Ingots	38	Cold rolled rods (base)	
Sheet bars	40	Hot rolled sheets (base)	

Special Nickel and Alloys

Malleable nickel ingots
Malleable nickel sheet bars
Hot rolled rods, Grades "A" and "C" (base)
Cold drawn rods, Grade "A" and "C" (base)
Copper nickel ingots
Hot rolled copper nickel rods (base)
Manganese nickel hot rolled (base) rods, "D"—low manganese
Manganese nickel hot rolled (base) rods "D"—high manganese

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots..... 11.00

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	12.15	12.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.00
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	$9.50
Copper, heavy, and wire	9.00	9.50	8.50
Copper, light, and bottoms	8.00	8.00	7.50
Lead, heavy	3.25	4.00	3.25
Lead, tea	2.00	3.00	3.00
Brass, heavy	6.00	6.00	9.00
Brass, light	4.50	5.00	4.50
No. 1 yellow brass turnings	5.00	5.00	5.00
Zinc	3.00	3.00	3.00

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.4	25.50@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.00
Chicago	20.50
Cleveland	22.50

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	43.50	35.00
Commercial	30.00	15.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$2.00	1.60
Hot pressed hexagon	List	2.00	1.60
Cold punches hexagon	List	2.00	1.60
Cold punched square	List	2.00	1.60

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	50%
Cleveland	75-10%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50-10%	60-10%	50%
1⅛ and 1¼ in. by 3 in. up to 12 in	50%	50-5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $4.00 Chicago..... $4.00

For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $3.75 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅜ by 6 in. and smaller	40%	50-10%	40%
Larger and longer up to 1 in. by 30 in.	40%	50%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	50%	60%	45%
Tinned	45%	60%	30%

Structural, ⅜, ½, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.65 Cleveland...$4.60 Chicago....$4.88 Pittsburgh..$3.70

Boiler, same sizes:
New York...$4.75 Cleveland...$4.70 Chicago....$4.98 Pittsburgh..$3.80

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	25.50
Brass	21.00	24.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ⅛-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$7.00 per 100 lb.; New York price is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	9.00@12.00	12.50	14.25
Colored mixed	6.50@ 9.50	9.50	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13¼	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville

	Current
Prompt furnace	$3.50@$4.25
Prompt foundry	4.50@ 5.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.73	$0.75	$0.82
5-gal. cans	.76*	.85	1.07

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

Conn., Norwalk—J. Donaldson, 32 Washington St., has awarded the contract for the construction of a 1 story, 50 x 136 ft. service station on West Ave. Estimated cost, $25,000. Noted April 28.

Conn., Norwalk—S. Kantor, 65 Cross St., plans to build a 1 story, 80 x 160 ft. garage and service station on Isasc St. Estimated cost, $40,000. H. W. Mather, 70 Washington St., Archt.

Conn., Waterbury — I. N. Albert, 268 South Main St., is having plans prepared for the construction of a 1 story, 50 x 185 ft. garage on North Main St. Estimated cost, $50,000. F. A. Wenzel, 6 Glen Ridge St., Archt.

Me., Bangor—The Swett Mullin Co. has awarded the contract for the construction of a 3 story, 100 x 130 ft. garage, sales and service building on Franklin St. Estimated cost, $250,000.

Me., Waterville—The Lewiston Buick Co., Lewiston, will build a 1 story, 90 x 114 ft. sales and service station. Estimated cost, $35,000.

Mass., New Bedford—Leary & Walker, Archts. and Engrs., Times Bldg., will soon award the contract for the construction of a 2 story, 62 x 124 ft. shop and garage on Kempton St., for G. J. Allen & Co., (Plumbers) 91 North Water St. Estimated cost, $75,000.

Mass., Springfield—Cordner & Montague, 373 Bay St., plans to build a 3 story, 160 x 210 ft. garage and warehouse near Railroad St. Estimated cost, $350,000. F. L. Knowlton, Engr.

R. I., Pawtucket—J. D. Crosby Co., Farrell St., has awarded the contract for the construction of a 1 story, 50 x 50 ft. addition to its iron foundry. Estimated cost, $10,000.

R. I., Providence — The Donnelly Taxi Motor Service Inc., 16 Dorrance St., is having plans prepared for the construction of a 1 story, 83 x 116 ft. garage and service station on Chestnut St. Estimated cost, $25,000. W. R. Walker & Son, 17 Custom House St., Archt.

R. I., Providence—Kelman & Lagovitz, 32 Ash St., plans to build a 1 story garage and repair station on Willard Ave. and Hilton St. Estimated cost, $10,000. Private plans.

R. I., Providence—S. Large, 208 Willard Ave., will soon award the ontract for the construction of a 1 story, garage and service station on Hilton and Ash Sts. Estimated cost, $35,000. W. G. Richards, 17 Exchange St., Archt.

R. I., Providence—L. Shea, Willard Ave., is having plans prepared for the construction of a 1 story, 64 x 121 ft. garage on Ash St. Estimated cost, $25,000. W. G. Richards, 17 Exchange St., Archt.

R. I., Providence — Z. Zawatsky, Pawtucket Ave., has awarded the contract for the construction of a 1 story, 100 x 120 ft. garage.

MIDDLE ATLANTIC STATES

D. C., Washington — The Metropolitan Garage Co. will soon award the contract for the construction of a 6 story warehouse on L. St. between 13th and 14th Sts. N.W. Estimated cost, $300,000. H. M. Bralove, Pres. Milburn Heister & Co., Union Savings Bank Bldg., Archts.

N. Y., New York—(Boro of Manhattan) The L. & B. Constr. Co., Inc., 700 Trinity Ave., is having plans prepared for the construction of a 1 story, 100 x 270 ft. garage at 402 East 107th St. Estimated cost, $80,000. J. DeHart, 1039 Fox St., Archt. and Engr.

N. Y., New York—(Borough of Manhattan) R. McCracker, 373 West 125th St., is having plans prepared for the construction of a 1 story, 100 x 188 ft. garage at 429 East 124th St. About $40,000. S. J. Lang, 110 West 34th St., Archt. and Engr.

N. J., Newark—The Cook Electric Co., 360-364 Jelliff Ave., plans to build a 40 x 75 ft. factory for the manufacture of motors. Estimated cost, $20,000. S. S. Cook, Engr.

N. J., Newark—L. Koppelon, 208 Hillside ave., will soon award the contract for the construction of a 98 x 118 ft. garage and store building on Chapel Court. Estimated cost, $60,000. H. Rosensohn, 188 Market St., Engr.

N. J., Newark—I. Raskind, 216 Hillside Ave. will receive bids until June 1 for the construction of a 2 story, 40 x 80 ft. store, garage and apartment building on Broad and Wright Sts. Estimated cost, $40,000. A. Peters, 828 Broad St., Archt. and Engr.

Pa., Philadelphia—M. Gallagher, 63d and Woodbine Sts., is having plans prepared for the construction of a 1 story, 60 x 80 ft. store and service station on 62d and Woodbine Sts. R. A. Kerns, Fuller Bldg., Archt.

MIDDLE WEST STATES

Ill., Chicago—J. J. Kocher, Archt., 6250 South Halsted St., will soon award the contract for the construction of a 1 story, 75 x 160 ft. garage, for T. J. Kiernan, 5859 Prairie Ave. Estimated cost, $40,000.

Ill., Chicago—The Wagner Bros., 5630 Harper Ave., have had plans prepared for the construction of a 1 story, 100 x 100 ft. garage. Estimated cost, $35,000. W. P. Doerr, 28 Jackson St., Archt.

Mich., Detroit—Saxer & Stein, c/o J. I. Weinberg, Archt., 401 Congress Bldg., will soon award the contract for the construction of a 2 story, 50 x 120 ft. garage and service station on Cass Ave. and Prentis St. Estimated cost, $40,000.

Wis., Cashton—M. Brody & Son, will receive bids about June 1 for the construction of a 2 story, 50 x 100 ft. garage and repair shop. Estimated cost, $60,000. Parkinson & Dockendorff, Linker Bldg., La Crosse, Archts.

Wis., Milwaukee—The West Side Express Co., 2319 Lisbon Ave., is having plans prepared for the construction of a 3 story, 30 x 130 ft. warehouse and a 1 story, 100 x 100 ft. garage. Estimated cost, $150,000. Buemming & Guth, 521 Jackson St., Archts.

Wis., Oshkosh—The Oshkosh Tractor Co. plans to build a 5 story, 60 x 210 ft. tractor factory on Main St. Estimated cost, $200,000.

STATES WEST OF THE MISSISSIPPI

Minn., Minneapolis—The Johnson Automotive Service Co. plans to build a 3 story, 80 x 118 ft. factory on Lyndale Ave. South between 27th and 28th Sts. Estimated cost, $90,000. A. A. Johnson, Pres.

Minn., Minneapolis—D. C. Thwing, 945 Andrus Bldg., wil receive bids about May 25 for the construction of a 2 story, 70 x 152 ft. garage at 1315 La Salle Ave. Estimated cost, $65,000. Bertrand & Chamberlin, 616 Northwestern Bank Bldg., Archts.

CANADA

Ont., Kingsville—A. Conklin & Son will soon award the contract for the construction of a 60 x 150 ft. garage with wing addition on Main St. Estimated cost, $50,000.

FOREIGN

T. H., Pearl Harbor—The Bureau of Yards & Docks, Navy Dept., Wash., D. C., will receive bids until June 29 for the construction of foundations to machine shop here.

General Manufacturing

NEW ENGLAND STATES

Conn., Norwalk—C. H. Harris, Inc., 136 West 24th St., New York City plans to build a 1 story factory to cover 30,000 sq. ft. of floor space on Main St., here, for the manufacture of windshields and other glass products. Estimated cost, $100,000.

Me., Winthrop—C. M. Bailey Sons Oilcloth Co. is having plans prepared for the construction of a factory to include a 3 story, 50 x 145 ft., 3 story, 95 x 120 ft. and a 1 story 80 x 98 ft. buildings. Estimated cost, $250,000. The Austin Co., 217 Bway., New York City, Engr.

Mass., Lawrence—The Oppenheim Clothing Co., 495 Essex St., will soon award the contract for the construction of a 2 story, 50 x 160 ft. clothing factory on Essex St. Estimated cost, $70,000. Tuck & Gilman, 34 School St., Boston, Archts. and Engrs.

MIDDLE ATLANTIC STATES

Pa., Philadelphia — A. Wolstenholme & Sons, 24th and Alleghany Sts., has awarded the contract for the construction of a 2 story, 35 x 65 ft. factory for the manufacture of wool and a garage on Fox and Alleghany Sts.

MIDDLE WEST STATES

Ill. Chicago—The Great Western Laundry Co., 2139 West Madison St., has awarded the contract for the construction of a 3 story, 95 x 175 ft. laundry at 3125 West Madison St. Estimated cost, $175,000. Noted Dec. 2.

Ind., Elkhart—The Amer. Coating Mills will soon award the contract for the construction of a 3 story, 100 x 160 ft. paper mill on Division St. Estimated cost, 675,000. J. L. Carey, 208 North Laramie Ave., Engr.

Ind., Ft. Branch—The Swinney Printing Co. will soon receive bids for the construction of a 1 story, 40 x 120 ft. printing plant. Estimated cost, $40,000. Anderson & Stingle, Evansville, Archts. Noted May 5.

Ind., Gary—The Barnes Ice and Coal Co., 105 Bway., will build a 2 story, 72 x 100 ft. ice plant. Estimated cost, $75,000.

Ind. Indianapolis — The Model Laundry Co., 614-18 East Ohio St., has awarded the contract for the construction of a 3 story, 42 x 75 ft. laundry on East Ohio St. Estimated cost. $50,000.

Mich., Detroit—Friesema Bros., Shelby and Larned Sts., have awarded the contract for the construction of a 2 story, 100 x 186 ft. printing building on East Grand Blvd. and Moran St. Estimated cost, $110,000.

O., Columbus—The Federal Ice & Refrigerating Co 20th and Whitcomb Sts., has awarded the contract for the construction of a 1 and 2 story ice plant on 20th St. Estimated cost, $90,000.

Wis., Milwaukee—A. D. Koch, Archt., 120 Wisconsin St., will receive bids until May 21 for the construction of a 2 story, 60 x 165 ft. addition to wholesale bakery on Central Ave., for the Atlas Bread Co., 927 Central Ave. Estimated cost, $125,000.

Wis., Milwaukee — Lesser & Schutte, Archts., Camp Bldg., will receive bids until May 23 for the construction of a 3 story, 45 x 90 ft. addition to packing plant for R. Gumz & Co., 125 Muskego Ave. Estimated cost, $50,000. Noted April 28.

Wis., Racine—The New York Market Co., 132 Washington St., has awarded the contract for the construction of a 2 story 100 x 110 ft. sausage factory, on Standard Ave. Noted March 17.

STATES WEST OF THE MISSISSIPPI

Col., Denver—The Farmers Union Milling & Elevator Co., 1725 Wazee St., has awarded the contract for the construction of a 6 story, 33 x 76 ft. mill and elevator building on 38th and Wyncoop Sts. Estimated cost, $200,000.

Ia., Cedar Rapids—The Peterson Baking Co., 316 6th Ave. E., will soon award the contract for the construction of a 2 story, 60 x 140 ft. factory on 6th Ave. and 4th St. Estimated cost, $80,000. Natton, Holmes & Anthony, 323 Masonic Temple, Archts.

Ia., Mt. Pleasant—The State Bd. of Control will soon award the contract for the construction of a 2 story, 60 x 120 ft. laundry. Estimated cost, $85,000. W. D. Sheehan, Des Moines, Secy. H. F. Liebbe, State Capitol Bldg., Des Moines, Archt.

Minn., Minneapolis—The Northern Display Advertising Co., 2016 Washington Ave., is having plans prepared for the construction of a 2 story, 110 x 225 ft. printing plant on 21st St. and Washington Ave. Estimated cost, $100,000. Zimmerman, Saxe & Zimmerman, 64 East Van Buren St., Chicago, Ill., Archts.

Mo., St. Louis — The Fleischman Yeast Co., 1535 Market St., will soon award the contract for the construction of a 3 story, 75 x 170 ft. factory at Forest Park and Bogle Ave. Estimated cost, $50,000. H. K. Stephens, Mgr. C. A. Jackson, 701 Washington St., New York City, Archt. Noted Dec. 23.

CANADA

Ont., Durham—The Jackson Mfg. Co. has taken over the buildings of the Chemical Co. and will remodel and build a 2 story, 60 x 75 ft. addition and install equipment for the manufacture of gramaphones. Estimated cost, $60,000.

Ont., Goderich—The Natl. Shipbuilding Co. plans to rebuild its plant on Maitland St., which was recently destroyed by fire. Estimated cost, $125,000. W. Hutchinson, Mgr.

Ont., St. Catharines—The Nukol Fuel Co., Ltd., 88 Bay St., Toronto, plans to build an artificial fuel plant, here. Estimated cost, $500,000.

Que., Montreal — The Canadian Consolidated Rubber Co., Inspector St., will soon receive bids for the construction of a 4 story factory on Alexander St. Estimated cost, $50,000.

Sask., Weyburn—The Saskatchewan Co-operative Creameries, Regina, plans to construct a creamery and cold storage plant here. Estimated cost, $60,000.

Sask, Yorkton—The Saskatchewan Co-operative Creameries Ltd., Regina, plans to construct a creamery and cold storage plant here. Estimated cost, $75,000.

American Machinist

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Planning and Controlling Production in a French Shop

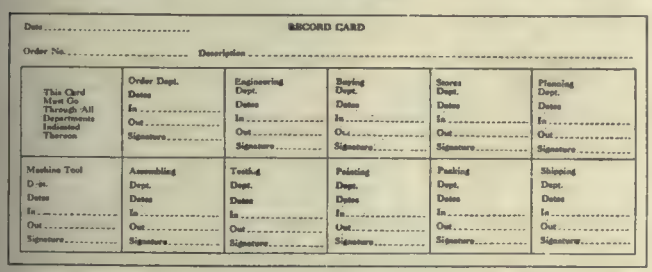
Engineering Department Responsible for Bills of Material — Cylindrical Control Board Saves Room—Calculagraph Used in Work Distributing Department

By E. JULLIEN

THE system which will be described in the following pages was devised and installed by the writer, to control the production at the works of Messrs. A. Savy Jeanjean et Cie., in Courbevoie, near Paris.

The works employ a normal working force of about 600 workmen, turning out special machines for manfacturing chocolate, biscuits, soap, etc.

Before starting with the new organization the works were divided into a number of departments and at the


Date ..... RECORD CARD

Order No. ..... Description .....

This Card Must Go Through All Departments Indicated Thereon	Order Dept. Dates In ... Out ... Signature ...	Engineering Dept. Dates In ... Out ... Signature ...	Buying Dept. Dates In ... Out ... Signature ...	Stores Dept. Dates In ... Out ... Signature ...	Planning Dept. Dates In ... Out ... Signature ...
Machine Tool Dept. Dates In ... Out ... Signature ...	Assembling Dept. Dates In ... Out ... Signature ...	Tooling Dept. Dates In ... Out ... Signature ...	Painting Dept. Dates In ... Out ... Signature ...	Packing Dept. Dates In ... Out ... Signature ...	Shipping Dept. Dates In ... Out ... Signature ...

FIG. 1. RECORD CARD

head of each was a foreman. There were two foremen over the machine shop department; the erecting floor was divided into five sections, each section being under the supervision of a foreman.

More than 100 different types of machines were and are still manufactured in the works, each section of the assembling floor having to assemble a certain number of types of machines.

The Manufacturing Department

The manufacturing of all the machines was carried out as follows: A manufacturing order for a certain number of machines of a certain type was sent from the commercial department to the works office, the works manager sent out a note to the assembling foreman of the section in which this particular type of machine had to be assembled, telling him to make so many machines of the type asked for by a certain date. The foreman, on receiving this note, had to find the shop drawings, the material bills in the shop's drawing stores, and find out in the manufactured stores which parts were already machined and available. In the rough stores he had to find the rough parts, forgings, castings, etc., available for the job, then make out a list of the parts necessary to complete the order, send the list to the works manager, who transmitted it to the buying department, indicating the date for which the material and parts were required.

The foreman had to be continually on the look out to see when the parts ordered out came in from the foundry and other sources of outside supply, then he had to issue machining orders to the machine-tool foremen and follow the work in the various departments of the machine shop. In other words, each assembling foreman had to do his own planning, the machine foremen had also to plan out their work in order to give satisfaction to each of the five assembling foremen, with the result that they never had any time to give to the most important part of their duty; give their advice to the workmen in order to get the work done in the quickest and most efficient manner. The men were left to themselves and worked in their own way. Generally the machine foremen did not plan their work in accordance with the urgency but in accordance with the degree of pressure put on them by each individual assembling foreman with the result that some assembling foremen were rapidly served, and turned out a certain number of machines, while others had a very poor output and no end of difficulties.

The Proportion of Output

The output was very small in proportion to the capacity for production of the whole plant, and it was absolutely impossible to guarantee the delivery of a machine for any date with a reasonable chance of fulfilling the promise given. At the same time, no hope

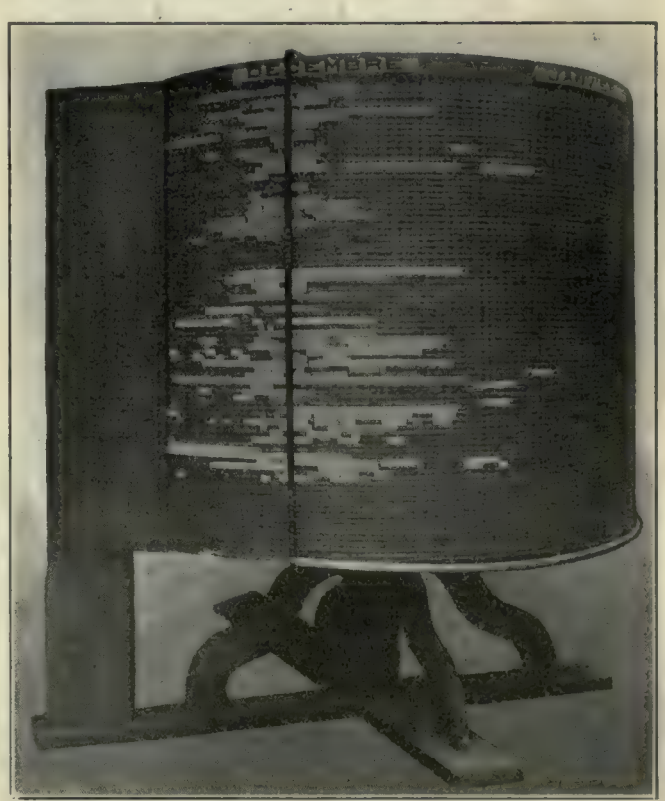


FIG. 2. THE REVOLVING CALENDAR

could be entertained of getting even a very rough idea of the progress of the work in the shops.

When the writer took charge of the plant, he studied the working conditions very carefully and developed a

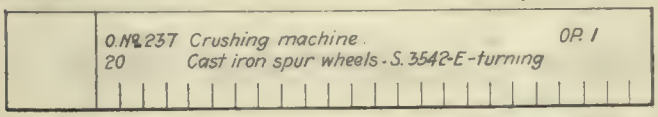


FIG. 3. PAPER RIBBON FOR THE CALENDAR

system for planning, controlling and routing the work through all the departments. The system provides complete records of all the information required to determine the amount of stock in hand and required, the progress of the work and the location of any part of a machine in construction at any time, the cost of any machine, any part or any operation, a few hours after the work is finished.

The New System

Under the new system all orders received from clients are sent to the estimating department where they are compared with the original estimates in order to see if everything is correct with regard to the type of machine, price, date of delivery, payment, etc. If everything is correct, the order is returned to the order department where the order forms are prepared, giving full particulars of the machines to be manufactured, delivery date, packing and shipping instructions and so forth.

When the machines required are intended for stock the order form is made up on paper of a different color and no packing or shipping instructions are given. Each order form is accompanied by a record card (Fig. 1); this card goes through all the departments where the dates both in and out must be filled. When the job is finished, if the time given for completion is exceeded, the record card indicates where delays occurred.

The order is first sent to the engineering and drafting department where all necessary drawings and material bills are prepared. The drawings are made in four sizes and can be folded to the same dimension. Only one part of a machine is shown on each drawing, and as far as possible, one drawing is made for each operation.

The machines are divided into a number of units and assembly drawings are made showing each unit. On these drawings, the symbol of each part is indicated.

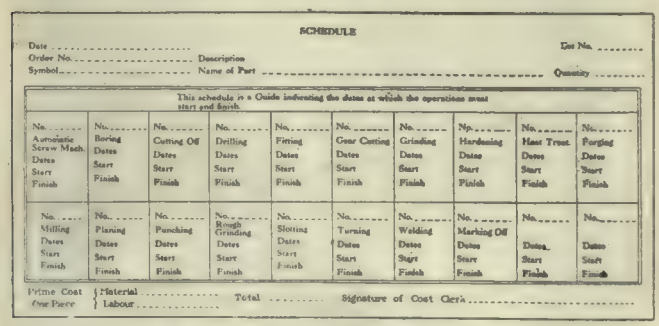


FIG. 4. MACHINING SCHEDULE

The material bills are also divided in units, the name of each unit and its own symbol are specified, the parts are written down in the following order: Steel castings, iron castings, malleable iron castings, bronze castings, aluminum castings, forgings, round steel and other steel sections, bolts, nuts, screws, washers, split pins, keys, etc. The symbol of each part, the drawing number, pattern number if any, the quantity of parts required for each unit, the name of the part and the material, are indicated in the columns provided for that purpose. In the case of bolts, nuts, screws, washers, etc., the size is given, the symbol by which these parts are known in the stores and the parts for which they are used.

Data for the Planning Department

The shop drawings and the material bills are sent to the planning department with the record card. The progress clerk attaches one progress sheet to each sheet of the material list, and writes in the first column the number of parts necessary to fill the order. The copy of the material bills with the progress sheets attached, is sent to the stores, where the number of rough parts and quantity of material available in stock will be marked in the second column by the stores clerk, who will also mark in the last column the number of finished parts which can be taken from stock; these parts are

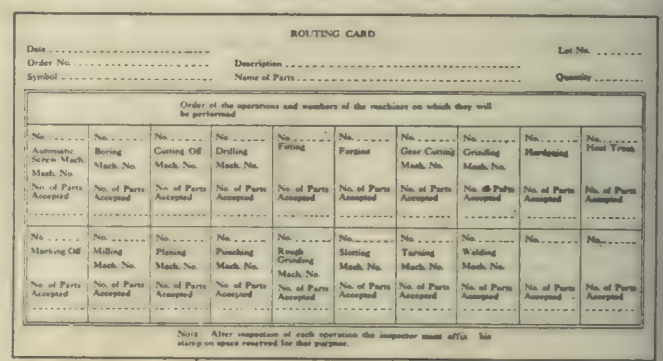


FIG. 5. ROUTING CARD

then reserved, and cannot be used for anything but that particular order. The quantities reserved are marked on the stock cards with the date and the order number. The difference between the number of parts necessary and the number available in stock is written in the third column.

The material bills with the progress sheets so far filled in, are sent to the buying department where orders are issued for the parts necessary to complete the machine. The name of the firm where the parts and material have been ordered from, the date, order number and probable date of delivery, are filled in the columns provided for that purpose. The material bills and progress sheets filled in are sent back to the planning department, where the work can now commence.

The delivery date has been indicated on the order form and everything must be done to have the machine ready for that date; every part of the machine must be finished and ready for assembling at a certain date, to allow the necessary time to assemble, test, paint and pack if necessary. Each part of the machine is studied with regard to the method of machining, machines on which the work must be done, tools and jigs required and time necessary for each operation. A time sheet is then prepared as well as a tool sheet and an instruction sheet.

To determine on which machine and when the work shall be done, a revolving calendar, shown in Fig. 2, has been provided. The calendar is a wooden drum which can easily be revolved around a vertical shaft socketed in a strong support forming a stand.

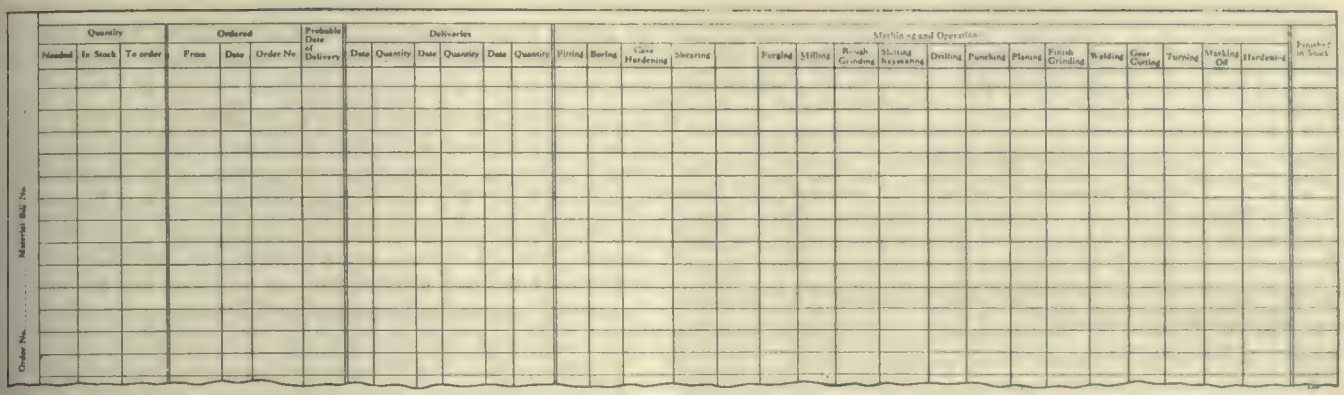


FIG. 6. PROGRESS SHEET

The circumference of the drum is divided in six equal divisions, each division representing one month. Each month is divided in 31 days, 31 divisions being necessary on account of the changing over taking place at the end of June. Black vertical lines indicate the divisions in months and days, the month lines being much thicker than the day lines. On a vertical board fixed on the standard, and at the side of the drum, vertical divisions are made, each division corresponding to one machine in the shop, all the machines being written down with their designation and number. Opposite each division on the board there is a copper strip nailed on the drum in such a way that a ribbon of paper can be inserted between it and the drum.

Supposing that for an order of twenty machines, twenty cast-iron spur gear wheels are required; on these wheels, there are three operations: (1) Turning; (2) cutting; (3) keyseating. The time required for turning is 1 hr. 10 min. per wheel or 23 hr. 20 min. for the lot: the time required for cutting is 1 hr. per wheel or 20 hr. for the lot; the time required for keyseating is 6 min. or 2 hr. for the lot. After each operation, a certain time must be allowed for inspection, trucking, etc., say two hours, then the total time required from start to finish is 23 hr. 20 min. + 2 hr. + 20 hr. + 2 hr. + 2 hr. = 49 hr. 20 min. for the complete machining of the twenty spur wheels. These parts will be required by the assembling foreman by a certain date, therefore the three operations will have to be placed in their proper order on machines which are free

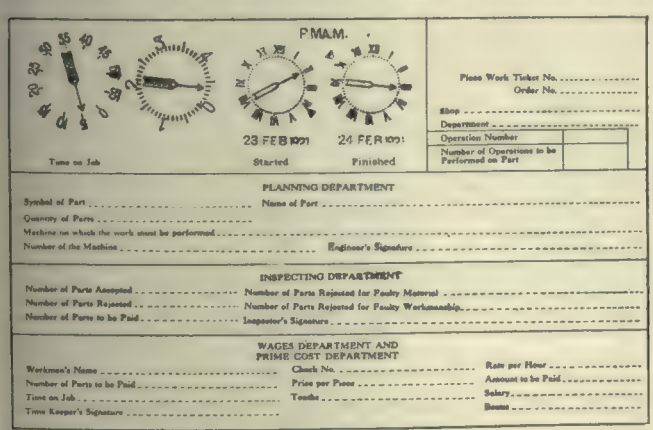


FIG. 7. PIECEWORK TICKET

between the planning date and the date wanted for assembling. For the turning operation, a ribbon of paper will be cut to a length of 24 hours. Ribbons are prepared in advance with the divisions in hours printed on, with 200 working hours in one month, each division being about $\frac{1}{8}$ in. On the ribbon, the order number will be written, the description of the machine, the number of parts, their names and symbols and the number of the operation and its description; see Fig. 3.

This first band represents graphically the time required for the first operation and is placed on the drum opposite the name of a machine suitable for performing the work; this particular machine must be free in time to allow the work to pass to the other operations in time to be finished by the date wanted for assembling. The same thing will be done for all the other operations and for all the parts necessary to assemble the machines called for on the order form. It is necessary to leave a small margin between the finishing and the starting time of the operations to allow for inspection, trucking and unavoidable and unforeseen delays which might occur.

Using the Calendar

When the machining of a lot of parts is set on the calendar, the starting and the finishing time for each operation can be easily read, the dates being printed on the top of each vertical column representing one day. The work can be scheduled accordingly and the routing cards can be prepared in accordance with the schedule. For this purpose, printed cards are used, one side is intended for the schedule, the other side for the routing. A space is provided on each side for the date, order number, description, number of parts required, name and symbol of parts, etc. The schedule

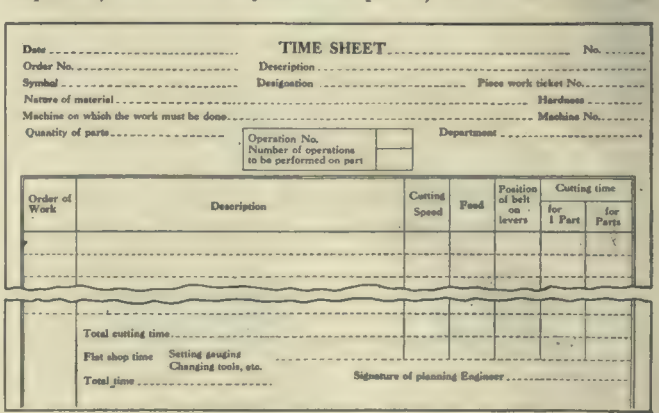


FIG. 8. TIME SHEET

side of the card is shown in Fig. 4. Twenty small rectangles are provided in which the names of all the operations which may be done in the works are printed in alphabetical order.

The order in which the operations must be performed is indicated by a number. In the example taken (20 cast-iron spur wheels) operation No. 1 is turning, No. 2 cutting, No. 3 keyseating. The starting and finishing

INSTRUCTION SHEET

Date ..... No. .....
Order No. ..... Description .....
Symbol ..... Designation ..... Piece work ticket No. .....
Nature of material ..... Hardness .....
Machine on which the work must be performed ..... Machine No. .....
Quantity of parts ..... Operation No. / Number of operations to be performed on part ..... Department .....

1° Make sure that the machine is in proper working order, clean, and well lubricated, tighten the belts, study the time sheet.

Sketches showing how the work must be set

2° Set the machine and the work according to sketch ....
3° Use the speeds and feeds indicated on time sheet ....
4° Cutting lubricant to be used ....
5° Don't force the plugs or gauges ....
6° Special instructions ....

Signature of preparator .....

NOTE.—If the speeds and feeds indicated on time sheet cannot be obtained, the machine or the tools are not in order—Tell the foreman.

FIG. 9. INSTRUCTION SHEET

dates for each operation are indicated in the spaces provided for that purpose.

On the back of the schedule is the routing card Fig. 5. This card is very similar to the schedule; it is also divided into twenty small rectangles each one bearing the name of one operation that may be performed in the works; the operation number must also be indicated as well as the number of the machine on which the work is to be done, spaces being provided for that purpose.

From the schedule so prepared, the progress clerk gets all the necessary information to fill in the progress sheet (Fig. 6), the operations to be performed on each part. On the progress sheet, one column has been provided for every operation marked on the schedule. All the clerk has to do is to mark in red and in their proper

TOOL SHEET

Date ..... No. ....
Order No. ..... Description .....
Symbol ..... Designation ..... Piece work ticket No. .....
Nature of material ..... Hardness .....
Work to be performed on ..... Machine No. .....
Quantity of parts ..... Operation No. / Number of operations to be performed on part ..... Department .....
To be prepared for (date) .....

Jigs No. .....
Turning tools .....
Formed tools .....
Knurling tools .....
Tool holders .....
Planing tools .....
Slotting tools .....
Milling cutters .....
Arbors .....
Boring tools .....
Boring bars .....
Drills .....
Reamers .....
Taps .....
Dies .....
Gear cutters .....
Cutting tools .....
Various tools .....
Templets gauges and plugs .....

NOTE.—Description and dimensions of tools to be clearly indicated. Signature

FIG. 10. TOOL SHEET

places the numbers indicating the order in which the operations are indicated on the schedule.

The piece-work tickets can now be prepared, one for each operation. All the necessary information to fill in these tickets is found on the schedule and routing card. The name of the workman and his check number is taken from a panel always kept up to date, and on which each machine with its number is clearly indicated.

The price is also indicated on the piece work card; it is easily worked out, since the time sheet indicates the time required to perform the work and determined rates are used for each class of labor. Fig. 7 shows a piecework ticket made up for turning 20 driving spur wheels. Each piece work ticket is numbered and registered by the clerk before sending it to the shops.

All the necessary information to machine one part is now ready and includes:

1. One schedule with routing card at the back.
2. One piecework ticket for each operation to be performed (Fig. 7.).
3. One time sheet for each operation to be performed (Fig. 8).
4. One instruction sheet for each operation to be performed (Fig. 9).



FIG. 11. WORK DISTRIBUTING DEPARTMENT

5. One tool sheet for each operation to be performed (Fig. 10).
6. One drawing (or one drawing for each operation when necessary).
7. One requisition ticket to obtain from the stores the parts or rough material to be machined (Fig. 11).

The documents prepared in this manner for each part and each unit of each type of machine to be manufactured, are sent to the work distributing department shown in Fig. 11. This department is situated in the machine shop, not too far from any of the machines.

The work distributing department is a long narrow room on the two long sides of which are fixed the distributing racks; each rack is divided into a number of pockets, each machine in the shop being represented by eight pockets bearing the machine number, four pockets in a vertical row for work in advance and four pockets in the next vertical row for the work in hand. The description and type of the machines are written in big letters on the top of the board. A desk for the distributing clerk is provided at one end of the room and near his desk is a calculagraph fixed in a suitable manner.

When the distributing clerk receives the necessary documents for manufacturing parts, units or machines, his first duty is to place all the above mentioned documents in the pockets according to the information given on the schedule and piece-work tickets. He leaves out the stores requisitions and the tool and jig sheet; he sends the stores requisitions, Fig. 12, to the stores,

where the material or parts are prepared according to instructions and date given.

The tool sheets are sent to the toolroom where the

STORES REQUISITION

PLANNING DEPT. AND STORES

Date ..... Lot No. .....
Order No. ..... Description .....
Symbol ..... Name of Part .....
Quantity ..... Weight of One Part ..... Total Weight .....
Pattern No. (If Required) .....
Section ..... Dimensions ..... (If taken from Bar)
Length to Cut ..... Number of Pieces ..... Total Weight .....
Material .....
To be Prepared for (Date) ..... To be Delivered to Machine No. ..... Signature .....
Taken from Bin No. ..... By .....
Delivered to the Shop (Date) ..... Storekeeper's Signature .....

PRIME COSTING DEPT.

Price per Pound ..... Weight ..... Total Price .....
Price per Piece ..... Quantity ..... Total Price .....
Signature of Cost Clerk .....

NOTE. When the material or parts are delivered to the shops this requisition form must be sent to the stores clerk, afterwards to the Prime Cost Dept.

FIG. 12. STORES REQUISITION

tools, jigs and gages are prepared according to a date given on the sheet. On the tool sheet the machine on which the work is to be done is indicated.

Two hours before a workman has finished his work, he must advise his foreman who gives warning to the inspector and the distributing clerk. The inspector inspects the work near the machine. If he finds any defects which can be made right, this must be done at once and the work inspected again. When all is in order, the inspector stamps the routing card with the date stamp in the space provided for that purpose and indicates on the piece work ticket the number of parts accepted and rejected for faulty material or workmanship.

When the distribution clerk is advised that a workman is about to finish his work, he must look on the board for the next job to be put on the workman's machine. This is easily done as all the pockets on the board bear a machine number. He makes sure that the material and tools are ready and gives instructions to the stores and to the toolroom to send the material and tools to the machine which is about to change work. The trucking instructions are on the routing card. When the operation to be performed is a first operation, the material or rough parts must be taken from the stores and trucked to the machine specified on the card. In case of a second, third, fourth, etc., operation, the inspector's stamp indicates which operation is finished and where the parts are located.

As soon as his work is passed by the inspector, the workman brings his piece work ticket and the routing card to the work distributing department and gives them to the distributing clerk. The routing card is placed on the trucking board. The piece work ticket is passed on to the calculagraph and the finishing date, time, and elapsed time are printed on. The workman receives in exchange a piece-work ticket, time sheet, instruction sheet and a drawing for his next job. Before giving him the new piece-work ticket, the clerk passes it through the calculagraph to print on the starting date and time. The workman returns to his machine, where he finds tools, gages, jigs and material for his new work.

The piece-work cards for finished work are handed over to the progress department, where the finished work is recorded on the progress sheets, which is simply done by writing near the operation number the quantity of parts finished at that operation.

From the progress department the piece-work cards are taken to the pay clerk and from there to the prime costing department.

When the last operation on one part is finished the routing card is returned to the planning department, where the scheduled dates are compared with the actual dates. When delays have occurred the reason must be found and, if possible, steps taken to prevent such delays in the future.

When parts are rejected by the inspector owing either to faulty material or workmanship, replacement cards, Fig. 13, are filled in and new parts made, the cost being charged to the job or, if the material is faulty, to the foundry. By consulting the progress sheets it can be easily seen when a job is ready for the assembling floor and the assembling order can be issued. When assembled, the machines are tested, painted,

REPLACE PART ORDER No.

INSPECTING DEPT.

Date .....
Order No. ..... Lot No. .....
Symbol of Part ..... Pattern No. .....
Number of Parts to Replace .....
Faulty Material or Workmanship .....
Inspector's Signature .....

WORKS OFFICE

Parts to be Replaced by .....
Cost to be Charged to .....
Signature .....

PLANNING DEPT.

Material to be Prepared .....
Section ..... Dimensions .....
Length to Cut ..... Number of Pieces .....
Signature .....

STORES

Parts to be Delivered to Shop (Date) .....
Quantity ..... Weight per Piece .....
Total Weight .....
Taken from Bin No. ..... By .....
Storekeeper's Signature .....

BUYING DEPT.

Parts Ordered (Date) .....
From ..... Replace Order No. .....
To be Delivered (Date) .....
Signature of Buying Clerk .....

WORKS OFFICE

This card must be kept by W. O. until the parts are received and put in hand.

PRIME COSTING DEPT.

Price per Pound ..... Total Weight ..... Total Price .....
Price per Piece ..... Quantity ..... Total Price .....
Signature .....

NOTE: When the material or parts are delivered to the shops this replace order form, must be sent to the Stores Clerk.
Afterwards to Prime Cost Dept.

FIG. 13. REPLACEMENT ORDER

packed and shipped according to instructions given on the order form.

From this description it can be seen that losses of time are avoided, the work can be traced through all the channels, and a clear view of the general working and progress of the shops can be obtained at any time; any out of balance in the production can be seen immediately and remedies sought. The cost of any operation, part, unit or machine can be obtained accurately a very short time after the work is finished. The output has been greatly increased, and it has been found quite possible to turn out any machine within a few days of the scheduled time.

Testing Equipment for Pneumatic Motors

Importance of Performance Records for Portable Air Motors—Examples of Testing Equipment in Several Railroad Shops

By J. V. HUNTER
Western Editor, *American Machinist*

THE pulling power of a pneumatic motor is considered by many shops to be a good index of its mechanical condition. When the shop mechanic has occasion to use an air motor to pull a heavy load and finds it will not pull as it once did, or will not pull at all, he complains that it is no longer in a serviceable condition. The fault may be with him or with the motor; if he has taken too heavy a cut it is certainly with him. Where to draw a distinction between serviceable condition and a condition that requires overhauling can be decided only by pre-determined records of motor tests. In order to create true test records for a motor it should be tested when new as it is then presumably in its most efficient condition. Each motor carries a factory number and its performance record should be kept under this number. When a motor is brought back to the toolooom with a complaint it should be tested and checked by its initial record to learn whether or not the complaint is justified.

The shops of many big railroad systems have large quantities of air motors used in overhauling equipment and perhaps more are used in locomotive boiler shops. In most cases, fortunately, the care of these motors has been placed under the jurisdiction of toolroom foremen, who have for some years realized the importance of having records of performance, and testing equipment to ascertain whether or not the motors are up to their standard operating efficiency. In the larger shops the majority of toolroom foremen have built testing equipment for obtaining data on the performance, both of new motors and of motors brought in for repairs.

Methods of Testing Motors

Some modification of the absorption dynamometer seems to be the generally accepted method for testing the pulling power of motors. It is considered more essential to have a motor pull a heavy cut with a reamer than to have it run at high speed and pull a very light cut. It is probably true that a motor with considerable air leakage will have difficulty in pulling a heavy cut while this air leakage will not be so apparent if it is run at high speed on a light cut.

Other foremen consider the air consumption of important. They have, therefore, supplied their testing equipment with air-flow meters so that air consumption can be determined during the brake test.

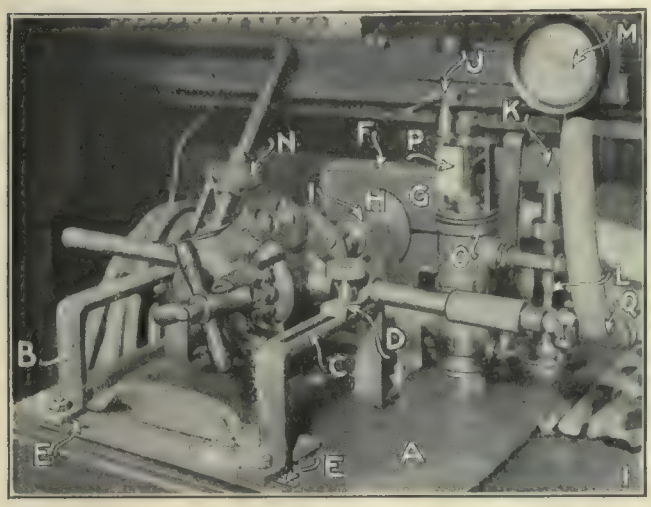


FIG. 1. MOTOR TESTING OUTFIT AT C. & A. SHOPS, BLOOMINGTON, ILL.

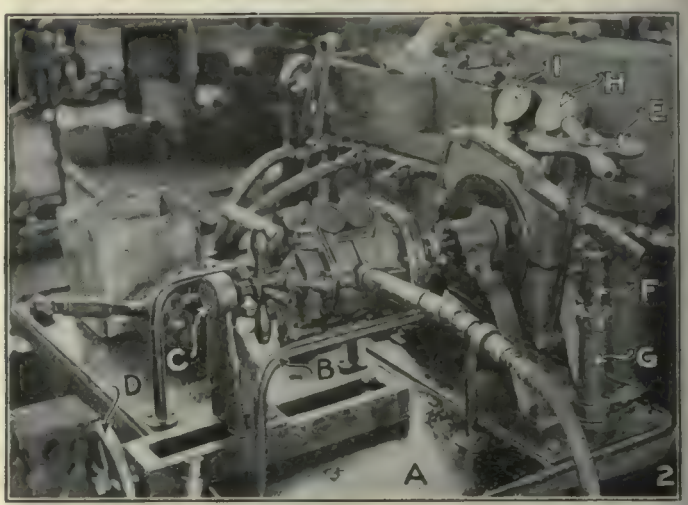


FIG. 2. TESTING OUTFIT AT BEECH GROVE SHOPS OF BIG FOUR AT INDIANAPOLIS

Testing Device in C. & A. Toolroom

A complete and compact testing outfit is used in the toolroom of the Chicago & Alton R.R. locomotive shop at Bloomington, Ill. All parts of this device, shown in Fig. 1, are mounted on the steel plate *A*. The motor is supported on a frame *B* made of steel bars. The bar at the right *C* is slotted so that the clamping device *D*, for holding one handle of the motor, can be shifted in or out to accommodate different sizes of motors. The bedplate is also slotted at *E* so that the frame can be spread apart when such adjustment is necessary.

The Prony Brake

A form of Prony brake is located at the rear of the frame. It has two steel bands *F* enclosing hard fiber braking blocks *G*, that are used to put the braking pressure on the wheel. The wheel *H* is steel and is mounted on a shaft with a bearing in the bracket *I*. The shaft is driven by a spindle that fits in the tool socket of the air motor.

Pressure on the brake is applied by the screw *J*. The screw applies pressure through a spring which keeps it more uniform and prevents any positive clamping action that might occur due to inequalities in the surface of the wheel or brake. The torque is determined

by means of a hydraulic device. The upper lever arm *K* of the brake extends to a bearing on the end of a piston operating in the cylinder *L*. The cylinder is filled with a fluid, the pressure of which is registered on the gage *M*. The graduations on the gage give a direct reading of the pressure exerted.

The air supply for the motor passes through the pipe *N* into the air meter *O*. It is a Tool-O-Meter made by the New Jersey Meter Co. A direct reading of the rate of air consumption is shown on the gage *P*. A section of air hose *Q* from the right side of the meter is equipped with a quick-acting coupler so that the motor can be rapidly connected for testing.

Motor Testing Outfit at Beech Grove Shops

An air motor-testing outfit that is somewhat similar is installed in the Beech Grove shops of the Big Four Railroad at Indianapolis. The device is mounted on a cast-iron bedplate *A*, Fig. 2. The motor's handles lie on the rod brackets *B*. The motor is further held in place by the bracket *C* which takes the thrust for the feed-screw. To accommodate different sizes of motors the bracket can be moved in or out by a screw controlled by the handwheel *D*. The friction pressure of the brake is controlled by the handwheel *E*.

In this device, also, the torque is determined by means of hydraulic pressure generated by the piston *F* in the cylinder *G*, and registered on the gage *H*. The second gage *I* is for indicating the air pressure on the supply line. An air meter has recently been obtained for this outfit and the foreman is planning its immediate installation. Its operation will be similar to the one used on the testing outfit in the Bloomington shop.

Testing Brake in Decatur Toolroom

An elaborate outfit has been developed and built for air-motor testing in the Decatur, Ill., shops of the

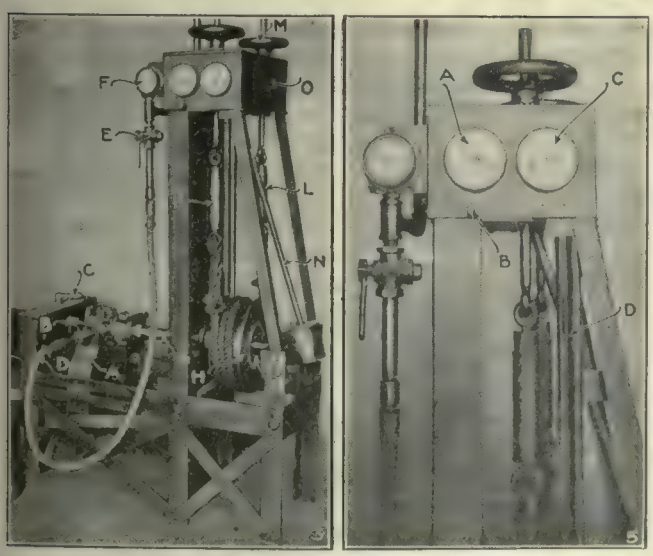


FIG. 3. COMPLETE BRAKE TESTING OUTFIT AND TIMING DEVICE AT WABASH SHOPS, DECATUR, ILL.
FIG. 5. HEAD OF MACHINE SHOWING DIALS FOR INDICATING TIME, REVOLUTIONS AND AIR PRESSURE

Wabash Railway Co. The device, shown in Fig. 3, follows closely the accepted lines of design of a hand or rope brake. The frame is substantially constructed of steel bars and angles. The two handles of the air motor are supported by the adjustable brackets *A*. The motor's feed-screw presses against the adjustable bar *B*. It can be moved in or out for different sizes of motors and locked in place by the screw-clamp handle *C*. A permanent air-hose attachment is provided at *D* and the air supply is controlled by the valve *E*. The air line has the gage *F* for indicating the air pressure.

Construction of Rope Brake

The air motor drives through the shaft *G* that is mounted on ball bearings. Bearings are provided on both sides of the brake drum *H*. The drum is made of an iron spider with a sheet-steel rim and has steel flanges welded to it. The joint between the flanges and the rim are so welded that they are watertight. The flanges extend inside of the rim toward the shaft and have a center opening *I* about 5 in. in diameter.

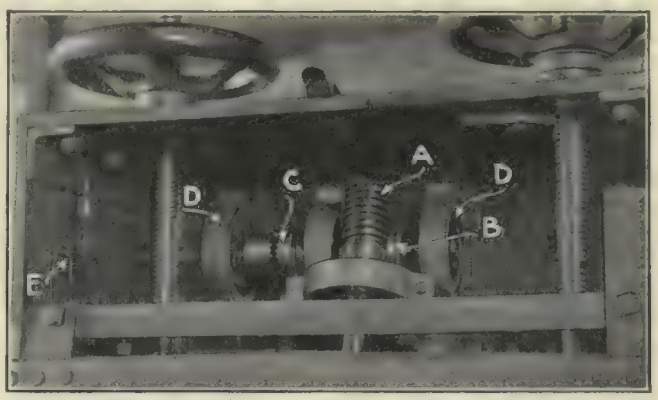


FIG. 4. INTERIOR OF HEAD SHOWING REVOLUTION-COUNTING AND TIMING DEVICES

Through this opening the drum may be partially filled with water, before starting a test. This prevents friction from developing enough heat to burn the rope during a prolonged run at high speed.

Three coils of ¾-in. manila rope inclose the drum for application of the braking friction. The two ends of the rope are spliced into eyes on the lower ends of the spring balances *K* and *L*. The total pull of the friction when the drum is revolving in a counter-clockwise direction (as viewed from the end opposite the motor) will be weighed by the spring balance *K*. The compensation pull is read on the spring balance *L*. This pull represents the tension on the rope and is increased in order to increase the friction on the drum. The pull on the balance *L* must be subtracted from the reading on *K* in order to determine the actual friction pull exerted. The spring balances were made in the shop. Adjustment on either end of the friction rope may be regulated by turning the handwheels *M* that lift the eyebolts from which the spring balances are suspended. These handwheels are mounted on ball bearings so they are more easily turned while supporting a heavy pull of the rope.

An extension of the drum shaft passes through the bearing at the right end and into a small housing. This housing encloses a pair of bevel gears that transmit the motion of the main shaft through a second shaft *N* extending to the compartment *O* at the top of the machine. The shaft operates a revolution counting device that is enclosed in the compartment. A cover on the side may be lowered, exposing the interior mechanism to view as may be seen in Fig. 4. The vertical-drive shaft terminates in the worm *A* which drives a worm

gear on the shaft *B*. This shaft can be connected by a clutch *C* with an extension that drives the revolution counting device. The count of the number of revolutions is shown on the dial *A*, Fig. 5. The small knob *B* is on the end of the rod that operates the clutch shown at *C* in Fig. 4. The convenient arrangement of the rod controlling the clutch enables the counting of the revolutions to be started instantly at the beginning of a test and stopped as quickly at its conclusion.

The shafts in this housing are all mounted on ball bearings *D*, Fig. 4. The ball bearings used were all reclaimed from the turbine units of headlight generators. These bearings are no longer suitable for turbine use when they show a little wear, but are always saved and are very satisfactorily used in all manner of shop equipment.

At *E*, Fig. 4, is a small timing device that counts the duration of the test in seconds. The count is shown by the hand on the dial *C*, Fig. 5. The clockwork is driven by a small weight which slides up and down in the tube *D*.

The timing device is used when determining whether or not the motor makes the required number of revolutions in a given period. The timing device operates constantly and it is therefore necessary to start a test as the second hand reaches zero on the scale. At that point the clutch on the revolution counter can be instantly engaged, and kept in for a certain specified time whereupon it can be released and the revolution reading made. It may be noted in closing that, like the other testing outfits described, the one at the Decatur shops is used, in the majority of cases, merely to ascertain the maximum torque exerted by the motor.

Factory Inspection

By Harry H. Armstrong

I have noticed lately different articles on factory inspection and there seems to be many different views on the subject as a whole—by this I mean not only criticism, but even going so far as to wonder if the factory could not do away with inspection entirely, and depend on the supervision of the foreman.

In my experience as a head inspector, I have come across two divisions of foremen and will classify them as mechanical and productive.

The mechanical foreman, in all probability started in as an apprentice and in due time worked up to be a valuable man. An opening came where a foreman was needed and he was given the position on his merit. It is safe to say that this man understands the business, he also knows whether a machine is made right or wrong, and if wrong, can tell what ails the construction. In other words, this type of foreman knows the game and his help recognize it and will try to do their work right. In a department under a foreman of this type inspection can be brought down to a minimum and be confined mostly to checking up the operators and in making sure that the machines are built in accordance with engineering specifications.

The other type of foreman, the productive man, is another proposition; he is there to get the "stuff" out and before he came to be on this job, he may have followed a line of work entirely foreign to that he now is engaged in. One of his operators may ask him a question which he is not able to answer; instead of coming out and saying so, he gives some sort of an answer which perhaps the operator knows is wrong. What happens? The man has got the foreman's number and knows he can fool him. This starts the quality of production on a doubtful road and a good wide-awake inspector is needed in this department. This will be apparent by the number of devices rejected for repairs. In such a case the inspection department is as vital as an oasis in the desert to a tired traveler.

A man may become a good commercial traveler or a barber or a successful insurance agent but he cannot be immediately transformed into a successful shop foreman without first getting the rudiments of mechanics. It is a fact that men of the productive type have asked for and insisted on having competent inspectors in their departments.

Another evil can be brought to the attention of the reader, or perhaps better—the chief inspector; viz.: an inspector of inferior quality should not be placed in a department where the machinists or operators are of a high caliber. It will not take them long to find out the inspector's qualifications and when they discover he is not "there," they regard him as a joke. It is from such cases that the jokes and satires on the inspector spring.

It is obvious that when an inspector holds up a piece of work, he must intelligently explain its defects. However, if he is not sure of his stand and is proved wrong, his standing in the department crumbles and he loses the confidence placed in him.

An inspector should be able to read blueprints and should be able to handle all kinds of measuring tools accurately. He should also be a mechanic and have a good knowledge of practical mathematics. There are some kinds of work in the inspection department where only gages are used but this is only one part of inspection; a gager is not an inspector.

It has been said that the better the supervision is in a department, the less is the need of inspectors. This is true to a certain extent, but it may happen that a foreman may be too precise and worry over details that are O. K. from a production standpoint.

The inspector should be in a position to judge this and once the thing is inspected and passed by him, the foreman should be relieved of needless worry.

During the war, on account of so much gage work on munitions, the standard of inspection dropped materially for the reason that a large percentage of the inspection was confined to operating gages which were fool-proof and if the piece passed the gage, it was automatically inspected. After the munitions contracts were completed, these so-called inspectors were transferred to piecework or laid off, as they could not take the place of real, first-class inspectors.

Another complaint against inspection and perhaps the most serious of all is the passing of material unfit for production, or failing to hold up defective work. The greatest criticism comes in at this point and the whole inspection system is called a farce.

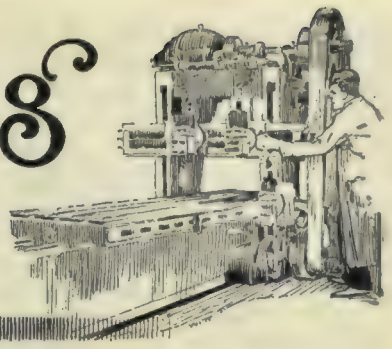
In quantity production, the inspector, to keep up with production, has to travel fast; certainly there are chances for a few pieces to get by unnoticed. This can be eliminated by 100 per cent inspection, if the number of defective pieces passed becomes a nuisance.

The inspection department is not infallible; it will make mistakes but it stops myriads of others that would otherwise reach the customer and later reflect on the company in the nature of complaints. It is safe to say that the inspection department will continue actively in the factories for years to come.



Metal Cutting Tools.

By A.L.DeLeeuw



X. Milling Cutters Continued—Gear Cutters—Finishing, Stocking and Duplex Cutters—Various Types of Hobs and Their Action

THOUGH gear cutters are, strictly speaking, form-mills, and though all that has been said about form mills applies to gear cutters, there are a few remarks which should be made because this practice in regard to gear cutters has been so developed and standardized that we can speak about established practice of gear cutters when we cannot say the same thing about form-mills in general.

Gear cutters are made in three different styles: finishing cutters, stocking cutters and duplex cutters. Finishing cutters are form-mills pure and simple and the contour of the teeth is the shape of the gap of the finished gear wheel. At the present time there is practically only one system of gear teeth for which standard cutters are made, namely, the involute system, and the standard cutters made for this system are all made on a compromise plan. Although, strictly speaking, a gear of twenty-two teeth requires a somewhat different cutter from a gear of twenty-three teeth, the standard cutter which would be used for either of these gears would be a cutter intended for all gears from 21 up to 25 teeth. Consequently, the shape produced by these cutters is not theoretically correct. However, it is so nearly correct that it will serve for most purposes. Where great accuracy is required, a special cutter should be made for this particular number of teeth. Even this would not be entirely satisfactory. In practically all

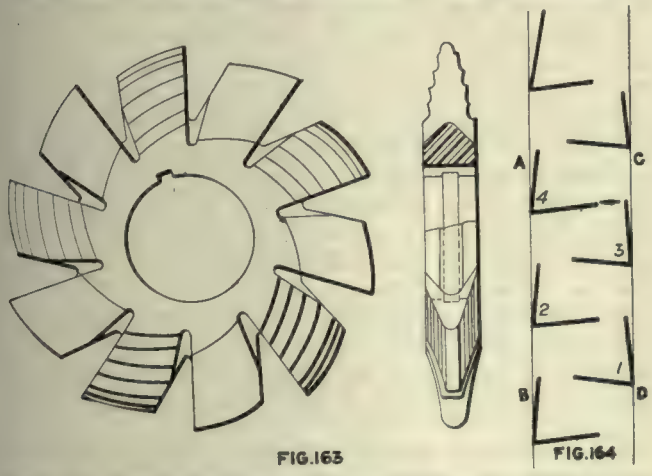


FIG. 163. STOCKING CUTTER WITH STEPPED TEETH. FIG. 164. DIAGRAM SHOWING CONSTRUCTION OF ALTERNATE-TOOTH CUTTER

cases the pure involute shape is not used but a correction is made to overcome the interference which would result if this involute form of teeth were employed. The amount of interference depends not only on the number of teeth of the gear but also on the number of teeth of its mating gear, so that a different amount of correction would have to be made if a different mating gear were to be used. In order, then, to get the best results, special cutters if used at all should be made for a given set of mating gears.

Stocking cutters are made so as to cut a gap closely resembling the gap made by the finishing cutter, but leaving enough metal for a finishing cut. Whereas a standard set of finishing cutters contains eight cutters for different numbers of teeth, stocking cutters are

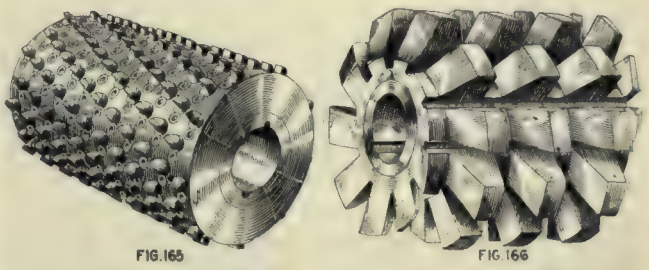


FIG. 165. "PORCUPINE" SLABBING CUTTER. FIG. 166. HOB WHICH MIGHT BE USED AS SLABBING CUTTER

made of a form so as to serve equally well for any number of teeth of a finished gear. As a rule stocking cutters are not used for six-pitch and finer, though for some special cases small stocking cutters might be made. If it is necessary to take more than one cut in gears with six-pitch or finer, the finishing cutter is used for stocking by reducing the depth of the cut.

One of the main objections to the cutting of gears with a disk cutter is the fact that the removal of a large amount of metal at a single point of the circumference of the gear causes local heating and corresponding distortion of the gear. Another trouble is that when some of the teeth have been cut and the cutter enters on a new cut, it has a tendency to push the tooth over into the previously made gap. For that reason it is necessary to take at least two cuts where a fair degree of accuracy is required. For heavy steel gears with coarse pitches, three cuts are taken.

If the stocking cutter were made to the same general outline as a finishing cutter, we would meet the same conditions as when cutting a deep slot with a slotting cutter. There are broad chips and a tendency of the chip to stick in the groove, causing rough surface and chatter and a corresponding short life of the cutter. For this reason, stocking cutters for the smaller pitches are made so that alternate teeth cut on the right or on

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the left side of the gap to be made. For instance, tooth No. 1 of the cutter will cut at the bottom and on the left side, whereas tooth No. 2 will cut at the bottom and on the right side, etc. In addition the teeth are stepped so as to break up the chips.

Fig. 163 shows both the stepping of the teeth and the construction of the alternate cutting edges. It has been found that when these alternate cutting edges are used with the coarser pitches, and especially on gears of large diameter, a weaving action is produced which may be so great in extent as to wipe out the amount of stock left for finish and in any case is harmful to the cutter besides producing a non-uniform result in the gear. For this reason stocking cutters for the smaller pitches are made with the alternate teeth and the step, whereas those for larger pitches are only stepped. When the system of alternate cutting teeth is employed it is often the practice to give the teeth side rake.

Fig. 164 shows in diagrammatic form how such a cutter is constructed. The lines *AB* and *CD* represent the sides

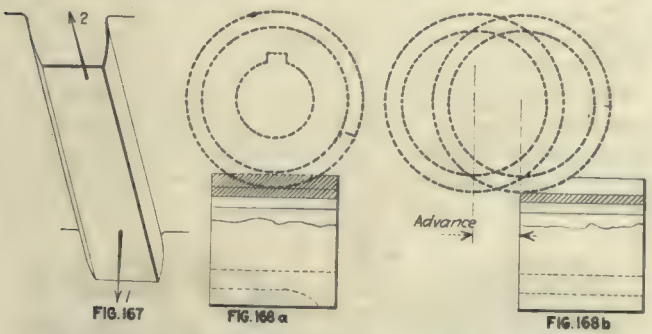


FIG. 167. TOOTH OF HOB SET PARALLEL TO FACE OF WORK. FIG. 168a. TOP VIEW OF GEAR AND HOB WITH HOB PARALLEL TO FACE OF GEAR. FIG. 168b. SIDE VIEW OF SAME

of the cut. The first tooth cuts as shown at 1, the second tooth as shown at 2, the third tooth as shown at 3, and the fourth tooth as shown at 4. This construction, though producing a smoother cutting action, accentuates the weaving of the gear under the cut and cannot be used with coarse pitches and large gears.

In order to expedite production gear cutters are sometimes made in gangs. For small gears two cutters can be set side by side; for large gears it becomes possible to use more than two cutters, and if a rack must be produced it would be possible to have as many cutters side by side as there are teeth in the rack. For the most accurate gear cutting such an arrangement is not advisable, but there are many cases where the duplex cutter produces a gear of sufficient accuracy for the purpose for which it is intended. In other cases a gang of cutters is used, arranged so that the first cutter does the stocking and the second cutter the finishing. This again is not advisable when great accuracy must be obtained because this arrangement, though providing for a roughing and finishing cut, does not take care of the local heating.

All that has been said about gear cutters can also be said about cutters intended for the cutting of sprockets, etc.

As a rule bevel gears are nowadays generated, and no other method will produce bevel gears which are even approximately correct. The generating process requires a more costly machine than the ordinary gear cutter and is somewhat slower. For this reason it is customary to stock bevel gears by means of the ordinary gear cutting process using a disk cutter as tool. To stock out a bevel gear we must use a cutter which can cut as deep as the deepest part of the bevel gear tooth, and which is as

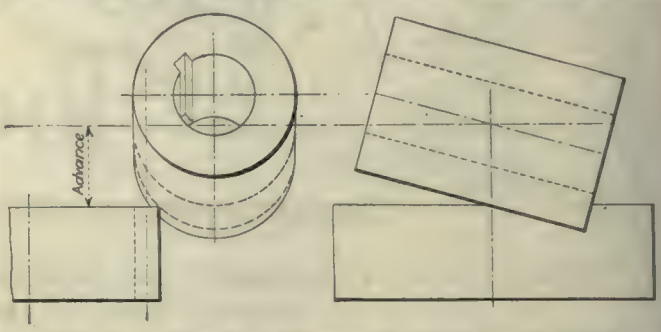


FIG. 169. HOB SET AT ANGLE WITH GEAR FACE

narrow as the narrowest part of the gap. Such cutters are made as a standard product and are very useful for the roughing operating in bevel gears. What has been said about stocking cutters for spur gears can also be said here.

There are various other form cutters which are more or less standardized, such as the cutters for cutting the grooves in twist drills, and three- and four-lipped drills, reamers and taps. Cutters for making round corners and for semi-circular grooves are also standardized.

Among the other standardized cutters, though not form cutters, may be mentioned cutters for the Woodruff key system, for T-slots, etc.

Hobs

Hobs are modified form-mills. An axial section through a form-mill would show the outline of the teeth to be made. An axial section through a hob would show a multiplicity of sections of a form-mill. If we should take a number of half round convex cutters and place them side by side on an arbor, and then take an axial section through this gang of cutters, we would get such a multiplicity as was mentioned a moment ago, and yet we would not have a hob. Most hobs, as we know them, are used for generating gears, and as the teeth in such hobs are placed spirally around the body of the cutter, it might be thought that if we have such a multiplicity of form-mills placed spirally around the body of a cutter that then we have a hob. However, this is not so, for there are hobs of which the teeth are not placed spirally around the body; thread milling hobs, for instance. It is therefore exceedingly difficult to say what a hob is, for the essentials of a hob lie not in the way it is constructed but in the way it is used. For instance a gear-cutting hob might be used as a slabbing mill, and a thread-milling hob might be used as a multiple grooving cutter.

The cutter shown in Fig. 165 is a slabbing cutter, (sometimes referred to in the shop as a "porcupine cutter"), which has a multiplicity of teeth placed in spirals around the body of the cutter, yet this cutter is not a hob.

Fig. 166 shows a hob which might be used as a slabbing cutter. The real essential of a hob is that it be used to generate some desired outline by a combined movement of cutter and work. For instance, a gear-cutting hob will generate the proper shape of the gear tooth by the following combination: the hob turns, the work turns in a certain fixed ratio to the number of revolutions of the hob and the hob advances in the direction of the axis of the gear teeth.

A thread milling hob generates a thread around the body of a screw by the following combination: the hob turns, the screw turns, (without any particular relation between the speed of revolution of hob and work), and the work advances in the direction of its axis and in a fixed relation to its speed of revolution. In both cases something is generated: in the first case, the shape of the gear tooth; in the second place, the spiral of the screw thread.

As hobs are used to generate a certain desired outline of the work, it is essential that the generating teeth of the hob shall not lose either size or shape after resharpening, and therefore the teeth of the hob must be made in the same way as the teeth of a form cutter. All that has been said about the uncertainty caused by the unavoidable inaccuracies after hardening, and, for that matter, in the manufacture of the form cutter, can also be said about the hob. In the chapter on "Cutter Sharpening" a method will be described by which some

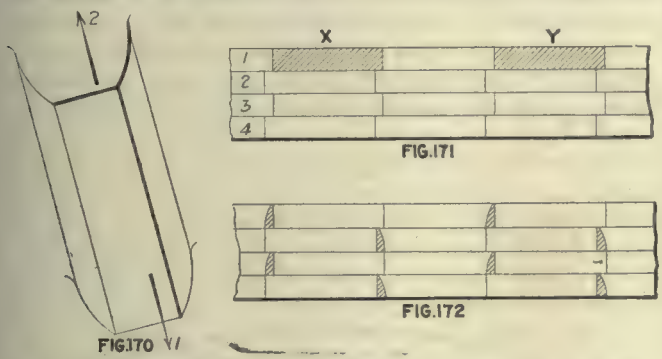


FIG. 170. TOOTH OF HOB SET AT ANGLE WITH GEAR FACE. FIG. 171. DIAGRAM OF GEAR TEETH CUT BY UNEVEN DOUBLE THREAD HOB. FIG. 172. SAME SHOWING EFFECT OF UNEVENNESS IN THE HOB

of these irregularities can be overcomee. The irregularities of which this method takes care might be called irregularities of indexing or spacing of the teeth around the body; in a hob there is another source of irregularity to be reckoned with. Not only must the teeth be spaced regularly around the circumference of the cutter but they must also be spaced regularly in an axial direction, and the method to which we refer here, though overcoming the first difficulty, does not overcome the second. In order, then, that a hob may be perfect, it is necessary to grind every surface of its cutting teeth before putting it into production. The irregularities are small and it is therefore unnecessary to use a ground hob except where accurate work is desired. For roughing or for work which requires no great accuracy, the hob can be used just as it comes from the hardening—after being properly sharpened, of course.

This is not the place to go into a treatise on gear cutting. The form of the teeth of the hob necessary to produce a good gear is a study in itself. We are concerned here with what should be done in order to make the hob cut properly and to make it retain its shape.

The first question to be answered in regard to a hob is whether the pitch of the hob should be the distance from center to center of two consecutive teeth measured in the direction of the axis or at right angles to the spiral. In other words, whether we should have axial or normal pitch. The answer depends on whether we wish to set the hob parallel with the face of the gear or not. If we do, the pitch of the hob must be measured in an axial direction. The direction of the cut will be tangential to the hob, and therefore the cutting faces of the teeth must be in an axial plane. The result of such an arrangement is that the cutting tooth of the hob has more clearance on one side than on the other.

Fig. 167 illustrates this condition in exaggerated form. A single tooth is shown in perspective. Arrow No. 1 shows the direction of the cut, and arrow No. 2 shows the direction of the spiral along which the teeth are wound around the body. It will be seen that there is much more clearance on the right side than on the left. The angle which the spiral makes with the normal plane might be so great that the clearance would be entirely wiped out, or that we might be confronted with negative clearance. As we know, one of the difficulties in a form cutter is to produce enough side clearance, and this arrangement, reducing the side clearance on one side of the teeth, makes the difficulty that much greater. A hob constructed in this way is easily set and requires less advance and consequently less time for a gear of given face. On the other hand, its cutting qualities are not so good as those of the other types.

Fig. 168a shows a top view of a gear and hob, the latter being set parallel to the face of the gear. Fig. 168b shows a side view indicating the advance; that is, the distance the hob must travel before it cuts to the full depth. Taking as example a gear of 2-pitch and a 5-in. diameter hob, the depth of cut would be 1.078 in. and the distance the hob would have to travel before it is in to the required depth would be 2.056 in.

Fig. 169 shows the hob set at an angle with the face of the gear. In the position shown, some point of the hob touches some point of the gear blank. The exact location of that point depends on the diameter of the blank and the angle to which the hob is set, but it is plain that it will be some time before a point of section *AB* touches the work. In other words, the amount of advance is greater.

In this type, the teeth are arranged as shown in Fig. 170 where a single tooth is again shown. Here, too, arrows No. 1 and No. 2 represent the direction of cutting and of spiral respectively; but in this case these two arrows have the same direction, and consequently the clearance is the same on both sides of the tooth and is therefore as favorable as it can be made under the circumstances.

When using a hob it is necessary to have its axis make an angle with the face of the gear equal to the angle of the spiral figured on the pitch line. If such a hob is used for the cutting of spiral gears, the angle of the hob with the face of the gear must be equal to the sum of the angles of the spirals of gear and hob, or their difference, depending on the direction of spirals.

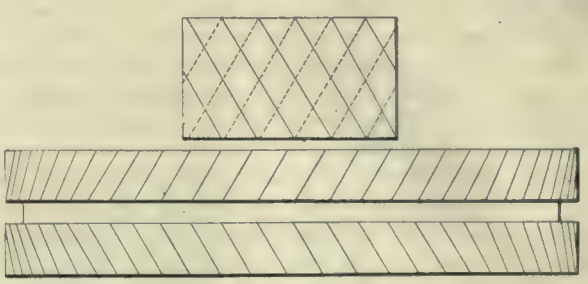


FIG. 173. HERRINGBONE GEAR CUT BY PARALLEL HOB

In order to expedite cutting, hobs are often made with multiple threads. If a single-thread hob is used, and the gear to be cut has sixty teeth, then sixty revolutions of

the hob are required for one revolution of the gear. If the feed of the hob downward is 0.060 in. per revolution of the gear, each revolution of the hob finishes the gear

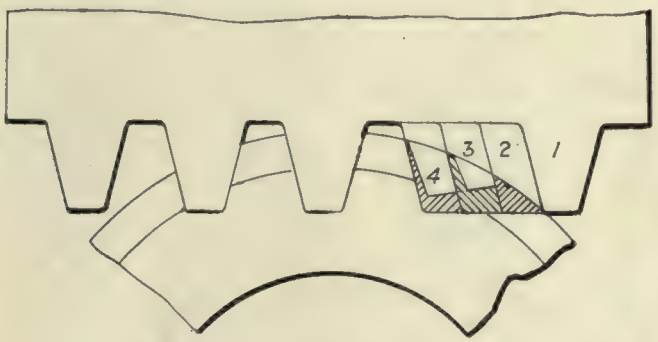


FIG. 174. AXIAL SECTION OF HOB AND 60-TOOTH GEAR BLANK

to a depth of 0.001 in. If a double thread hob were used, thirty revolutions of the hob would correspond to one revolution of the gear, and 0.002 in. of the gear would have been finished by one revolution of the hob. This shows plainly how the multiple thread hob is preferable if rapid production is the object. In that sense, it will be still more desirable to have triple or quadruple thread hobs and, as a matter of fact, such hobs are often used.

One of the reasons why a hob, generally speaking, produces a better gear than the disk cutter, is the fact that we are more or less independent of the accuracy of indexing. The index movement is continuous which makes us entirely independent of much delicate mechanism which must be employed when the indexing is intermittent. We are dependent on the accuracy of the hob, and it is possible, by proper methods, to make hobs which possess this quality to a high degree.

In constructing the hob we use methods of thread cutting combined with backing off, and when high-grade hobs are made, they are ground after hardening, again employing the same general methods as used in thread cutting and backing off. These methods lend themselves to a very high degree of accuracy, provided that the hob has a single thread only. When, however, we construct a double thread hob or in general a multiple thread hob, we must interrupt the operation of thread cutting when we have finished a single thread, after which we must index the hob to a new position suitable for the commencement of the second thread, and we must then set our tools or grinding wheel, or whatever we use, to exactly the same finishing position which they had at the end of the first thread, so that we introduce two new elements here: the accuracy of the indexing as well as the accuracy of the tool setting. In other words we meet the same difficulty which we meet in the cutting of multiple thread screws. We may therefore say that, in general, a multiple thread hob is not quite so accurate as a single thread hob.

If we consider the 60-tooth gear again, and cut it with a double thread hob, and we call the two threads of the hob *A* and *B*, teeth Nos. 1, 3, 5, 7, etc., will all be cut by thread *A;* and teeth Nos. 2, 4, 6, 8, etc., will all be cut by thread *B*. And if there is any error in accuracy between threads *A* and *B*, either in spacing or in size of the teeth, their depth, or the like, this error will be reproduced in the gear, and teeth Nos. 1, 3, 5, 7 will be different from teeth Nos. 2, 4, 6, 8. If the gear had 61 teeth we would have a somewhat different condition. The first time the gear goes around, thread *A* of the hob will generate a small portion of teeth 1, 3, 5, 7 . . . 57, 59, 61, and thread *B* will generate a small portion of teeth 2, 4, 6, 8, . . . 56, 58, 60. But when the gear goes around the second time, thread *A* will generate the next element of teeth 2, 4, 6, 8, . . . 56, 58, 60, and tooth *B* an element of teeth 1, 3, 5, 7, . . . 57, 59, 61. This shows that the error between teeth *A* and *B* is not bodily duplicated in the gear. The first element of tooth No. 1 might be a little bit too far to the right, but the second element, being generated by tooth *B*, would be proper; and furthermore, the nature of the way in which the hob tooth approaches the work would make it remove most of the excess metal left by tooth *A*. The total result in such a case might be that the width of all the tooth gaps would be slightly too great.

Fig. 171 shows a front view of a portion of a gear, two gaps being shown, *X* and *Y*. The first element is made by tooth *A*, the second by tooth *B*, etc., and the illustration represents the gear as if the first element were cut without the hob having any effect on element 2, and as if the second element were cut without the

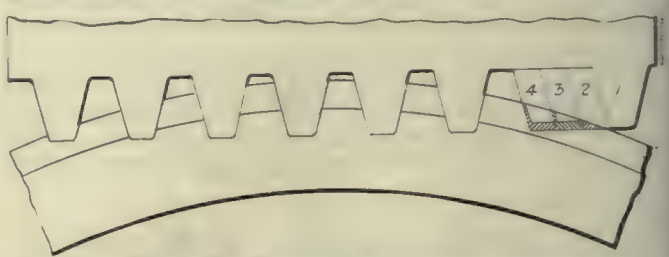


FIG. 175. AXIAL SECTION OF HOB AND 15-TOOTH GEAR BLANK

hob having any effect on elements 1 and 3. Fig. 172 shows the same thing, this time indicating how the hob does have an effect on other elements besides the one it is generating, and it shows very plainly how the final effect must be a wider tooth gap than desired. This error of a somewhat wider tooth gap is, as a rule, not highly objectionable, so that we find that it is possible to cut a fairly accurate gear of 61 teeth with a double thread hob; but it would not be possible to cut an accurate gear of 60 teeth with that same hob.

In general we may say that errors of the hob are reproduced in the gear when the number of threads in the hob is a divisor of the number of teeth of the gear. It would not be possible, then, to produce a very accurate gear of 60 teeth with a hob with two, three, four, five or six threads; but it would be possible to produce such a gear with a hob with a single thread or with seven threads. It should be understood that the errors mentioned are very small in a well-made hob, but that, however small this error may be, there is an additional source of error contained in the fact that we use a hob with multiple threads.

As it is possible to make a single thread hob so that the pitch of the gear is the same as the pitch of the hob measured in an axial direction, or in the direction at right angles to the spiral, so it is possible to make a hob so that the pitch of the gear corresponds to the pitch of the hob measured in some other direction—in any arbitrary direction, in fact. Doing this it becomes possible to construct a hob with parallel gashes, but which must be set at an angle in order to produce the correct pitch. In that way the difficulty mentioned before,

namely, the lack of clearance on one side of the hob teeth, can be largely overcome. It might be asked what advantage is left in regard to the use of hobs with parallel gashes if we set them at an angle with the face of the gear. The answer would be that it is much easier to resharpen a hob with parallel than with spiral gashes.

This method is often followed when constructing hobs for spiral gears, and especially for herringbone gears. As a rule, it is advisable to have the two parts of a herringbone gear as close together as possible. If such a herringbone gear is generated in a shaper, the only space between the two parts of the gear required for the run out of the tool will be $\frac{1}{16}$ to $\frac{1}{4}$ in.; so that the method of shaping a herringbone gear is very attractive if nothing else must be considered except the space between the two parts. However, the shaping method, developing local heat, is much more apt to produce an incorrect gear than the hobbing method, provided that all other conditions such as accuracy of machine and care in the operation are the same.

Where herringbone gears are employed it is generally desirable to have them running very quietly; in fact it may be said that this is the chief reason for the use of spiral and herringbone gears. Naturally, then, one would want to use that method which gives the highest degree of accuracy and this would be the hobbing method. If we should have to cut a herringbone gear with a spiral angle of 45 deg., we would have to set the hob to that angle, more or less; so that a part of the hob would run into the second part of the gear long before we had finished the first part, unless the gap between the two parts was made very wide. It is therefore desirable in such cases to find a way which makes it unnecessary to set the hob to the angle of the spiral.

Fig. 173 represents a herringbone gear and a hob set parallel with it. The teeth which will come in contact with the gear, the cutting teeth, are back of the hob and are shown in dotted lines. These teeth must be in the direction of the teeth of the gear, so that the teeth in front of the hob will appear as shown by the full lines. The spiral along which the teeth of the hob are wound around the body will have a very large lead, and it will therefore be necessary to make the hob with multiple threads in order to get that lead.

In such a case it becomes necessary not only to select the proper number of threads to give the correct lead, but also to select a diameter of hob on which this lead will produce the desired angle. If, for instance, we should wish to cut a spiral gear with a normal pitch of 1 in., and a spiral angle of 45 deg., we would have to make the spiral of the hob threads also 45 deg. If we should find that the smallest hob which can be put in the machine is $2\frac{1}{2}$ in. in diameter on the pitch line, then the circumference on that pitch line would be 7.854 in., which means that the lead would also be 7.854 in. if we wish to have a 45-deg. angle. The normal pitch of the spiral gear being 1 in., its circumferential pitch will be 1.4142 in.; so that we would have to make five threads in order to come somewhat near the desired lead of 7.854 in. This lead, however, would be only 7.071 in., which is not enough. We must, therefore, give the hob six threads, which brings the lead up to 8.4852 in., and this again means that the circumference of the pitch line of the hob must be that amount—8.4852 in. In order to have this circumference, we should have made the hob 2.670 in., and not $2\frac{1}{2}$ in. in diameter.

A hob constructed in such a way will produce any spiral gear of 1 in. pitch normal, and 45. deg. spiral angle, but will not be useful for a gear of any other pitch or spiral angle. As far as the pitch is concerned the hob does not suffer in comparison with other hobs because one hob is good only for one pitch, but when the hob is so constructed that it must be set to the spiral angle plus or minus the angle of the thread of the hob, then such a hob is good for any gear of that pitch and the gear may be either a spur or spiral gear of any angle.

In ordinary milling practice we know exactly the amount of metal to be removed on a given piece of work. If the piece is a rough casting or forging the amount may vary as we feed along, but whatever this amount may be it is the same for all the teeth of the cutter, and this is true for a form mill as well as for a spiral mill or end mill. This uniform condition does not exist when we use a hob. Each tooth of the hob removes a different amount of metal if it comes into action at all. If we should cut a hob in two in an axial plane we would find that the outline of the section is the same as a rack. The action of the hob on the gear is the same as if this rack moved up and down like a slotting tool and while moving up and down moved also endwise, keeping in mesh with the gear just as if gear and rack were meshed together. As a matter of fact there is no such endwise movement, but the location of successive teeth in a spiral around the body has the same effect as if the cutter were moving endwise. If there are twelve teeth in one convolution, each tooth will be $\frac{1}{12}$ of the pitch further toward the right or left (according to whether the spiral is right or left handed), and when the hob has made one complete turn twelve cuts have been taken, each one $\frac{1}{12}$ of the pitch further to the right or left.

Fig. 174 shows an axial section of a hob, operating on a gear blank. The action of only one of the convolutions, the end one, is shown. The hob is supposed to have only three teeth per revolution. Position No. 1 shows a tooth just touching the work. After one complete revolution position No. 4 is reached by some tooth, the first tooth of the next convolution. The shaded portions show the chip taken by the different teeth, Nos. 2, 3 and 4. As a matter of fact the shape of these chips would be slightly different, due to the fact that the wheel is meanwhile rotating, but this detail has been left out of consideration in order to bring out the main point, namely, that each tooth removes a different amount of metal. As a result the different teeth will wear to a different degree. There will be some teeth which have merely scraped the work, others which have taken heavy amounts of metal, and consequently the life of the hob depends on the size of chip taken by that tooth which does the heaviest work.

Not only does the amount of metal removed per tooth depend on the pitch of the gear and the number of teeth per convolution, but it also depends on the size of the gear. Fig. 174 represents a gear with sixty teeth, while Fig. 175 represents one with fifteen teeth. It will be seen that the hob is much longer in action on the large than on the small gear, and consequently that the full amount of the gap between the two teeth must be removed in a very much shorter time on a small than on a large gear. The illustration shows plainly that the chips removed in positions Nos. 1, 2, 3 and 4 are not at all of the same section in the two gears. As more teeth come into action on a large gear we may expect

the life of a hob to be greater when cutting larger gears.

There is still another point which affects the life of the hob. In order to illustrate this we will consider a hob used for generating spline shafts. Spline shafts as used in automobiles are made with 4, 6, 8, or 10 teeth or splines. In order to bring out the peculiar action of a hob when cutting a spline shaft with a small number of splines, we will assume a small hob and a large shaft: say a hob 2½ in. in diameter and a shaft with a diameter of 5 in. We will further assume that the depth of the spline is ¼ in. Under such conditions a tooth of the hob will work in the spline along an arc of which half the chord is ⅜ in., which is an arc of approximately 37 deg. The hob makes four revolutions for one revolution of the shaft, so that, during the time the hob has traveled through an arc of 37 deg., the spline has traveled through an arc of 9¼ deg. In other words, any point of the spline shaft has traveled through a circular distance of 0.800 in. We see, then, that while the tooth of the hob is going through the work a distance of approximately 0.75 in., the work moves sideways against the tooth of the hob a distance of 0.800 in. This shows the necessity of having ample clearance on the sides of the teeth of the hob. The failure to provide sufficient clearance is one of the chief sources of failure of the hobbing process.

In order to reduce as much as possible the size of the heaviest chip taken by a hob tooth it would be necessary to have as many teeth in the hob as possible. However, the teeth must be strong enough and must have metal enough to stand a number of grindings, so that the only way we could make a hob with a large number of teeth would be to make it of large diameter. But when we do so we limit production. If, for instance, we should have a gear of 60 teeth and a hob 4 in. in diameter, and we find that we can run at a cutting speed of 100 ft. per minute, then we would make 100 revolutions per minute, approximately. If we further find that a feed of 0.060 in. per revolution of the gear is the best we can do with the desired finish, we will finish 0.060 in. of the face of the gear in 60 revolutions, or in 36 seconds. If now we should make the hob twice as large, 8 in. in diameter, in order to get more teeth, we would be able to run the hob only thirty revolutions per minute and it would now take 72 seconds to finish 0.060 in. of the face of the gear. Here again is a case for compromise.

There is often doubt on the part of the shopman as to whether he should use a ground hob or not. The methods employed in making ground hobs are of a high degree of accuracy and as a result the accuracy of the gear produced will be much greater. Besides, the fact that the roughness caused by hardening has been removed, makes the hob better considered as a cutter. The same advantage which is found to exist in a cutter of which the teeth were ground on all sides will be found in the teeth of a ground hob, in other words, a ground hob will have a somewhat longer life between sharpenings. However, some hobs are ground in such a way that it is not possible to give as much clearance as on unground hob, and in that case all the advantages of the ground hob as to long life disappear. It is well, therefore, to examine a ground hob as to the amount of clearance given by the grinding. Due to the great difference in price of ground and unground hobs it may be advisable to use unground hobs for roughing and even for finishing where extreme accuracy is not required.

Where Some Sales Systems Are Weak

By S. Owen Livingston
President, Grand Rapids Grinding Machine Co.

In times like these it would seem as if it behooved every manufacturer to give the most efficient service on all inquiries, yet many of them are subjecting their prospective customers to a serious and I believe needless annoyance.

My point can be illustrated by a couple of instances that have occurred within the last couple of weeks. A mechanical device made in Chicago seemed to be of interest to my firm. A letter of inquiry was addressed to the Chicago office and we patiently waited for a reply. It was delayed to such an extent that we were about to send a second inquiry, feeling that the first one had been lost, when we received a reply from Cleveland, Ohio, from which office apparently the state of Michigan was covered.

In another case we were considering the use of a certain part which we had reason to believe could be best purchased from a manufacturer in Cleveland. We wrote asking for information, explaining it was wanted as a basis for tentative design. Just one week later we received a reply from the Cleveland office saying that our inquiry had been referred to their Detroit representative and not giving us any of the information we asked for.

We believe that these instances are more or less typical of many. Of course we realize that any manufacturer must work with his branch houses and sales agencies, but we do not believe that the co-operation with these would be in any way handicapped by giving the information direct from headquarters promptly and supplying such branch office or sales agency with a carbon copy of the letter giving the information. Certainly headquarters should be in a position to give as accurate and complete information as can be given by a branch unless the branch is in a position to make an immediate personal call. The prompt reply would have been of distinct advantage to us in both cases referred to and the delay has caused an antagonistic feeling that it will take mighty good salesmanship to remove.

I know of one case, not a personal one however, where a manufacturer of sensitive drill presses referred an inquiry to a sales agency in a branch house, but failed to send the inquirer the information regarding prices, specifications, delivery, etc., which had been requested. The dealer to whom the inquiry was sent seemed to prefer to sell some other make, with the result that the customer was almost forced to buy a make that he was not partial to. If the manufacturer had sent the full information regarding prices, delivery, and machinery specifications to the prospect and sent a carbon copy to his sales agency, the manufacturer would have received an order for the machine and the customer would have been better satisfied. Of course the sales agent in this case was inexcusable and subject to just censure but the blame can be directly charged to the manufacturer who was so short sighted as to fail to protect his own interest and the interest of his prospective customer, through the mistaken idea that he was more fully protecting the interest of his sales agent.

My plea is that every inquiry which a manufacturer receives should be immediately answered with the most complete information possible or with a courteous explanation of the reason why the information is not forthcoming.



The Foreman and His Job

Suggestions for live foremen who wish to go up the ladder, and for firms who want better shop executives

By FRED H. COLVIN
Editor, American Machinist

WHETHER the foreman is directly responsible for the training of workers or not, the man who wants to succeed should be somewhat familiar at least with the methods used in various plants. None are perfect, none will apply to all plants as conditions vary greatly. But from them all we can gain a little which may help in our own problems.

We must consider first what we wish to teach. Is it simply to train a man or woman to perform one operation—to drill one size hole in one piece—or do we wish to have them handle several operations on the same piece?

According to some theories the greatest efficiency is secured by sub-dividing the work into minute operations, to have each operator become so familiar with the work that it becomes second nature and requires no thought. There is a growing belief, however, that this is more theoretical than practical as it ignores the human side and considers men and women as attachments to machines rather than as individuals. Careful experiments show that production depends upon more than experience and skill, that the attitude of mind has much to do with it as well.

When an operator tackles a new job the production is necessarily low until he or she becomes familiar with the work. Then the production curve rises until it reaches a maximum, which will of course vary with different conditions such as hard castings, trouble with machines and other factors. This average will continue as long as the operator is interested in the work or what it brings.

Teaching Several Operations

The time usually comes, however, when the monotony of doing the same minor operation, day after day and month after month, affects production and the rate begins to fall. Recognizing this, some shrewd managers are advocating teaching the worker how to do several operations instead of one. Then, before the production falls, the worker is transferred to another operation which renews the interest. Of course this does not secure maximum production at all times, but the average should be higher and we are more apt to have a contented lot of workers than with the other system.

This also has another advantage in providing a more flexible working force. For should the workers of any department be subject to an epidemic, or should a given department fall behind in its production, we can recruit its working force from other departments and so maintain a balanced production. The greatest value, however, is almost sure to come from the affect on the mind of the workers. The looking forward to a change of work can hardly fail to help prevent monotony and to renew and maintain the worker's interest in the plant. And the changes should be made as often as it may prove desirable, always keeping an eye on the maximum of production and the minimum of grouches and discontent.

Changing to Another Job

The length of time between changes must not be a hard and fast rule figured out by formula and a calculating machine. It must depend upon the kind of work, the kind of people employed and the physical conditions of the plant and its surroundings. Phlegmatic people, plodders as we call them, do not require frequent changes and, in fact, might even resent them. In such cases we may be tempted to forget all about shifting them at all.



This Was Good Enough for Grandfather

But we must remember that the temperament which opposes change or progress in the shop, will also oppose progress in town or city government. And unless we wish to stand against progress of all kinds we must not forget that we owe a duty to the country in doing something toward instilling progressive ideas in the minds of the men and women in our shops. The policy of "letting well enough alone" would have kept us in the cave and our mode of transportation would have been the ox cart and the dug-out, instead of the airplane and the ocean steamship.

One of the best examples of the desirability, if not the necessity, of changing men from one job to another —and having this change depend on the man and the conditions of the work, happened in a foundry. The man, a foreigner of only average intelligence and temperament, ran the rattler or rumbler that shakes and

pounds the sand from the castings. It is a noisy job and a dirty one, but it is a necessary part of the foundry output.

One day the rattler broke down under suspicious circumstances. The gears which drove it suddenly went to pieces and there seemed to be good evidence that someone had deliberately dropped a casting into the gears. The operator had held this job a long time and he stoutly denied smashing the gears. Finally the manager took a hand and called Mike into the office. Without any preliminaries he said: "Mike, what made you smash those gears?"



MIKE'S SAFETY VALVE

With only a second's hesitation Mike replied "Because I couldn't stand that d—— noise any longer."

The manager was human—he had vision and imagination—and he saw the light. A little questioning showed that Mike had sickness at home, had lost much sleep on account of it and his nerves were raw and on edge. He had been on this job seven years.

"Mike you've been on that job too steady. You're a good man and we need you there. But you're going to have a change. You go home now and rest up a few days. Come back Monday and we'll forget all about the smash up. We'll give you some quiet work next week, then you can take the rattler again—and change every week. It's too noisy for a steady job. The next time you feel like smashing the gears—don't—come and see me instead."

This is only a small incident and with only what we call a "common laborer." But the effect of such broad-minded management spread through the whole shop and was more far reaching then we can tell. It is acts like this that make for loyalty and co-operation all down the line.

Abstract from the Annual Report of the Committee on Industrial Education of the N. M. T. A.

During the past year the work of the Committee on Industrial Education of the National Metal Trades Association has been one of progress. Inquiries from interested members have been numerous and have come from every section covered by the association. When the request has been for personal service, it has not always been possible to comply, as with only a single representative in the field it has been necessary to work systematically by districts, but, of course, such temporary assistance as could be rendered by correspondence has been furnished.

As a result of its studies during the year, the committee finds the following conditions to exist:

(1) There is a shortage of efficient workers for normal production.

(2) Too few companies train workers.

(3) Many of those who do attempt to train workers have nothing even approximating a definite schedule for this work, and have not definitely determined the responsibility for instruction and training as part of the duties of some person or group.

(4) Very few foremen are able to give proper instructions in the necessary training.

(5) Conditions within the various plants determine the type of training necessary.

In view of these findings, the committee has two specific recommendations to offer, namely:

(1) That a definite number of specialists or apprentices be trained in each shop; this number to be proportionate to the total number employed.

(2) That a committee on industrial education and training be formed in each branch, such committees to co-operate with local educational or training institutions on questions pertaining to technical, vocational, part-time and continuation schools and to consider ways and means of furthering training and education within the plants of our members. The committee is of the unanimous opinion that training in industry is vital, and that every member should do something in this respect.

It is the belief of the committee that in a majority of instances, shops with one hundred or more employees should consider seriously the establishing of a training department. In the smaller shops the quota could be trained in connection with the toolroom or some special department. Each plant should have some individual in charge of and responsible for the training.

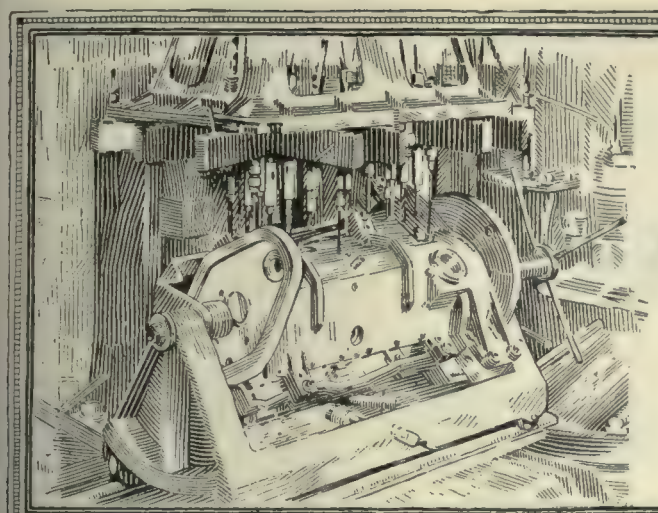
The Only Bolt Works in India

The illustration shows the sole manufacturing plant devoted to the making of bolts in all India, the Bengal Bridge and Bolt Co., Ltd. The source of power consists of two traction engines. They are connected to the lineshaft by belts over the flywheels.

As can be seen from the photograph the shop is nothing more than a shed with a dirt floor. We are indebted for the snapshot to Mr. Meyer of the Landis Machine Co., who is now in the Orient.



THE ONLY BOLT WORKS IN INDIA



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Drill Jig Design Continued—V-Block Design—Leaf Jig Design—Leaf Construction—Clamps in the Leaf—Leaf Stops—Leaf Locks

MANY types of V-blocks for locating and clamping are found, several of which are shown in Fig. 45. The type shown at *A* is found in every toolroom and is used for various jobs on the milling or drilling machine. Clamping action in setting up a piece of work, such as shown at *B*, should be in the direction indicated by the arrow. It is not, however, necessary to have the pressure of clamping through the center of the V-block as it may be a trifle to one side or the other without causing any inaccuracy in the work. Another type of V-block, shown at *C*, is very useful in jig work. The angle is slightly less than a right angle and as a consequence pressure applied in any direction indicated by the arrows will force the work *D* directly into the block. This type is commonly used for small work.

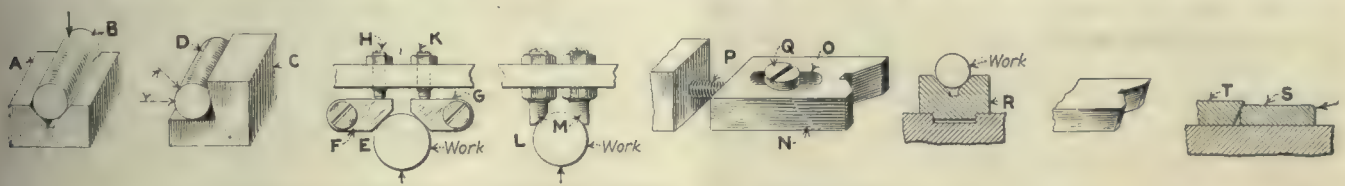


FIG. 45. V-BLOCKS, STATIONARY AND ADJUSTABLE

An adjustable V-block is shown at *E*. The blocks *F* and *G* are pivoted on the studs indicated and may be adjusted by means of the headless screws *H* and *K*. After the adjustment the check nuts must be tightened to make the location permanent.

Still another type of adjustable V-block, shown at *L*, will need some round pins cut at an angle at the point *M*. This type of *V* can be adjusted by means of the check nuts. The objection to this type, and also to that shown at *E*, is that there is always a possibility of the nuts loosening so as to cause variation in the location.

The principle of a sliding V-block is shown at *N*. The block has a slot at *O* which permits adjustment. Pressure can be applied through the screw *P* to adjust the block. An arrangement of this kind is not good on account of the opening at the slot which allows chips to accumulate, causing considerable trouble. Furthermore, practically all of the pressure applied by the angular jaws is taken on the head of the screw *Q*. If it becomes necessary at any time to use a block of this type it should be tongued as shown at *R* and a suitable sheet metal cover should be placed over the slot to protect it from chips and dirt. When a V-block is made like that shown at *R* there is always a possibility of chips accumulating under the sliding portion so that after a while it can be operated only with difficulty. For locating several V-blocks in line with each other when they are not adjustable they may be tongued as shown. Occasionally a piece of work is located in a V-block and it is at the same time desirable to hold the work down by means of the V-block. An example is shown at *S*, where the work is located by means of the sliding V-block *T*. The block may be undercut to an angle of about 10 or 15 deg., so that it will not only locate the work but will hold it down as well.

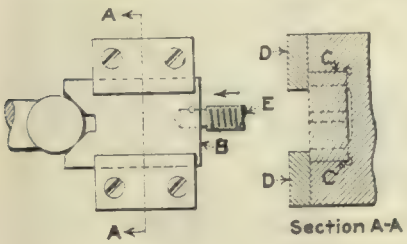
At *B* in Fig. 46 is shown an approved method of locating sliding V-blocks. The block is fitted on the sides to the slot at *C* and is held down by means of gibs at *D*. The block is operated by means of a screw at *E*. This is the best method of making a sliding V-block, but it is sometimes desirable to make the gib *D* in the form of a flat plate extending completely across the V-block. Naturally these points may be varied to suit and do not affect the fundamental features of design. Another type of block is shown at *F*. There may be cases when a block of this kind has advantages but in general it is expensive to make and has no practical advantage over the design shown at *B*. The plate *G* is expensive and difficult to fit.

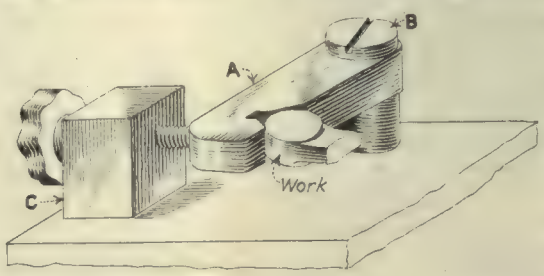
The method of fitting a slide as shown at *H* is not to be commended as it is much more difficult and expensive than the design shown at *B*. We have seen V-blocks made in this way but have not approved of the design. It is usually considered good practice to keep a design as simple as possible so as to avoid unnecessary machining and fitting.

In Fig. 47 is shown at *A* a type of swinging V-block

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which is quite useful on small work. Blocks of this kind are useful where the work is located by a central stud on the jig. The work shown would be difficult to locate in a regular sliding V-block. Blocks of this kind can be made up in quantities for small work and to a certain extent standardized so that they can be used by simply drilling and tapping a hole for the screw shown at *B* and applying the block *C* which carries the backing-up screw.





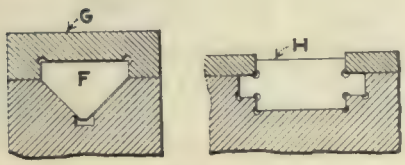


FIG. 46

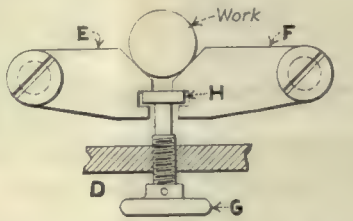


FIG. 47

FIG. 46. SLIDING V-BLOCK DESIGN. FIG. 47. SWINGING V-BLOCK DESIGN

Another type of swinging V-block is shown at *D*. The V-block is made in two parts, *E* and *F*, controlled and adjusted by means of the thumbscrew *G*. The thumbscrew has a shoulder at *H* which engages with two supports on the swinging members. This type is used to a considerable extent by a large manufacturer in this country.

Leaf Jigs

In the design of leaf jigs there are many points to be considered. In the example shown in Fig. 48 the jig *A* was designed for holding the work *B*, while being drilled through the portions indicated at *C*. The work is fastened into the jig in one position, after which the jig is turned over until it assumes the position shown, in which position the drilling is done. There is no particular objection to this type of jig and it is in common use in many factories. However, a leaf jig design is shown at *D* for comparison. The leaf *E* is swung back against the leaf stop indicated while the work *B* is being loaded on to the stud. The leaf is then swung down into position carrying the work with it until it takes the location shown by the dotted lines. A quarter-turn screw *F* is used to locate the leaf in position. The advantages of this type over the one at *A* are that it is much more convenient to operate and if a multiple drill-head is used, it can be clamped firmly to the correct location on the table.

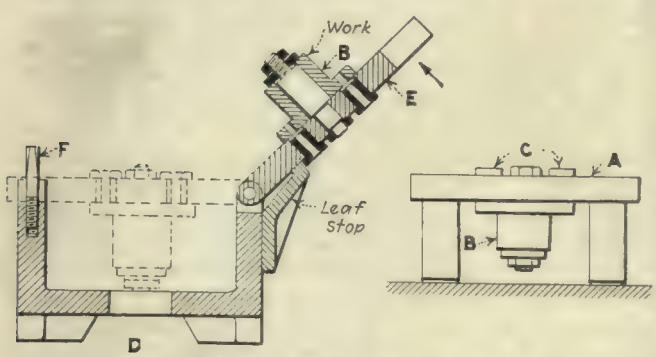


FIG. 48. LEAF JIG OF SIMPLE DESIGN

In the construction of jig leaves the hinge is an important factor. Several methods are in vogue. There is a straight pin such as that shown at *A* in the upper part of Fig. 49. In this construction it is considered good practice to make the pin so that it will be a drive fit in the leaf *B* and a running fit on the two end bearings. Probably the best construction obtained is by making the pin a standard taper like that shown at *C*. When this construction is used the adjustment for wear can be made very easily and any amount of freedom can be made in the leaf by simply giving an additional turn to the taper reamer.

It is sometimes desirable to make a leaf like that shown at *D* in order to obtain a slightly equalized action on the leaf when it is used for clamping or for some other purpose. In the construction of jigs which are to be used for thousands of pieces, it is advisable to make proper provision for wear in the leaf in order to preserve the accuracy. A construction such as that shown at E is excellent and is in use by a number of manufacturers. The wear plates shown at *F* are hardened and set into both the leaf and the jig body. It will be seen that they can be readily replaced when worn.

Clamps in the Leaf

In connection with leaf construction we must also consider the instances when clamping action is applied through the leaf. There is an important point which should always be thought of when clamps are to be inserted in a jig leaf, and that is that the leaf must be made heavy enough so that it will not buckle when the pressure is applied. In Fig. 50 several types of clamps which can be applied to the leaf of a jig are shown. The leaf *A* should be made heavy enough to take the pressure of the screw *B* so that it will not tend to buckle and take the position indicated by the dotted lines, as this would make the bushing *C* out of alignment with the work. Attention should also be paid to the position of the screw *B* in relation to the bushing *C*. The amount of space required at *D* will be dependent upon the general condition and size of the jig.

Another method of clamping through the leaf of a jig is shown at *E*. Pressure is applied through the clamp *F* by means of the screw *G* so that the ball-portion *H* comes in contact with the work as indicated. One end of the clamp is rounded at *K* where it bears against the leaf. It is prevented from falling out of the leaf by the pin lever *L* and the guard pin *M*. This construction was used in order to allow free use of the bushing *N*, and at the same time clamp very close to it. It is evident that a hole in the clamp is necessary as indicated.

A very useful type of leaf clamp for small work is indicated at *O*. It is a type that is used preferably on finished work because its action is limited. The movement of the pin *O* is controlled by the screw *P* acting

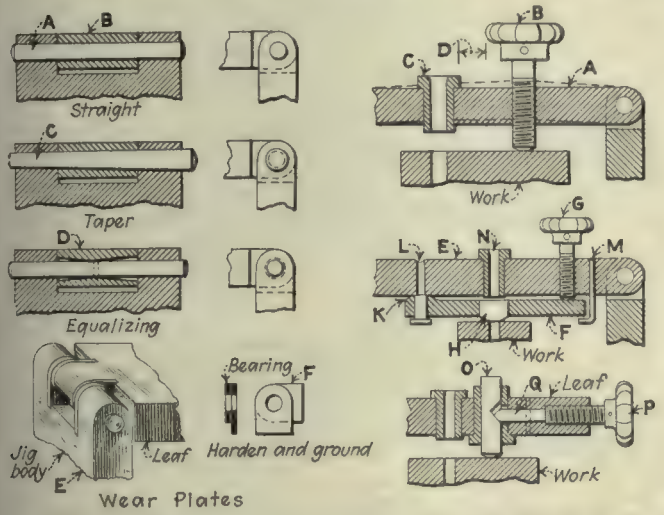


FIG. 49. JIG LEAF CONSTRUCTION. FIG. 50. CLAMPS IN JIG LEAVES

on the angular cut in the pin through the plug *Q*, also cut to an angle on the end which engages with the cut in the pin.

There are some cases where the clamp is used in a leaf when the leaf does not carry any bushings. Referring to Fig. 51, the sketch at *A* shows a leaf of this sort having a rocking clamp *B* pivoted on the leaf. There are no bushings on the leaf and it is used principally for clamping. The clamp pressure is applied through the eye-bolt and hand knob *C* and *D*. The end of the leaf must be supported so that the bolt can be swung out of place in order to lift the leaf. This form of construction is very common and will be found useful in many cases.

When a leaf contains several bushings as at *E* the form of construction shown is commonly used. The end of the leaf is so supported that the quarter-turn screw *F* passes through it when the leaf is lifted. When it is locked in position the head of the thumbscrew binds it firmly in place.

In Fig. 52 several kinds of leaves are shown. Two methods of making a hinge are indicated at *A* and *B*. In the case *A* the hinge swings at *A* and therefore has a short bearing, while in the other case the hinge

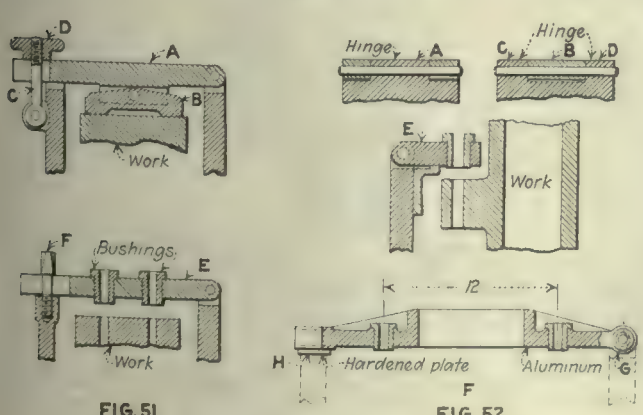


FIG. 51. LEAF CONSTRUCTION. FIG. 52. LEAF CONSTRUCTION

hangs from the points *C* and *D*, which are much further apart so that greater accuracy is assured.

A leaf like that shown at *E* is sometimes useful in jig construction when it is necessary to place a bushing close to the work and at the same time get it out of the way while the work is being removed. It is a good idea to provide some means of clamping the leaf while drilling. A quarter-turn screw or some other approved method can be used.

It is often necessary to lighten a large jig in order to expedite the handling of it. Sometimes it is advisable to make a leaf out of aluminum as shown at *F*. It is a good idea to provide bushings at the hinge point *G* and hardened plates at the end *H* in order to avoid having the wear on the soft metal.

Leaf Locking

Jig leaves may be locked in a variety of ways, several of which are shown in Fig. 53. The leaf *A* is fastened by means of a quarter-turn screw *B*, the end of the leaf being supported. Wear plates at the bearing points should be provided if the jig is to be used for a great number of pieces. Sketch *C* shows provision to simplify

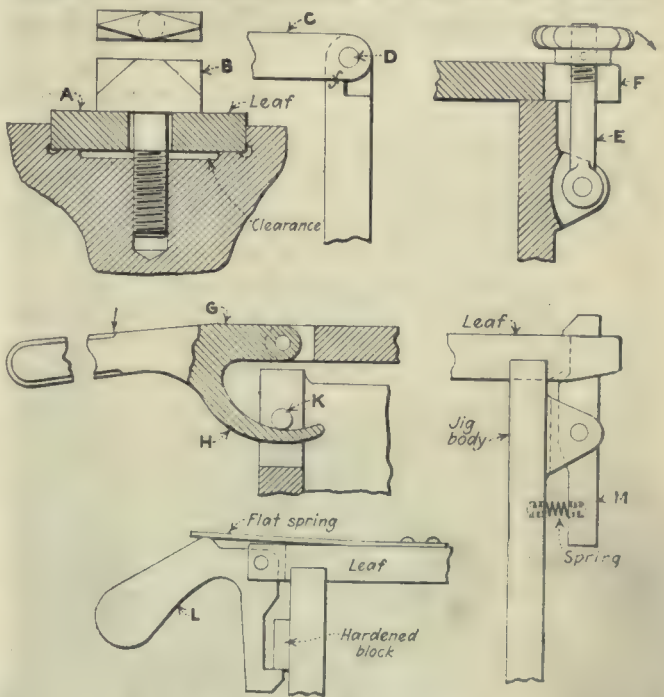


FIG. 53. LEAF LOCKING

the toolmaker's work in putting on the pin *D* by leaving the finished support *f* from which to locate the jig leaf while drilling the pin hole. This support can be machined when planing up the jig. An eye-bolt lock having a jig leaf is shown at *E*. When such a lock is used the end of the leaf should be rounded off at *F* in order to facilitate the opening. The cam lever fastening shown at *G* can be used to advantage in many cases for fastening the leaf in position.

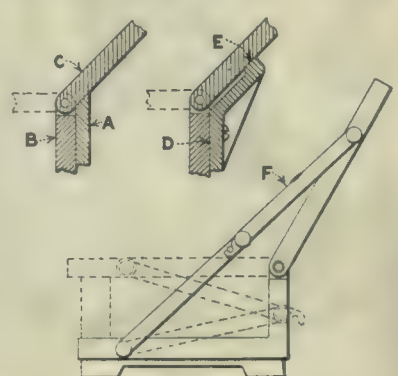


FIG. 54. LEAF SUPPORTS

Care must be taken to make sure that the radius *H* is not too small to prevent the proper locking on the pin *K*. As a general thing tool designing departments have a set of standard cam levers which give the important dimensions. Two other types of leaf lock levers are shown at *L* and *M*. Speaking generally the writers do not favor these forms of construction. It must be admitted, however, that they are in use in a number of factories with more or less success. The principle objection to their use is the fact that there is very little adjustment for wear and they are therefore likely to become inaccurate after they have been used a short time.

When a jig is being used it is important to provide a rest for the leaf when it is thrown back in loading or unloading the jig. If some provision is not made there is a chance that the operator may throw the leaf over and break or strain it. Several types of leaf stops are shown in Fig. 54. The one indicated at *A* is a simple type which is fastened to the wall of the jig *B* so that the leaf, when swung up, comes against it at *C*. Another type, shown at *D*, is somewhat similar, but very much better, because the point of leverage *E* is farther away from the hinge.

Another type of leaf support is shown at *F*. The leaf is held up by means of an arrangement similar to a trunk lid support. This construction is incorrect and possesses no particular advantages. There may be cases, however, in a very large jig where it may be found useful.

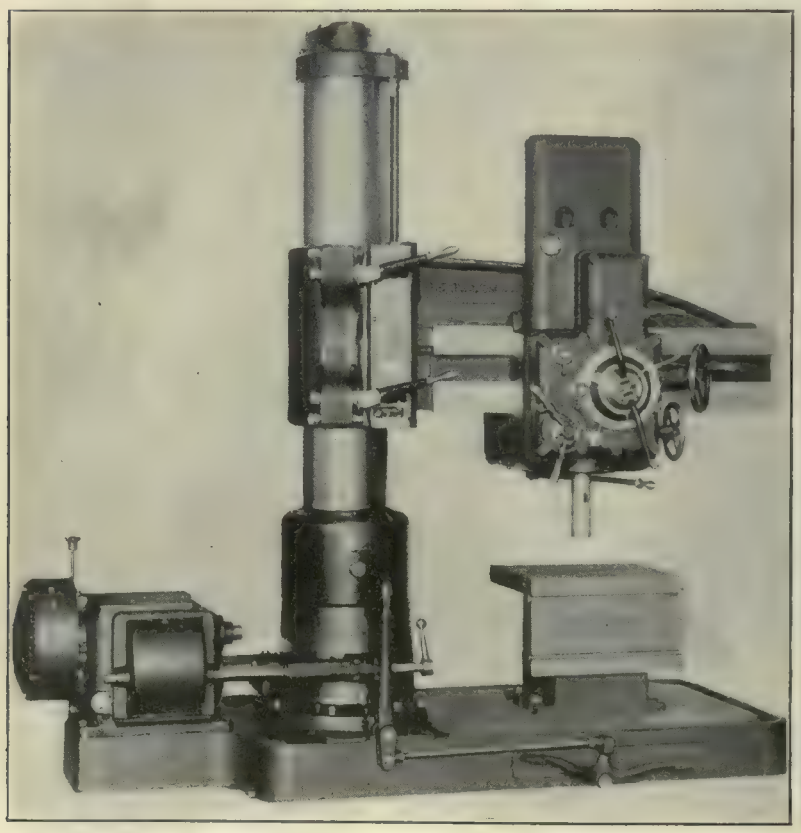
Carlton Heavy-Duty Ball Bearing Radial Drilling Machine

Unit Principle of Construction—Ball Bearing Mountings for Shafts—Centralized and Convenient Control—Balanced Spindle Housing—Diversity of Driving Methods

BY J. V. HUNTER
Western Editor, *American Machinist*

A LATE CREATION among the standard types of machine tools is the new model ball bearing, heavy-duty, geared radial drilling machine made by the Carlton Machine Tool Co., Cincinnati, Ohio, and shown in Fig. 1. The machine is designed and constructed to meet the requirements either of large machine shops or of the jobbing shop. It is built in three sizes, designated as 4, 5 and 6 ft., respectively. In order to reduce the wear and deterioration of the running parts, all are mounted on ball bearings designed to take both the radial and thrust loads. The elimination of friction thus obtained is stated to result in a saving of power and to permit the use of a smaller motor.

The base is heavily ribbed on its under side and has a large working surface that is surrounded by a channel for collecting the coolant and returning it to the reservoirs. Large covered pockets, connected by a tunnel, are provided in the base on each side of the column for



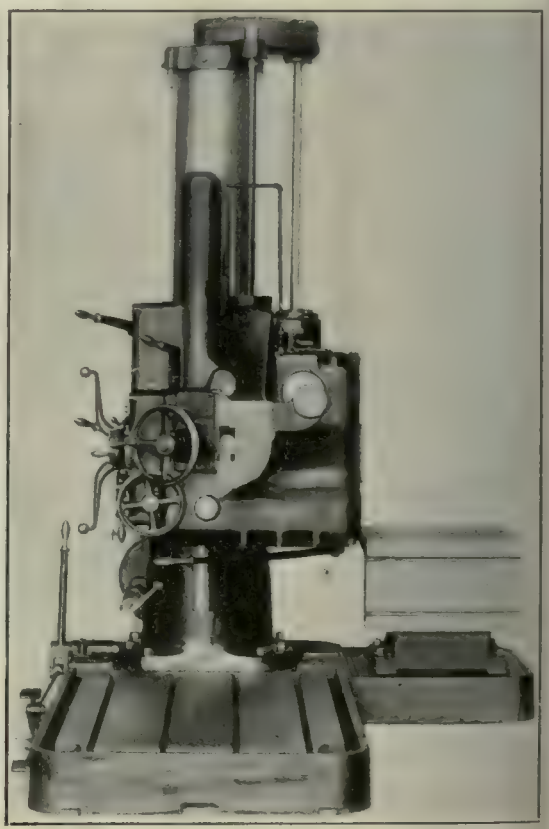


FIG. 1. CARLTON RADIAL DRILLING MACHINE. FIG. 2. END VIEW OF MACHINE EQUIPPED WITH TABLE WING

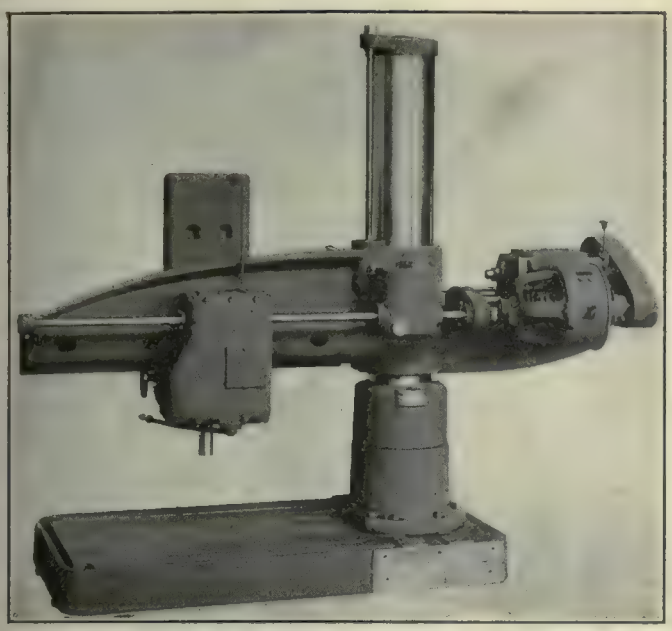


FIG. 3. REAR VIEW SHOWING CONSTANT-SPEED MOTOR MOUNTED ON ARM EXTENSION

storing the coolant. An opening is provided on each side so that the reservoirs may be cleaned without removing the pump. An extension on the rear of the base serves either for mounting a speed-gear box or a variable speed motor.

The Column

Neither the inner nor the outer column is split, and the locking is accomplished by two rings operated either by a hand lever or by the treadle attached to the base. The treadle is placed where it will be convenient to the operator, and it permits him to release the column in order to change the position of the arm and again lock it in place without moving to and from the column. This form of locking equipment is standard on all machines and takes the place of the pneumatic clamps sometimes specified.

The column is hung from the top on a ball-thrust and large radial bearing, and at its point of contact with the stump-knee is guided by a roller bearing. This mounting eliminates the friction that ordinarily occurs in swinging the arm and column when positioning the drill spindle, and therefore the action requires but little effort on the part of the operator. The stump-knee below the column contains the bevel gears connecting the drive with the vertical shaft. The gears run in a bath of oil and are mounted on sleeves or shafts supported at both ends by ball-bearings.

The column is a semi-steel casting and is ground to a finish over the section that affords a bearing for the arm. The vertical drive shaft through the column carries the power to the column cap where it is transmitted through three steel gears, mounted on ball-bearings, and thence through the vertical drive shaft to the arm, Fig. 2.

The Arm

The arm has a box-form section, with a rib of I-section along its top that serves to give it additional stiffness. The arm is clamped in position on the column by two hand levers fitted with an interlocking device so that the gear train on the elevating screw cannot be engaged while the arm is clamped. Conversely, the levers are held in an upright position and cannot drop and lock the arm while the elevating screw is operating. The elevating-screw gear-drive train is located in a unit housing mounted on the rear of the arm, Fig. 3, and containing the necessary bevel gears and a tumbler gear. The elevating screw nut revolves about the elevating screw, which remains stationary. When the arm travels to its maximum height on the column, it is stopped automatically by means of a plunger control; also, when the arm is lowered, if it or the spindle head should meet any obstruction, it stops automatically.

The Spindle Housing

The spindle head, Fig. 4, is entirely enclosed and is one complete unit consisting of a number of individually complete subunits. The arm is finished with long flat ways for bearing the head, which is clamped to the arm by dovetailed gibs. The head is designed to be in balance on the long flat guide on which it rests on the arm, thus giving it a freedom of movement, so that it can be pulled or pushed the full length of the arm if the operator desires to do so and avoid using the hand traverse wheel.

The spindle head may be traversed by the handwheel *A*, and locked in place on the arm by the binding lever *B*. Four spindle speeds, controlled by the levers *C* and *D*, can be obtained by gearing incorporated in the spindle housing, and these speeds, together with six changes afforded by the standard speed box, give a total of 24 speeds, ranging in geometrical progression from 18 to 800 r.p.m. All spindle gears are of heat-treated chrome-nickel steel. All shafts in the spindle head, together with the spindle itself, run in ball bearings. The spindle has a low-hung drive, with its drive gear mounted on and double-splined to the largest diameter of the spindle. The spindle is made of high-carbon

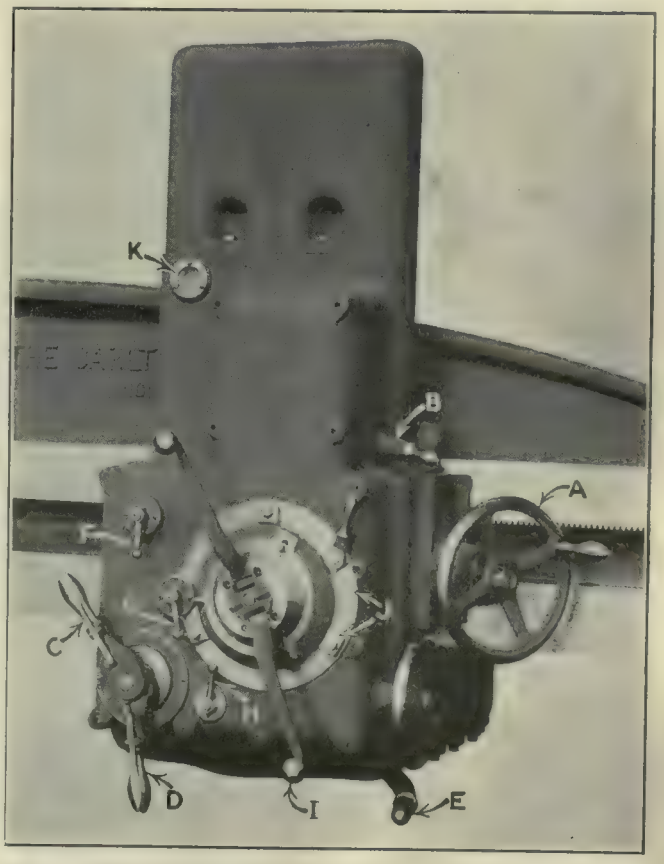


FIG. 4. THE SPINDLE HEAD SHOWING CONTROL LEVERS

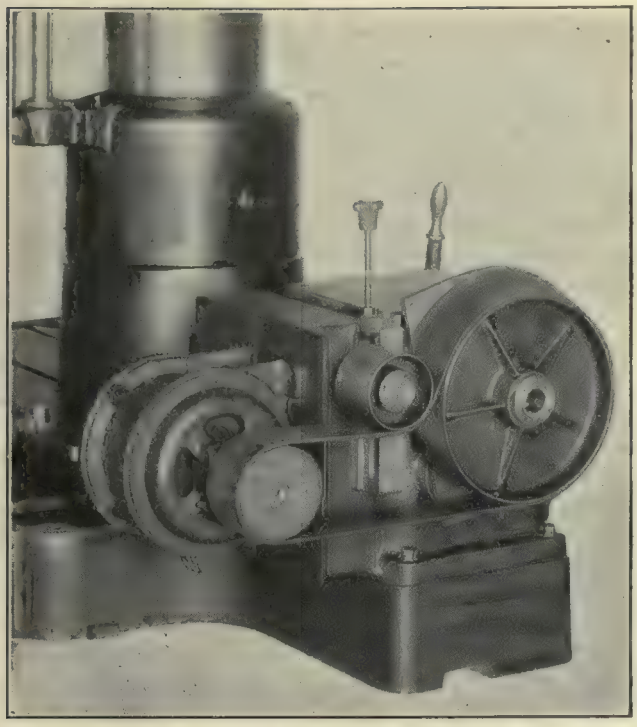




FIG. 5. BELT DRIVE FOR MACHINE EQUIPPED WITH CONSTANT-SPEED MOTOR
FIG. 7. CARLTON UNIVERSAL WORK TABLE

steel and is fitted with a hardened steel renewable tang inserted in the spindle nose. The lever *E* is provided for starting, stopping and reversing the spindle.

Spindle Feed Mechanism

The spindle feed mechanism is a sub-unit of the head, and gives twelve feed changes controlled by the levers *F* and *G*, ranging from 0.005 to 0.069 in. per spindle revolution. The power feed is engaged by the lever *H*. The sleeve for raising and lowering the spindle is mounted on its top and balanced by a counterweight that acts through the pinion of the spindle rack.

The quick-acting clutch levers *I* are used for rapidly raising or lowering the spindle to clear it or bring it down to the work. The power feed on the spindle is fitted with automatically acting stops that control its maximum travel up or down. It also has a depth dial *J* on which dogs may be set for stopping the feed at any required point. The spindle housing is filled with 10 gal. of oil and has a pump that throws the lubricant constantly to all gears and bearings. A glass-covered peep-hole *K* is provided for observation of the flow of oil.

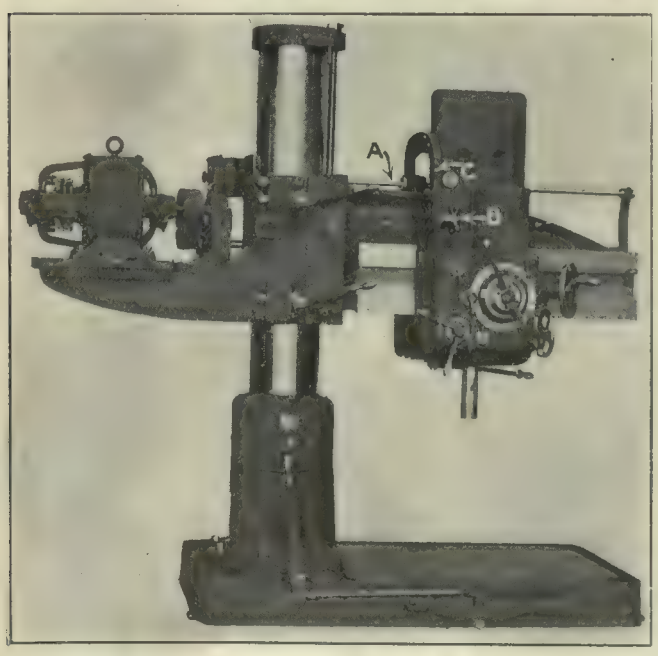


FIG. 6. VARIABLE-SPEED MOTOR MOUNTED ON ARM EXTENSION

The Speed Box

The speed box is located behind the column on an extension of the base, Fig. 1, and is controlled by a rod that passes through a boss on the stump-knee to a lever conveniently placed for the operator. The change gear mechanism gives six speeds and is designed so as to roll in, with a pawl to keep the gears continually in motion in order to avoid shocks due to putting them into motion when changing the speeds. The speed box is entirely enclosed to keep it free from dirt and the gears run in an oil bath. The speed-box drive is connected with the stump-knee by a standard coupling that makes all machines interchangeable with respect to their drive.

Methods of Machine Drive

Either pulley or motor-driven machines can be furnished; and unless a variable speed motor is required, the machines are all equipped with the standard speed-gear drive box. The machine shown in Fig. 1 is motor driven, and for belt drive the belt case at the left is replaced by a standard pulley and belt case for a tight and loose pulley and fitted with a belt shifter. The loose pulley is mounted on roller bearings. A belt drive carries the power from the motor to the speed box, and is shown in Fig. 5 with the belt guard removed. The idler pulley has a mounting that permits its adjustment for tightening the belt by means of a screw and hand-nut that can be operated from the front of the machine. When a variable-speed motor is used for driving, it is

mounted on the base in place of the speed box and connected with the shaft extension from the stump-knee by a set of reducing gears.

Another design of the machine arranges for mounting the motor on an extension of the arm to the rear of the column, and a variable speed motor with its starting mechanism and control rheostat is shown thus mounted in Fig. 6. The shaft *A* mounted on special brackets from the arm has been provided for manipulating the motor control mechanism, and is worked by the operating handle *B* through a chain drive concealed in the case *C*. A constant-speed motor with belted drive mounted on the extension of the arm can also be employed. This form is illustrated in Fig. 3, the arrangement of its belting being identical with that shown in Fig. 5.

The table wing, Fig. 2, is a separate unit and can be furnished as an extra attachment. A boss is finished on the right side of the base, to which the table wing can be bolted and keyed into position. Another attachment is the universal table, Fig. 7, with a head mounted on ball-bearings that can be adjusted to any angle from zero to 90 deg. by means of a worm drive. A graduated scale is provided for setting the table at the desired angle, and a pair of locking levers secures it in place. For making the table fully universal, the additional round table mounted on top of the square head can be furnished.

Specifications: Built in three sizes with 4, 5 and 6-ft. arms. Respective capacities: Drills to center of, 8 ft. 3½ in., 10 ft. 4 in. and 12 ft. 3½ in. circle. Maximum distance between spindle and base, 5 ft., 5 ft. 6½ in. and 6 ft. 3½ in. Feed to spindle, 18 in. Taper hole in spindle, No. 5. Twelve feeds ranging from 0.005 to 0.069 in. per spindle revolution. Twenty-four speeds ranging from 18½ to 800 r.p.m. Tight and loose pulley drive, 14x4½ in. Working surface of table, 22x28 in. Working surface of base, 3 ft. 6 in. x 4 ft. 5 in., 4 ft. x 5 ft. 5 in. and 4 ft. x 6 ft. 5 in. Floor space, 3 ft. 6 in. x 9 ft. 6 in., 4 ft. x 10 ft. 7 in. and 4 ft. x 11 ft. 7 in. Net weight, 9,000, 11,500 and 14,800 lb.

Some New England Railroad Shop Repairs

Pouring Driving Box Hub Liners—Milling Crossheads and Rod Brasses—A Special Milling Cutter—Using Air Clamps—Locomotives Staggered to Save Room

By FRED H. COLVIN
Editor, *American Machinist*

THE shops at North Billerica, Mass., handle heavy repairs for a large part of the whole Boston and Maine Railroad system. This includes repairs to the electric locomotives which are used through the Hoosac Tunnel in the western part of the state. These locomotives have incidentally, given excellent service and stay out of the shop for long periods.

One of the interesting methods is that used in pouring the hub liners into the driving boxes. This differs in some ways from the usual practice. Figs. 1 and 2 show how this is done.

The babbitt is melted in the furnace shown, the air and liquid fuel coming in at the left end. The driving box to be babbitted is mounted on the small four-wheel truck shown in the foreground and is prepared for holding the babbitt in the usual way. The partial ring *A* forms the outside of the mold, the casting *B* holding the ring in position during the pouring operation.

Fig. 2 shows the hub lining just after it has been poured, showing the ring completely filled with the metal. The truck is simply run into its proper position near the rotary furnace, which is then turned over by the pilot wheel shown at the right and the babbitt poured directly into the mold, obviating the use of a ladle.

Two rather interesting milling operations are shown in Figs. 3 and 4. Fig. 3 shows how two strings of four crossheads each are mounted for milling on an Ingersoll machine. This view also shows the arrangement of the two gangs of inserted tooth cutters, each gang consist-

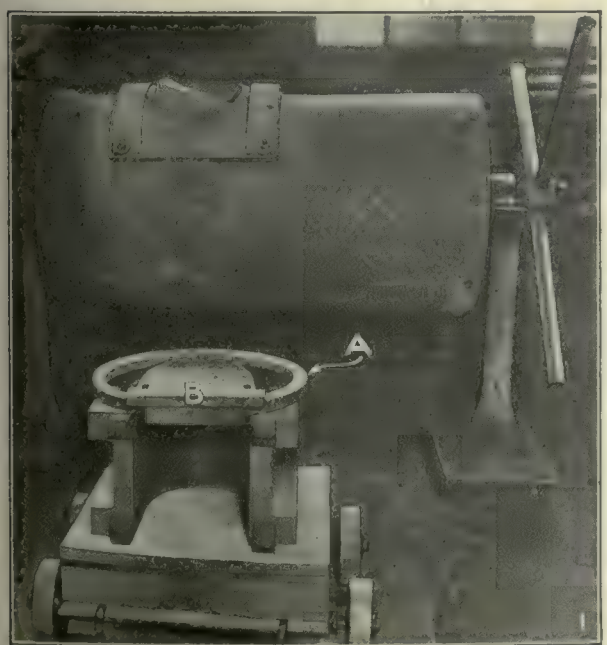


FIG. 1. READY TO POUR A HUB LINER

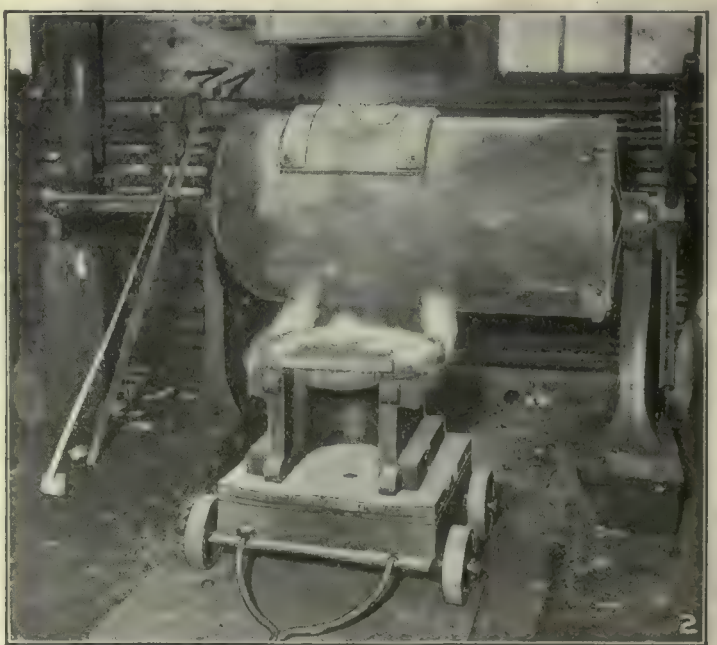


FIG. 2. THE HUB LINER POURED

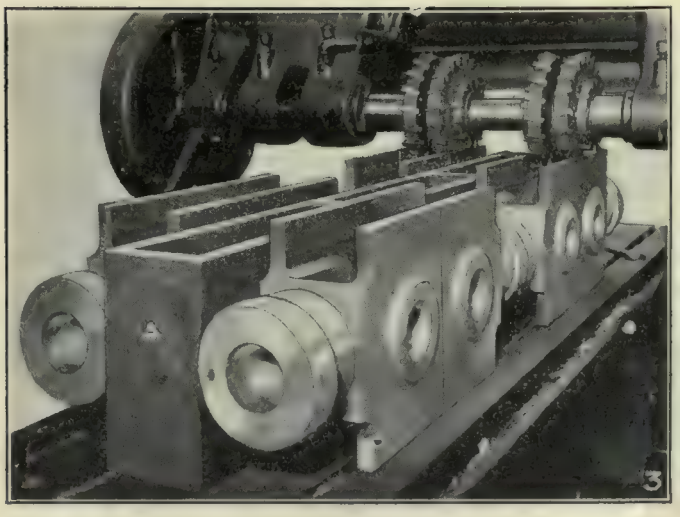


FIG. 3. STRING-MILLING LOCOMOTIVE CROSSHEADS

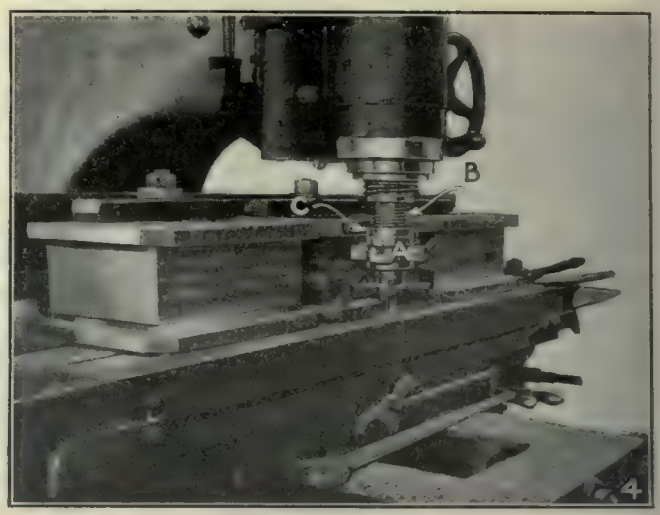


FIG. 4. AN UNUSUAL MILLING CUTTER

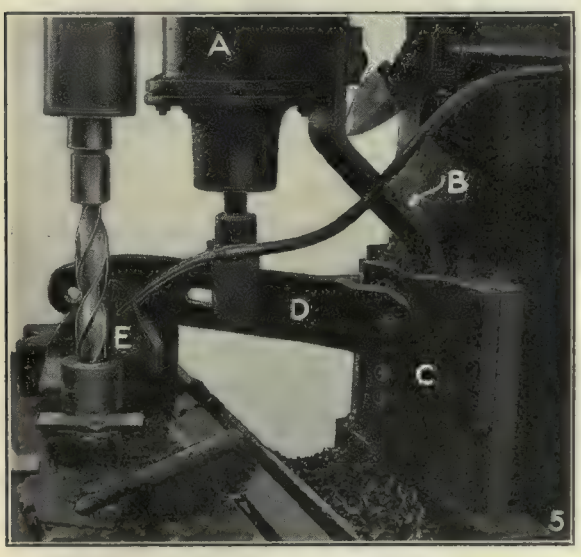


FIG. 5. VERTICAL AIR CLAMP ON DRILLING MACHINE.

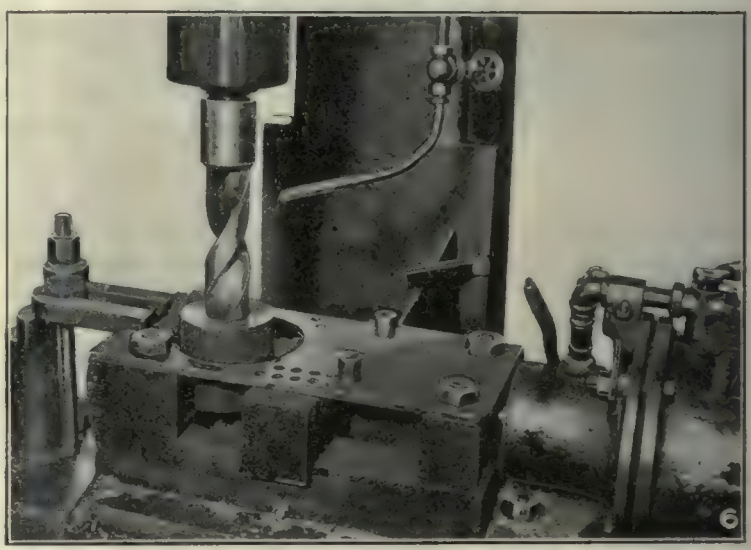


FIG. 6. AIR CLAMP FOR VALVE MOTION BUSHINGS

ing of four cutters. The crossheads are squared up by the central block *A* fastened in the center of the machine table. This block spaces the crossheads the proper distance for the two gangs of milling cutters to machine them in their proper relation to the piston rod hole.

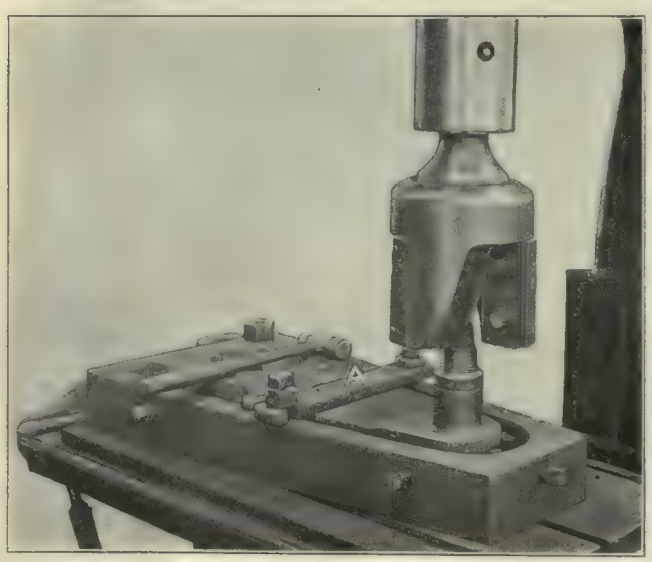


FIG. 7. TURNING CRANKPIN ON HALF CRANK

A somewhat unusual type of milling cutter is shown in Fig. 4 in use on a Becker vertical milling machine. This cutter is double headed, each head being in the form of a cross and carrying four cutting tools, each of which is adjustable separately for resetting after grinding.

The upper head *A* is adjustable with relation to the lower head by simply turning it on the screw *B* which forms the body or spindle of the milling cutter. The head *A* is threaded on the inside and can be adjusted to any desired position within its range, being fastened at the desired point by means of the locknut *C*. This cutter is used for milling the flanges the correct distance from each other, the adjustment making it possible to secure the desired width between them.

The use of compressed air for various purposes has long been one of the outstanding features in railroad shops. In some places, such as crane hoists, it has to a great extent been superseded by the electric motor. But for clamping work while being machined, it seems likely to hold sway for sometime. It is, in fact, being used more and more for this purpose in general machine shop work.

Two air clamping devices for drilling machine work are shown in Figs. 5 and 6. These are very simple devices but save considerable time in the course of a month in the handling of work on and off the machine.



FIG. 8. A GENERAL VIEW OF THE ERECTING SHOP

In Fig. 5 the air cylinder *A* is mounted on the frame of the drilling machine, being connected at the bottom by means of the brace *B*. The bracket *C* carries the arm *D*, which in turn is provided with the equalizing or floating shoe *E*. The bracket *C* is provided with five holes for the fulcrum pin of the lever so as to utilize it to the best advantage for work of various thicknesses. All that is necessary for the operator to do is to place the work to be drilled in the desired position, turn the air valve handle and the work is clamped instantly. Releasing the air loosens the work.

A somewhat different fixture is shown in Fig. 6. This is a special fixture for holding valve motion bushings and enabling them to be handled very rapidly. The air cylinder is horizontal in this case.

The method of turning the crankpin on the half crank for the valve motion is shown in Fig. 7. This shows the box fixture used for centering the half crank forging so as to bring the crankpin in the desired position with relation to the hole at the other end. The latch *A* is simply to offset any lifting tendency. A sweep tool or hollow mill, is used for turning the pin and has been found very satisfactory.

A general view of the shop is shown in Fig. 8. A somewhat unusual feature may be noted in the case of the two rows of locomotives along the sides of the bay at the rear. These locomotives are set staggered in the same way as automatic screw machines are generally arranged, so as to enable boiler tubes to be removed or replaced, without allowing the usual distance between every locomotive and to economize shop space.

This view also gives a good idea of the substantial shop construction and the way in which three rows of locomotives can be handled in the erecting bay.

Slip of Involute Gear Teeth

Gear Efficiency Increased and Wear Decreased by Using Large Numbers of Teeth—Shorter Addendum Reduces Slip—Friction Losses Increase with Increases in Angle of Obliquity

By A. B. Cox

THE intent of these data and curves is to show that the efficiency of gears can be increased and the wear decreased by choosing large numbers of teeth; that the use of gears of shorter addendum or greater obliquity of the line of action reduces slip and increases the percentage of rolling contact; and that the gain in efficiency from increasing the angle of obliquity is offset by the increased friction losses in the bearings in proportion as the angle increases.

There is shown in Fig. 1 an involute pinion driving an involute gear. Since at point O_1, where the pinion teeth first make contact with the gear teeth, a is in contact with f, and when the teeth reach the line of centers and the contact point is at O_0, b is in contact with e, it is evident that in moving through the arc of approach the length of pinion involute ab acts on the length of gear involute ef. If length ab were equal to length ef there would be true rolling contact and no slipping. When they are unequal (as they always are) the actual net slip is equal to the difference in length of ab and ef.

$$\text{Approach slip } S_A = ef - ab \qquad (1)$$

$$\text{The length of rolling contact (net)} = ab \qquad (2)$$

Similarly the slip, while the pinion rotates through the arc of recess, is

$$S_R = bc - de \qquad (3)$$

$$\text{and} \qquad \text{Length of rolling contact} = de \qquad (4)$$

The total net slip of the pinion tooth on the gear tooth for the entire arc of contact is (1) + (3), or

$$S_T = ef - rb + bc - de \qquad (5)$$

$$\text{and the net rolling contact} = ab + de \qquad (6)$$

If (5) and (6) be divided by the radius r of the pinion, curves for gears and pinions of various numbers of teeth

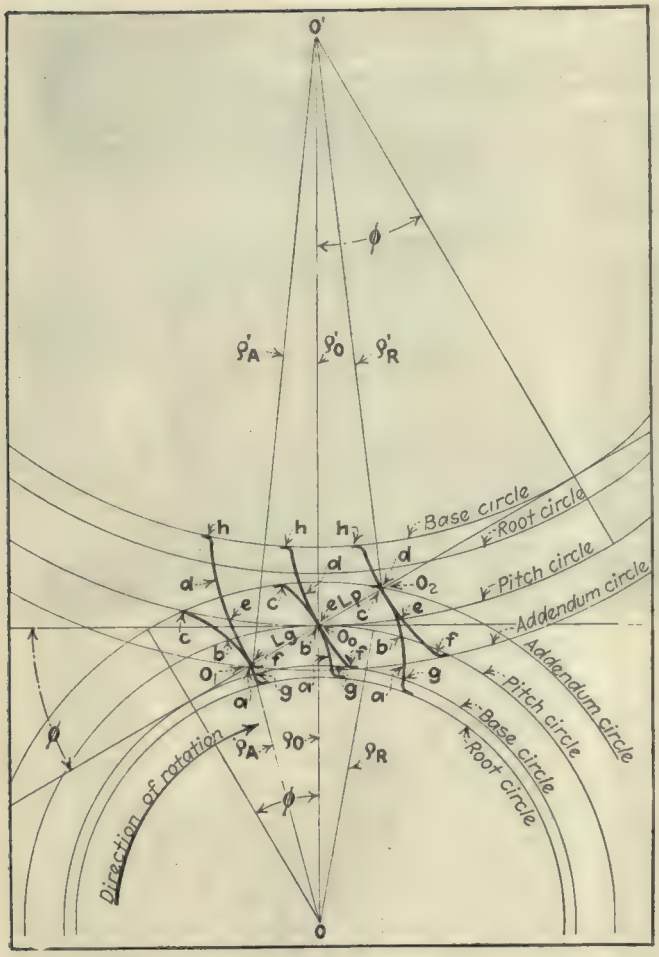


FIG. 1. INVOLUTE PINION AND GEAR

and ratios can be plotted for convenient comparison of different sets of gears as regards wear, efficiency, etc.

The formula for the length L_I of an involute is fortunately very simple (see any good standard calculus):

$$L_I = \frac{r_B \Theta^2}{2} \qquad (7)$$

r_B in the case of involute gears is, of course, the radius of the base circle:

$$r_B = r \cos \phi \qquad (8)$$

Substituting (8) in (7)

$$L_I = \frac{r \cos \phi \, \Theta^2}{2}. \qquad (9)$$

The value of $\theta = \sqrt{H^2 \sec^2 \phi - 1}$ (10)

and $\theta^2 = H^2 \sec^2 \phi - 1$ (11)

(See *American Machinist*, vol. 54, page 559, "Angles of Approach, Recess and Contact of Involute Gears".) Substituting in (9) we obtain

$$L_I = \frac{r \cos \phi}{2} (H^2 \sec^2 \phi - 1) \qquad (12)$$

By means of formula (12) the lengths of involute *ab*, *bc*, et al, can be calculated and the value of S_T (see (5)) determined.

In the *American Machinist*, vol. 53, page 899, "Derivation of a Formula to Determine Number of Teeth in Contact of Two Meshing Gears," the length of $O_1O_o = L_g$ was shown to be

$$R\left[-\sin \phi + \sqrt{\sin^2 \phi + \frac{4}{N^2}(N+1)}\right]$$

and $O_oO_2 = L_p = r\left[-\sin \phi + \sqrt{\sin^2 \phi + \frac{4}{n^2}(n+1)}\right]$

These quantities within the brackets occur so frequently that for convenience they have been given the symbol "Z". $L_g = RZ_g$ and $L_p = rZ_p$. $K = \frac{R}{r}$. $R = Kr$. $L_g = KrZ_g$.

$$\rho_A = \sqrt{r^2 + L_g^2 - 2rL_g \cos (90 - \phi)}$$
$$= \sqrt{r^2 + K^2r^2Z_g^2 - 2r^2 Z_g \sin \phi}$$
$$= r\sqrt{1 + K^2Z_g^2 - 2Z_g \sin \phi}.$$

$$H_A = \frac{\rho_A}{r} = \sqrt{1 + K^2Z_g^2 - 2Z_g \sin \phi}.$$

$$\theta_A^2 = H_A^2 \sec^2 \phi - 1$$
$$= [(1 + K^2Z_g^2 - 2KZ_g \sin \phi) \sec^2 \phi - 1]$$
$$= [(K^2Z_g^2 - 2KZ_g \sin \phi) \sec^2 \phi + \tan^2 \phi].$$

Length of involute $ag = \frac{r\theta_A^2 \cos \phi}{2}$.

$$= \frac{r \cos \phi}{2} [(K^2Z_g^2 - 2KZ_g \sin \phi) \sec^2 \phi + \tan^2 \phi] \quad (13)$$

At O_o, $\rho_o = r$. $H_o = 1$. $\theta^2_o = \sec^2 \phi - 1 = \tan^2 \phi$.

Length of involute $O_o g = \frac{r \cos \phi}{2} \tan^2 \phi = bg$ (14)

Length of involute $ab = bg - ag$

$$= \frac{r \cos \phi}{2} [\tan^2 \phi - (K^2Z_g^2 - 2KZ_g \sin \phi) \sec^2 \phi - \tan^2 \phi]$$
$$= \frac{r \sec \phi}{2} [2KZ_g \sin \phi - K^2Z_g^2] \qquad (15)$$

$$\rho'_A = R + \frac{1}{P} = \frac{R(N+2)}{N}. \quad H'_A = \frac{\rho'_A}{R} = \frac{N+2}{N}.$$

$$\theta'^2_A = \frac{(N+2)^2}{N^2} \sec^2 \phi - 1.$$

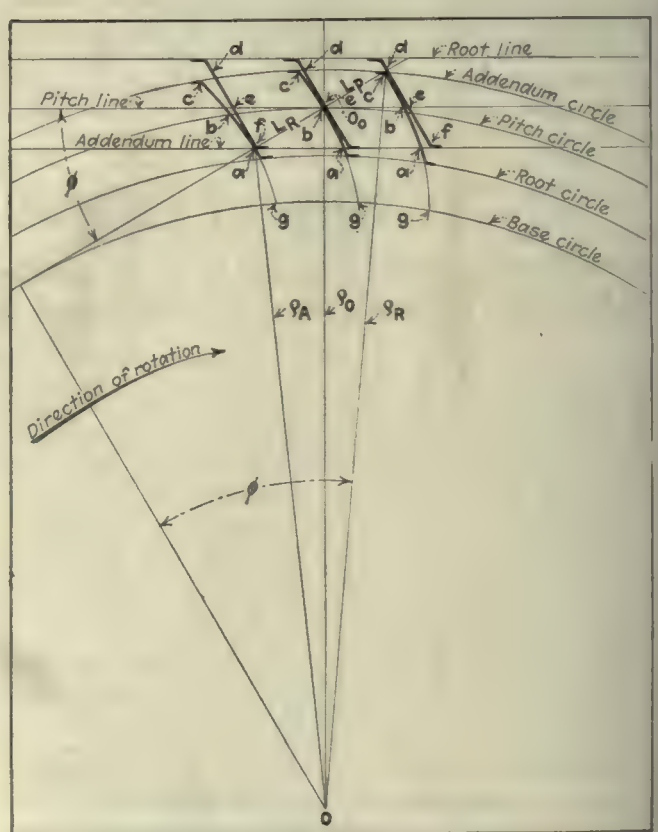


FIG. 2. INVOLUTE RACK AND PINION

Length of involute $hf = \frac{R\theta'^2_A \cos\phi}{2} =$

$$\frac{R\cos\phi}{2}\left[\frac{(N+2)^2}{N^2}\sec^2\phi - 1\right] \quad (16)$$

Length of involute $eh = \frac{R\cos\phi}{2}\tan^2\phi$ (17)

Length of involute $ef = hf - eh$

$$= \frac{R\cos\phi}{2}\left[\frac{(N+2)^2}{N^2}\sec^2\phi - 1 - \tan^2\phi\right]$$

$$= \frac{R\cos\phi}{2}\left[\frac{(N+2)^2}{N^2}\sec^2\phi - \sec^2\phi\right]$$

$$= \frac{R\sec\phi}{2}\left[\frac{(N+2)^2}{N^2} - 1\right]$$

$$= \frac{R\sec\phi}{2}\left[\frac{N^2+4N+4-N^2}{N^2}\right]$$

$$= \frac{R\sec\phi}{2}\left[\frac{4(N+1)}{N^2}\right] \quad (18)$$

$$= 2Kr\sec\phi\left[\frac{Kn+1}{K^2n^2}\right] \quad (19)$$

$$= \frac{r\sec\phi}{2}\left[\frac{4K(N+1)}{N^2}\right] \quad (20)$$

Slip of approach $S_A = ef - ab$

$$= \frac{r\sec\phi}{2}\left[\frac{4K(N+1)}{N^2} + K^2Z_g^2 - 2KZ_g\sin\phi\right] \quad (21)$$

Similarly, $\rho_R = r + \frac{1}{P} = r\frac{n+2}{n}$

$$H_R = \frac{n+2}{n};$$

$$\theta^2_R = \frac{(n+2)^2}{n^2}\sec^2\phi - 1.$$

Length of involute $gc = \frac{r\cos\phi}{2}\left[\frac{(n+2)^2}{n^2}\sec^2\phi - 1\right]$ (22)

Length of involute $gb = \frac{r\cos\phi}{2}\tan^2\phi$ (23)

Length of involute $bc = gc - gb$

$$= \frac{r\cos\phi}{2}\left[\frac{(n+2)^2}{n^2}\sec^2\phi - 1 - \tan^2\phi\right]$$

$$= \frac{r\cos\phi}{2}\left[\frac{(n+2)^2}{n^2}\sec^2\phi - \sec^2\phi\right]$$

$$= \frac{r\sec\phi}{2}\left[\frac{(n+2)^2}{n^2} - 1\right]$$

$$= \frac{r\sec\phi}{2}\left[\frac{n^2+4n-n^2+4}{n^2}\right]$$

$$= \frac{r\sec\phi}{2}\left[\frac{4n-4}{n^2}\right]$$

$$= \frac{r\sec\phi}{2}\left[\frac{4(n+1)}{n^2}\right] \quad (24)$$

And by trigonometry:—

$$\rho_R = \sqrt{R^2 + L_p^2 - 2RL_p\cos(90-\phi)}$$

$$L_p = rZ_p.$$

$$\rho_R = \sqrt{R^2 + r^2Z_p^2 - 2rRZ_p\sin\phi}.$$

$$r = \frac{R}{K}.$$

$$\rho_R = \sqrt{R^2 + \frac{R^2Z_p^2}{K^2} - \frac{2R^2Z_p}{K}\sin\phi}$$

$$= R\sqrt{1 + \frac{Z_p^2}{K^2} - \frac{2Z_p}{K}\sin\phi}.$$

$$H'_R = \sqrt{1 + \frac{Z_p^2}{K^2} - \frac{2Z_p^2}{K}\sin\phi}.$$

$$\theta'^2_R = \left[(1 + \frac{Z_p^2}{K^2} - \frac{2Z_p}{K}\sin\phi)\sec^2\phi - 1\right].$$

$$\theta'^2_R = \left[\left(\frac{Z_p^2}{K^2} - \frac{2Z_p\sin\phi}{K}\right)\sec^2\phi + \tan^2\phi\right].$$

Length of involute $hd =$

$$\frac{R\cos\phi}{2}\left[\left(\frac{Z_p^2}{K^2} - \frac{2Z_p\sin\phi}{K}\right)\sec^2\phi + \tan^2\phi\right] \quad (25)$$

Length of involute $he = \frac{R\cos\phi}{2}\tan^2\phi$ (26)

Length of involute $de = he - hd$

$$= \frac{R\cos\phi}{2}\left[\tan^2\phi - \left(\frac{Z_p^2}{K^2} - \frac{2Z_p\sin\phi}{K}\right)\sec^2\phi - \tan^2\phi\right]$$

$$= \frac{r\sec\phi}{2}\left[2Z\sin\phi - \frac{Z_p^2}{K}\right]. \quad (27)$$

Slip of recess $= bc - de$

$$= \frac{r\sec\phi}{2}\left[\frac{4(n+1)}{n^2} + \frac{Z_p^2}{K} - 2Z_p\sin\phi\right] \quad (28)$$

Total slip = slip of approach + slip of recess.

$S_T =$ (21) + (28).

$$= \frac{r\sec\phi}{2}\left[\frac{4K(N+1)}{N^2} + K^2Z_g^2 - 2KZ_g\sin\phi + \frac{4(n+1)}{n^2} + \frac{Z_p^2}{K} - 2Z_p\sin\phi\right]. \quad (29)$$

For 1 to 1 ratio of gears, $K = 1$, $Z_p = Z_g$, and $n = N$. (29) therefore reduces to:

$$\frac{r\sec\phi}{2}\left[\frac{8(n+1)}{n^2} + 2Z^2 - 4Z\sin\phi\right].$$

$$S_T = r\sec\phi\left[\frac{4(n+1)}{n^2} + Z^2 - 2Z\sin\phi\right]. \quad (30)$$

This can be reduced still further as follows:

$$Z = \left[-\sin\phi + \sqrt{\sin^2\phi + \frac{4}{n^2}(n+1)}\right].$$

$$Z^2 = \sin^2\phi - 2\sin\phi\sqrt{\sin^2\phi + \frac{4}{n^2}(n+1)} + \sin^2\phi + \frac{4}{n^2}(n+1).$$

$$-2Z\sin\phi = +2\sin^2\phi - 2\sin\phi\sqrt{\sin^2\phi + \frac{4}{n^2}(n+1)}$$

$$Z^2 - 2Z\sin\phi = 4\sin^2\phi - 4\sin\phi\sqrt{\sin^2\phi + \frac{4}{n^2}(n+1)} + \frac{4}{n^2}(n+1)$$

$$= -4Z\sin\phi + \frac{4n+1}{n^2}.$$

$$\frac{4(n+1)}{n^2} = Z^2 + 2Z\sin\phi. \quad (30\text{-a})$$

$$S_T = 2r\sec\phi\,Z^2 \quad (31)$$

For the case of rack and pinion, formula (29) becomes indeterminate and a new equation becomes necessary. Referring to Fig. 2, this is derived as follows:

Addendum of rack teeth $= \frac{1}{p} = \frac{1}{\frac{n}{2r}} = \frac{2r}{n}$.

$$L_R = \frac{2r}{n \sin \phi}.$$

Length of $ef = \frac{2r}{n} \sec \phi.$ (32)

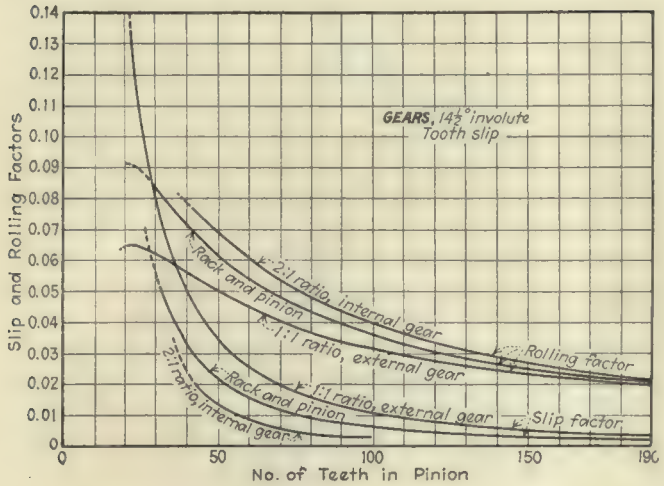


FIG. 3. TOOTH SLIP, 14½ DEG. INVOLUTE

By trigonometry:

$$\rho_A = \sqrt{r^2 + L_R^2 - 2rL_R \cos (90 - \phi)}$$

$$= \sqrt{r^2 + \frac{4r^2}{n^2 \sin^2 \phi} - \frac{4r^2 \sin \phi}{n \sin \phi}}$$

$$= r \sqrt{1 + \frac{4}{n^2 \sin^2 \phi} - \frac{4}{n}}.$$

$$H_A = \sqrt{\frac{n^2 + 4 \operatorname{cosec}^2 \phi - 4n}{n^2}}.$$

$$\theta_A^2 = \left[\left(\frac{n^2 + 4 \operatorname{cosec}^2 \phi - 4n}{n^2}\right) \sec^2 \phi - 1\right].$$

$$\theta_A^2 = \left[\left(\frac{4 \operatorname{cosec}^2 \phi - 4n}{n2}\right) \sec^2 \phi + \tan^2 \phi\right].$$

Length of involute $ga =$

$$\frac{r \cos \phi}{2}\left[\left(\frac{4 \operatorname{cosec}^2 \phi - 4n}{n^2}\right) \sec^2 \phi + \tan^2 \phi\right] \quad (33)$$

Length of involute $gb = \frac{r^2 \cos \phi}{2} \tan^2 \phi.$ (34)

Length of involute $ab = gb - ga.$

Length of Involute ab

$$= \frac{r \cos \phi}{2}\left[\tan^2 \phi - \left(\frac{4 \operatorname{cosec}^2 \phi - 4n}{n^2}\right) \sec^2 \phi - \tan^2 \phi\right]$$

$$= 2r \sec \phi \left[-\left(\frac{\operatorname{cosec}^2 \phi - n}{n^2}\right)\right] \quad (35)$$

Slip of approach $= ef - ab$

$$= 2r \sec \phi \left[\frac{1}{n} + \frac{\operatorname{cosec}^2 \phi - n}{n^2}\right]$$

$$= \frac{2r \sec \phi \operatorname{cosec}^2 \phi}{n^2} \quad (36)$$

The recess slip is found in a similar way: $L_p = rZ$. Length of $de = L_p \tan \phi = rZ \tan \phi$, which for convenience is expressed as

$$2r \sec \phi \left(\frac{Z \sin \phi}{2}\right). \quad (37)$$

$$\rho_R = r + \frac{1}{p} = r \frac{n+2}{n}.$$

$$H_R = \frac{n+2}{n}.$$

$$\theta_R^2 = \left(\frac{n+2}{n}\right)^2 \sec^2 \phi - 1.$$

Length of involute gc

$$= \frac{r \cos \phi}{2}\left[\left(\frac{n+2}{n}\right)^2 \sec^2 \phi - 1\right]$$

$$= \frac{r \cos \phi}{2}\left[\frac{(n^2 + 4n + 4) \sec^2 \phi - n^2}{n^2}\right]$$

$$= \frac{r \cos \phi}{2}\left[\frac{4(n+1)}{n^2} \sec^2 \phi + \tan^2 \phi\right] \quad (38)$$

Length of $gb = \frac{r \cos \phi}{2} \tan^2 \phi$ (39)

Length of $bc = gc - gb$

$$= \frac{r \cos \phi}{2}\left[\tan^2 \phi + 4 \frac{n+1}{n^2} \sec^2 \phi - \tan^2 \phi\right]$$

$$= 2r \sec \phi \frac{n+1}{n^2}. \quad (40)$$

Recess slip $= bc - de$

$$= 2r \sec \phi \left[\frac{n+1}{n^2} - \frac{Z \sin \phi}{2}\right]. \quad (41)$$

From (30-a), (41) becomes $2r \sec \phi \frac{Z^2}{4}.$ (41-a)

Total slip = Approach slip + Recess slip = (36) + (41-a),

$$= 2r \sec \phi \left[\frac{\operatorname{cosec}^2 \phi}{n^2} + \frac{Z^2}{4}\right]. \quad (42)$$

The values of slip given by (31) and (41) calculated for $\phi = 14\frac{1}{2}°$, and various values of "n" have been divided by "r" and plotted in Fig. 3. The slip "S" divided by the radius "r" of the pinion has been called the "slip contact factor." These curves afford a ready means of comparing the relative amount of slip of one set of gears with any other set. Tooth interference prevents the dotted portions of the curves having any true meaning. (See *American Machinist*, p. 707, Vol. 53.)

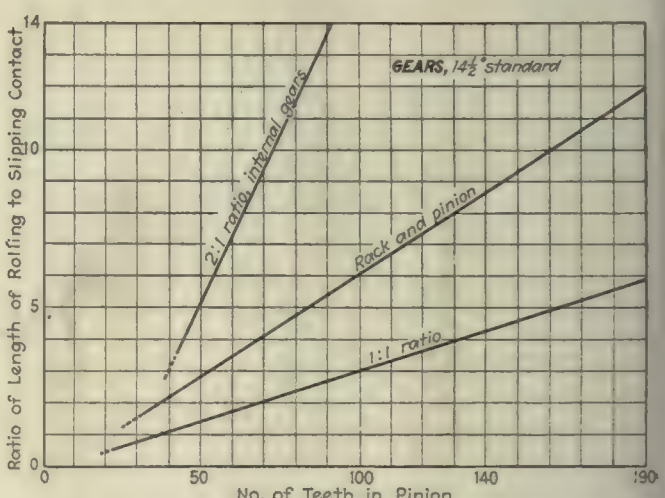


FIG. 4. RATIO OF ROLLING CONTACT FACTOR TO SLIP CONTACT FACTOR PLOTTED AGAINST NUMBERS OF PINION TEETH

The curves for ratios between the 1 to 1 ratio and the rack and pinion ratio, of course, fall between the curves for these two conditions.

The net rolling contact is found by (6) to be as follows:

For any ratio $= ab + de$

$$= r \sec \phi \left[2KZ_g \sin \phi - K^2 Z_g^2 + 2Z_p \sin \phi - \frac{Z_p^2}{K} \right] \quad (43)$$

For 1 to 1 ratio this becomes: $\frac{r \sec \phi}{2} \left[4Z \sin \phi - 2Z^2 \right]$.

$$= 2r \sec \phi \, [2Z \sin \phi - Z^2] \quad (44)$$

$$= 8r \sec \phi \left[Z \sin \phi - \frac{n+1}{n^2} \right] \quad (44\text{-a})$$

(see (30) and (31)).

for rack and pinion, rolling contact $= ab + de$,

$$= 2r \sec \phi \left[-\left(\frac{\operatorname{cosec}^2 \phi - n}{n^2} \right) + \frac{Z \sin \phi}{2} \right]$$

$$= 2r \sec \phi \left[\frac{1}{n} - \frac{\operatorname{cosec}^2 \phi}{n^2} + \frac{Z \sin \phi}{2} \right]. \quad (45)$$

(43), (44) and (45) divided by "r" has been called the "rolling contact factor," and plotted in Fig. 3 for $\phi = 14\frac{1}{2}^\circ$ and various values of "n." The ratio of this factor to the slip contact factor has been plotted in Fig. 4 for various numbers of pinion teeth. It is interesting to note that these ratios are straight lines. The ratios of rolling to slipping plotted in Fig. 12 are not straight lines as will be seen later because plotted against angles of approach and recess.

(To be continued in next week's issue.)

Employment by Mail

By H. M. Fitz

We have found out through the columns of the *American Machinist* that we can get the right men by advertising in the right way; now let us find out something about employment by mail, as there are no doubt many firms that hire thousands of employees by mail, and probably many who have had experiences similar to ours, as follows:

Not getting the desired results with the application blank we were using we decided to find out what kinds of blanks some of the other firms were using. So we wrote to thirty-two firms, asking them to kindly send us copies of their blanks, receiving an answer with a blank from twenty-eight. Standardization along this line has probably never been attempted, or at least carried out, as no two blanks were alike. The least number of questions asked was five, and the greatest was fifty-two. Only two had the same number of questions, and these asked them in different ways. This showed that most of them like ourselves were on what we believe to be the wrong track.

Unless a very rigid and expensive follow-up system is used you will never know the correctness, or rather, truthfulness, of the answers to the following questions: (1) What books do you read? (2) What is your religion? (3) Are you a property owner? (4) Do you carry life insurance? How much? (5) How many do you support? (6) Do you smoke cigarettes? (7) Do you use intoxicants? (8) Have you ever been arrested? If so, what for? (9) What lodges do you belong to? (10) What labor organizations are you a member of?

The above questions are, of course, asked for a reason. They are likewise answered for a reason. The questions themselves will tell the applicant what to answer, with the exceptions, possibly, of Nos. 2 and 9. A two-years' individual record showed that 61 per cent of the applicants employed answered some or all of the above questions incorrectly. An extreme case we will call Employee No. 13. His application nearly two years ago shows that he reads all the best books and mechanical magazines, that he is a church member, owns all kinds of property, carries heavy life insurance, supports a family of six, never smokes or drinks, has never been in trouble of any kind, belongs to several high-class lodges, and is not a member of any labor organization.

The last is the only correct answer out of the ten, according to the follow-up system. It was found that the the man owns nothing, never goes to church, carries no life insurance, is a widower without a family, smokes, chews, and drinks at every opportunity, has a jail record for one night, even though by mistake, and belongs to no lodges or labor organizations. It is easier to lie than to do a lot of explaining.

A psychologist said "That man is unreliable. Why did you keep him for nearly two years when you knew all these bad things about him?"

The answer was "Because we do know this about him—he is one of seven men on one particular class of work, each building the same class of unit on contract, with the same advantages, materials, tools, hours, price; yet he produces nearly twice as many units as the other men in the same length of time and, of course, makes just 89 per cent more money than any of the other six men. He is the best paid mechanic in that department, and the best investment. His aptitude, regularity, loyalty, and conduct in the shop are all good—that is why we keep him. And that is also why all the personal questions are going to be cut off the employment blank. They only tend to make a liar out of the applicant. Get out your application blanks and check them up; you will be surprised to learn what a good bunch of smokeless and drinkless church members have been working for you.

As far as production is concerned, what difference does it make whether a man supports one or six? From a humane standpoint it does make a difference—but maybe the applicant doesn't know the enployer is humane. The answer may mean a turn down, and not many men are willing to convict themselves.

A report returned on one applicant showed that he owned no property as claimed. When asked what he wanted for his property he answered "It is not for sale."

"Well, I am offering you twice the amount you name for it."

"I don't own any property."

"Your application states so."

"Yes, I know. The question was there. I needed a job and answered to the best of my ability."

According to production standards he is an efficient workman and is still on the job. Of course they don't all turn out to be good workmen, but the actual test is what counts and answers the stay-on-the-payroll question, regardless of follow-up returns. As we figure that the information contained in the returns has very little bearing on the employees' loyalty or productivity the value of the information is small compared to the cost of obtaining it. Information is of no use unless correct. Why not save the applicant the humiliation, and the employer a lot of trouble and expense, by eliminating most of the personal questions. A better way, and far more reliable, is to secure what information is required from the applicant's references.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

How the Racks on the Ram of the Greenerd Arbor Press Are Cut

BY AMOS FERBER

The rack teeth on the ram of an arbor press must be strong beyond the strength of the average gear teeth for the reason that when in service they are subjected to abuse that would soon put an ordinary gear out of



FIG. 1. SET-UP FOR PLANING RACK TEETH

business; and they must be accurately formed and spaced because the pinion is "bottomed" in the rack—that is, the teeth are in contact on both leading and following faces so as to be without backlash, yet are expected to run freely over the whole length of travel.

The larger racks are cut, one tooth at a time, on the planer shown in Fig. 1. A fixture, made for the purpose, holds two racks square with the planer bed and the teeth are cut with a formed tool fed down to a stop and indexed for position by the device shown in Fig. 2 on the back of the cross-rail and saddle.

An accurately-cut guide rack is permanently attached to the rail in such position that it just clears the back of the saddle, and to the latter is fastened a swinging pawl the lip of which is a formed gear tooth fitting the rack. A strap is bolted to the top of the saddle, projecting over the pawl and carrying at its projecting end a set screw to bear upon the pawl.

To move the saddle one position, the set screw is



FIG. 2. DETAILS OF INDEXING MECHANISM

turned back sufficiently to allow the pawl to be lifted over the intervening rack tooth, the saddle moved by means of the cross screw until the pawl drops into the next space and the set screw again run down to bear upon the back of the pawl. As the lip of the pawl is a perfect gear tooth to match the guiding rack, it will not go to the bottom unless the saddle is in exactly the right position.

Two cuts are taken over the length of the rack, the first one taking out most of the stock and leaving but a few thousandths of an inch for the finishing cut. As the spacing for each cut is independent of any other cut, and dependent directly upon the guide rack, there is no possibility of cumulative error.

The method described above is applied only to the larger sizes. Smaller rams have the rack teeth milled, all the teeth being cut at one pass of the cutters as shown in Fig. 3. The cutters are made up in multiples of six and strung on the milling machine arbor to the number required to cut the particular ram in hand. Keyways in the cutters vary in their position

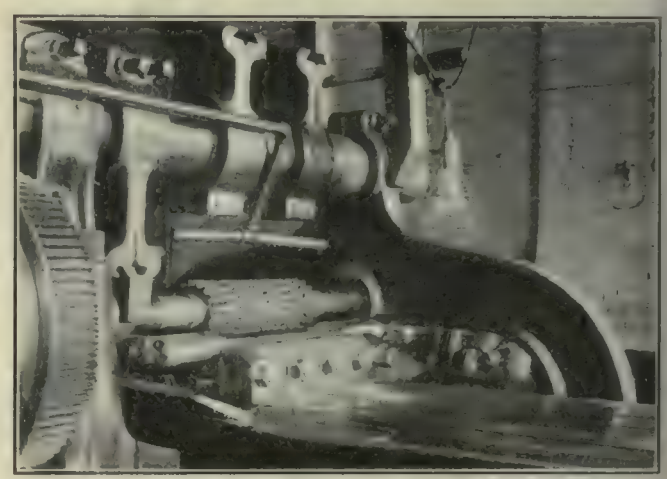


FIG. 3. MILLING THE SMALLER RACKS WITH MULTIPLE CUTTERS

relative to the tooth faces, so that the cutting line is staggered or broken up instead of being parallel with the center line of the arbor, thus reducing the tendency to rhythmic vibration and chatter.

Provision is made to take the thrust of long gangs of cutters by putting intermediate half bearings on the arbor wherever the set-up will allow. Movable supports depending from the overarm are so made as to receive the bearing blocks, which are dove-tailed into the supports at an angle that allows the two parts to go together without removing the cutter arbor.

One of the extra bearings is shown in place in Fig. 3 near the spindle nose. Two others are swung up out of the way.

A heavy casting takes the place of the usual tie bars at the end of the overarm.

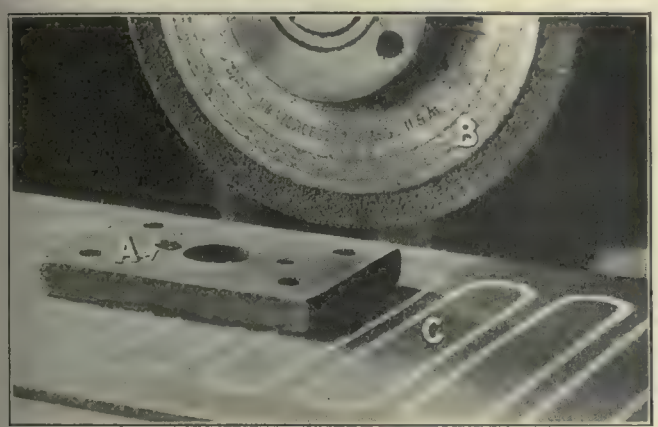
Making Compression Springs of Uniform Length

By E. A. Dixie

The other day I had the job of making some small compression springs. They were made of wire about 0.040-in. diameter and were wound to go inside a ¼-in. hole. The finished springs were required to be *about* ½ in. long. There was nothing particular about the length except that all of them had to be the *same* length within a few thousandths.

After the correct size of mandrel was found the springs were wound in lengths of about a foot and before taking the lengths off the mandrel they were compressed to make sure that they would not set after they were in use.

The long coils were next cut with pliers into short lengths of about ⅝ in. and one end of each spring was



GRINDING SPRINGS TO UNIFORM LENGTH

held up against the side of an abrasive wheel and flattened off, free hand. An attempt was then made to use this method of bringing all the springs to uniform length but it was a failure.

The idea of doing the job on the surface grinding machine presented itself and a ¼-in. hole was drilled in an old cast-iron rapping plate, shown in the illustration at *A*, and the plate placed on the magnetic chuck of the grinding machine. This hole was an easy fit for the spring and a spring was dropped into it to see what would happen when it was passed under the grinding wheel *B*. The only thing that happened was that the end of the spring was nicely finished off. There was no tendency for the wheel to pull the spring out of the hole and when some of the springs which were extra long were passed under the wheel they compressed and fed themselves to the wheel.

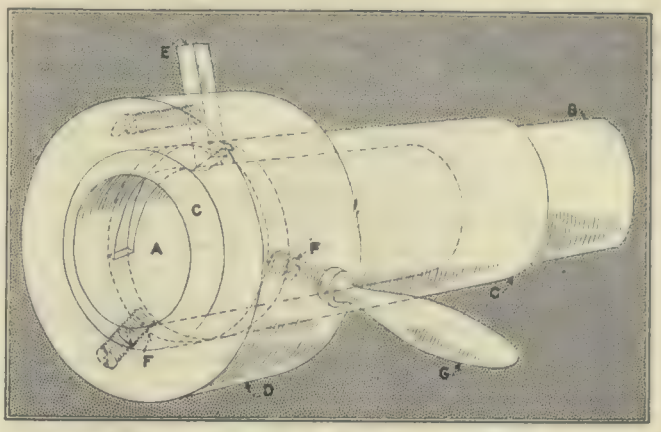
Current was kept on the magnetic chuck *C* all the time, the springs being picked out of the hole by the fingers when they were finished.

When all the springs were finished the difference in length of the longest and the shortest could not be noticed. After the wheel was adjusted to correct height with relation to the table no further adjustment was necessary, the springs being merely fed under the wheel and allowed to remain under its center till the sparks stopped coming.

An External Grooving Tool

By Harry Moore

The sketch shows a tool recently made to cut a groove on the outside of work being machined on a hand screw machine. It was impossible to do the operation



EXTERNAL GROOVING TOOL TO BE USED IN TURRET OF HAND SCREW MACHINE

with the cross-slide, the piece protruding too far, and the cross-slide being in use on the back end of the work. The hole *A* is concentric with the shank *B*, the outside *C* being eccentric. Collar *D* held the tool *E* and was held in place by the round-edge screws *F* which engaged in a groove cut in *C*. These screws were adjusted, then locked; one by another screw, and the other by the handle *G*. A slot cut in the side of *C* allows the tool to reach the work, and the end of this slot acts as a stop. The material being machined is brass.

An Assembling Fixture

By Bert Towler

A useful assembling stand is shown in the accompanying illustration. A round pedestal open at the front and provided with shelves to hold tools, is bolted to the floor in any convenient position and the upper surface is supplied by an old four-jawed independent chuck. The chuck jaws may be removed if desired and the face of the chuck used as a table; or with the jaws in place, any shape of piece within their capacity may be held firmly. The stand is shown with a piece of work held by the chuck jaws ready for reaming.



ASSEMBLING STAND

Turning a Large Hollow Spherical Casting

By E. Jullien

Director of Works A. Savy-Jeanjean et Cie., Courbevoie, Paris, France

The castings, one of which is shown in the drawing and halftone, are used in soap machinery. They must be machined where indicated by a double line on the drawing, Fig. 1. All the machining excepting the inside part was done on a Gisholt-vertical boring mill. The turning of the spherical part was done on a large Bouhey lathe of French manufacture, of a type that can be found in any large machine shop.

To machine the spherical surface the tool block and top carriage was removed and replaced by a 24-in. circular milling attachment on which was fixed a large

toolholder with the proper kind of turning tool affixed thereto. The saddle and cross-slide of the lathe were set and fixed in such a position as to make the center

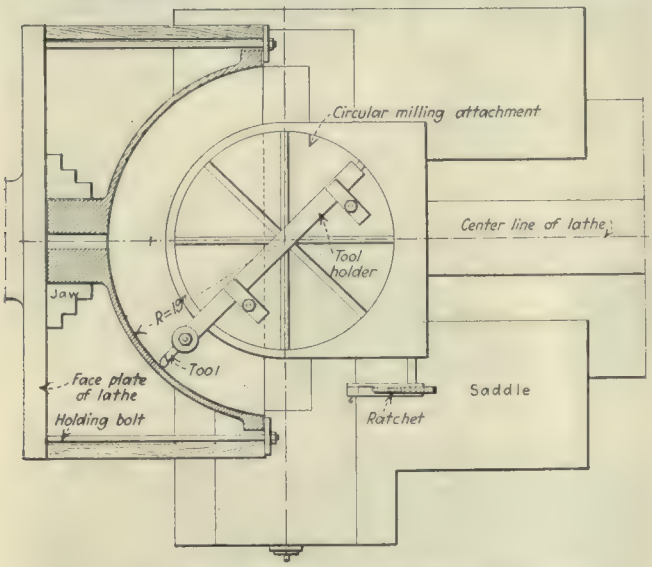


FIG. 1. OUTLINE OF CASTING TO BE MACHINED

of the circular milling attachment agree with the center of the spherical part to be turned. The set-up is shown in Fig. 2.

In order to obtain an automatic feed the handwheel of the milling attachment was replaced by a ratchet, to the handle of which a light chain was attached, the chain being carried over two pulleys fixed on the over-

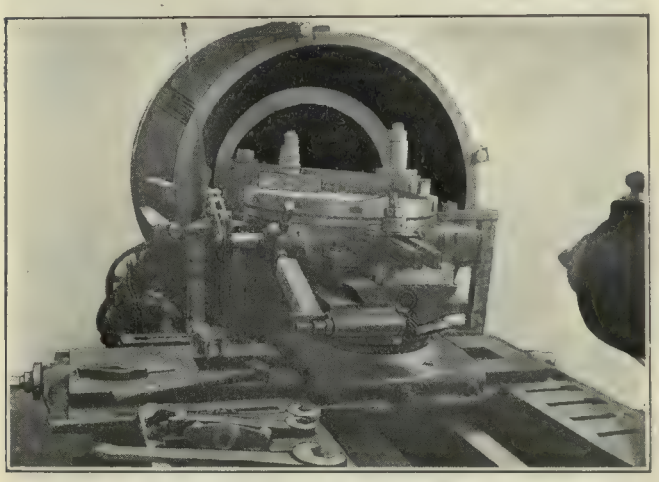


FIG. 2. THE SET-UP IN THE LATHE

head structure and the outer end fixed to an eccentric mounted on a shaft projecting from the headstock.

The drawing and photograph give a good idea of the arrangement. The results obtained were satisfactory in every way.

Emergency Repair on a Large Extractor

By Elias J. Parks

I was recently called into a dye house one Sunday morning to see what could be done with a large steam extractor. The ball bearing base under the basket shaft had been changed a number of times, so the proprietor had ordered a special one made and when the time came to put it in, the shaft was about $\frac{3}{4}$ in. higher than the connecting rod of the engine; which was mounted above the extractor. As this company was working on special contract work the machine could not be stopped for any length of time, and to send the basket and shaft to a machine shop would have meant a big job, as we could not get it out of the shop without knocking out some of the bricks around the door to let the basket pass.

The extractor basket was 6 ft. in diameter, by 2 ft. deep and the shaft $2\frac{1}{8}$ in. in diameter, if I remember correctly. I decided to try and shoulder the shaft down as required. I built two very strong horses, fastened them to gether and put a piece of $\frac{1}{2}$ x 2 x 6-in. flat steel on top of each horse in the center. These I countersunk for ball bearings and then with a chain block I lifted the basket up into place on the horses where it rested on ball bearings and turned freely.

I went to a friend in a garage nearby and borrowed a cutting-off tool and a small motor. I bolted a block of wood to the side of one of the horses to hold the tool level and clamped the cutting-off tool in position. I passed a rope from the motor pulley around the basket, turned on the juice and the "lathe" was in operation. The cutting-off tool was $\frac{1}{4}$ in. wide so I made three cuts from $2\frac{1}{8}$ in. down to 1 in., feeding the tool by tapping the back end with a hammer.

At first I had some trouble from the tool chattering and digging into the shaft but this I overcame and at three o'clock that afternoon the machine was running on test.

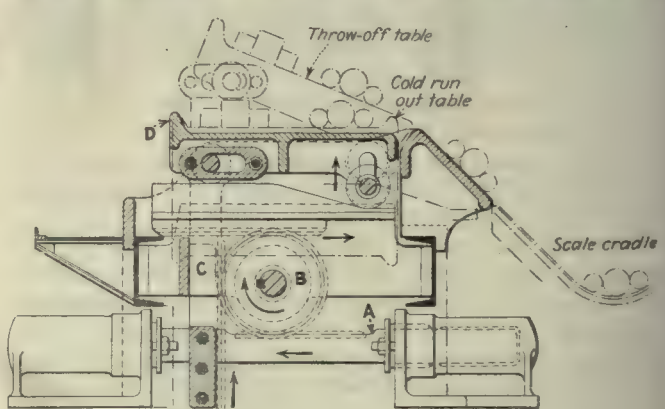
Throw-Off Table for Rolling Mills

By A. A. Rackoff

The illustration herewith shows a throw-off table designed by the writer for use in rolling mills working on merchant bars.

In ordinary mill practice the bars, after reaching the cold run-out table, are thrown off and into the scale cradle by hand, requiring the work of two laborers. With the device shown this labor is eliminated, as the operation is by hydraulic power controlled from the same pulpit by the operator of the run-out table.

The piston rod *A* has a rack in the top, meshing into the gear wheel *B* which in turn meshes into a rack on the vertical lifting member *C*. With the piston moving in the direction of the arrow, the lifting member is



THROW-OFF TABLE FOR ROLLING MILLS

raised carrying with it one side of the hinged table *D* as shown by the dotted lines at the top. As the table is tilted, the bars roll off and drop into the scale cradle as shown by the dotted lines at the right.

Improved Parallel Clamps

By Charles H. Willey

The sketches show how a toolmaker in our shop has improved the old-style plain parallel jaw clamps by making the jaws heavier and machining a shoulder on the

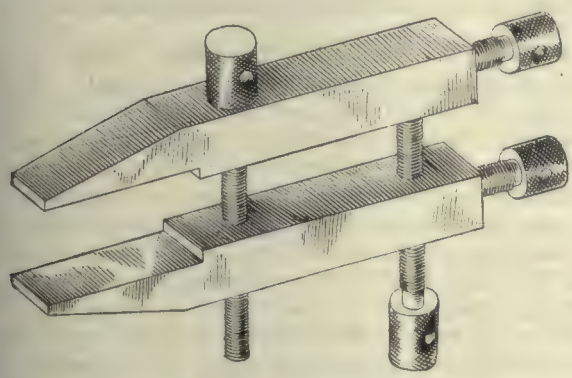


FIG. 1. THE IMPROVED CLAMP

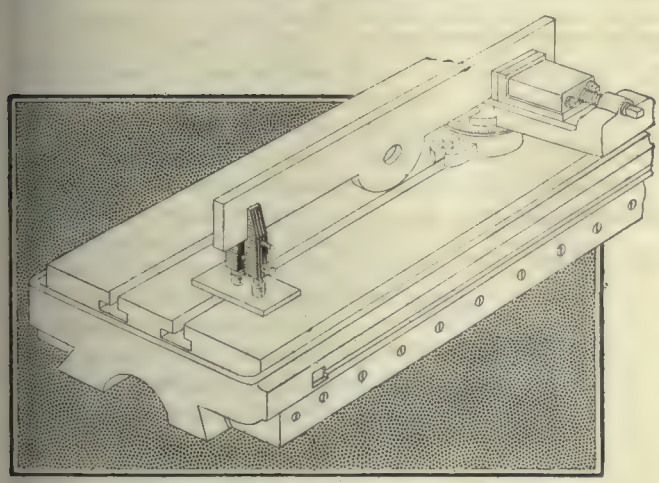


FIG. 2. SHOWING USE OF THE IMPROVED CLAMP

inside of each jaw, and also fitting adjustment screws in the back end of each jaw. The clamps can be used for any regular work for which the ordinary clamp is adapted, and in addition have many advantages that will be obvious to the experienced mechanic.

Should Jigs and Fixtures Be Designed?

By Ernest C. Allen

On page 289 of the *American Machinist* John Mark May furthers the discussion of "Should Jigs and Fixtures Be Designed?" It is gratifying to see that this subject is attracting more than passing interest. To my mind it is immensely important, but despite the fact that I have studied the question for years, I have never been able to reach any satisfactory or lasting conclusion. Figures to sustain any opinion of the matter are practically impossible to obtain. Only by taking two factories, identical in product, size, wage scale and personnel, one operating with, and one without a tool design department could conclusive figures be obtained. Other comparisons always contain abstract facts or elements of executive favor, and although they may be very convincing, they are never conclusive.

In my own experience I have seen tool design departments lumbering along in such ponderous, inaccurate blundering fashion that it seemed a crime to let them exist. I have on the other hand, seen tool design departments which gave every indication of being a paying investment to their factories. The difference in the two was in the way the draftsmen worked. In the former there was too much theorizing, contemplating this and that design and taking too long to do the job. I have seen an entire day's work expended on drawings of such simple things as reamers, simply because of endless and unnecessary comparison of ideas by the draftsmen and useless interference on the part of the checker or department head. In the latter type the draftsmen work; they are enabled to do so by a department system, shorn of all unessentials; instructions to men given in the briefest possible manner; checkers not allowed to tamper with drawings except to hold them within certain pre-arranged standards; no arguments over matters of mere opinion and a strict accounting kept of the time spent upon each drawing.

In addition to the above, I have seen tool rooms which would be helpless without drawings, and still others where draftsmen and drawings would be a positive detriment. Innumerable conditions argue for and against tool drawings. It is manifestly more difficult to build without drawings a box jig for a large, complicated piece requiring an elaborate pattern, than to build a blanking die to a sample of the piece to be made. On the other hand, it is often far easier to build small jigs around the sample, fitting each dimension to the piece than to follow blindly the dimensions on a drawing. The greatest controlling feature, however, seems to lie in the size of the shop. In a small shop everyone knows everyone else. All the processes, the likes and dislikes of the foreman applying them, are more or less perfectly known to the toolroom foreman and even to the toolmaker himself. A toolmaker building a die knows not only the details of the piece to be made, its use, the accuracy and finish required, but he also has access for trying out purposes, to the press where the die is to be used.

In the large shop, like the large city, intimate contact is lost. The toolroom foreman rarely sees what is going on outside his department—the toolmaker never does. Intimate knowledge of the shop's processes becomes restricted to their respective specialists, and tools must be made according to the desires of those using them. What the toolroom then wants and what it must have is definite instructions for its work. Hence, the need of drawings.

A more abstract but still important condition which makes tool drawings necessary in a large shop is the problem of control. With a toolroom employing a hundred men, it becomes impossible to deliver instructions or observe their fulfillment by the old "cut and try" methods. Blueprints are ideal under such conditions as an instrument of control, for not only the toolroom foreman but higher executives can go over and supervise work laid out in blueprint form, when it would be impossible by any other method.

On the whole, tool design departments are expensive, inefficient, blundering things but indispensible where works become too big for a one-man personal supervision. For instance: Let us say a new automobile motor has passed the experimental stage and is given to the superintendent to put into production. The jigs, fixtures, gages, etc., required for such a task are literally numbered by the thousand. Imagine if you can the confusion, resulting from an attempt to plan, lay out the details and convey working instructions to the mechanics by word of mouth only for a job of such a size.

IN THIS ISSUE

THE author of our first article, E. Jullien, describes the system that he installed at the works of Messrs. A. Savy Jeanjean et Cie, Courbevoie, France. The product is special machinery for manufacturing such commodities as chocolate, biscuits and soap. More than one hundred types of machines are manufactured, so that systematizing must have offered a problem of considerable size. The article explains the methods and provides samples of the printed forms used in the control system.

Hunter, in a railroad article, page 894, reminds us that there is something to do to air motors beside run them. He emphasizes the point that they should be kept as close as possible to the condition which will enable them to deliver maximum power. It is easy to see, of course, that keeping motors in perfect repair is a matter of economy and it is equally easy to see how such tools, after grilling performances, may be shoved back into the toolroom without receiving proper attention. The article advocates running tests on new motors to obtain performance standards and frequent tests thereafter to determine whether or not they need repair. Testing methods and testing devices that are in use in the C. & A. shops at Bloomington and the Beech Grove shops of the Big Four at Indianapolis are described.

The tenth installment of DeLeeuw's series on metal cutting tools, page 897, takes up special forms of milling cutters, such as gear cutters, finishing, stocking and duplex cutters, and various types of hobs. This installment is a valuable section of the series.

Colvin takes up a fairly big subject this week in "The Foreman and His Job," page 903. What he says deals with the advisability of frequently changing the worker from one operation to another. There would be few who would advise applying such a system to all operations, and no doubt there are shops where the idea would not even need to be considered. But just as surely there are operations on which a man should not be kept continuously, where a rotation of operators would raise the average production and benefit those engaged thereon.

Dowd and Curtis are still pounding away on drill jig design and we venture that the many readers of this series do not find any fault because of that. General principles of design that are used in jigs and fixtures for milling, profiling, splining and other operations are necessarily used in the design of drill jigs, so that a comprehensive treatment is bound to be a lengthy one. The specific subjects treated this week are V-block and leaf jig design, leaf construction, clamps in the leaf, leaf stops and leaf locks. The illustrations are well and carefully thought out and are plentiful. Page 905.

The heavy-duty, ball-bearing, radial drilling machine that has been placed on the market by the Carlton Machine Tool Co., Cincinnati, is described in this issue, beginning on page 908.

We classified Hunter's article on pneumatic motors as a railroad article, because it deals with practice as found in railroad shops. We have another, however, beginning on page 911, that is confined strictly to a treatment of railroad equipment. It goes in for such operations as pouring hub liners in driving boxes, milling crossheads and rod brasses, the use of air clamps and a method of placing locomotives to save room. The data were obtained in a New England shop of the Boston & Maine at North Billerica, Mass.

We shall let A. B. Cox speak for his own article, "Slip of Involute Gear Teeth," page 913: "The intent of these data and curves is to show that the efficiency of gears can be increased and the wear decreased by choosing large numbers of teeth; that the use of gears of shorter addendum or greater obliquity of the line of action reduces slip and increases the percentage of rolling contact; and that the gain in efficiency from increasing the angle of obliquity is offset by the increased friction losses in the bearings in proportion as the angle increases."

This is the convention season. Reports on three are furnished in our news section (not published in the European edition). They are those of the triple convention of the Supply and Machinery Dealers and Manufacturers Associations, the National Association of Manufacturers and the Taylor Society. Also, there are in the editorial section, abstracts of several of the addresses made before the National Foreign Trade Convention held recently in Cleveland.

Coming Features

Next week's issue will furnish some very good advice on how the shop manager can use an appraisal. The article was written by Morgan G. Farrell, of Miller, Franklin, Bassett & Co.

The magnetic chuck of the Persons-Arter Co., of Worcester, Mass., is the subject of the eighth installment of Ellsworth Sheldon's Magnetic Chuck series, to be in the next issue.

The manufacture of oil well tools has become of greater magnitude than many realize. We have allotted six pages of the next number to a story by Colvin on this subject.

There will be an "economy" article by Stanley; "Saving Material in a Railroad Shop" is the title.

Tool Engineering will, of course, be a part of the issue. The sixth installment continues with drill jig design.

EDITORIALS

Cutting Down Government Overhead

ONE of the big jobs in President Harding's proposal to put more business in government is the reorganization of government departments. Various investigators have pointed out the overlapping of functions that exists in the present system which has been handed down to us by our great-grandfathers. Mr. Hoover has bumped into it hard in his endeavors to make the Department of Commerce a real aid to business.

Everyone admits the need for a regrouping of administrative functions, but the difficulty is to get action. A new administration with the country behind it can do much in its first month in office to change long-established customs. The forces of obstruction are temporarily in disorder and their defeat is relatively simple.

But once the dust of the disturbance has settled and the standpatters have had a chance to look around and get their bearings, the opportunity for further innovations is but fleeting at best. It is no more than human nature for the head of the department that will lose by a change to object, and he will have many earnest supporters who are more or less personally interested. At this stage of the game, therefore, only a thoroughly aroused public opinion can force through desirable and even necessary changes.

The McCormick Bill contains the recommendations of the United States Bureau of Efficiency. Other bills looking to the same ends have been introduced. Don't forget, however, that bills are quite likely to die in committee rooms if there is not a concerted demand for their passage. Make government reorganization a live subject by discussing it wherever you have a chance. If enough people get to talking and thinking about it the echoes are sure to reach Washington and then, and not until then, can action be expected of the powers that sit in Congress assembled.

More About the Department of Commerce

HERBERT HOOVER has taken another important step toward making the Department of Commerce of real service to business by appointing, as his personal assistant, F. M. Feiker, vice-president of the McGraw-Hill Co., Inc. Besides having back of him an abundance of the right kind of experience, Mr. Feiker knows where to go for information, how to get it, and how to use it, several points in his make-up that indicate an ability suited to the job. His work of organizing and developing those branches of the Department of Commerce which relate directly to commerce and industry, will have to do largely with statistics and research.

Mr. Feiker, in a statement of the purposes of his new work, said: "I am keenly interested in Mr. Hoover's broad plans for the development of the Department of Commerce as an aid to industry. Mr. Hoover is particularly anxious to learn from industry itself in what way this department can expand so as to be of service to the business men of the country. I hope to be able to assist Mr. Hoover in the development of the statistical and research branches of the Government in such a way as to provide information and help for the needs of the average business man and the small manufacturer. Our great industries have learned the value of and have established statistical and research bureaus, but the average business man has neither the time, nor the opportunity, nor the capital, to make the necessary investment individually to make this possible. The Government's functions in the collection of fundamental data and trade information can be put to his service in a definite and practical way."

Though covering only a part of the scope of the department, the field outlined by Mr. Feiker is a big one and offers opportunity for some hard and very necessary work. A good man has been selected to do it.

Good News from Governor Harding of the Federal Reserve Bank

THE steady rise in the reserve percentages of the Federal Reserve banks has not been without significance to careful observers. It has resulted, as predicted, in a reduction of certain discount rates and consequently in a better outlook for general business.

In a recent address Governor Harding of the Federal Reserve Board said, among other things, "The Federal Reserve banks are today in a very strong position, with an average percentage of gold and lawful money against deposits and note issues of fifty-five per cent, as compared with forty-two per cent a year ago, the reserves are higher than they have been since the fall of 1918 before the flotation of the Fourth Liberty Loan. They are able now safely to take part in a movement to stimulate business, with a view to liquidating frozen credits, that they have not been in a position to do heretofore.

"The time has come for renewed courage and confidence. We are entering now the springtime, are upon the threshold of the production season. Frozen credits, which must be thawed out gradually must be taken care of. Many men have liquidated down to the bone. They should be encouraged to build themselves up. We are reaching every day a safer basis on which to do business. There can be no question that the present maladjustment is temporary. The economic forces are seeking to reconcile themselves and they will do so."

Up to the present time there have been many voices calling to the business man and the manufacturer to start something, but nothing has been said about the very practical matter of procuring the wherewithal. The bankers have come in for their share of criticism for not extending further credit and perhaps this was justified in some cases. We do not care to enter into a justification of banking policies, there are other and better agencies for doing that. But now that the banks are beginning to feel equal to a move to stimulate business, we cannot help but be encouraged no matter how gloomy things may look in our own particular sphere of action. The return to prosperity may be slow but it is none the less sure.

Shop Equipment News

Niagara Horizontal Duplex Double-Seaming Machine

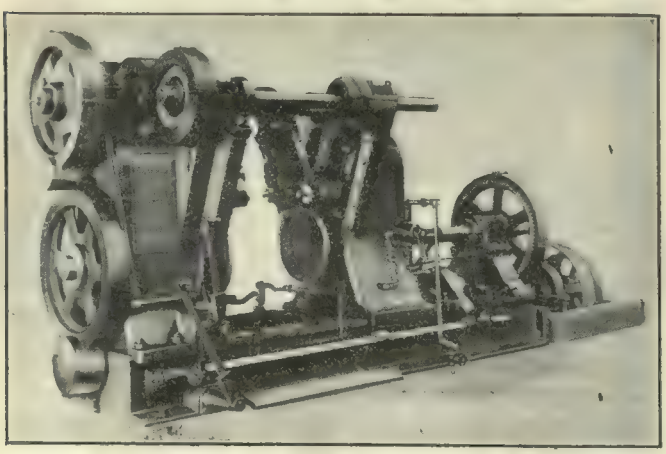
The Niagara Machine and Tool Works, Buffalo, N. Y., has recently placed on the market a machine, shown in the accompanying illustration, for double-seaming simultaneously both ends of sheet-steel barrels or drums. The machine is handled by only one man. It is capable of seaming barrels from 18 to 36 in. in diameter and from 20 to 45 in. in height and made of No. 12 gage or lighter steel.

The right-hand column is arranged to slide horizontally on the bed and is moved forward or backward by means of a hydraulic cylinder controlled by a three-way valve. Approximately 50 lb. per square inch water pressure is sufficient to produce the required pressure on the barrel heads. The main gears are made of steel and are machine cut. The seaming rolls are high-grade tool steel and are run on large, bronze-bushed bearings. All movable parts are well guarded.

When operating the machine, the barrel, with the heads in place ready for seaming, is rolled in on runways onto the horizontal bars. The barrel is located on the supports by stops, and is raised in line with the chucks by means of a treadle. The column is then moved into position by the hydraulic cylinder, which is operated by means of a hand lever. The pressure thus exerted clamps the barrel between the two chucks, forces the heads into their proper position, and holds the body while the seaming operation is being performed.

The seaming operation is started by means of a hand lever which releases a positive instantaneous clutch and sets two camshafts into motion. The curling rolls are automatically brought down to the work, and curl the seams. These rolls then recede, and the flattening or finishing rolls move into position and finish the seams. The machine makes a predetermined number of revolutions, to allow sufficient time for the proper performance of the work. Only about forty revolutions of the barrel are required to complete the seams.

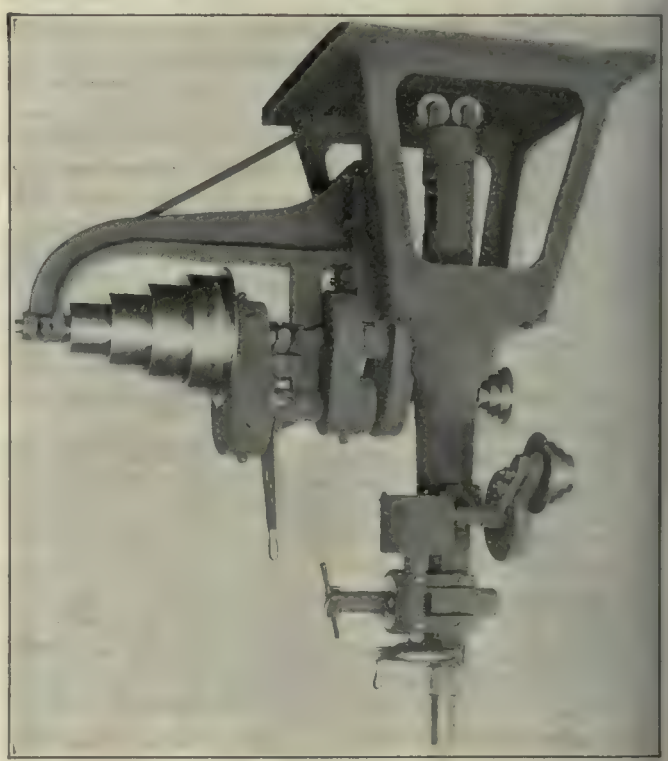
A countershaft, equipped with a two-step cone pulley to run at 300 r.p.m., and running the drive shaft at 255 and 450 r.p.m., is furnished with the machine. Both chucks are driven by the drive shaft, with a ratio of 3:1. Twenty-five horsepower is required to operate the machine. The motor can be direct connected. The machine is 93 in. high, 62 in. from front to back and 211 in. from right to left. Equipped with one set of rolls, it weighs approximately 21,000 lb.



NIAGARA DUPLEX DOUBLE-SEAMING MACHINE

Reed-Prentice Suspended Drilling Machine

The Reed-Prentice Co., 53 Franklin St., Boston 9, Mass., has recently placed on the market the suspended type of drilling machine shown in the illustration. The machine is suspended from the ceiling and fastened thereto, or to overhead timbers, by screws or bolts. There is nothing on the machine to interfere with work that may be brought under it. Owing to the construction of the frame, no truss rods are needed to support the machine. The spindle is counterbalanced, has hand and power feed, a quick-return movement, and three changes of feed. The operating mechanism resembles that found on the usual type of upright drilling machine. The work can be held in any manner desired, because of the absence of the machine table.



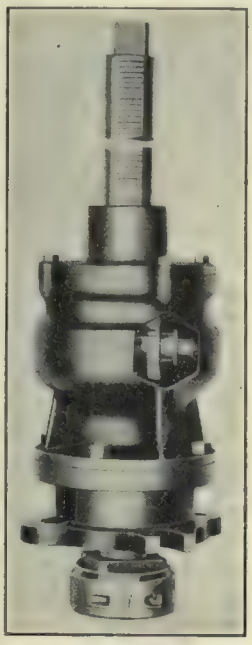
REED-PRENTICE SUSPENDED DRILLING MACHINE

Specifications: Spindle; feed, 19 in.; diameter, 2 in.; taper hole No. 4 Morse. Countershaft; tight and loose pulleys, 14x4 in.; speed, 200 r.p.m. Distance from ceiling to lower end of raised spindle, 68 in. Ceiling space required to fasten frame; 36 x 36 in. Weight; net, 1,800 lb.; boxed, 2,200 lb. Export box, 54 cu.ft.

Change gears can be furnished to give any required feed. The handle for operating the back gears can be made any desired length, so as to extend to about the same position as the handwheel on the feed and to be easily reached by the operator. The machine is capable of drilling holes up to 2 in. in diameter. A countershaft is furnished.

Van Dresser Cylinder-Reboring Tool

The illustration shows a device recently placed on the market by the International Purchasing and Engineering Co., 506 McKerchey Building, 2631 Woodward Ave., Detroit, Mich., for the purpose of reboring the cylinders of automotive engines. The device is known as the Van Dresser cylinder-reboring tool and consists essentially of a cutter or reamer, a driving and a feeding mechanism for it, a housing and a base which can be fastened directly to the top of the cylinder to be machined.



VAN DRESSER CYLINDER REBORING TOOL

The size of the reamer is adjustable, so as to make it applicable to cylinders of different diameters. The high-speed steel blades are ground helically, and can be adjusted in unison from the lower end of the reamer head without removing the head from the feed bar.

The base of the housing is said to be adaptable to any motor, although special bases can be furnished to fit any particular motor. A centering plug is applied in order to properly fit the base of the machine to the motor cylinder. The spindle bar is hardened and ground and has a bearing 9¼ in. long in the housing. There are no threads upon it, although rack teeth are cut in one side. Due to the long bearing of the spindle, and to the clamping of the device upon the cylinder block, it is said the hole is bored true throughout its entire depth.

The device may be operated by hand or run by a drill press. In the latter case, the feeding mechanism of the drilling machine may be used, after disengaging the feed of the reboring tool. A floating driving socket is provided to automatically take care of any misalignment of the drill spindle with the tool itself. An extension driving bar may be provided for use with drilling machines. Because of the fact that the feeding mechanism is continuously engaged, it is stated that a smooth finish can be obtained in a cylinder even though the spindle be turned by hand.

The motor cylinders on many cars may be rebored with the motor in place in the chassis. The necessary precautions must, of course, be taken to prevent chips from reaching the bearings of the motor. The device is made in seven sizes, to bore cylinders from 2¾ to 4½ in. in diameter, each size being adaptable to cylinders varying in size ⅜ to ¾ of an inch.

Fischer Oil-Grooving Machine No. 2

The Fischer Machine Co., 310 North 11th St., Philadelphia, Pa., has recently placed on the market the oil-grooving machine shown in the accompanying illustration, and intended for the grooving of the internal surfaces of bearings up to 15 in. in diameter and 15 in. in length. The machine is said to combine the standard features of construction of engine lathes and crank shapers.

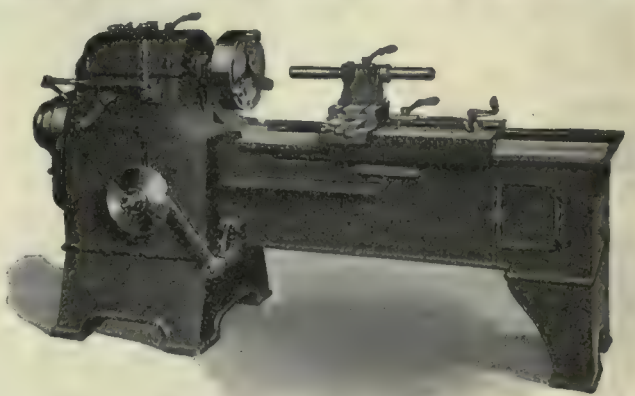
The bearing in which the oil grooves are to be cut is mounted on a revolving chuck or faceplate, and the boring bar is carried by a block mounted on a reciprocating slide. By different combinations of movements of the tool and work, oil grooves of various types can be produced. By holding the work stationary and reciprocating the toolslide, a straight oil groove may be cut parallel with the axis of the bearing; but with the toolslide stationary and the work revolving, a circular groove may be cut in a plane perpendicular to the axis. By operating both movements simultaneously, grooves may be cut at any angle to the axis of the bearing.

The machine is driven by cone pulleys from a countershaft, and it is started by engaging a friction clutch on the drive shaft. The work-holding spindle can be clamped in position when it is so desired, or a positive clutch can be used to index the work a fraction of a revolution.

In order to cut helical grooves of different pitch, change gears are provided, so as to vary the speed ratio between the spindle and the carriage. The length of stroke is adjusted by means of a wrench, and a scale underneath the carriage indicates this length, to aid in setting the stroke. To provide for varying the diameter on which the tool is cutting, a cross-slide on the carriage is operated by means of a screw and a ball crank. The position of the tool on the carriage may be adjusted longitudinally by means of a crank, being clamped to the reciprocating carriage after it has been properly positioned.

In order to cut grooves that are symmetrical, it is necessary to have some means of compensating for the errors which would result from the angularity of the connecting rod which transmits the reciprocating motion to the carriage. This is accomplished by a compensating mechanism incorporated in the drive, so that the tool has the same motion as would result from the use of a connecting rod of infinite length.

The machine is equipped with a relieving and taper attachment, to provide for cutting oil grooves in tapered bearings as well as in straight ones, and also for withdrawing the cutting tool at different points in the revolution of the crank, when it is desired to modify the form of grooves that would be cut by the machine. In this way, it is possible to cut grooves in such forms as a cross, a half circle, or a right- or left-hand helix of varying pitch.



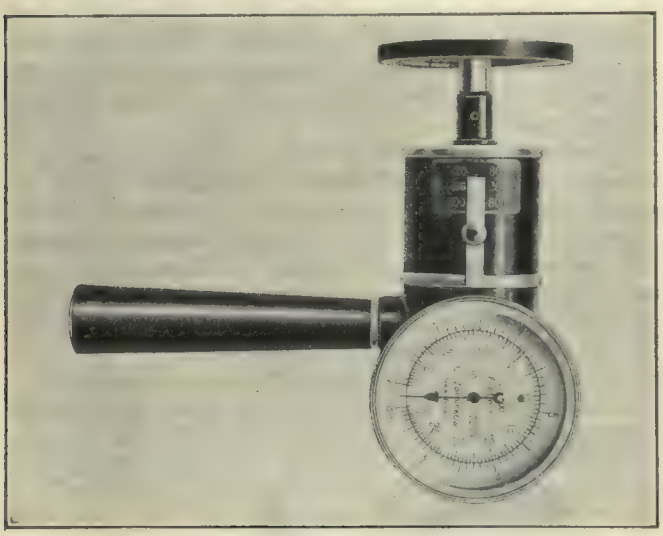
FISCHER OIL-GROOVING MACHINE NO. 2

Specifications: Hole in spindle, through, 1¾ in.; taper, No. 3 Morse. Thread on spindle; diameter, 3 in.; pitch, 6 per inch. Spindle speeds, 14, 21, 32, 48, 73 and 111 r.p.m. Maximum length of groove cut, 15 in. Revolutions of spindle to one of crank, 1, 2, 3, 4, 5 or 6. Swing over bed, 19 in. Speed of countershaft, 200 r.p.m. Horsepower required, 2. Height above floor; spindle, 3 ft. 8 in.; ways, 2 ft. 10½ in. Floor space, 8 ft. 8 in. x 2 ft. 8 in. Weight; net, 3,000 lb.; crated, 3,380 lb.; boxed, 3,600 lb. Export box, 9 x 3 ft. x 5 ft. 2 in.

O-Z Cutmeter

The device shown in the illustration, known as the O-Z cutmeter, has recently been placed on the market by O. Zernickow, 15 Park Row, New York, N. Y. It is intended for determining the cutting speed of machine tools of all types. It may also be used for such purposes as ascertaining the speed of rolls in paper mills and the linear speed of belts and ropes.

When in operation the device is held by means of the handle, and the small wheel is placed in contact with the moving works or machine table, the surface speed being shown directly on the dial. The meter operates on the governor principle, and it is said that its accuracy is not affected by changes in temperature, by moisture or by the presence of magnetic fields. A damping mechanism is incorporated, so as to prevent vibration of the indicating hand, the mechanism serving to neutralize shocks and vibration which would be transmitted from the machine or work being tested. When fitted with the pointer provided for the purpose, the device may be used to indicate revolutions per minute. It is not necessary to use a watch to time the period



O-Z CUTMETER

of test, nor to calculate the speed. The device is said to operate equally well in any position.

The housing is of an aluminum alloy, black enameled with nickle-plated trimming. The handle is removable, so that the instrument may be placed in the case which is provided. By means of the three separate ranges, the device may be used to indicate revolutions per minute from 30 to 1,200 and speeds in feet per minute from 20 to 800. The diameter of the dial is 2⅜ in., while that of the wheel is 2½ in. The length of the instrument is 5¾ in., and its net weight ¾ lb.

Cincinnati Hy-Speed Machine Co. Drilling Machine

The Cincinnati Hy-Speed Machine Co., Cincinnati, Ohio, has recently developed and placed on the market a line of drilling machines of the type shown in Fig. 1, and sold under the name of "Hy-Speed."

Among the features of the machine are the single-pulley, direct, overhead drive and the dry-plate clutch operating in connection with the externally clamping, adjustable, air-cooled brake. By means of a single handle directly in front of the operator, the machine can be instantly started and stopped, adding considerable speed and convenience to the operation of the machine. The elevating mechanism of the table is so arranged as to allow drills and taps to pass through the center of the table. This construction, combined with the use of the quick-releasing chuck, allows tapping without reversal. The spindle speeds are controlled by a handle on the side of the column. An automatic power feed and an automatic tapping attachment can be arranged on any spindle. Unit construction is embodied in the machine. The entire clutch, brake and the initial driving gear form a separate unit that is set into the top bracket of the machine. Fig. 2 gives a view of the driving pulley and mechanism. For accessibility, the counterweight of the spindle is hung on the outside of the machine.

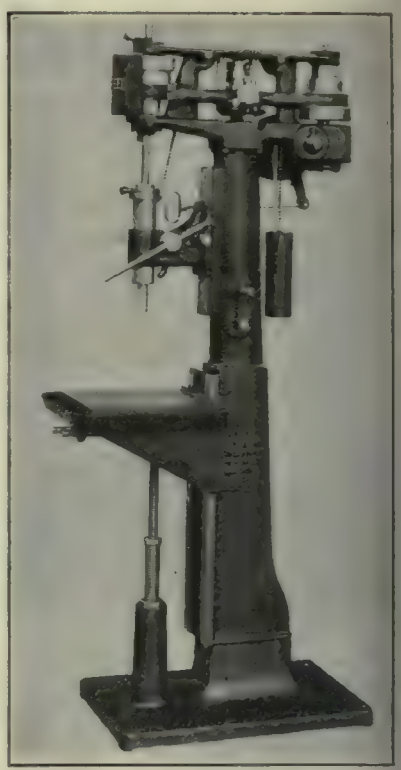


FIG. 1. "HY-SPEED" DRILLING MACHINE

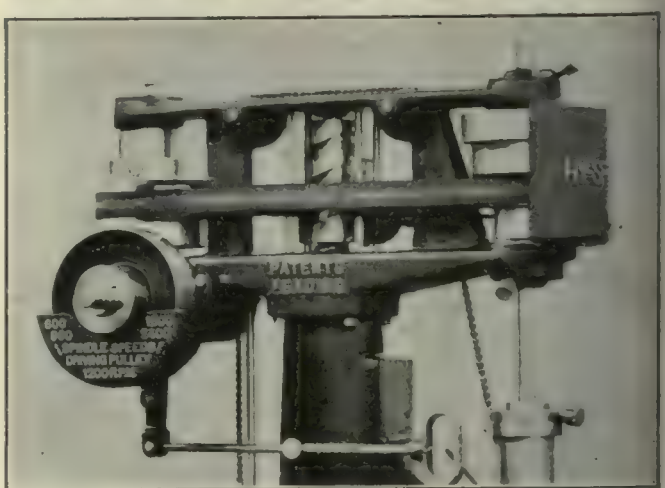


FIG. 2. DRIVE MECHANISM ON CINCINNATI "HY-SPEED" DRILLING MACHINE

The narrow-faced idler pulley is carried directly on the belt shifters and, moving intermittently with the shifters, helps lead the belt from one step to another. All pulleys are made of aluminum. The pump and tank form a separate unit, attached to the base of the machine and arranged for ease in cleaning. S. K. F. ball bearings are used throughout the entire machine.

The machine is built in various types for either floor or bench use, with a single speed if desired, or a belted motor drive, an automatic power feed or an automatic tapping attachment.

Abstracts of Foreign Trade Convention Addresses

What Prominent Business Men, Financiers and Legislators Think of Present Industrial Conditions—Some Thoughts on the Future

In these abstracts of several of the addresses delivered before the Eighth Annal Convention of the National Foreign Trade Convention, held at Cleveland, Ohio, the field has been covered in a broad way, and subjects of genuine interest to all are discussed.

The Effect of Double Taxation on Our Foreign Trade

By Daniel R. Williams
American Chamber of Commerce, Manila

The commanding position achieved by Great Britain in her overseas commerce is due in very large part to the presence of British resident merchants in practically every port and market of the world. The encouragement offered such merchants is evidenced by the fact that today, despite the urgent need of Great Britain for revenue, no tax is imposed upon the local income of British subjects resident abroad. This attitude of co-operation and helpful assistance assumed by Great Britain toward her nationals engaged in foreign business is followed by practically all the great trading nations of the world. Our Government, however, with its expensive and elaborate foreign service organization, has failed utterly to recognize the essential rôle played by its foreign merchants, and the imperative need for safeguarding their interests. Instead of extending help and protection to them, or offering encouragement to those who might be induced to venture their capital and efforts abroad, it burdens them in such manner as to render success doubtful if not impossible. No American can establish a business in any foreign country today without facing the fact that the disadvantage worked on him by this income tax requirement may nullify his efforts and leave him at the mercy of his more fortunate rivals. Those who have actually sat in this foreign trade game realize that the odds are already great enough against them without stacking the cards in favor of their more experienced opponents. An even break, with a fighting chance for success, is the least our pioneer trade missionaries have a right to expect in the struggle they are making to create and develop new markets for American products. Any person who has striven for success in sport or business will know how killing a handicap of this sort may prove. It is certainly anomalous for our Government to insist upon the one hand that the needs and prestige of the United States require that Americans engage in foreign service and undertake foreign ventures, and at the same time voluntarily start them in the race with this tax burden upon their backs. To expect them to win in such case against competitors trained to the minute, and carrying no weight, is to ask the impossible.

The situation thus painted cannot be dismissed as mere special pleading. The evidence which comes from every quarter of the globe as to the discrimination worked by such tax against Americans and to the advantage of their competitors is too unanimous and too overwhelming to be questioned or minimized.

Another fact to be emphasized, and upon which some confusion exists, is that in seeking exemption from this tax there is no effort or purpose on the part of our nationals abroad to escape a legitimate obligation. The protest is not against being taxed *per se*, but against being compelled to pay this particular tax when others, with whom we are competing for a proper place in world commerce, suffer no such burden.

A further important consideration apparently forgotten or overlooked by our legislators is that the incidence of a tax applied within the United States is or may be altogether different from that of the same tax when sought to be applied beyond our borders. In the former case such tax, whether collected as customs dues or otherwise, is uniformly added by the persons affected to the selling price of their products, whereas such a recoupment on the part of non-resident Americans may prove utterly impossible. It is *prima facie* that our foreign merchants must meet the prices of their competitors or go out of business. Where these prices are fixed, however, by persons who pay no such tax but who handle identical products, the consequences are apparent. The American is compelled, if he does business at all, to liquidate this additional demand upon him out of profits. Argument is superfluous to convince that this cannot be done for any length of time, as profits equivalent to this exorbitant tax are not possible in modern competitive business. As the law now stands an income of $100,000 must pay a tax of $31,190, while upon an income of $600,000 the Government takes $375,190. Payment of such enormous amounts as these is only possible where the burden applied uniformly upon all persons engaged in the same business or calling. It is not possible to our resident merchants abroad, whose competitors are exempt from any such payment.

The logical effect of this tax, if continued, must be to drive our citizens out of foreign communities where they cannot compete on even terms, or to give them a substantial inducement to acquire a citizenship less burdensome than ours. These consequences, through the law of diminishing returns, would eventually defeat the purposes of the act—without, however, repairing the damage already accomplished. On the other hand, the suggested exemption will not only tend to greatly stimulate our foreign trade, but will, through the increased revenue derived from profits realized by domestic concerns interested in such trade, much more than compensate the Government for any loss suffered from the other source.

Practical Developments in Edge Law Banking

By Philip B. Kennedy
Vice-president, First Federal Foreign Banking Association

Owing to the fact that I have been associated with the the management of an Edge Law bank since the middle of last June I have been asked to tell how it works in practice. Present experience to draw upon is necessarily limited because there are only two Edge Law banks actually in operation, one of which has had nearly a year's experience and the other several months' experience.

Existing experience has not fully tried out the possibilities of the Edge Law because it has applied to only one of two kinds of financing which may be done by banks organized under its provisions. Such a bank may do either an acceptance business or a debenture business, but not both. The Federal Reserve Board ruled in its regulations that an Edge Law bank may not have outstanding at the same time both acceptances and debentures except with the approval of the board. Later, when requested by one of the Edge Law Banks for a ruling, the board held that a bank having outstanding acceptances could not issue debentures. This means that there will be two kinds of Edge Law banks. One kind will be an acceptance bank which will issue longer term commercial import and export credits to exporters and importers; the other kind will do a debenture business, which generally speaking means making long time loans to foreign countries. The first kind of Edge Law bank will deal directly with exporters and importers, grant them lines of credit, take their foreign drafts for discount or collection, and do a general international banking business; the second kind of Edge Law bank is not expected, except in unusual instances, to deal with individual importers or exporters, but is counted upon to improve general business conditions by making large capital loans abroad. It will therefore be seen that the two different kinds of Edge Law banks have distinct fields and cannot be said to compete with one another.

The proposed hundred million dollar corporation, according to public announcement, is to be of the debenture type.

Since it has not yet emerged from the promotion stage no experience has thus far been had with debenture financing.

The debenture is a new type of security in the American investment market, and would have to be made generally known before regular sales could be counted upon. Since a new type of security would have to be popularized there would be need, no doubt, for a large-scale undertaking. The acceptance market, on the other hand, has been effectively developed in this country for the past five years.

Although Edge banks ought to take energetic steps to help finance the oversea shipments of our great staples this is not their only business. They also offer credit facilities to the individual shipper. This does not mean that they are trying to take manufacturers or export merchants away from their regular deposit banks. Such relations are not disturbed because Edge banks do not receive deposits except such as are incidental to foreign transactions. The Edge bank does not predicate its accommodation to an exporter on the basis of his deposit balance. It asks for no deposit account, but extends its special foreign facilities at net cost.

Confidence at Home and Credit Abroad

By U. S. Senator Walter E. Edge, New Jersey

To maintain production at normal and to stimulate it to the full potentiality of our great development under stress of war we must, of course, have markets—domestic markets to maintain it at normal and foreign markets to absorb the surplus output and occasion a demand for more products. So the pressing need of the moment is the providing of markets, at home and throughout the world. Uncle Sam now is suffering from "complications." The real ill is a lack of markets, caused at home by a "buyers' strike" and abroad by lack of cash and non-cultivation of credit. The first medicine for the buyers' strike must be confidence, and for the foreign situation it must be the provision of credit and the transmutation of that credit into dollars to pay to American producers and American labor and American agriculture.

The foundation of all business is confidence, and credit is the cornerstone. There can be no confidence among the people while uncertainty prevails as to the nature of the remedies to be provided for the present uncertainty and apprehension. And credit is apt to be mighty tight till confidence is established. Nor can confidence be firmly and solidly established on a quicksand of theoretical, visionary or artificial legislation. Practical, businesslike legislation need not be devoid of ideals simply because it is practical; but practical ideals must not be sacrificed to theoretical ideals that cannot helpfully be put into effect.

Nor will it be necessary to defer the cultivation of world markets till the home market has been created; the two movements well may go forward together. Under the Export Finance Amendment to the Federal Reserve Act expanding the American banking system to international proportions immense credits may be furnished to impoverished foreign purchasers of American goods, these credits being turned into American money for payment to American producers and vendors, with profit to every American involved in the transactions. No legislation is needed for this procedure; it already has been provided. It merely remains for the financial and commercial groups in the United States to take advantage of the opportunity and the procedure.

All these ills—depression in business, depression in production, lack of business for railroads and the merchant marine and consequent unemployment—will be corrected only if we attack the root of the evil, and the only solution to these and other related problems is the securing of a market. The buying power both at home and abroad exists; if abroad it is aided by an extension of credits we can well afford to extend, and they have the security to protect us; and at home by the return of confidence which can only be brought about by a realization that men can develop, can make a reasonable profit on their enterprise and, most important, retain it. We cannot expect to rejuvenate home or domestic enterprise as long as the Government continues a policy of requiring as high as 70 per cent of the profits to be paid to the Government; the tax system must be revised so that the burden will be more equally distributed and in the long run the rich will pay the bill just the same, because they will be encouraged to do big things, and thus employ labor, increase production and radiate that happiness and contentment necessary to insure general prosperity.

Value of Long Credits to the Exporting Manufacturer

By George R. Meyercord
President, Illinois Manufacturers' Association

As I view the Edge Law foreign trade financing machinery, it offers the first step whereby the manufacturer gets some reasonable measure of relief toward creating that highly desirable, stabilized situation whereby his frozen inventory is rendered more liquid.

History will repeat itself in Europe. Countries now struggling bravely to regain their pre-war standing have lost little in natural resources or industrial competency. All they need is time—a little time—to recover. They are solvent. They furnish the most inviting field in the world for foreign trade, for they are in need of American goods. Their supply of machinery for production, agricultural implements, transportation equipment, tools, hardware, electrical supplies and innumerable commodities that can be supplied by our manufacturers, is exhausted or very low. They need above all the raw material or the partly manufactured stocks which can be furnished by this country, and which can fast be turned into money by the industrious millions of war-sick Europeans.

Our manufacturers, our mines and our farmers are willing and anxious to supply European needs. They expanded during the war, and overseas trade is essential to their enlarged capacities. But as they cannot always operate their plants on future promises to pay, no matter how dependable those promises are, they must have behind them some financial organization that temporarily will supply this money while the rich European trade is being garnered.

Every day American manufacturers are being offered profitable European business that they reluctantly are obliged to decline because this country has lacked the foreign trade financial machinery that has been developed so successfully by Great Britain.

The Foreign Trade Financing Corporation through its debentures speaks in American dollars to the American investor, and the American investor need only have faith in the vast capital of the corporation and in its management. Surely it is axiomatic that this faith will follow. It is unthinkable that the management will not be both able and of a superior order.

The manufacturer who invests in the stock of the Foreign Trade Financing Corporation will be amply repaid. It will be a profitable investment. It will help every manufacturer and business man in the country. It will solve employment problems and restore the general prosperity to which progressive industry is entitled.

In closing I want to protest most strenuously against the viewpoint so prevalent and now so often expressed to the effect that we must keep down the tariff bars to our own markets. This viewpoint is on the theory that the only way Europe can pay is to flood our markets with goods. We could better afford to give our foreign friends the funds direct with which to rehabilitate themselves.

I submit that it is rank financial heresy to throw a $6 a day man out of a job in this country and substitute a $1 a day man in Europe, which is a starvation wage at best, and expect a saving to accrue out of the dollar that will compensate the American workman for the loss of his $6 a day job.

I submit further that the world's purchasing power has been reduced five-sixths under this plan and the American purchasing power has been reduced six-sixths.

I desire to commend President Harding for his sane attitude on this thought. America's export business will never be built up on a foundation of destruction of its domestic market. I believe that the proper plan is to invest our surplus in foreign securities of the Foreign Trade Financing Corporation now organizing.



NEWS SECTION

Garman Is New President of American Engineers

H. O. Garman, chief engineer and consulting engineer for the Indiana Public Utilities Commission and the Indiana Railroad Commission, was elected president of the American Association of Engineers at its annual meeting held this month at Buffalo, N. Y.

Mr. Garman is prominent in engineering circles in the Middle-West, having been engaged in various engineering enterprises and at one time a professor of engineering at Purdue University.

Other officers elected at the convention were: A. N. Johnson, dean of engineering at Maryland State College, vice-president; A. S. Morris, of the C. & N. W. R.R., second vice-president; E. F. Ayres, W. L. Benham, Garrison Babcock, Morris Bien, G. M. Butler and W. R. McKeen, directors.

Annual Convention of the American Drop Forge Association

Chicago has been selected as the location for the eighth annual convention of the American Drop Forge Association, which meets annually in connection with the Drop Forge Supply Association. The meetings will be held at the Congress Hotel on June 22, 23 and 24. Arrangements have been made for a trip of inspection of the Gary Works of the Illinois Steel Co., and other shop visits will doubtless be arranged for. The preparation of the program is in charge of E. B. Horn, secretary, 6026 Helen Ave., Detroit, Mich.

The preliminary announcement of the program of papers for the meeting includes "Costs," by J. B. Sehl, Billings & Spencer Co.; "Board vs. Steam Hammers," by Edward S. Jordan, Jordan Motor Car Co.; "Electric Furnace Heat Treatment of Dies and Forgings," by E. F. Collins, General Electric Co.; "Twenty-five years of Forging Experience," by E. A. Adams; "Wage Conditions," by Arthur A. Young, International Harvester Co.; "The Future of the Tractor Business," by James M. Irvine, Curtis Publishing Co.; and "Hot Sinking of Drop Forged Dies," by Ralph H. Tyler, the Herbrand Company.

McGraw-Hill Officer to Be Assistant to the Secretary of Commerce

F. M. Feiker, vice-president of the McGraw-Hill Co., of New York, has been appointed Assistant to the Secretary of Commerce. This event is of real significance to advertising and business interests generally. Briefly, Mr. Hoover has divided the bureaus of the Department of Commerce into two parts. Assistant Secretary Huston will supervise the Bureaus of Fisheries, Lighthouses, Navigation, etc. Mr. Hoover



FRED M. FEIKER

will give his personal attention to the Bureau of Foreign Commerce, Standards and Census. Mr. Feiker will directly assist Mr. Hoover in the expansion of these bureaus.

Mr. Feiker is a graduate of the engineering school of Worcester (Mass.) Polytechnic Institute. He was engaged in electrical research work for several years and later served in an advisory capacity with the General Electric Co. He had also been chairman of the editorial board of various engineering publications before joining the McGraw-Hill forces.

The immediate problem is to find out what kind of facts and figures industry needs from the Government by means of a series of conferences with the representative men of industry. Having organized the department to function according to the requirements, the next problem is to devise an adequate system of clearing the collected data back to business. It will be apparent at once that with Mr. Feiker's background of engineering training, viewpoint on the needs of industry, publishing experience and sense of publicity, he will be able to render unusual service.

It is Mr. Hoover's purpose to develop the Department of Commerce so that it will have the same relation to business that the Department of Agriculture now has to the farmer. In other words he feels that its function is to aid industry, not regulate or control it. Considering his intimate knowledge of foreign conditions, his masterful grasp of economic principles, and his present official position, we may take a most optimistic view of the developments in prospect.

Mr. Feiker has been granted a leave of absence from the McGraw-Hill Co.

Material Testers to Convene at Asbury Park

The provisional program for the twenty-fourth annual meeting of the American Society for Testing Materials has been announced. The testers will gather on June 20 to 24 at Asbury Park, N, J., with headquarters at the New Monterey Hotel.

Besides the various committee meetings there will be ten main sessions at which papers of unusual interest will be presented and discussed. The sessions, as arranged, are as follows: (1) Miscellaneous committee reports; (2) preservative coatings and textiles; (3) presidential address and reports of administrative committees; (4) cement and concrete; (5) road materials and concrete aggregates; (6) ceramics, lime and gypsum; (7) testing and nomenclature; (8) petroleum products; (9) steel and wrought iron; (10) cast iron, corrosion and non-ferrous metals.

List of Machinery Dealers

The Far Eastern Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., has compiled a list of importers and machinery dealers in British Malaysia. It contains all the latest information and copies can be obtained by writing to the bureau, referring to number FE—18005-A.

Business Conditions as the Big Banks of the Country See Them

Fifty Per Cent Tax on German Goods Not Satisfactory to Manufacturers in England

The London trade representative of the Guaranty Trust Co. of New York reports that the tax of 50 per cent which is being levied on the declared value of all German exports to the United Kingdom is not working satisfactorily. It has already been modified by several amendments which have made it possible for a fairly large volume of German goods to enter England. These amendments are mainly designed to permit the admission of goods contracted for before March 8, 1921, or the admission of such goods that cannot be produced or worked elsewhere than in Germany and by companies of which the capital is not less than 90 per cent British.

During the last few weeks there has been a great rush of German goods to England. Some British ports in fact have been choked with German imports which cannot be released until proof is produced that they were contracted for prior to March 8. Critics of the Reparation Act point out that it will not be a very difficult matter to evade this provision of the act regarding the German origin of the goods. There is nothing to prevent plants being established in neutral countries where machines of German manufacture may be assembled and thence sent to England. Poland, for example, might easily be used for this purpose and the goods thus assembled could be imported into England and escape the 50 per cent tax on the ground that they were of Polish origin.

At first glance the operations of the act would appear to be quite simple. The British importer pays into the British Treasury 50 per cent of the declared value of the German goods he is to buy. The importer pays this in British currency and receives a receipt which he turns over to the German exporter as representing a 50 per cent payment on the goods. This receipt is presumably good for its equivalent value in marks at the time when it is presented by the German exporter to the German government. The success or failure of the scheme, therefore, depends upon whether or not the German government will honor these 50 per cent receipts. Grave doubt already exists on this point and it is a fact that British firms are being notified by exporters in Germany that they will not sell except against payment of the full amount by checks on a German bank. The German exporter takes this stand on the ground that his government refuses to refund the 50 per cent retained for tax purposes by the British importer. Unless, therefore, some way can be found to compel the German government to refund this 50 per cent to the German exporter the British importer of German goods must either pay the tax himself or the German exporter will enhance his prices enough to cover the tax.

The Iron and Steel Trade

The Guaranty Trust Co. reports that very little business is being done in the iron and steel trades in Great Britain, and the output has fallen 40 per cent. The latest statistics available show that the number of workers had fallen in February, 1921, to 71 per cent of the number at the end of 1920, and a very large proportion of those remaining at work are on short time. The output of pig iron has been in excess of the demand, despite the fact that many furnaces have been closed down. Wages have been reduced 25 per cent in some branches of the iron industry. It is generally believed that the iron and steel trades will be confronted with American competition in the near future. Some large American steel firms have opened negotiations with Birmingham merchants with a view to shipping consignments of semi-finished material as soon as there is an improvement in the exchange.

A South Wales railway company has just placed an order for 5,000 tons of steel rails with a Belgian plant whose price was £6 per ton cheaper than that of the Welsh Rolling Mills. It was stated recently at a meeting of the London and South Western Railway that in consequence of the very high cost of British locomotives that company was purchasing American engines. It is estimated that orders to the value of £3,000,000 have been lost in England because of the inability of British makers to meet American and other competition.

Money and Markets from the Viewpoint of the National Bank of Commerce of New York

In the manufacturing countries of Europe the productive machinery is in better condition than it has been since the end of the war. Physical plants have been rehabilitated, railway congestion relieved and fuel shortage overcome. Unfortunately, under present conditions, the productive capacity of Europe, like that of the United States, cannot be profitably employed. Every country in the world has large stocks of imported merchandise awaiting absorption and in some localities stocks are so large that it is impossible to provide proper storage facilities. The absorption of this accumulation has begun, but is being retarded in the countries which are Europe's best customers because those countries are unable to dispose of their own products. This condition is further aggravated by the fact that the world-wide fall in commodity prices has affected primary commodities more than semi-finished and manufactured articles. The South American, Asiatic and Australasian communities which produce a large share of the world's raw material have had to bear the heaviest burden of price deflation, and as yet they have not recovered their commercial equilibrium.

The uncompromising attitude of British miners appears to contrast with the attitude of labor on the continent of Europe. There have been no important strikes or other labor disturbances on a large scale in the continental countries, and while further adjustments must still be made in labor conditions abroad as well as in America, the attitude of labor generally offers a basis for encouragement.

The settlement of the reparations terms was absolutely essential to the resumption of sound business. It should stimulate trade and will unquestionably have a favorable influence on business throughout the world. The rebuilding of export business must come gradually. Until present large stocks are absorbed, and a healthy demand once more established, artificial stimulation must be detrimental to the best interests both of exporters and their customers.

Railroads

The reduction of the Pennsylvania Railroad quarterly dividend from 1½ to 1 per cent was not unexpected but it remains, nevertheless, a concrete illustration of the difficulties through which railroads have been passing. Not since 1880 has the company's dividend rate been so low as 4 per cent per annum.

Encouragement may be taken from the action of the state legislature of Pennsylvania in repealing the so-called Full Crew Law, the final vote being taken the day after the reduction in the Pennsylvania Railroad dividend. This is one of the first signs of a more intelligent attitude toward the railroads on the part of state authorities. The cost of this statute to the transportation companies of Pennsylvania during the ten years during which it has been in effect is estimated to have been $40,000,000. The Full Crew Laws were among the earliest measures which resulted in forcing on the railroads uneconomical expenditures. Such laws continue in force in a number of states, with an estimated annual charge on national transportation of approximately ten times the cost of the Pennsylvania statute.

Annual Triple Session of the Supply and Machinery Dealers and Manufacturers

An attendance of over 400 members and guests marked the successful spring triple session of the National Supply and Machinery Dealers Association, the Southern Supply and Machinery Dealers Association and the American Supply and Machinery Manufacturers Association at Atlantic City, May 16, 17 and 18. Following the usual custom separate executive meetings were held by all three associations as well as general meetings in which every one participated.

The first session of the Manufacturers Association was held at ten o'clock Monday morning in the Marlborough-Blenheim. The first order of business was the president's address delivered by Charles W. Beaver, of the Yale & Towne Manufacturing Co., of New York. Mr. Beaver commented on the growing importance of world trade to the American manufacturer and pointed out that this country could not reach full prosperity while other parts of the world were practically bankrupt. He called attention also to the fact that in the past approximately one-fifth of our goods have been exported and that consequently foreign commerce must be fostered in every possible way. He stated that the best way to do this was to maintain the first quality in goods, for which our manufacturers have always been famous, and to add to that a first quality service. The unpleasant fact was also brought out that the enormous debt must be paid and that those who have the wealth will have to pay it. The president closed with the statement that we could expect a steady return of business from now on.

The annual report of the secretary-treasurer, F. D. Mitchell, was then presented and following that the reports of the various committees. The membership committee through its chairman, John C. Ruf, of I. B. Williams & Sons, Dover, N. H., reported that forty-two new members had been added during the past year. Mr. Ruf said that although his committee had been unable to live up to its slogan of a member a week he felt that under the circumstances attending a commercial depression the results attained were as good as could have been expected.

H. S. Demarest of Greene, Tweed & Co., New York, chairman of the standardization committee, quoted at length from the report of Henry R. Towne to the American Society of Mechanical Engineers on the adoption of the metric system as a national standard of weights and measures. He added a number of reasons of his own telling why the adoption of the metric system would not be advisable and altogether made a very clear case against the advocates of this radical policy. We shall hope to give Mr. Demarest's report more fully in a future issue.

At the conclusion of the committee reports the members listened to an address by Magnus W. Alexander, of the National Industrial Conference Board, on fundamental factors affecting wage and price movements. Mr. Alexander's presentation of this subject was very impressive and left those present with a good deal to think about.

The morning sessions of the other two associations were devoted to reports and other routine business dealing with other particular problems. In the afternoon a joint meeting was held at which addresses were made by: W. P. Simpson of the C. T. Patterson Co., Ltd., on "Southern Conditions"; by Melville W. Mix of the Dodge Manufacturing Co., on "Business Conditions," and by S. N. Thompson of the White Co., on "Motor Truck Transportation." For Monday evening the entertainment committee had arranged a vaudeville program followed by an informal dance.

At the session of the manufacturers association on Tuesday morning addresses were made by members of the other two associations on present problems in our industry from the dealer's viewpoint. The meeting was then turned over to Charles Coolidge Parlin, of the Curtis Publishing Co., who spoke on business of today and tomorrow. Mr. Parlin's address was illustrated by charts prepared in his department of the Curtis Publishing Co. and consisted of a logical analysis of present business conditions, showing that the present depression is due more to lack of buying willingness than to lack of buying power. Being an advertising man, Mr. Parlin naturally wound up with a few words about the power of advertising to produce business.

Tuesday morning and afternoon were devoted by the dealers associations to discussions of supply and demand, raw material and labor conditions, price tendencies and finished products, and over-head costs. The formal ball of the meeting was held in the Marlborough-Blenheim Ball Room at 9 p.m. on Tuesday and was very successful.

Abolition of Excess Tax

The final meetings were held Wednesday morning when reports of the resolutions and nominating committees were received and acted upon, and the newly elected officers were introduced. The resolutions committee of the manufacturers association offered a resolution urging the abolition of the excess profits tax and the reduction of the high surtax rates on individual incomes and also urged that every possible means of retrenchment be tried before additional taxes were imposed to make up for the ones abolished.

The second resolution set forth as the duty of all American manufacturers, and particularly of the members of the association, the support in every possible way of the reliable and worthy corporations formed under the Edge Act. Both resolutions were passed unanimously.

Officers Elected

The chairman of the nominating committee read his slate and forthwith moved that the nominations be closed. The motion was carried and the secretary cast the ballot for the following new officers of the association: President, N. A. Gladding, E. C. Atkins & Co., Inc., Indianapolis, Ind.; first vice-president, Irving W. Lemaux, Indianapolis Brush and Broom Manufacturing Co., Indianapolis, Ind.; second vice-president, John C. Ruf, I. B. Williams & Sons, Dover, N. H.; third vice-president, S. D. Baldwin, Cincinnati Rubber Maunfacturing Co., Cincinnati, Ohio. Executive committee: Joseph G. Deericks, Pittsburgh Steel Co., Pittsburgh, Pa; Dixon C. Williams, Chicago Nipple Manufacturing Co., Chicago; Edward Blake, Jr., Greenfield Tap & Die Corp., Greenfield, Mass.; A. T. Simonds, Simonds Manufacturing Co., Fitchburg, Mass., and H. F. Wright, Wright Manufacturing Co., Lisbon, Ohio; secretary-treasurer, F. D. Mitchell retained as secretary-treasurer.

The new presidents of the other associations, J. H. McKinnon of the Cameron & Barkley Co., Jacksonville, Fla., for the Southern Association, and Mr. Crannell Morgan of the Hardware and Supply Co., Akron, Ohio, for the National Association were then introduced and made a few remarks to the assemblage.

Industrial Cost Association in Conference

The National Industrial Cost Conference under the auspices of the Industrial Cost Association is being held this week at the Roycroft Inn, East Aurora, N. Y. The dates are May 26, 27 and 28.

A program of addresses and discussion covering a wide field of subjects which, however, are directly related to cost accounting in industry, has been arranged. The opening address of the conference will be delivered by J. W. Stannard, of the American Autoparts Co., Detroit, Mich., who will speak on "Post-War Changes in Economic Conditions." Other addresses are on subjects which are intended to bring out the viewpoint and opinions of various sections of the industrial world on cost accounting as applied to present business conditions. Many trade associations have signified their intention of attending the Friday sessions which have been arranged to cover their particular field.

At the dinner on Friday evening Elbert Hubbard II will be the toastmaster.

Convention of National Association of Manufacturers Features Foreign Trade

Foreign trade was the subject which predominated in importance at the twenty-sixth annual convention of the National Association of Manufacturers, held at the Waldorf-Astoria Hotel, New York City, on May 16, 17 and 18. The gathering was the largest and most successful in the history of the organization.

The program of speakers contained the names of many men of importance. The Honorable Herbert Hoover, Secretary, Department of Commerce, making his first public appearance in New York since he became a member of President Harding's cabinet, addressed the gathering at the closing session. Mr. Hoover was ably assisted on the program by such men as Simeon D. Fess, Representative in Congress from Ohio, Admiral William S. Benson, Chairman of the United States Shipping Board, and Eugene Meyer, Jr., of the United States War Finance Corporation.

The meeting of a large number of men of weight in the field of business and industry is of great import; but the convention was even more noteworthy on account of the presence of so many diplomats and representatives of foreign countries. A conference on the subject of world trade was attended and participated in by ambassadors, ministers, charges d'affaires, consuls, and other dignitaries, who are diplomatic and commercial representatives in this country of about forty foreign nations. More representatives of foreign governments attended the convention than had ever assembled in any one place in the country, outside of the national capital.

In addition to the group of foreign representatives, the National Government was represented at the conference in a Trade Advisory Section, at which there were advisers from the State Department, the Bureau of Foreign and Domestic Commerce of the Department of Commerce, the Pan-American Unions, and other administrative departments. The several Government departments were represented by special exhibits in the suite set aside for the conference.

Opening of Program

The convention opened on Monday afternoon with a session devoted both to the appointment of committees on Rules and Order, Credentials, Resolutions, Reception, and Foreign Trade, and to the reports of the standing committees on Immigration, Industrial Betterment, Health and Safety, Open Shop, Regulation of Combinations, Patents, Taxation and Merchant Marine. In the report of the committee on Open Shop, which committee is under the chairmanship of Clarence E. Whitney of the Whitney Manufacturing Co., Hartford, Conn., an open shop was defined as "a shop in which workmen are employed without respect to their membership or non-membership in any lawful organization operating in a lawful manner."

Monday evening's session was devoted to addresses, Jules S. Bache, of J. S. Bache & Co., speaking upon the subject of "Upbuilding of Business Dependent Upon Future Taxation Policy," Frederick A. Wallis, Commissioner of Immigration for the Port of New York, upon "The Immigrant, an Economic Problem," and Wm. McClellan, president of the American Institute of Electrical Engineers, upon "Public Utilities and Their Relation to Industry." Mr. Bache dealt with the depressing effect of present taxes on business, and he favored the sales tax as a remedy for the revenue problem. Among his statements was the following:

Favors Sales Tax

"The sales tax, if enacted and placed on the statute books of the United States, will, with the exception of the money raised through customs duties and the tobacco tax, be the only honest tax in its application and its results that we have on these statute books. It will be honest for two reasons because every cent collected under it will go to the United States Treasury, and, above all, because it states in its initiation that it is a consumption tax, pure and simple, paid in totality by the ultimate consumer, while the other taxes are consumption taxes, thinly or wholly disguished, but nevertheless consumption taxes."

Mr. Wallis went exhaustively into the operation of the immigration laws, conditions past and present at Ellis Island, the classes and character of immigrants received there, and incidentally, he spoke in condemnation of the treatment of immigrants by some marine and railroad transportation lines. The problem, which is "the immigrant himself, not immigration," said Mr. Wallis, "can be met, both socially and economically, by scientific selection, intelligent distribution and broad assimilation." Among the Commissioner's statements were:

"Revision of the system of handling these people is needed before this nation can be assured of getting the better class of immigrants. Some method of preferential selection must be immediately put in operation at the ports of embarkation. I believe that 90 per cent of the 'culling' out process could be done on the other side at the ports of embarkation. It is said that the other nations would not permit us to come to their shores and pick the desirable from those seeking emigration to this country. If this policy were adopted either through diplomacy or legislation or both; I believe it would only be a short time before public opinion in those countries would so assert itself that the nations would be asking us to send our doctors and our inspectors to their ports. Inspection over there is infinitely better than rejection over here."

On Tuesday morning the annual address of the president was given by Stephen C. Mason. After expressing his sense of the importance of the present convention because of the large number of representatives of foreign countries present, and the value of their counsel in the solution of the present economic problems, Mr. Mason considered conditions in the business world and the means of remedying some existing evils. Among his statements should be noted:

"A great deal depends, however, upon our industrial success in arriving at a basis of lower cost and quantity production. Workmanship and skill, I firmly believe, ought to rank higher in both industrial operation and in the eyes of public opinion than membership in a union. Our people must, at once and for all time, abandon the idea that wealth can be created merely by expanding credit to suit our fancies, and once again return to the well established truth—that wealth can only be made by efficient, abundant and economic production."

Mr. Mason was followed by Henry Abbott, treasurer of the association, and George S. Boudinot, secretary, both of whom rendered reports.

Conference of Foreign Representatives

The afternoon session on Tuesday was presided over by His Excellency J. J. Jusserand, Ambassador of France, and it was devoted to addresses on world trade by representatives in the United States of foreign countries. The speakers were as follows: Augusto Cochrane de Alencar, Ambassador of Brazil; Dr. Carlos Adolfo Urueta, Minister of Colombia; Dr. Rafael H. Elizalde, Minister of Ecuador; Sadigh-es-Saltaneh, Minister of Persia; Jonkheer W. H. de Beaufort, Charge d'affaires of the Netherlands; W. T. Munthe de Morgenstierne, Commercial Adviser, Legation of Norway, and Dr. Charles Bruggman, Secretary of the Legation of Switzerland.

On Tuesday evening another session on world trade was held, the honorary chairman being Senator Vittorio Rolandi Ricci, Ambassador of Italy. The speakers were Senator Ricci; Dr. Julio Bianchi, Minister of Guatemala; Armas Herman Saastamoinen, Minister of Finland; John Boyce Broderick, Commercial Counsellor of the British Embassy; Georg Bec', Consul General of Denmark; Don Alejandro Berea, Consul General of Spain; and Iuming C. Suez, Consul of the Republic of China. Sen-

ator Ricci presented a practical discussion of the present state of the industries of his country. He said that, "While Italy has not escaped the effects of phenomena general throughout the world, such as high costs of raw materials, fuel and building, she faces the crisis without need of foreign help or credits." Regarding the steel and machinery industry, he said, "The work in the majority of the branches of this industry is limited by difficulty in disposing of the finished product. This difficulty is due, partly at least, to successful foreign competition. All those branches of this industry working on government orders, such as those producing railroad material, rolling stock, and the industries for the production of electric material, machinery, and appliances, are working to their full capacity."

Mr. Suez spoke of methods by which America may develop her trade with China, stating that the United States needs a strong central organization to study the needs of China and to meet them, if we would capture that market or even hold what trade we have gained during the past war. Dr. Bianchi covered very well the subject of relations between U. S. and Latin America.

The session of Wednesday morning was the last one devoted to addresses of diplomatists. Addresses were made by the following: Frederico Alfonso Pezet, Ambassador of Peru; Prince Casimir Lubomirski, Minister of Poland; Prince Antoine Bibesco, Minister of Roumania; Dr. Slavko Y. Grouitch, Minister of the Serbs, Croats and Slovenes; Dr. Bedrich Stepanek, Minister of Czechoslovakia; Capt. Axel F. Wallenberg, Minister of Sweden; Dr. Don Santos A. Dominici, Minister of Venezuela.

Mr. Pezet declared that his country wanted goods from the United States, but was not able to pay inflated prices for them. He believes the United States financiers and statesmen should arrange to see that certain of the other American republics are properly financed. Among Dr. Grouitch's statements, the invitation to American capital to the Serb-Croat-Slovene State is interesting.

The summary of the opinions of the foreign dignitaries was that closer contact and increased trade between their countries and the United States would be to our mutual advantage.

American Viewpoint

The American viewpoint on world trade was brought out in the afternoon session on Wednesday. Eugene Meyer, Jr., managing director of the United States War Finance Corporation, spoke on "A Missing Link in International Finance and Its Relation to the Market for American Manufactures." He said, "The missing link I have in mind is a properly established market for international securities—that is, for securities having free, broad, public markets in the United States and in foreign countries.

"If there is any idea that in the future we are going to play a larger rôle as a financial center in this world situation than we have in the past, we must determine to establish an international security market in this country. And let us remember that merely the dollar obligations of the foreign borrowers, no matter what the quantity may be, will not make an international security market. We ought to have here securities which are readily marketable in other countries. The speculative investor, above all things, wants a market, an active market and a public market. If the resources of the speculative investor are to be availed of for the general situation and in the general interest, and if bankers consider that these funds are worth obtaining, it would seem appropriate that the facilities of our great public markets should be used as their officials would be glad to have them used. The stock exchanges, I understand, are anxious to furnish their facilities in connection with sound business that seems to be in the public interest. The long term funds must come from the investors; the short term money ought to come from the banks and bankers; and the sooner we can enlist investment funds on a sound basis, the better."

Hoover Talks

The convention closed with a banquet on Wednesday evening. The principal speaker was the Honorable Herbert Hoover, Secretary of the Department of Commerce of the United States. Mr. Hoover defended the "open-door" policy in world trade, and he asserted that the U. S. was willing and ready to adhere to that policy, as she has done. The future peace of the world, as well as its economic readjustment, is being menaced by some nations who are striving for domination, declared the Secretary. Some of his remarks are as follows:

"It is my purpose tonight to call your attention to the fact that there is a rapid drift in many countries away from these foundations and that it has a direct reflect upon us and upon many other countries who adhere with us to these beliefs. It arises, first as the pre-war offspring of the class governments of Europe driving for nationalistic domination; second, from continuation of the rigid contradictions at the hands of government during the war; third, from the economic desperation growing out of the war. There are many of these growths and tendencies that make for the direct or indirect closing of the open door, the reductions of equality in opportunity.

"If these tendencies are to continue into large realities, sooner or later those states which shall hold the open door and equality of opportunity will be at the parting of the ways from these policies. We do not have in the United States today a combination of exporters able to control the distribution or price of a single export commodity; we have no combination of importers to control the price of produce from abroad; we have no combinations of capital that can, by unfair competition, crush the energies of other nationals. We have sought no exclusive concessions of the resources of other peoples; we have admitted all nationalities to exploit our raw materials and resources on the same terms as our citizens.

"But if great trusts are to grow up abroad that by weight of wealth can crush the individual trader, if the control of our agricultural produce by combinations of buyers is to be attempted, if our people are not to be allowed the development of the natural resources of other countries on the same terms as the citizens of those countries have in ours, if nations are to put their strength behind the finding of exclusive concessions to exploitation first in one country and then another in effectual closing of the open door, if governments are to find capital with which to stimulate domination of the world's raw material—then the public opinion of this and other open countries will demand advantages to their citizens of the same order. We want only that share of the world's commerce that our citizens can secure without special privilege.

"It would indeed be a fateful day in the history of the world if it abandons these basic policies of the open door and equal opportunity. It means the irresistible pressure to exert intolerant national strength; it means the enforcement of this strength by the weight of government, which means armies and navies; it means a long sequence of reprisals, of favored nation classes, of reciprocity arrangements, of discriminations through which the weak always go to the wall and the strong always win.

"This is indeed not a threat, it is not an announcement of a national policy. It is a plea that the world should 'stop, look and listen,' for if the day comes when the United States with her gigantic resources and the intelligence of her people, shall be forced to enter upon those courses in her own protection, it will be a day of infinite losses to real progress and real liberalism."

"The American Merchant Marine as an Aid to World Development," was the subject of Admiral William S. Benson, Chairman of the U. S. Shipping Board. Admiral Benson reported material progress in the adjustment of the labor situation, despite the grave issues which had been faced during the past few weeks.

Simeon D. Fess, Representative in Congress from Ohio, was the last of the speakers on the program.

The newly elected president of the association, J. E. Edgerton, of the Lebanon Woolen Mills, Lebanon, Tenn., outlined the policy of the organization for the coming year. The other new officers are: Vice-president, William H. Barr, National Founders Association, Chicago, Ill.; vice-president and general manager, J. P. Bird, National Association of Manufacturers, N. Y. City; secretary, George S. Boudinot, National Association of Manufacturers, N. Y. City, and treasurer, Henry Abbott, Calculograph Co., N. Y. City.

Washington Notes

By Paul Wooton
Washington Correspondent

Ordnance officers to be trained in the future are to be schooled particularly in the duties connected with overseeing production in factories and with the making of contracts. One of the weak points of our military and industrial organization disclosed during the World War was the fact that ordnance officers had too little knowledge of factory practice, and the manufacturers, including superintendents and other members of their factory staff had too little knowledge of the requirements for ordnance. Major General Clarence C. Williams, Chief of Ordnance of the army, is concentrating his attention at this time on plans for officers' training camps. He emphasizes the need for training men to superintend production and to handle the highly important contracts it is necessary to make with industry.

General Williams is much concerned with the need for the army to keep abreast of mechanical development. He points out that mechanical development is progressing now at a much faster rate than it was at the close of the Civil War. The mechanical equipment of the army used in the World War will become obsolete in fewer years than did the mechanical equipment in use at the end of the Civil War. For that reason he is very anxious to keep up the research work being done by the Ordnance Department and to maintain a sufficient volume of manufacture at the arsenals to accomplish that end.

Just at the present time General Williams is interested in the development of the mechanical transportation of artillery by motor vehicle. Just as mobile guns on railway carriages have revolutionized coast defense in that they have largely supplanted guns on fixed mounts, General Williams believes that effects even more far-reaching will result from the increased possibilities of mobile artillery on automotive mounts. He believes the time is not distant when guns as large as those of eight-inch caliber will be handled with great facility wherever motor vehicles can go.

Oppose Tax on Trucks

Several representatives of the automobile industry have appeared before the Senate Committee on Finance to emphasize that the automobile industry is the heaviest burden bearer of the present tax load. In pointing out that the industry is taxed more than is any other, it was shown that there are five main levys on it, as follows: National and State income tax, common to all industries; sales tax, limited to automobiles and a few other industries; taxes on repair parts, a permanent charge on the life of every automobile, a tax specific to the industry; State license and registration fees; scattering municipal and personal property taxes.

It was pointed out to the committee that there are no federal sales taxes on other units of transportation, such as steamships, locomotives, trolley cars and horse-drawn vehicles. Attention was called to the fact that the motor truck is the farmer's private short-haul transportation line. The definite need that the truck is filling in agricultural sections is indicated by the fact that Iowa registered 29,800 motor trucks during 1920, an increase of 110 per cent over the preceding year. Throughout the country last year 5,000,000 head of live stock were hauled to the market by motor truck. These and other important facts were brought to the attention of the committee, which now is considering tax revision.

Weights and Measures Conference

The principal items making up the program for the fourteenth annual conference on weights and measures, May 23 to 26, in Washington, are as follows: The Weight Problem in Interstate Commerce; Destination Weighing of Coal; Enforcement of Law Providing for the Marking of the Weight on Wrapped Meats; Bread Legislation from the Baker's Standpoint; Bread Weight Legislation in Illinois; Enforcement of Bread Weight Legislation; Testing of Mine Scales; Testing of Liquid Measuring Devices; Standardization of Containers for Foods; Net Weight Marking on Packages of Commodities Other Than Foods; Proper Equipment for Testing Wagon and Automobile Truck Scales; Proper Sealing of Commercial Weighing and Measuring Apparatus; Uniform Bushel Weights.

The metric system bill now before Congress is to be formally discussed as is the "slack-filled package" bill.

Compulsory Standardization

The bill to fix standards for hampers and other types of baskets has been reported favorably to the House of Representatives by the Committee on Coinage, Weights and Measures. While this bill, of itself, is not of interest to the machinery industry, it is of significance in that it shows the tendency on the part of the committee and on the part of Congress to standardize in the matter of weights and measures.

Foreign Notes

During the last few days of April the first American locomotives (of the Baldwin works) 150 in number—ordered by the Roumanian government, arrived at the port of Constantza, on the Black Sea. How badly these engines are needed may be gathered from the following remarks. All over Roumania the railroad traffic is nearly at a stand. For a net of about 15,000 kilometers there are scarcely 300 engines available. If the present situation does not improve in the very near future the crisis must lead to untenable conditions. The government has tried to meet these difficulties by inviting foreign capitalists to take charge of the locomotive and other workshops of the state railways. Two foreign concerns, the French Vulcan Works and the British Garvens Co., have accepted this proposition and will take charge of the establishments. These two firms have engaged themselves to build within a period of seven years 2,500 locomotives, 1,500 passenger cars and 15,000 freight cars. After a certain number of years, that is to say after the country possesses at least 5,000 locomotives, the above works will be turned over again to the Roumanian state. In connection herewith it may be added that railroad conditions are not much better in any of the other Balkan states. Servia, Bulgaria, Greece, Turkey, etc., are suffering from similar conditions. All those countries offer a valuable market for American machinery.

On the occasion of a visit paid the Basle Fair the Mexican Consul General at Berne, Señor Barreda, declared that Mexico was anxious to establish closer commercial relations with Switzerland and that his country was especially in the market for all kinds of machinery of Swiss origin.

Communism in Italy

The Italian press publishes some interesting data about the breakdown of a communistic enterprise. The following abstract may be of interest to the readers of the *American Machinist*:

On April 1, 1920, a company styled "Co-operative Garibaldi," was formed at Genoa. The Italian government (Nitti) placed a shipping tonnage valued at 60 million lire at the disposal of the company, exempt from any interest. The superior principle of the company, the members of which included seamen of all grades, was: highest wages, least work, comfortable rooms and best kitchen. Faithful to the communistic ideas all ships of the company had double the crew of other ships of the same size. Large cabins, comfortable dining and smoking rooms were built on board, in consequence of which the space for cargo was very limited. Arriving at a foreign port the ships remained there until it happened that some freight was offered. Today, exactly one year after, the company is indebted to such an extent that even wages cannot be paid any more. After this experience the "administration" has decided to dissolve the company.

Switzerland Gets Orders

The Bulgarian government has entered into an arrangement with Swiss capitalists and manufacturers, according to which all locomotives of the Bulgarian state railroads will be repaired in Switzerland, where also considerable orders for all kinds of machines and tools will be placed. One-third of the amount to be paid for the repair work and purchases will consist of Bulgarian corn supplies.

Beginning Jan. 1, 1921, railway, freight and passenger fares in Victoria, Australia, were increased 18 per cent, as a result particularly of the increased cost of coal, according to an announcement in the Melbourne *Argus*.

Dr. Edward B. Rosa, Noted Scientist, Dies

Dr. Edward Bennett Rosa, chief physicist of the United States Bureau of Standards, died suddenly in his office in the bureau on May 17.

Dr. Rosa had done notable work in electrical research. He was born in the scientific field, and particularly in electrical research. He was born in Rogersville, New York, Oct. 4, 1861. After graduating from Wesleyan University, Middletown, Conn., in 1896, he entered Johns Hopkins University, Baltimore, and received the degree of Doctor of Philosophy. Serving for short periods as instructor at the University of Wisconsin and as professor of Physics at Wesleyan, he became the chief physicist of the Bureau of Standards in 1901.

One of his first achievements was to develop the physical side of the respiration calorimeter with Professor W. O. Atwater, at Wesleyan. This apparatus was of great value in the pioneer investigations of the value of foods.

With Dr. Dorsey as collaborator, Dr. Rosa in 1907 began work on the determination of the ampere which has been perfected until it is now possible to define the ampere in a satisfactory manner. With Dr. Grover he collected practically all the known formulas for computing inductions. This collection is known throughout the world as a model.

Another achievement was to definitely establish the laws governing electrolytic corrosion, a problem of major importance to public utility companies, particularly those operating underground gas and water pipes and electric railways.

In the World War, Dr. Rosa developed a number of scientific instruments of great value to the American forces in France. Among these were a sound ranging device for locating big guns, the geophone for detecting mining operations, the development of aircraft radio direction finders by which enemy ships and aircraft could be located. Under his direction the Bureau of Standards has established what is perhaps the finest radio research laboratory in the country. Dr. Rosa has also perfected devices to insure safety devices in industrial plants.

He was a member of several notable scientific societies including the National Academy of Science. In March, 1894, Dr. Rosa married Mary Evans, of Harrisburg, Pa., who survives him.

Three hundred furloughed employees of the Pennsylvania Railroad in Ft. Wayne, Ind., returned to work May 9 after a period of idleness of more than two months. Employees of the machine shop, the erecting department, copper shop, blacksmith shop, boiler shop, paint and cab departments are included in those called back to their jobs.

France and French Possessions To Receive a Proportion of the Value of Imported German Goods

The French "Journal Official" for April 22 contains a law, dated April 21, which provides that importers of German goods are to pay to the French treasury a proportion of the value of such goods, to be fixed by decree, but not to exceed 50 per cent. The receipt for the sum paid is to operate as a discharge as against the person to whom the purchase price of the goods is due. The law defines "German goods" as: (1) All goods which are regarded, for Customs Tariff purposes, as of German origin; (2) all goods produced, manufactured or worked up in a country other than Germany, but in which German elements (raw material, working up, etc.) account for 50 per cent or more of the value.

The provisions of the law do not apply to foods sent in transit, or deposited in bonded warehouse; or to goods ordered from German firms before March 8 last and wholly or partly paid for before that date. General exemptions from the operation of the law may be granted by a Ministerial Committee in consideration: (1) Of the nature and kind of goods; (2) of the conditions or place of production or manufacture; (3) of the importation of goods under the "temporary importation" regime; (4) of the restoration of the devastated districts (when goods are imported under prescribed conditions); (5) of the provisions of Article 68 of the Treaty of Peace (relating to imports into Alsace-Lorraine).

Individual exemptions may also be allowed in respect of contracts in course of execution.

The law extends to Algeria and to French colonies and possessions, and steps are to be taken to apply it also in French protectorates.

New York State to Train Vocational Teachers

The State of New York is developing a broad program of industrial and technical education as a part of the public school system. The state is selecting each year twenty-five men from the trades and technical occupations and providing them with a scholarship of $1,000. The men selected spend one year in a teacher training institution preparing to teach their specific occupations.

The University of the State of New York is offering twenty-five scholarships to qualfied trade and technically trained persons who desire to prepare themselves for teaching. Persons selected to hold these scholarships who satisfactorily complete the prescribed one year resident industrial teacher training course are licensed for life to teach their specific occupations in the vocational schools of the state. The salaries paid vocational teachers now range from $1,800 to $3,500 per annum.

Spring Meeting of the Taylor Society

The spring meeting of the Taylor Society was held at the Hotel Statler, Cleveland, Ohio, May 19 to 21. After the addresses of welcome by Alexander C. Brown, president of the Cleveland Chamber of Commerce, and Richard A. Feiss, vice-president of the Taylor Society, the sales executive session was opened with W. C. Dunlap, vice-president of the American Multigraph Co., presiding.

The methods of compensating salesmen were discused by C. K. Woodbridge, sales manager of the Dictaphone department of the Columbia Graphophone Co., and by Charles J. Crockett, Prof. Harry R. Tosdal, W. C. Dunlap and others.

At an administrative officers' session, with D. C. Mills, chairman of the board of the Federal Reserve Bank of Cleveland, presiding, the value of an index number of physical production to administrator and manager was shown by Carl Snyder, statistician of the Federal Reserve Bank of New York, and discussed by Col. Leonard Ayres, Dr. N. I. Stone, E. W. Hulet and others. The plan endeavors to make possible more exact information concerning general business conditions.

The second or plant managers' session, was devoted to a study at first hand of a plant in which scientific management has been applied in many, if not all departments. The plant was the Clothcraft shops of the Joseph & Feiss Co. After a short preparatory address by Richard A. Feiss, manager of manufacturing, Keppele Hall, superintendent of planning told what to look for in going through the plant.

Opportunity was given to see all the departments and processes. A visit to the recreation grounds was followed by a luncheon in the shop restaurants, as guests of the company. Then the visitors were divided into groups in accordance with their special interests, each group having as a guide the head of that department or process. These included: employment and service; general planning; routing and assignment; time study; supply and storage; and others.

Two other sessions were held, one on personnel administration and the other on industrial relations. The former was presided over by Morris A. Block, of the H. Block Co., the latter by William G. Lee, grand chief, Brotherhood of Railway Trainmen. At the former session performance ratings and bonuses for salaried employees was discussed by Howard G. Benedict, while Morris L. Cooke took up the subject of unemployment scores. The session on industrial relations consisted of a symposium on joint action of employees and management in establishing standards, tasks, rates and other standard conditions. The various angles were presented by John M. Cormody, production manager, H. Block Co.; Meyer Perlstein, vice-president, International Ladies' Garment Makers' Union; W. R. Basset, of New York.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Trailer Car, Scoop-Body

Easton Car and Construction Co., 50 Church St., New York, N. Y.

"American Machinist," Feb. 24, 1921



The body is mounted on a structural-steel turntable and may be dumped from any one of the four sides. The wheels are equipped with roller-bearings. The low height of the car makes it convenient for hand loading. The car can be used for handling such materials as sand, coal, castings, cinders and metal chips. It is equipped with flat-tread instead of narrow-gage-track wheels, not being confined to the limits of a track system. It can be handled by one man, where single cars, either hand-pushed or pulled, can be employed. The capacity of the car is 27 cu.ft.

Block, Size, Adjustable

M. B. Hill, 10 Eden St., Worcester, Mass.

"American Machinist," Feb. 24, 1921



The block is adjustable in size and intended for use in setting cutting tools to height above a surface. It is made of carbon steel, hardened and ground all over, and the sliding surfaces are lapped. In the inclinded surface of the larger piece is a T-slot, in which slides a small T-head stud that extends up into the hollow sliding member. A tapered hole in the upper end of this stud receives the correspondingly pointed end of the knurled-head screw, a turn of which serves to clamp the sliding member in any position. The setting is, of course, measured by means of a micrometer over both members.

Platform, Lift-Truck, Pressed Steel

Powell Pressed Steel Co., Hubbard, Ohio

"American Machinist," Feb. 24, 1921

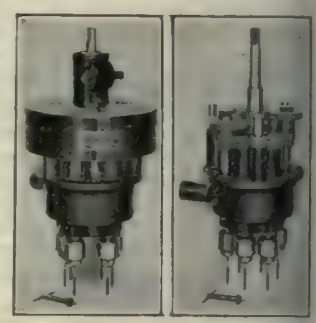


The platform is made of one piece of sheet steel and is formed by a cold process, which sets the material to the form required. The height, or inside clearance, of the platform is generally from 6½ to 12 in. The corrugations used to strengthen the platform are 1½ in. wide by ¾ in. deep and spaced at 6-in. centers. It is stated that a platform made of No. 9 gage steel will easily carry from 15,000 to 20,000 lb., and may be overloaded considerably, that the life of a platform is practically endless, and that no repairs are required. Racks or boxes may be built onto the platform, and to provide a large flat top a sheet-metal plate is spot-welded to the top of the platform.

Head, Tapping, Multiple-Spindle

John H. Dorman & Son, 5148-52 Hudson Blvd. West, West New York, N. J.

"American Machinist," Feb. 24, 1921

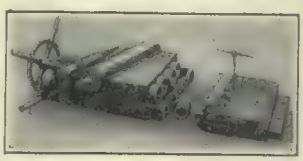


The device is intended for tapping simultaneously six holes grouped together, the holes not lying on the circumference of the same circle. The head at the left is completedly assembled, while the housing has been removed from the head in the view on the right. The gears driving the tapping spindles are compounded, the driving spindle carrying two gears of different sizes. In this way the taps can be given the same speed of rotation, although they are placed at different distances from the center line of the driving spindle. It is possible also, to vary the speeds of the different spindles by means of the gearing, so that taps of different pitch can be used at the same time. The direction of rotation reverses automatically when the head is raised.

Centers, Fluting, Multiple-Spindle, No. 2½

Miller & Crowningshield, Greenfield, Mass.

"American Machinist," Feb. 24, 1921



The device is intended for use on the table of a milling machine when fluting taps or reamers, and it consists of an indexing head and a tailstock. It can be furnished with either three or four spindles, the same range of work being handled in each case. The spindles can be turned simultaneously in the same direction by means of the crank. The indexing for any number of flutes up to 20 can be done by means of a single full turn of the indexing handle, change gears being provided to vary the ratio. The spindles are clamped simultaneously by means of one handle. The tailstock is separate from the head, being made either solid or with separate vertical adjustment for each center. Either round or square stock can be held.

Chuck, Universal, Drilling Machine

John Chuck Co., Milwaukee, Wis.

"American Machinist," Feb. 24, 1921



The device is intended to be used for holding work while performing such operations as drilling, milling, grinding and tapping, being employed chiefly on the tables of drilling machines. False jaws are made to conform to the work. An adjustable arm is furnished to hold the stop. The jaws are operated by means of a right- and left-hand screw, thus being self-centering. The screw is of high-grade steel and provision is made for takng the end thrust. A handle is provided, by which the screw can be operated from either end of the chuck. The body and crossheads of the chuck are made of cast iron. Provision is made for taking up the wear on crossheads. Extension bases can be furnished for long work.

Charger, Storage Battery, Automatic, for Electric Industrial Vehicles

Acme Electric and Manufacturing Co., Cleveland, Ohio

"American Machinist," Feb. 24, 1921

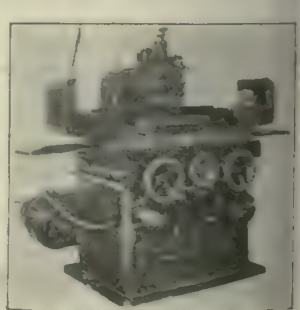


The device is intended to charge the battery at the rate recommended by the battery manufacturer. The charger takes up a little more than a square foot of floor space. Its motor is built for heavy service, and the generator is constructed to suit the battery. The shaft is one solid piece, rotating on ball bearings, the dynamically balanced armature and rotor both being mounted on it. The commutator has a large radiating surface and maintains a low operating temperature. Cool operation is afforded by a Sirocco-type fan, which ventilates the machine by drawing air through the windings. An automatic operating panel accompanies the charger. It is made of rubber-finished electrical slate mounted on an angle-iron frame, and contains the instruments and switches.

Grinding Machine, Surface, High-Duty, Type C

Diamond Machine Co., 9 Codding St., Providence, R. I.

"American Machinist," Feb. 24, 1921



The machine is intended to do small work, although it can handle pieces up to 10 in. wide, 24 in. long and 8 in. high. It is made much heavier than the usual small surface-grinding machine, so that rigidity and freedom of vibration may be obtained. The machine has individual motor drive, the motor being a component part of the machine and standard in all respects. The wheelhead is cast integral with the vertical column, the combined column and head being adjusted vertically to suit the thickness of the work. The ways are completely covered by metal guards. The traverse is automatic, and adjustable from 0.001 to 0.020 in. per stroke.

Clip, paste on 3 x 5-in. cards and file as desired

Business Items

The Brown Hoisting Machinery Co., of Cleveland, Ohio, announces the opening of a southern office in the Whitney-Central Bldg., New Orleans, La. The states of Texas, Louisiana, Mississippi, Alabama, Georgia and Florida will be covered from this office. Charles H. White, manager of the new office, has been with the Brown company for a number of years, and is an experienced sales engineer on all types of Brownhoist products. Among these are locomotive cranes, buckets, electric hoists, trolleys and a wide range of cranes and hoists. Other branch offices of the company are located at New York, Pittsburgh, Chicago and San Francisco.

The Air Reduction Sales Co., New York City, has secured control of the National Carbide Corporation, of Virginia, with a new plant at Ivanhoe, Va., and beginning May 1 will direct the policy and control the operation and sales of that corporation. The Carbide produced at the new plant will be marketed in the future as "Airco Carbide" through the chain of Airco distributing stations.

The Modern Tool Co., Erie, Pa., announces arrangements whereby the E. L. Essley Machinery Co., 551-557 Washington Blvd., Chicago, Ill., becomes the exclusive selling agent in Chicago territory for Modern plain and universal grinding machines.

The Detroit office of the Black & Decker Co. (Baltimore, Md.), has been moved to 27 Watson St. C. G. Odell is in charge of this branch.

It is understood that Armstrong, Whitworth of Canada, Ltd., contemplate closing the entire works at Longueuil, Canada. The reason given is the failure of the Dominion government to provide tariff protection on the manufacture of locomotive steel tires, which is the chief product of the company.

Alfred Herbert, Ltd., Coventry, England, has moved its New York City office from 54 Dey St., to 50 Church St., room 275, the change becoming effective on May 1.

The Lancaster Iron Works, Inc., of Lancaster, Pa., has recently purchased the electric furnace business of the F. T. Ryan & Co., of Philadelphia, Pa. The Ryan company will handle all furnace business in the future from the Philadelphia office.

The Crane Company, Bridgeport, Conn., has awarded the contract for remodelling and enlarging its boiler house, to the T. J. Purdue Construction Co. The work will be arranged so as not to interfere with the regular operation of the plant. It is said that the cost of the work will reach $125,000.

The Master Motors Corporation, now located at Saginaw, Mich., will locate in Erie, Pa., as soon as a suitable plant has been erected. The concern was recently incorporated under the laws of Delaware, with a capital stock of $2,500,000. D. H. Palmer, Erie, Pa., is president.

The Dana Machine Co., Providence, R. I., has recently been incorporated under the laws of the State of Rhode Island, to engage in the machinery business. The capital stock of the company is $1,000,000, and the incorporators are: W. Irving Bullard, of Danielson, Conn.; P. LeRoy Harwood, of New London, Conn.; Frank I. Dana, of Providence, R. I., and F. R. Wheelwright, of Providence, R. I.

The Columbus Machine Works, the oldest manufacturing establishment in Columbus, Ind., has doubled its capitalization, raising it from $25,000 to $50,000. The company recently added a pipe threading machine to its manufacturing products and the increase in capitalization has been made to finance the increase in business caused by this product. The company was established forty years ago and Frank P. Boyd is the present general manager.

The Chrobaltic Tool Co., an Illinois corporation, has started a branch in Indiana, located in Michigan City. The company recently filed papers with the secretary of state showing a total of $25,000 of its capital stock was held in Indiana. C. H. Cannon, of Michigan City, is named as the Indiana agent.

The Black & Decker Manufacturing Co., Baltimore, Md., announces that the New York branch office, formerly at 141 Broadway, is now located in the Printing Crafts Building, Eighth Ave. and 33rd St. In order to co-operate more closely with jobbers in this territory, a service station has been established there, with a factory-trained mechanic in charge. A complete stock of parts will be carried and prompt efficient service will be offered to all users of Black & Decker products. G. R. Lundane, who is well known in the trade, is manager of the New York territory and is assisted by E. I. Firestone and R. T. Watts.

At the first annual meeting of the Kelly Reamer Co., Cleveland, Ohio, held on April 16 in its new plant, the retiring board of directors was re-elected for the ensuing year. They are: H. C. Putnam, president and general manager; W. A. Calhoun, vice-president; H. W. Strong, treasurer; A. C. Carter, secretary; G. H. Moore, assistant secretary; J. M. Davie, chief engineer. This company recently increased its capital stock from $60,000 to $250,000 and all shares offered were taken up by the present stockholders. An opportunity was afforded all the stockholders to inspect the new plant and the additional equipment which has recently been installed.

At a recent meeting of the board of directors of the Homestead Valve Manufacturing Co. at Homestead, Pa., a resolution was passed to increase the capital stock from $500,000 to $1,000,000.

The Slick-Knox Steel Co., Sharon, Pa., with factories in Elwood City and Wheatland, Pa., has been reorganized. The new name is the Sharon Pressed Steel Co. and the officers are: President, Harry W. Torney of Torney & Co., Inc., New York; vice-president in charge of sales, Albert W. Morris, formerly of the Harley Co., Springfield, Mass.; vice-president in charge of manufacture, Arthur E. Swan, formerly of the Crucible Steel Co., Harrison, N. J. The Sharon Pressed Steel Company's plants cover an area of approximately thirty acres and are equipped to make automobile and truck frames, pressed steel automobile car and boat parts and fittings, hot and cold pressings, hot and cold hydraulic forgings and disk wheels.

The Missouri Car Co., Central National Bank Building, St. Louis, Mo., will establish a machine plant for the manufacture of electric railway cars. The minimum output will be about 600 per year. All the machinery will be direct driven.

The Alabama Mica and Manufacturing Co. of Maryland is erecting a manufacturing plant at Anniston, Ala., for the purpose of grinding and cutting mica. The mica is mined on the company's property of 200 acres of valuable mica land in Randolph County, Ala. The officers of the company are Harry H. Wand, Chattanooga, Tenn., president; Hugh Brown, Chattanooga, Tenn., vice-president; J. Albert Tapley, Anniston, Ala., secretary and treasurer.

David A. Wright, machinery and equipment, 568 Washington Blvd., Chicago, Ill., moved on May 1 to a new location at Jefferson and Monroe Sts. The new show room will have approximately four times the space now occupied, with seven large windows. In addition the firm has a warehouse and factory where a large stock of machinery is stored and rebuilt. This plant is equipped with machinery for rebuilding machine tools.

The Dale Machinery Co. of Chicago, Ill., has been made sales agents for the Chicago territory for the combined Reed-Prentice Co., Worcester, Mass., the Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass., and the Becker Milling Machine Co., Hyde Park, Mass.

Normoyle & Lapp of Philadelphia, Pa., with offices at 514 Liberty Bldg., has been made sales agent in the eastern Pennsylvania territory for the combined interests of the Reed-Prentice Co. and the Whitcomb-Blaisdell Machine Tool Co., both of Worcester, Mass., and the Becker Milling Machine Co. of Hyde Park, Boston, Mass.

The Johnson-Thompson Foundry Co., which has been constructing a new plant in Birmingham, Ala., has taken out an additional building permit calling for additional construction to the amount of $20,000. The original permit was issued some months ago and work has been in progress on the plant since that time.

Condensed-Clipping Index of Equipment

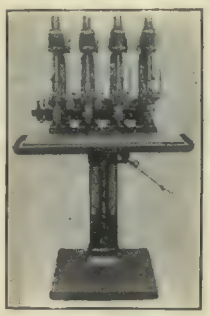
Patented Aug. 20, 1918

Threading Machine, Two-Spindle, ¾-In.
Geometric Tool Co., New Haven, Conn.
"American Machinist," March 3, 1921



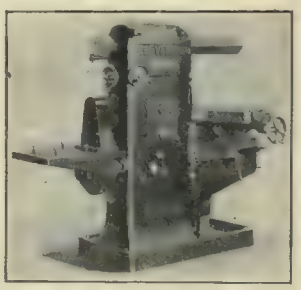
The bed of the machine carries two spindles, which are mounted in large bronze bearings. The spindles are driven by a single pulley, located at the rear of the machine, but may be operated and controlled independently by means of the change gear levers at both sides of the machine. The speeds are indexed according to the size of work being handled, but may be varied. Both spindles may be fitted with die heads for external threading, or may be fitted with taps for internal threading. Or, one spindle may carry a die head and the other may carry a tap. Each carriage is fitted with a two-jawed chuck operated by a hand-wheel. A single-geared pump forces oil through the spindle and die head against the work. The machine will cut U. S. Standard thread to ¾ in. in diameter.

Drilling Machines, Sensitive, High-Speed, "Pecorp"
Providence Engineering Corporation, Providence, R. I.
"American Machinist," March 3, 1921



The machine was formerly made by the A. C. Mason Co., Inc., Paterson, N. J. It is built in both bench (Model E) and floor (Model F) types and with either one, two, three, four or six spindles, the illustration showing a multiple-spindle floor-type machine. It is fully equipped with ball bearings, and the bearings and moving parts are covered, the only visible rotating parts being the driving pulley and the nose of the spindle. The spindle is provided with a device for retaining the lubricating oil, a reservoir being incorporated in the sleeve. Oil which has passed through the lower bearings on the spindle is caught, when thrown outward, by the interior surface of the non-rotating sleeve, and then drops downward from the bottom of the sleeve, thus protecting the operator. Holes $\frac{5}{16}$ in. in diameter can be drilled in steel.

Milling Machine Drive, Individual Motor, Cleveland
Clark Mesker Co., 18511 Euclid Ave., Cleveland, Ohio
"American Machinist," March 3, 1921



The motor bracket and drive mechanism are built in two sizes, to fit the Nos. 1 and 2 milling machines. It is claimed that this direct-connected motor drive obtains the advantages of belt-driving by the incorporation of a friction clutch between the lower sprocket and the main drive-shaft. The grip of the clutch can be adjusted by a nut at the back of the clutch housing. The drive can be applied to the present models of belt-driven machines. The bracket is designed to support the motor high enough, so that it be free from the dirt of the floor. The sprockets and chain run in a bath of oil. A 2-in. Morse chain is used on the No. 1 machine, and a 2½-in. chain on the No. 2. The motor has a constant speed and runs at 1,200 r.p.m.

Boring Tool, Small
M. B. Hill, 10 Eden St., Worcester, Mass.
"American Machinist," March 3, 1921



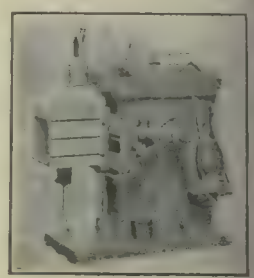
The tool is suitable for use in small lathes. The toolbar is held to the shank by a swinging link that permits it to be raised and lowered, to accommodate various heights of center, without throwing it out of parallel. The link is simultaneously tightened upon the stud and upon the toolbar by means of a single screw. Three toolbars are provided with each holder. A split bushing is furnished to adapt the holder to a smaller size of toolbar. Extra bars can be made from drill rod.

Screw Machine, Automatic, Four-Spindle
Cone Automatic Machine Co., Windsor, Vt.
"American Machinist," March 3, 1921



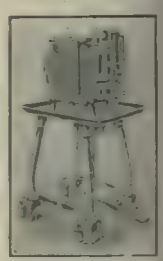
Changes in the design have altered the appearance of the machine to a considerable extent, although the principle of the Cone automatic is retained in the present design. The frame carrying the camshaft rests upon uprights that are a part of the lower frame and that carry the spindle turret and driving mechanism. The upper frame furnishes the support for two auxiliary spindles, while two other spindles are carried upon the turning tool-slides, making four independently driven auxiliary spindles. The turning tools are supported by slides that have bearings directly upon the bed of the machine and travel in a direction parallel to the work. The machine is built in three sizes, the one shown handling bars up to 1½ in. in diameter and producing pieces 6 in. long. Floor space, about 6 by 8½ ft. Shipping weight, 8,000 lb.

Shaper, Crank
Samson Works, Berlin, Germany
"American Machinist," March 3, 1921



The gear for the link drive and its journal are made in two separate parts, the journal being of steel, hardened and ground. The coupling of the link and ram is pivoted. The ram runs between two steel gibs. The adjustment of the table feed is made by means of a pawl. The feed during reversal of the ram is actuated by two cams fitted on the main drive gear, and is transformed into the reciprocating rotation of a vertical feed shaft by means of a completely encased train of spur and bevel gears. Forced lubrication is provided for all main parts, by means of a pump feeding a constant jet of lubricant.

Rivet-Heating Machine, Electric
Elektrische Schweissmaschinen Gesellschaft, Charlottenburg 4, Germany
"American Machinist," March 3, 1921



The machine is intended for use in the erection of steel structures, and for boiler shops, shipyards and other industrial plants. The transformer is placed on a cast-iron table resting on legs equipped with rollers. In the front of the transformer are the electrodes. The regulating switch has six steps and is encased and mounted in the rear. The switching on and off of the current, and the movement of the electrodes for feeding and removing the rivets are actuated by the treadle. The machine is fed by a weak medium-tension alternating current, which is converted into a very strong low-tension current. This latter current passes through the rivet, which is put between the electrodes and is heated in a few seconds. The machine is made in two sizes, for rivets up to ¾ and 1¼ in., respectively. The smaller size of machine heats 400 rivets per hour.

Tool and Holder, "Twisto"
John H. Monstream, Hartford, Conn.
"American Machinist," March 3, 1921



The device is intended for use on lathes, planers and shapers, being adapted to general machining work. The cutting tool or bit resembles a three-lipped twist drill, it being provided with three helical grooves. The cutting is done on the ends of the bit, one edge cutting at a time. The bits are regularly furnished in lengths of 2 in., it being stated that there are 6¾ in. of length of cutting lip available for wear on each bit. When sharpening the tool, only the ends of it are ground. The bit is clamped in the holder in a horizontal position, a long bearing being provided in the holder, so that the bit is securely held. The holder is adapted to the use of disk tools. The shank of the tool passes through the hole used for the "Twisto" tool, and a stud passed through the lower hole in the holder serves to steady the edge of the disk.

Clip, paste on 3 x 5-in. cards and file as desired

Personals

FRANK MCCARTHY has severed connections with the Youngstown Sheet and Tube Co., Youngstown, Ohio, to assume active duty as president and general manager of the Federal Iron Works in the same city. Mr. McCarthy served the Youngstown company for ten years.

W. J. LYNCH, who has been special steel plant representative of the Bonnot Co., Canton, Ohio, has been appointed manager of the Chicago district, with headquarters in the Continental and Commercial Bank Building, Chicago.

HOMER J. FORSYTHE, manager of the construction division of the engineering department of the Du Pont company, has been transferred to the position of assistant general manager of the Hyatt Roller Bearing Co. of Newark, N. J., a subsidiary of the General Motors Corporation. Mr. Forsythe was selected for this important position because of his wide experience in machine shop work and his ability to handle difficult problems in his line.

CHARLES R. POLLARD has resigned from the trade research division of the Goodyear Tire and Rubber Co., Akron, Ohio, to resume the office of secretary of the Alexander Milburn Co., Baltimore, Md. Mr. Pollard will take charge of the territorial development for the Milburn company's products.

EARL M. HARTRIDGE, president of the Allied Machinery Company de France, Paris, is in the United States for a few weeks' visit, making his headquarters at the office of the Allied Machinery Company of America, 51 Chambers St., New York City.

JOHN BOSSERT of the sales force of the Hart-Parr Co., Charles City, Iowa, has been transferred from the local offices to supervision of sales in the Southern States, with headquarters at Memphis, Tenn.

DONALD MCSKIMMON has resigned as purchasing agent of the S. W. Card Manufacturing Co. of Mansfield, Mass., to accept the position of sales manager of the J. T. Slocomb Co., Providence, R. I.

FREDERICK H. PAYNE of Greenfield, Mass., president of the Greenfield Tap and Die Corporation of Greenfield, has recently been chosen president of the S. A. Smith Manufacturing Co. of Brattleboro, Vt. The Smith company manufactures toys and toy machinery.

J. R. STONE, of Detroit, Mich., for many years identified with the machinery and tool business in this country, has returned from a six months' trip to South America, where he has been investigating the field for the new company which he will organize. He reports a large and fertile field for American trade.

Obituary

THOMAS L. SMITH, founder, director and chief stockholder of the T. L. Smith Co., died on April 29 at his home in Milwaukee. Mr. Smith brought out a number of successful inventions during his life, and is known as the inventor and manufacturer of the line of Smith tilting mixers. Because of his activities in designing and producing mixers, pavers, excavators, crushers, etc., his career has a most unique significance in the field of construction and engineering. In 1920, Iowa State College conferred upon him the Honorary Degree of Doctor of Engineering, in recognition of his accomplishments. The Smith Engineering Works, Milwaukee, manufacturer of Tel-smith rock and ore crushers, is another company organized and developed to a high degree of success by the inventive genius and business ability of T. L. Smith.

ROBERT L. BRIDGMAN, for thirteen years New England representative of the L. S. Starrett Co., of Athol, Mass., died at his home in Belchertown, Mass., on May 7. He was sixty-seven years of age. Previous to joining the Starrett forces he was the representative of the Athol Machine Co., for over thirty years.

ADOLPH SORGE, JR., Chicago representative of the H. S. B. W.-Cochrane Corporation of Philadelphia, Pa., died on May 5. Mr. Sorge was prominent in Western engineering circles and is credited with many improvements and inventions in steam plant and boiler construction.

D. W. DWIRE, foreign representative of the Yale & Towne Manufacturing Co., Stamford, Conn., died at the Bronx Sanitarium, in New York, on April 15. Death was due to peritonitis, secondary to an attack of typhoid fever. Mr. Dwire's territory consisted of Porto Rico, Santo Domingo, Trinidad, the Guianas, Venezuela, and the Lesser Antilles.

CHARLES H. MORSE, founder of Fairbanks, Morse & Co., scale manufacturers, died at his winter home in Florida on May 5. He was 87 years old. Mr. Morse was born in St. Johnsbury, Vt., but spent the best part of his life in Chicago, where he started the scale manufacturing business which is known throughout the country.

Trade Catalogs

Punch and Shear. The Cleveland Punch and Shear Works Co., Cleveland, Ohio. Four-page circular illustrating and describing a complete line of punches and shears as manufactured by this company.

Gears. Boston Gear Works, Quincy, Mass. Catalog G-1, a complete list of Boston gear products with specifications and prices.

Thread Lead Variator. The Precision and Thread Grinder Manufacturing Co., Philadelphia, Pa. A four-page illustrated circular describing the thread lead variator and the perfected multi-graduated thread grinder for attachment to a lathe.

Internal Micrometer. John Bath & Co., Inc., Worcester, Mass. Bulletin No. 10 describing the latest creation in a line of internal measuring instruments.

Johnson Friction Clutches. The Carlyle Johnson Machine Co., Manchester, Conn. A stock list showing a comprehensive assortment of sizes of Johnson friction clutches.

Flexible Shaft Equipment. The Hergi Manufacturing Co., Bridgeport, Conn. A sixteen page 6 x 9-in. catalog devoted to a description of Hergi portable electric machinery, including drills, grinders, screwdrivers, hammers and various attachments.

Air Compressors and Vacuum Pumps. Pennsylvania Pump and Compressor Co., Easton, Pa. A sixteen page illustrated catalog, No. 101, describing a line of air compressors and vacuum pumps. Tables of operation and specifications for all sizes and types are included.

Power Transmission. The Chicago Pulley and Shafting Co., Chicago, Ill. Circular entitled "Handicapped Power Transmission Penalizes Production," which treats of the products of this company. Many types of ball bearing power transmitting appliances, pulleys, shafting and clutches are described briefly.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A manufacturer in Quebec desires to purchase metal stamping machines for stamping metal novelties. Quotations should be given f.o.b. port of shipment. No reference offered. No. 34866.

A Commercial agency firm in France desires to secure an exclusive agency for the sale of automobiles and agricultural machinery. Correspondence should be in French. References. No. 34867.

A mercantile firm in Manchuria desires to secure the representation of manufacturers for the sale of enamel ware, hardware, scales, engineers' supplies and tools; machinery for metal working, milling, pipe cutting and threading, sawmills, and woodworking; machine-shop equipment and supplies for building, sewerage and water, and heating systems; and pumps, belting, iron, steel, tin and zinc. References. No. 34871.

Forthcoming Meetings

The Society of Automotive Engineers, 29 West 39th St., New York, announces that its summer meeting will be held at West Baden, Ind., on May 24 to 28 inclusive.

The American Railway Association will hold the Spring meeting of its Purchases and Stores Section at the Blackstone Hotel, Chicago, June 9 to 11, and the Spring meeting of its Mechanical Section at the Drake Hotel, Chicago, June 15 and 16.

The 1921 annual meeting of the American Society for Testing Materials will be held at Asbury Park, N. J., on June 20 to 24, with headquarters at the New Monterey Hotel. C. L. Warwick, Engineers Club, Philadelphia, Pa., is secretary.

The eighth annual convention of the American Drop Forge Association and the Drop Forge Supply Association will be held at Chicago, Ill., June 22 to 24 with headquarters at the Congress Hotel.

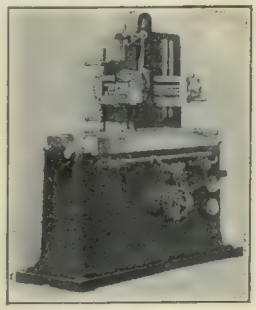
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Planer, Crank, Open-Side, Coulter

Automatic Machine Co., Bridgeport, Conn.

"American Machinist," March 10, 1921

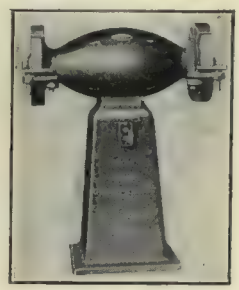


The machine is similar to that described on page 819, Vol 50, of the *American Machinist*, being particularly adapted to toolroom work. The combination clutch and brake mechanism is operated from the front of the machine, and by means of it the table can be stopped and started instantly without change of the motion of the motor or countershaft. It is stated that it contains the advantages found in a shaper, such as the quick-return stroke, variable speeds, and the ability to cut to a shoulder, with the accuracy and table capacity of a planer. The maximum stroke can be taken anywhere on the table by merely positioning the table under the tool without disturbing the work, and the maximum stroke can be taken with the same degree of accuracy as a shorter one.

Grinders, Electric, Bench and Floor

Glow Electric Co., 219 Walnut St., Cincinnati, Ohio.

"American Machinist," March 10, 1921



The machines are made in a range of sizes in both bench and floor types, and are adapted for grinding, buffing and polishing. The device equipped with scratch brushes is adapted for brushing and scouring small articles, being especially intended for the use of manufacturing jewelers. The machine is built in capacities of ¾, 1, 3 and 5 hp., for either direct or alternating current, and either with or without pedestals. The head is totally inclosed and is dustproof, its contour enabling it to be easily kept clean. The grinders are equipped with heavy cast-iron guards and adjustable work rests. The 3- and 5-hp. machines are furnished with push-button controllers mounted inside the pedestal. The bench machine in the smaller sizes is equipped with a snap switch, mounted in the frame of the motor, so as to make the switch convenient for use and to protect it.

Drilling Machine, Sensitive, Floor-Type, "Pecorp"

Providence Engineering Corporation, 5 Nassau St., New York, N. Y.

"American Machinist," March 10, 1921



The machine, formerly known as the Mason-Widmer drilling machine, is built in two styles, the Model K having a larger table than the Model H. It is fully equipped with ball bearings. The spindle is provided with a device for retaining the lubricating oil. Because of the fact that the non-rotating sleeve extends below the bearings, oil which has passed through the bearings drops straight downward from the bottom of the sleeve, instead of being thrown outward and upon the operator. The belt can be shifted by means of a crank on the front of the head. Two idlers tighten the belt, which is under tension only when the load is applied, thus saving wear on the belt. The machine can be driven by means of a belt or either horizontal or vertical motors, the illustration showing the latter type. It can be made with any number of spindles up to eight.

Indicator, Test

M. B. Hill, 10 Eden St., Worcester, Mass.

"American Machinist," March 10, 1921

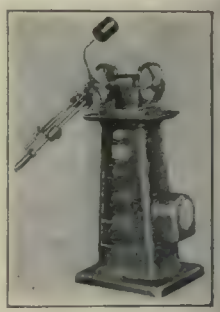


The rectangular shank is split so that the tool may be held in the toolpost of a lathe and clamped against turning by the tool post screw. The stock can be turned easily within the shank, so as to bring the graduated scale into any position convenient for reading. The little bellcrank lever is also adjustable as to position, or may be removed and the implement presented to the work at a right angle. The bell crank is held in position by a spring clamp, and may be put on and taken off without the aid of tools of any kind. Its use allows the indicator to be presented to the work from different angles. Each graduation on the scale represents a motion of 0.001 in. of the sensitive point.

Grinding Machine, Drill, Semi-Automatic, No. 20B

Bellevue Industrial Furnace Co., Detroit, Mich.

"American Machinist," March 10, 1921

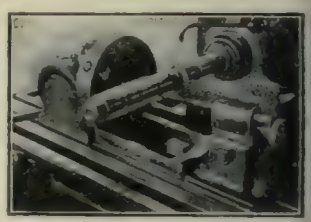


The machine is a self-contained unit with its driving motor located in its pedestal and partly inclosed by the projecting housing on the right of the pedestal. It is equipped with a two-step cone pulley for the drive to the spindle. The machine can also be arranged so that it can be driven from a line shaft. The machine grinds on the periphery of the wheel instead of on the side. It can be equipped with a carriage for grinding left-hand drills, as well as right. Drills with two, three, four or more lips can also be ground. The machine is made in two sizes. The smaller size handles drills from $\frac{1}{16}$ to $1\frac{1}{2}$ in. in diameter, the smaller sizes of drills being held in any standard form of chuck. The larger machine grinds drills from $\frac{3}{4}$ to 3 in. in diameter.

Center, Tail, Adjustable

New Britain Tool & Manufacturing Co., Harvard St., New Britain, Conn.

"American Machinist," March 10, 1921

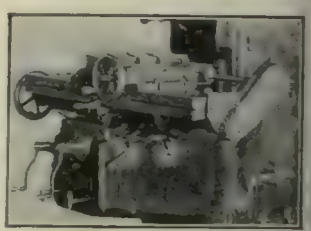


This center is a complement to the indexing head made by the same concern and described on page 143, Vol. 51, of the *American Machinist*. The height of the center can be adjusted within reasonable limits, to furnish an outboard support when fluting taper reamers or similar work. The bracket holding the center is secured in place on the base by only one bolt, so that the center can be swivelled to the desired angle and clamped. The device is here shown in position on the table of a milling machine.

Table, Rotary, Milling Machine, Cleveland

Clark-Mesker Co., 18511 Euclid Ave., Cleveland, Ohio.

"American Machinist," March 10, 1921

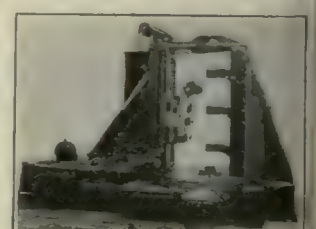


There are two sizes of the table, designated as Nos. 1 and 2, for the corresponding sizes of milling machines. It can be operated either by hand or by power feed. There are 16 changes of power feed, controlled from the front of the knee by the same mechanism that controls the feed changes for the sliding table. The driving worm is made with coarse pitch and runs in oil. Its end thrust in each direction is taken care of by ball thrust bearings, and means are provided for taking up the wear. The table rests in a taper bearing. Its surface is slotted with T-slots of the same size as those in the milling machine table. The rotating table is surrounded by a coolant-collecting trough formed by a rib cast on the base.

Hobbing Machine, Gear, 13 Ft.

J. E. Reinecker, A.G., Chemnitz, Germany

"American Machinist," March 10, 1921



The machine is built for hobbing gears up to 13 ft. in diameter and 6 ft. in width, being used on the reduction gears for turbine-propelled ships. The table, which will carry a load of 33 tons, has secured to it a large indexing gear. The change gears of the indexing mechanism are at the extreme left of the gear box. Both the main vertical housing and the counter-weighted saddle mounted on it are provided with hand and power mechanisms for traversing and elevating. The toolslide swivels on the saddle so that the hob may be adjusted to any desired angle. There is a continuous transverse movement of the hob while it is in action, so that the full cutting width is in service, and wear is practically uniform. When it is desired to cut pinions, the upright shown mounted on an extension of the base is used.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

N. J., Newark—The Essex Fdry., Murray St.—one 42 in. Bullard vertical turret lathe of New Era type.

N. Y., Buffalo—The L. G. Schoeflin Auto Repairs, 80 West Mohawk St.—universal electric drill up to ½ in. (Used and in good condition.)

N. Y., Springville—S. E. Spencer Machine Shop—milling machine, (used), and an acetyline cutting torch.

Fla., St. Petersburg—The Marine Ways Machine Co., 236 7th Ave., J. W. Appleby, Proprietor—bench lathe, 6 to 9 in. swing (used and in good condition).

Ga., Cedartown—The Brewer Automobile Headlight Co., I. L. St. Clair, Pres.—machine tools and machinery for the manufacture of automobile headlight equipment.

Ga., Columbus—The Centenial Cotton Gin Co., K. R. Lummus, Secy.—machine tools and machinery for the manufacture of cotton gin machinery, capacity to be 3 gins per day.

La., New Orleans—The Dixie Machine Welding & Metal Wks., Inc., 1031 Annunciation St., J. Szodomka, Proprietor—medium size milling machine and medium size shaper. (New or used.)

La., New Orleans—The F. H. Koretke Brass & Mfg. Co., Ltd., 922-924 Magazine St., E. E. Gosselin, Vice Pres.—turret lathes and screw machines for brass work.

Ill., Chicago—The Chicago, Rock Island Pacific Ry. Co., La Salle Station, F. D. Reed, Genl. Purch. Agt.—
Two 16 in. lathes.
One 48 in. radial drill.
Two 1⅝ in. capacity screw machines.
One combination punch and shear on truck wheels. (New.)

Ill., Springfield—The Bd. Educ., M. G. Owens, Pres., Ferguson Bldg. — manual training equipment for high school.

Mich., Detroit—F. Koss, 2281 Hunt St.—screw cutting lathe (Used preferred).

Mich., Lansing—The Lansing Stamping Co., South Penn St.—One single spindle, belt driven disk grinder to handle a surface 15 x 25 in., equipped with one universal lever feed table; similar to a No. 21, 36 in., G. type Besley. (Used.)

O., Canton—The Arctic Ice Machine Co., Market Ave., South and Penn. Ry.—
One 15 ton electric traveling crane from 48 to 50 ft. span.
One 30 in. swing lathe to take about 12 ft. between centers, direct connected, etc.
One 24 in. swing lathe to take about 10 ft. between centers, direct connected, etc.

O., Cleveland—The Fishel & Marks Co., Ft. of Krakov Ave., Iron and Steel Workers—
Plate squaring shear complete with driving motor with capacity for cutting ⅜ in. thickness.
Plate squaring shear, complete with driving motor with capacity for cutting ½ in. thickness.
Plate squaring shear complete with driving motor with capacity for cutting ¾ in. to 1 in. thickness.
Length of blades for all these shears to be as long as possible with gaps sufficiently deep so that widths 24 in. to 36 in. could be cut on same.

O., Columbus—The Columbus Forge & Iron Co., Foot of West First Ave., D. W. Singleton, Secy. and Treas.—Three or four large steam drop hammers and presses.

Wis., Grafton—Weber & Hoffman, E. Weber, Purch. Agt.—lathe and drill press.

Wis., Milwaukee—The Badger Packard Machinery Co., 133-139 West Water St.—
No. 75½ Bliss straight-side press.
No. 78½ Bliss straight-side press.
One 36 in. x 28 ft. lathe. (Used.)
One 5/16 in. x 12 ft. capacity squaring shear.
One 8 ft. x ¼ in. steel bending brake, similar to a No. 186 Chicago.
One 8 ft., 10 ft. or 12 ft., 16 gage capacity steel bending brake.
One 22 in. x 22 ft. lathe. (All new.)

Wis., Milwaukee—J. R. Lamboy, 2702 St. Paul Ave.—small lathes, jigs, high speed drills, bench tools and 3 grinders, 14 in. to 16 in. wheel, 2½ in. base.

Wis., North Milwaukee—R. Lohse, Hopkins Rd., (Machinist)—Six screw machines, 4 millers, 14 in. to 22 in. several shapers—none smaller than 6 in., radial drill press 20 in. to 24 in. and several lathes.

Ia., Perry—The Bd. Educ., W. H. Wimger, Secy. — manual training equipment for school.

Mo., Joplin—The E. A. Martin Machinery Co.—machine shop tools.

Mo., St. Louis—The Crescent Steel Co., 515 West Tessen St.—A 10 ft. power brake.

S. D., Sioux Falls—The Bd. Educ., A. Ayres, Pres.—manual training equipment for high school.

Ont., Exeter—The Ontario Flax Mills, L. Davis, Mgr.—$15,000 worth of boiler, engine and flax machinery.

Ont., London—The Car Owners Garage Co., G. A. Miller, Mgr.—complete garage and repair shop equipment.

Ont., Ottawa—Beeby & Aikins, Ltd., 202 Jackson Bldg.—equipment for the manufacture of stoves, ranges and furnaces.

Ont., Strathroy — W. A. Hodgins—complete garage and repair shop equipment.

Que., Montreal—A. Trudeau, 1116 St. Denis St.—lathe and other garage equipment.

Machinery Wanted

Conn., Middletown—The Millbrook Dairy Co., 4 Main St.—dairy equipment.

R. I., Providence—S. Sweet, Willard Ave.—equipment for bakery.

N. Y., Buffalo—The city, Municipal Bldg., will receive bids until May 31 for conveying machinery. F. T. Reynolds, Bldg. Comr.

N. Y., Buffalo—The Jakiel Lumber Co., 1247 Bway., J. M. Jakiel, Pres.—machinery for planing mill.

Pa., Reading—The Brown Eng. Co., 123 North 3rd St.—Platform scale with a capacity of 15 to 20 tons known as the truck type.

O., Columbus—The Lilles Laundry, 1011 West Rich St., P. M. Lilles Pres.—laundry machinery.

Wis., Marshfield—Blum Bros.—machinery for the manufacture of wooden cheese boxes.

Wis., Sheboygan Falls—The Falls Roller Mills Co., c/o E. Gonzerbach, Mgr.—mill equipment.

Ont., Kingsville—Brown & Wigle, E. A. Brown, Mgr.—equipment and machinery for woolen mill.

Ont., Laforest—The Marshay Lumber Co.—complete sawmill equipment.

Ont., New Liskeard — Black, Fasken & Hennessey, c/o A. Fasken, Pres., Excelsior Life Bldg., Toronto—pulp mill machinery.

Ont., Peterborough—T. H. Kennedy—artificial ice machinery.

Ont., Windsor—E. B. Winter and A. A. Little, 35 Elm Ave.—refrigerating equipment.

Metal Working

NEW ENGLAND STATES

Conn., Hartford—B. A. Sellew, Archt. and Engr., 721 Main St., will soon award the contract for the construction of a 1 story, 30 x 120 ft. garage for S. F. Hines, 20 Wethersfield Ave. Estimated cost, $30.000.

Conn., New Haven—S. Konick, 277 Dixwell Ave., has awarded the contract for the construction of a 1 story, 50 x 65 ft. garage on Dixwell Ave. Estimated cost, $10,000.

Conn., Norwalk—S. Kantor, 65 Cross St., will soon award the contract for the construction of a 1 and 2 story, 80 x 160 ft. garage and service station on Isaac St. Estimated cost, $40,000. H. W. Mather, 79 Washington St., Archt. Noted May 19.

Mass., Boston—The Meisel Press Mfg. Co., 944 Dorchester Ave., is having plans prepared for the construction of a 1 story, 180 x 300 ft. machine shop on Dorchester Ave. Estimated cost, $250,000. MacNaughton & Cleverden, 19 Congress St., Archts.

Mass., Dorchester—T. G. Buckley, 690 Dudley St., has awarded the contract for altering garage building on Dudley St. Estimated cost, $40,000.

Mass., Lowell—Katz Bros., 202 French St., will build a 1 story, 98 x 99 ft. garage on Armory St. Estimated cost, $50,000.

Mass., Lowell — J. T. Meyers, Middlesex St., will build a 1 story, 35 x 66 ft. garage on Green St. Estimated cost, $10,000.

Mass., Salem—O. Bouchard, 22 Willow Ave., will build a 1 story, 55 x 150 ft. garage on Washington St. Estimated cost, $20,000.

Mass., Shelburne Falls—A. Bruffee, Athol, will build a 1 story, 40 x 90 ft. garage and 40 x 45 ft. ell addition for a repair shop on Mohawk Trail. Estimated cost, $30,000.

Mass., Springfield—The Gulf Refining Co., Albany St., will build a 1 story, 70 x 70 ft. garage. Estimated cost, $25,000. Noted May 12.

Mass., Willimansett—S. Boisvert, Chicopee St., will build a 1 story, 30 x 90 ft. garage on Chicopee St. and Warrington Ave. Estimated cost, $15,000

THE WEEKLY PRICE GUIDE

This Week's Market

Business in the steel trade is extremely light. Warehouses report that deliveries from mills are poor, owing to reduced production. Orders are so small that mills accumulate them until there are enough to warrant changing rolls. Little improvement is expected before September.

Metal market dull, but no worse than a week ago.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$28.75
Northern Basic	26.52
Southern Ohio No. 2	27.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	34.26
BIRMINGHAM	
No. 2 Foundry	24.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	26.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	*25.00
CHICAGO	
No. 2 Foundry local	24.00
No. 2 Foundry, Southern, sil 2.25@2.75	30.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26.46
Basic	24.46
Bessemer	26.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.23	$3.33	$3.09	$3.23
Soft steel bars	3.13	3.23	2.99	3.13
Soft steel bar shapes	3.13	3.23	3.48	3.13
Soft steel bands	4.18	4.28	6.25	
Tank plates	3.23	3.33	3.78	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	4.25	4.00	4.13
No. 12	3.15	4.30	4.05	4.18
No. 14	3.20	4.35	4.10	4.23
No. 16	3.30	4.45	4.20	4.33
Black				
Nos. 17 and 21	3.75	4.95	4.80	5.20
Nos. 22 and 24	3.85	5.00	4.85	5.25
No. 25 and 26	3.90	5.05	4.90	5.30
No. 28	4.00	5.15	5.00	5.40
Galvanized				
No. 10 and 11	4.00	5.30	5.00	5.70
No. 12 to 14	4.10	5.40	5.10	5.80
Nos. 17 and 21	4.40	5.70	5.40	6.10
Nos. 22 and 24	4.55	5.85	5.55	6.25
No. 26	4.70	6.00	5.70	6.30
No. 28	5.00	6.25	6.00	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$4.73	$4.63	$4.25
Flats, squares and hexagons, per 100 lb.	5.23	4.63	4.75

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55%
Cleveland	50%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 3/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ½, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.50	8.00	8.25
Spring steel (light)	8.00	7.00	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.20
Hoop steel	3.64	3.69	3.83
Cold rolled strip steel	6.00	8.25	7.90
Floor plates	5.30	3.09 . 3.40	5.78

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of April 13, 1921:

BUTT WELD

Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
1 to 3	62½	50	¼	33½	18½
			1 to 1½	35½	20½

LAP WELD

2	54½	41	2	30½	16½
2½ to 6	58½	45	2½ to 4	34½	22½
7 to 12	54½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	60½	49	1 to 1½	35½	21½
2 to 3	61½	50			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	52½	41	2	31½	18½
2½ to 4	56½	45	2½ to 4	34½	22½
4½ to 6	55½	44	4½ to 6	33½	21½
7 to 8	50½	37	7 to 8	24½	12½
9 to 12	45½	32	9 to 12	19½	7½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13.87½
Tin in 5-ton lots	33.50
Lead	5.62½
Zinc	5.87½
ST. LOUIS	
Lead	5.22½
Zinc	5.47½

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.50	22.00	23.50
Copper wire (carload lots)	15.00	17.50	20.00
Brass sheets	16.25	21.00	20.75
Brass pipe	20.00	24.00	24.50
Solder (half and half) (case lots)	24.00	22.75	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	14.25
Cleveland	18.00
Chicago	18.75

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	41
Electrolytic	43

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	[illegible]
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots..... 11.00

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	12.15	12.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.00
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	$9.50
Copper, heavy, and wire	9.00	9.50	8.50
Copper, light, and bottoms	8.00	8.00	7.65
Lead, heavy	3.25	4.00	3.00
Lead, tea	2.00	3.00	2.85
Brass, heavy	6.00	6.00	9.00
Brass, light	4.50	5.00	4.50
No. 1 yellow brass turnings	5.00	5.00	5.00
Zinc	3.00	3.00	3.00

ALUMINUM—The following prices are spot from warehouse, cents per pound;

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.4	25.50@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.00
Chicago	20.50
Cleveland	22.50

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	43.50	35.00
Commercial	30.00	15.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$2.00	1.60
Hot pressed hexagon	List	2.00	1.60
Cold punches hexagon	List	2.00	1.60
Cold punched square	List	2.00	1.60

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	50%
Cleveland	75-10%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50-10%	60-10%	50%
1¼ and 1½ in. by 3 in. up to 12 in	50%	50-5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $4.00 Chicago..... $4.00
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $3.75 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅜ by 6 in. and smaller	40%	50-10%	40%
Larger and longer up to 1 in. by 30 in	40%	50%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	50%	60%	45%
Tinned	45%	60%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.65 Cleveland...$4.60 Chicago....$4.88 Pittsburgh..$3.70
Boiler, same sizes:
New York...$4.75 Cleveland...$4.70 Chicago....$4.98 Pittsburgh..$3.80

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	25.50
Brass	20.00	23.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼-2 in., inclusive in rounds, and ½-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$7.00 per 100 lb.; New York price is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	9.00@12.00	12.50	14.25
Colored mixed	6.50@ 9.50	9.50	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$3.50@$4.25
Prompt foundry	4.50@ 5.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.85

LINSEED OIL—These prices are per gallon:

	New York	Current Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.73	$0.75	$0.82
5-gal. cans	.76*	.85	1.07

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

Mass., Worcester—The Rockwood Sprinkler Co., 38 Harlow St., will alter its factory. Estimated cost, $15,000.

MIDDLE ATLANTIC STATES

Pa., Forty Fort (Kingston P. O.)—The Delaware, Lackawanna & Western R. R., Coal Mining Dept., Scranton, has awarded the contract for the construction of a 1 story, 83 x 92 ft. forge and machine shop. Estimated cost, $30,000. J. Reynolds, Supt.

Pa., Pittsburgh—E. A. Harrigan & Son, 520 Robinson St., Northside, are having plans prepared for the construction of a 2 story, 56 x 68 ft. garage and machine shop. Private plans.

MIDDLE WEST STATES

Ill., Elgin — Wait & Ross, Undertakers, are having plans prepared for the construction of a 2 story, 74 x 77 ft. building including garage. Estimated cost, $75,000. G. E. Morris, Sherwin Bldg., Archt.

Ill., Elmhurst—The Cregar Co., 144 York St., is having plans prepared for the construction of a 1 story, 50 x 135 ft. garage. Estimated cost, $40,000. E. N. Braucher, 6 North Clark St., Chicago, Archt.

Ill., Galesburg—The Mackmer Motor Co. will build a 1 story, 112 x 170 ft. garage and salesroom. Estimated cost, $90,000.

Ill., Paxton — L. Rasnussen, 355 West Franklin St., will build a 2 story, 50 x 160 ft. garage. Estimated cost, $75,000.

Ind., Vincennes—The Dyer Realty Co. has awarded the contract for the construction of a 1 story, 150 x 160 ft. garage. Estimated cost, $75,000.

O., Cleveland—The Armature Coil Equipment Co., c/o A. Fathauer, 3202 Scranton Rd., has awarded the contract for the construction of a 1 story, 30 x 40 ft. factory. Estimated cost, $40,000.

O., Cleveland—The Lorain & Clark Garage, c/o A. Barth, 8901 Clark Ave., has had plans prepared for the construction of a 2 story, 100 x 124 ft. garage on the corner of Lorain and Clark Aves. Estimated cost, $60,000. A. E. Keller, 1298 Carlyon Rd., East Cleveland, Archt.

O., Cleveland—The R. W. MacMurphy Co., 8755 Bway., plans to build a 1 story garage. Estimated cost, $40,000. R. W. MacMurphy, Pres.

O., Cleveland—P. M. Platten, 348 Engineers Bldg., plans to build a 1 story, 45 x 137 ft. store and garage building on East 133d St. and Miles Ave. Estimated cost, $40,000. J. L. Cameron, 10406 Euclid Ave., Archt.

O., Cleveland—The Woodland Ave. Corp., c/o M. K. Lertzman, 5608 Woodland Ave., plans to build a 1 story, 60 x 150 ft. garage on Kinsman Rd. near East 75th St. Estimated cost, $40,000. N. Altschuld, 5116 Woodland Ave., Archt.

O., Dayton — B. H. Zeihler, 415 South Main St., plans to build a 2 story, 42 x 195 ft. auto sales and garage building on South Main St. Estimated cost, $50,000.

O., Madison—The Lyon King Implement Co. plans to build a 50 x 200 ft. factory for the manufacture of garden implements, tractor attachments, etc. Estimated cost, $30,000. W. E. Arnold, Pres.

Wis., Cedarburg—The E. & W. Mfg. Co., 325 Oregon St., Milwaukee, has awarded the contract for the construction of a 1 story, 60 x 160 ft. factory for the manufacture of trucks and trailers on Main St. Estimated cost, $80,000. Noted March 24.

Wis., Milwaukee—The W. F. Horn Co., 150 8th St., has awarded the contract for the construction of a 2 story, 50 x 150 ft. garage on 5th St. Estimated cost, $75,000.

Wis., Milwaukee—The Main Express Co., 117 Oneida St., plans to build a 1 story, 60 x 120 ft. garage on Market St. Estimated cost, $75,000.

Wis., Platteville—The Fiedler Motor Co. has awarded the contract for the construction of a 1 story, 100 x 136 ft. garage. Estimated cost, $40,000. Noted May 12.

STATES WEST OF THE MISSISSIPPI

Mo., Joplin—The E. A. Martin Machinery Co. has had plans prepared for the construction of a 2 story sales building and machine shop on 5th and School Sts. E. A. Martin, Pres. Guieman & Martinie, 420 North Wall St., Archts.

Mo., St. Louis—The Eagle Motor Truck Co., 6154 Bartmer Ave., has purchased a site and plans to build a 1 story, 50 x 100 ft. factory. Estimated cost, $50,000. Private plans.

Wyo., Casper—The city has awarded the contract for the construction of a 2 story, 75 x 140 ft. fire station and garage on South David St. Estimated cost, $75,000. Noted Feb. 10.

Wyo., Casper—The Ohio Oil Co. has awarded the contract for the construction of a 1 story, 114 x 140 ft. garage and warehouse on Market St. between B and C Sts. Estimated cost, $75,000.

WESTERN STATES

Wash., Seattle—The School Bd., Central Bldg., has awarded the contract for the construction of a 3 story, 216 x 337 ft. high school to include complete shops, etc., on 15th St., Northeast and East 66th St. Estimated cost, $820,825.

CANADA

Ont., Hamilton — The Patricia Photo Players, Ltd., is having plans prepared for the construction of a 1 and 2 story, 275 x 300 ft. photo studio and garage building. Estimated cost, $200,000. Stewart & Jolley, 340 Lester Bldg., Archts.

Ont., London—The Car Owners Garage Co. will soon award the contract for the construction of a 1 story, 100 x 150 ft. garage on York St. Estimated cost, $40,000. G. A. Miller, Mgr. Watt & Blackwell, Bank of Toronto, Archts.

Ont., Ottawa—Beeby & Aikins, Ltd., 202 Jackson Bldg., plans to build a stove factory. Estimated cost, $150,000. Architect not yet appointed.

Ont., Strathroy—W. A. Hodgins will receive bids until June 1 for the construction of a 1 story, 50 x 100 ft. garage on Frank St. Estimated cost, $25,000.

Que., Montreal—A. Trudeau, 1176 St. Denis St., will receive bids until June 1 for the construction of a 2 story, 35 x 100 ft. garage on St. Denis St. Estimated cost, $20,000.

Man., Brandon—The Imperial Oil Ltd. plans to construct a 50 x 200 ft. marketing plant to include a warehouse, garage, etc. Estimated cost, $250,000. D. S. Paterson, Mgr.

General Manufacturing

NEW ENGLAND STATES

Conn., Bristol—The Horton Mfg. Co., 187 North Main St., has awarded the contract for the construction of a 3 story addition to its plant for the manufacture of fishing rods and tackle. Estimated cost, $40,000.

Conn., Hartford—B. A. Sellew, Archt. and Engr., 721 Main St., will soon award the contract for the construction of a 1 story, 40 x 104 ft. addition to the grain plant for the Garber-Northam Grain Co., 409 Windsor Ave. Estimated cost, $25,000.

Conn., Hartford—The Underwood Typewriter Co., Inc., 581 Capitol Ave., will build a 1 story addition to its factory. Estimated cost, $15,000.

Conn., Middletown—The Millbrook Dairy Co., 4 Main St., is having plans prepared for the construction of a 3 story, 50 x 60 ft. dairy plant on Church and Broad Sts. Estimated cost, $40,000. Buck & Sheldon, Inc., 60 Prospect St., Hartford, Archts. and Engrs.

Conn., Norwalk—C. H. Harris Inc., 136 West 24th St., New York City, is having plans prepared for the construction of a 1 story, 100 x 220 ft. plant for the manufacture of windshields and other glass products on Main St. Estimated cost, $100,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Archts. and Engrs. Noted May 19.

Me., Winthrop—The Bailey Oil Cloth Co. has awarded the contract for the construction of a factory to include a 3 story, 50 x 145 ft., 3 story, 95 x 120 ft. and a 1 story, 80 x 98 ft. buildings. Estimated cost, $250,000. Noted May 19.

Mass., Taunton — The Presbrey Stove Lining Co., 212 Somerset Ave., has awarded the contract for the construction of a 1 and 2 story, addition to its plant. Estimated cost, $30,000.

R. I., Providence—H. Marshak, Archt., 310 Strand Bldg., will soon award the contract for the construction of a 1 story, 30 x 100 ft. bakery for S. Sweet, Willard Ave.

R. I., Woonsocket—Lepoutre Bros. have awarded the contract for the construction of a 3 story, 100 x 135 ft. weave shed, and a 1 story, 41 x 133 ft. finishing building on Manville Rd. Estimated cost, $175,000. Noted April 7.

MIDDLE ATLANTIC STATES

Md., Baltimore—J. Thomas & Sons, Inc., (Lumber) 818 Leadenhall St., has awarded the contract for the construction of two 2 story, 113 x 118 ft. mill buildings and two 20 x 22 ft. sheds. Estimated cost, $50,000.

N. J., Audubon—The Hadden Label Co., Hadden Heights, has awarded the contract for the construction of a 1 story, 20 x 75 ft. factory on Railroad St. Estimated cost, $15,000.

N. J., Trenton—The Standard Inlaid Mfg. Co., East State St., plans to build a 1 story, 50 x 300 ft. drying room linoleum factory to replace the one recently destroyed by fire. Estimated cost, $75,000. Private plans.

N. Y., Buffalo—J. M. Jakiel, 1247 Bway, will build a 2 story, 34 x 50 ft. planing mill on Bway. Estimated cost, $10,000.

SOUTHERN STATES

Ga., Atlanta—The Capital City Laundry has had plans prepared for the construction of a 3 story, 50 x 100 ft. laundry on the corner of Boulevard and Cain Sts. F. Fauss, Pres. J. J. Chase, 140 Peachtree St., Archt.

Va., Richmond—The Old Dominion Beveridge Co., West Broad St., has awarded the contract for the construction of a 3 story, 40 x 64 x 130 ft. factory on Broad and Kenny Sts. Estimated cost, $75,000.

W. Va., Morgantown—The United States Window Glass Co. plans to enlarge its plant here or build a new unit. H. E. DeVaughn, Chief Engr.

MIDDLE WEST STATES

Ill., Bloomington — The Illinois Oakoal Corp. has awarded the contract for the construction of an oakoal plant. Estimated cost, $100,000.

Ill., Chicago—E. W. Bredemeier & Co., 213 North Morgan St., has had plans prepared for the construction of a 3 story, 125 x 140 ft. printing plant on Honore and Van Buren Sts. Estimated cost, $225,000. Berlin, Swern & Randall, 19 South La Salle St., Archts.

Ind., Columbia City — The Columbia Woolen Mills plans to build an addition to its factory. Estimated cost, $200,000. Private plans.

Ind., Dunkirk—The Indiana Glass Co. has awarded the contract for the construction of a 1 story, 110 x 146 ft. factory. Estimated cost, $75,000.

Ind., Lafayette—The Lafayette Printing Co. has awarded the contract for the construction of a 3 story, 40 x 75 ft. printing plant. Estimated cost, $75,000.

O., Ashtabula—The Silurium Mfg. Co., Sloan Bldg., Cleveland, plans to build a 1 story factory for the manufacture of clay products. Estimated cost, $500,000. E. Steinbrenner, Pres.

STATES WEST OF THE MISSISSIPPI

Mont., Billings — The Montana Refining Co. is having plans prepared for the construction of an oil refinery to have a 1,000 lb. capacity. Estimated cost, $120,000. R. Molt, Pres.

Mont., Eureka—The Lincoln Co. Bd. of Comrs., is having plans prepared for the construction of a 150 x 150 ft. chemical factory for the manufacture of products used in soft drinks and baking powders on the Fair Grounds, here. Estimated cost, $90,000. L. C. Klenck, Libby, Mont., Clk.

CANADA

Ont., Peterborough — T. H. Kennedy has awarded the contract for the construction of a 1 story, 50 x 100 ft. ice manufacturing plant. Estimated cost, $35,000.

Ont., Toronto — The Provincial Government, Dept. of Pub. Hwy. plans to build a cement plant to have an annual capacity of 300,000 bbls. G. Hogarth, Parliament Bldg., Engr. The Legislature voted $1,000,000 for the project.

Ont., Windsor—E. B. Winter and A. A. Little, 35 Elm Ave., will receive bids until June 4 for the construction of a 2 story, 50 x 200 ft. market building to include a refrigerating plant on Quellette Ave. Estimated cost, $150,000.

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How the Shop Manager Can Use an Appraisal

Some Appraisals Not Worth Their Cost—Values to Be Included—Where an Appraisal Helped—How to Prepare an Appraisal—Periodic Inventories

By MORGAN G. FARRELL
Miller, Franklin, Basset & Co.

FOR a long time plant appraisals were used solely to set a selling price when the plant changed hands, or as a means to determine how much insurance to carry. More recently they have been used to calculate invested capital, in preparing Federal tax returns. In no event was an appraisal considered to be anything more than a necessary but lamentable expense. As soon as its figures had been digested, it was, as a rule, put in the most inaccessible and dimly lit part of the safe where by no chance could it intrude itself upon the owner's consciousness and remind him of the thousands of dollars tied up in it. And because of the form many appraisals are in, it is no wonder that no attempt has been made to use them as constructive helps to management.

Typical of most appraisals is the one I recently saw of a plant of moderate size, made some two years ago, which was handed to the engineers representing the prospective purchasers as a guide to the negotiable values of plant and equipment. It was a weighty volume in which were long itemized lists of nipples, elbows and what not, with no clue to their use or location. At the right of each page was a single inconspicuous column of assigned values, which investigation proved to be the replacement costs as of the date of the appraisal. These costs were carefully summarized for each building with no reference whatever to the departments operating therein, and the whole was accompanied by a surveyor's map of the property, locating the buildings and nothing else. What possible use such an appraisal with all the toil and expense involved, could have served, other than to give a lump value of the property, is hard to see.

Determining Values

Much—too much—has been said of late, as to the proper values to be presented in an appraisal—whether sound, reproductive or original. The method of arriving at the values has also been a chosen field for academic discussion; whether or not to include tangible assets, patent rights, financing expenses, etc. All of these are of interest, perhaps, to rate-setting bodies controlling the activities of public utilities corporations. But they have very little real interest for the executives of industrial plants whose principal care is to produce a suitable return on investments, and who, therefore, want to know in common-sense terms how the fixed portion of that investment stands, and how it analyzes for each operating department and each machine.

A properly drawn-up industrial appraisal should present only such values, detailed and summarized and accompanied by clear, correct drawings as will best adapt it to the following uses: (1) As a fixed asset record; (2) to set up burden charges and rates of depreciation; (3) to graphically locate equipment; (4) as a basis for tax returns; (5) to establish insurable values.

If more appraisals could stand the test of fulfilling the first three requirements, it would be possible for plant managers to see how they could use them as a basis for the more economical and profitable operation of the business. It is because so many appraisals fail to meet the proper tests that they end up in dusty oblivion.

How One Manager Used an Appraisal

Here, for instance, is how the production manager of a fairly large shop in the automotive industry used an intelligently compiled appraisal in revising the planning and cost system in his shop. War and post-war business had added so many new models, methods and machines that the old system broke down. Production demands were so insistent that no one had time to sit down and analyze the new models for standardization. The only planning attempted was to keep the machines busy and to get work out regardless of set-ups and short-cuts. In fact, no one was especially familiar with the possibilities of the new tools, which were regarded as intruders, let in for a specific use which no longer existed. Detailed costs had to be abandoned as hopeless, and an arbitrary general cost, based on past performances, was assigned to the old models of the product and estimated costs were guessed at for new and special ones.

In the meantime the control records were approaching chaos, and the accounting department spent most of its time sending out calls for help. It had a record of total expenditures, right enough, but the distribution of them was on the hit-or-miss plan—mostly miss. Tax returns were coming due. Prices were changing rapidly and no one knew exactly what to charge for some newly undertaken models. The statements at the end of the 1919 fiscal year justified the most pessimistic expectations. Obviously, heroic efforts to get down to a sound manufacturing basis must be made.

Before deciding upon an appraisal the management attempted to clear up the fog by itself. Three statistical lists of all equipment were made up; one by the accounting department from its records; one by the engineering department from its records; and one by the shop superintendent from an actual survey. No two agreed, even remotely.

Two weeks of discussion followed, at the end of which it was decided to have an appraisal made by disinterested outsiders who should have a free hand to

A. & B. GEAR WORKS

CLEVELAND PLANT

EXHIBIT A V: SCHEDULE (a) - MACHINE TOOLS.

Shop No.		Ann. Dep. %	Original Installed Cost	Cost Dep. to Jan.1,1920
C-7-TL	1 No. 6A Potter & Johnson semi-automatic, four-spindle turret lathe with countershaft. No tools. Mfrs. No. 11,000. Potter & Johnson Mach. Co., Pawtucket, R. I. 1916	5	2 287 00	1 943 95
	* * * *			
F-14-G	1 No. 1 LeBlond Universal Cutter and Reamer Grinder, with cylindrical, internal and gear cutter attachments and countershafts. Mfrs. No. 10,000.			
	1 Extra Universal attachment for above. No. 666.			
	1 Extra Surface Grinder attachment for above. No. 6710 R. K. LeBlond Mach. Tool Co. Cincinnati, Ohio. 1913	6 2/3	470 00	282 00
	* * * *			
B-8-MM	1 No. 2-C Rockford Horizontal Milling Machine with countershaft. Mfrs. No. 8000.			
	1 Extra Twin Dividing Head for above. No. 4300			
	1 Extra No. 2 Plain Dividing Head for above. No. 5400			
	1 Extra Bevelling Head for above. No. 6600. Rockford Machine Tool Co., Rockford, Ill. 1917	5	1 610 00	1 449 00

FIG. 1. A TYPICAL SCHEDULE SHEET

bring the business back under control. The old guesses based on incomplete records were to be scrapped and a fresh start made. It was hoped that this would establish a sure foundation for costs, for the revision and correction of accounts and incidentally for shop planning. The first step was to take a complete census

A. & B. GEAR WORKS

CLEVELAND PLANT

GENERAL SUMMARY OF CLASSIFIED VALUES

	Original Cost	Cost Dep. to Jan.1,1920	Reproductive Value as of 1920.
Exhibit A I - Land	27 500 00	* 55 000 00	55 000 00
(a) Factory Land	27 500 00	55 000 00	55 000 00
Exhibit A II - Land Improvements	8 700 00	7 100 00	13 820 00
(a) Walks, Drives, etc.	8 700 00	7 100 00	13 820 00
Exhibit A III - Buildings & Their Equip.	185 000 00	149 500 00	375 000 00
(a) Buildings	141 050 00	110 750 00	282 000 00
(b) Plumbing	9 550 00	7 370 00	18 100 00
(c) Steam Heating	8 200 00	6 100 00	16 000 00
* * * *			
Exhibit A IV - GENERAL OFFICES	18 750 00	13 570 00	25 500 00
(a) Office Furniture & Fixtures	9 100 00	6 660 00	12 140 00
(b) Office Machines	9 650 00	6 910 00	13 360 00
Exhibit A V - MANF'G EQUIPMENT	396 940 00	292 875 00	740 880 00
(a) Machinery	227 000 00	167 700 00	450 140 00
(b) Electric Motors	8 980 00	6 600 00	17 650 00
(c) Mechanical Transmission	10 260 00	8 150 00	18 400 00
(d) Furnaces	12 580 00	9 370 00	24 560 00
(e) Boilers, Tanks, etc.	14 600 00	10 800 00	27 570 00
(f) Piping	* 7 810 00	6 100 00	14 220 00
(g) Scales	1 110 00	930 00	2 000 00
(h) Trucks	1 960 00	1 430 00	3 710 00
* * * *			
Grand Total	636 890 00	518 045 00	1 210 200 00

* Appreciated Value.

FIG. 2. CLASSIFIED SUMMARY OF VALUES

of the plant and the equipment in it. This showed prices, performances, capacities and condition.

The accompanying cuts show the form in which the appraisal was presented. Fig. 1 is a typical schedule sheet; Fig. 2, the classified summary of equipment, and Fig. 3 the classified summary of equipment arranged by production centers. All of the values set forth were based upon a search through all available records, books, invoices, time-sheets, etc., and checked as a whole with the principal ledger accounts. Schedules were detailed as far as good judgment warranted. Each item of equipment was assigned a code number, as for instance, *A*-5-*M*. In this code *A* indicated the department in which the item was located; *M* the class of machine or equipment, and 5 the serial number of that type of machine in the department. The corresponding machine was tagged with its number, and referred to by that number in all records.

As part of the appraisal, the engineers prepared in card form a plant register. This, as its name indicates, is a file in which are registered all items of plant and equipment. A card for a typical machine tool is shown in Fig. 4. There is a card for each tool bearing full statistics and the history of the tool. The cards are kept up-to-date in the accounting department, to which the engineering department reports technical changes or additions as they are made.

Uses of the Plant Register

The uses of the plant register in this flexible form are many. For instance:

1. It furnishes a perpetual inventory of all plant and equipment items.
2. It furnishes full physical data of each item.
3. It furnishes the exact new and current values of each item, and the annual rate chargeable against each.
4. The accounting department uses it to assemble depreciation accounts.
5. In card form, it facilitates following a machine, transferred from one department or plant to another. The cards can be grouped or filed in any desired way for any purpose.

The rental value of the floor space for cost purposes is obtained directly from the form shown in Fig. 3 and is pro-rated among the machines according to floor area occupied. Another item necessary in setting machine rates, namely the annual using-up of the machine, is obtained from its register card, Fig. 4.

The machine layout was used for plotting the routing of component parts of the several models. Taken in conjunction with time studies, tool capacities, etc., a more advantageous machine layout was finally developed.

It will be noted that it is relatively easy to work with a machine plan on which the individual tools are identified by numbers, in conjunction with cards bearing complete data regarding them as it is quite impossible to letter the necessary information on the drawing itself in legible fashion.

Separating the Sheep from the Goats

With correct cost and machine data in hand, the plant executives knew just what they had to work with and it was then possible to install a system of shop planning with the result that it was soon possible to segregate the profitable from the unprofitable models. Later on it was possible to reduce the number of models from forty to twelve. A working appraisal was the starting point for these betterments.

A. & B. GEAR WORKS

CLEVELAND PLANT

GENERAL SUMMARY OF VALUES ARRANGED BY MANFG. DEPTS.

	Original Cost	Cost Dep. to Jan. 1, 1920
Exhibit B I - Land	27 500 00	55 000 00
(a) Factory Land	27 500 00	55 000 00
Exhibit B II - Land Improvements	8 700 00	7 100 00
* * * *		
Exhibit B III - Buildings and their equipment prorated among manfg. depts. on a space basis.	185 000 00	149 500 00
1. Receiving & Raw Stock 3300 sq.ft.	14 550 00	11 750 00
2. Machine Dept. 8400 "	37 000 00	29 900 00
3. Automatic Mach. Dept. 4500 "	17 900 00	16 100 00
4. Case Dept. 5000 "	22 015 00	17 800 00
5. Assembling " 3000 "	13 210 00	10 680 00
6. Tool & Experim. " 3300 "	14 550 00	11 750 00
* * * *		
Exhibit B IV - General Offices	18 750 00	13 570 00
* * * *		
Exhibit B V - Manufacturing Equipment	396 940 00	292 875 00
1. Receiving and Raw Stock	5 980 00	4 660 00
2. Machine Dept.	92 415 00	69 504 00
3. Automatic Machine Dept.	75 108 00	56 386 00
4. Case Dept.	66 670 00	49 220 00
5. Assembling "	12 814 00	9 180 00
6. Tool & Experim. "	27 560 00	21 255 00
* * * *		
Grand Total	636 890 00	518 045 00

FIG. 3. CLASSIFIED SUMMARY OF EQUIPMENT ARRANGED BY PRODUCTION CENTERS

The foregoing is characteristic of many such instances and the inevitable conclusion is that, from an operating point of view, periodical inventories of plant and equipment are as important as stock-taking.

There is a large class of miscellaneous equipment representing a high investment, the condition of which at any time is ordinarily only a matter of conjecture. These are jigs, punches, dies, attachments for machines,

Form 3-42

A & B GEAR WORKS
CLEVELAND PLANT REGISTER

Serial Nº C-5-TL Location *Automatic machine dept.*

Description *2⅛"-4-spindle automatic turret lathe with countershaft & 1 set drill supports, Adjustable stud turner, turners with rest, Finishing slide, Automatic dies*

Estimated life 20 years Annual rate of depreciation 5%

Purchased from *Manning Maxwell & Moore N.Y.C.*

Date *1916* Builders Nº *5767* Residual value

Cost			Depreciation		
Purchase price:	*1813.00*		Accrued to 1920	*283*	*80*
Freight:	*37.00*		1920	*94*	*60*
Installation:	*42.00*		1921		
Total		*1892 00*	1922		
Additions & changes			1923		
			1924		
			1925		
			1926		
			1927		
			1928		
			1929		
			1930		
			1931		
			1932		
			1933		
			1934		
			1935		
			1936		
			1937		
			1938		
			1939		
			1940		

FIG. 4. MACHINE REGISTER CARD

patterns, templets, flasks, and toolroom equipment. Usually, it seems that foremen, who are asked for lists of such equipment, are always just on the point of making one up, or have one in preparation. But, except when the toolroom foreman is unusually capable, there is seldom a satisfactory record of the existence—still less of the value and condition—of such items. They seem to be regarded as expendible, like ammunition. Yet they seldom amount to less than 20 per cent of the total investment in machine-shop equipment.

If an industrial appraisal served no other purpose than to provide a reliable, priced, descriptive list of these individually smaller items, it would still be of demonstrable value to the plant executive. But properly made, and intelligently used, such an appraisal can be made of much broader use, as a tool which will have a daily value in guiding the policies of the business.

Hardening in Hot Oil

BY A. E. TWIGG

I should like now to have some information as to why hot whale oil hardens steel harder than when cold. Now this statement may take the breath away from some of your readers. I heard it stated by a foreman who always prepared his oil bath for hardening cast steel cutters by getting a small die red hot and plunging it into the oil to warm the oil preparatory to hardening. When another foreman was recommended to try this he ridiculed the suggestion, expressing the futility of it. He instanced the provision of circulating water to keep oil cool in the hardening bath by those who know all about such things. He was asked to try it nevertheless, and I suppose he did as he could not be induced to make any further remarks upon the subject although repeatedly asked to do so.

I may say that some time ago I hardened about 30 cutters 2 in. in diameter by ⅞ in. thick. The quenching tank held about two or three pints of oil and the cutters were quenched singly. The last one quenched made the oil so hot that it boiled over and left the previously hardened cutters bare. I went over them all with a file to test them, thinking I had gone too far, but found that they were "all right."

I can quite understand that the boiling point of whale oil is considerably less than that of linseed or tempering oil, but I should like to know the reason for hot oil hardening better than cold oil. It may be because it is more fluid; at any rate some of your hardening experts probably could enlarge upon this subject.

My father, who had some knowledge of the steel button trade in the early fifties told me that he had heard a hardener remark that the oil hardened better at the end of the day when it had become well warmed up.

Our cutters are now heated by natural draft gas furnaces and quenched in hot or warm water, but I should imagine that on the question of warping, or on tricky work, hot oil would be better. I may add that in my first experience of using linseed oil for tempering springs, during which more heat was wanted and more coal was put on the fire, the oil boiled over until the flames nearly reached the ceiling. The top of the thermometer was blown off, though this was not noticed until later. Why the thermometer broke I did not understand, particularly as the maker subsequently informed me that mercury boiled at 620—but I expect he is wiser now as this happened thirty years ago.

Manufacturing Oil-Well Tools in Texas

Unexpected Development of Quantity Manufacture—Using Batteries of Gear-Cutting Machines and Turret Lathes—Oil-Well Tools and How They Work

BY FRED H. COLVIN
Editor, *American Machinist*

EXCEPT in the older oil fields and in the long-settled parts of the country, we do not look for machine shops with manufacturing equipment and methods. This makes it more of a gratifying surprise to find shops down in Texas where oil-well tools and machinery are being manufactured in modern buildings and with up-to-date equipment.

The City of Houston, Tex., has many surprises, but none appeal to the shopman more than to visit such a plant as that of the Hughes Tool Co., with its saw-toothed roof, modern locker rooms with shower bath and all up-to-date appliances, a lunch room and a self-service grocery and supply store for its employees.

Abandoning the old type of well-boring tools and the older method of the Pennsylvania oil fields, the boring of oil wells in the Texas field is a strictly mechanical proposition in which the oil derrick becomes the headstock for the huge vertical boring machine whose boring tool is sometimes on the end of a bar a full mile below the earth's surface. The average depth, however, may perhaps be placed at 2,500 ft. The headstock or driving head is a story by itself, being entirely independent of the tools used and their manufacture. The beginning of the hole is usually made with a flat fish-tail bit, as in Fig. 1, sometimes as large as 20 in. in diameter but more often not exceeding 16 in. When rock is reached, however, it becomes advisable if not absolutely necessary, to use an entirely different type of tool if efficient drilling is to be done. The necessity for this method has developed several types of boring tools or bits, among them the Hughes bit shown in Fig. 2. The cutting members are serrated hard steel cones, two or three being used according to different conditions. As the bit revolves, these cones roll around over the rock, each tooth striking at a different point, crushing and cutting its way through. The mechanic will immediately compare it to the star wheel type of tool used for truing abrasive wheels. These cones are mounted on substantial studs set in a rigid head or body. As this bit is rotated, it cuts its way through the rock, the cuttings being flushed out by a pressure of water from above, provision being made both for the inlet and outlet of this stream. In addition to the end-cutting tools, reaming tools are mounted up in the body of the bit to insure the hole being full size all the way down.



FIG. 1. FISH TAIL BIT

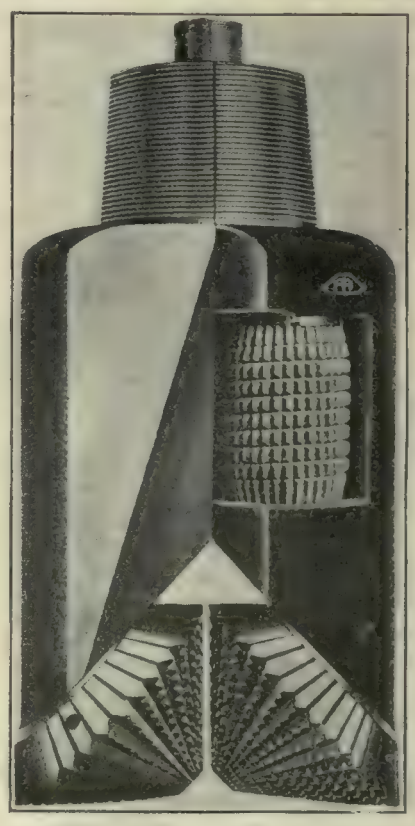


FIG. 2. HUGHES ROLLER BIT

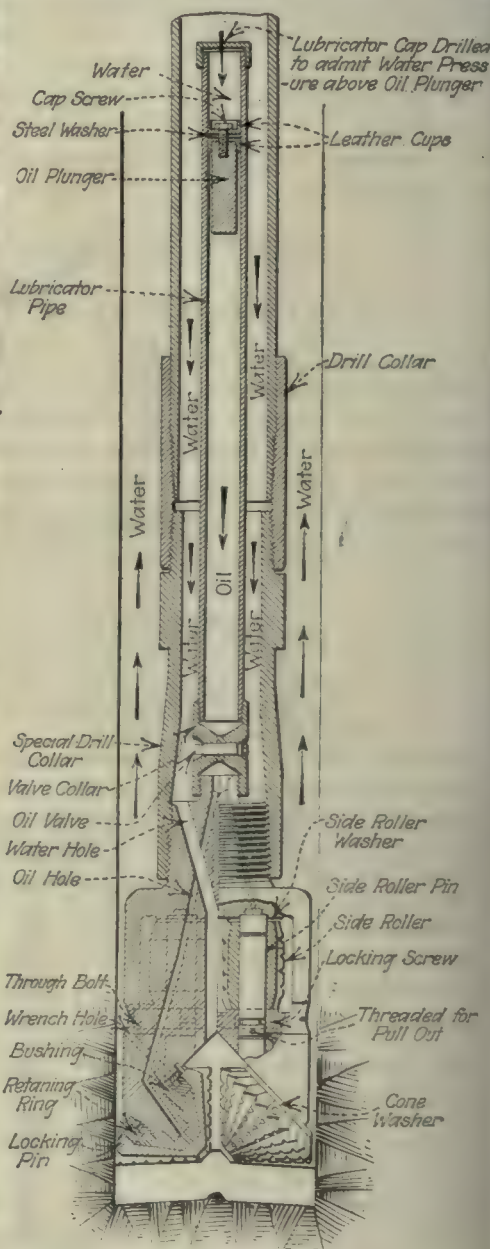


FIG. 3. HUGHES BIT AT WORK

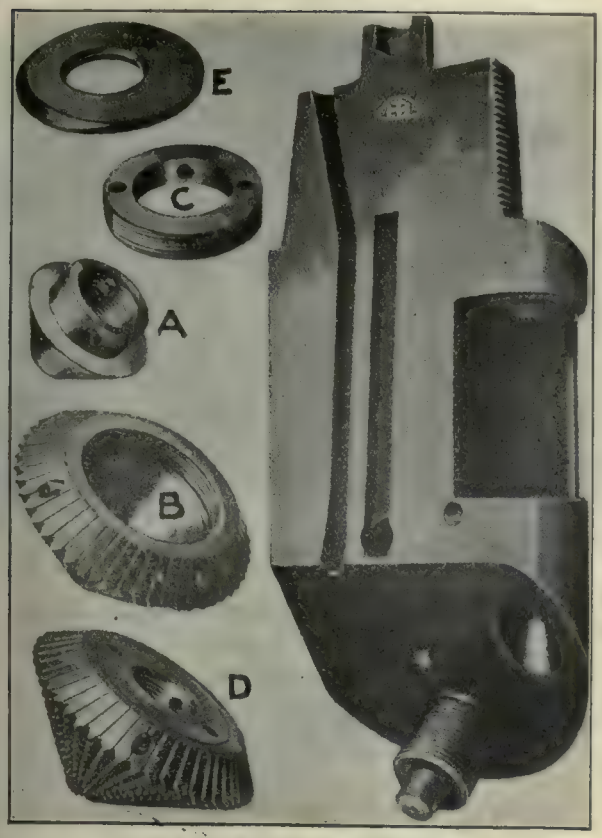


FIG. 4. PARTS OF THE BIT

The way such a bit operates is shown in Fig. 3, in which the various parts of the tool and holder are designated. Water is forced down on the inside of the drill pipe, which varies from 4 to 6 in. in diameter, the excess water as well as the cuttings going up outside of the pipe as indicated. Fig. 4 shows some of the details of construction, among them the conical bronze bushing *A*, which fits inside the cone-cutting tool *B* and the threaded retaining ring *C* holding it in place as shown at *D*. The inside of the bushing screws on a stud on the angular surface of the body of the tool. The other details can be readily understood by comparison with the head as a whole. The odd-shaped, hardened washer *E* forms the end bearing for the collar *C*.

Some idea of the necessity of rigid connection for these boring heads may be had by carefully considering the weight which they carry while drilling. In addition to the weight of the head and of the drilling-tool pipe, which, of course, increases as the well goes down, the tools are also loaded to secure best results. The recommended weight on these bits varies from 2,870 lb. on a bit 2⅜ in. in diameter to 12,000 lb. on one of 9⅞ in. diameter. On extremely hard rock, however, it is advised to use less weight and more speed, instead of exceeding the weight given.

The body of the bit is made of steel castings, while the cutting cones and the studs which take the thrust and wear are made of alloy steel and heat treated. Lubrication, necessary to insure satisfactory operation and prevent the various bearings from wearing out, is secured by an oil reservoir seen in the center of Fig. 3, the oil pressure being controlled by the water, and consequently, to some extent at least, by the depth of the hole. Bearing this in mind, the shop views shown in Figs. 5, 6 and 7 will give a good idea of the work done and the equipment which has been installed.

Part of the Gisholt battery is shown in Fig. 5, this, as can be seen, being engaged on a variety of work. The second lathe is making large cones for cutters,



FIG. 6. GEAR CUTTING DEPARTMENT



FIG. 5. TURRET LATHE DEPARTMENT IN HUGHES SHOP

some of them being shown piled on the floor at the end of the lathe. It will also be noted that each lathe is provided with a drip pan at the end for catching the overflow of lubricant. This drip goes back to a main tank where it is settled, and the clean lubricating liquid pumped back to every machine in the shop.

The cones are grooved be-

fore taking from the lathe. After this, they go to the modern double-spindle Gould & Eberhardt gear cutters shown in Fig. 6, where the teeth are automatically cut, some of the finishing cutters being shown on the floor. Next comes the heat treating of the cutters, this department being shown in Fig. 7. There are four good-size hardening furnaces with all the necessary cooling baths, pyrometers and other devices for securing the desired condition of the cutters. The equipment also includes Smalley thread-milling machines for the cones and an up-to-date engine-lathe equipment. Although no women workers show in the illustrations, a goodly number of them are employed and at exactly the same pay as men for the same work. Furthermore, the company ha:



FIG. 7. HEAT-TREATING ROOM

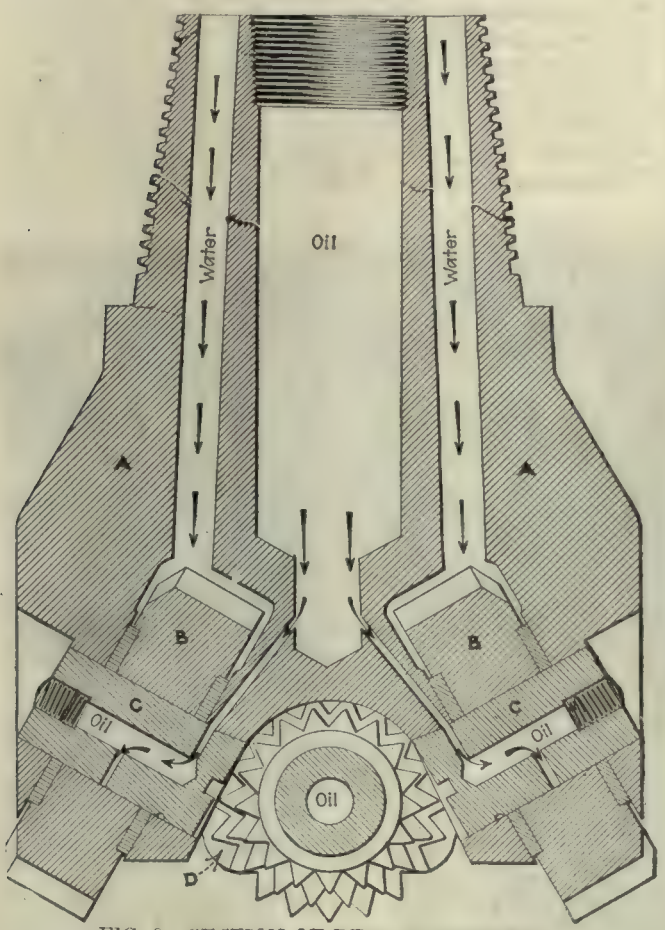


FIG. 8. SECTION OF REED ROLLER BIT

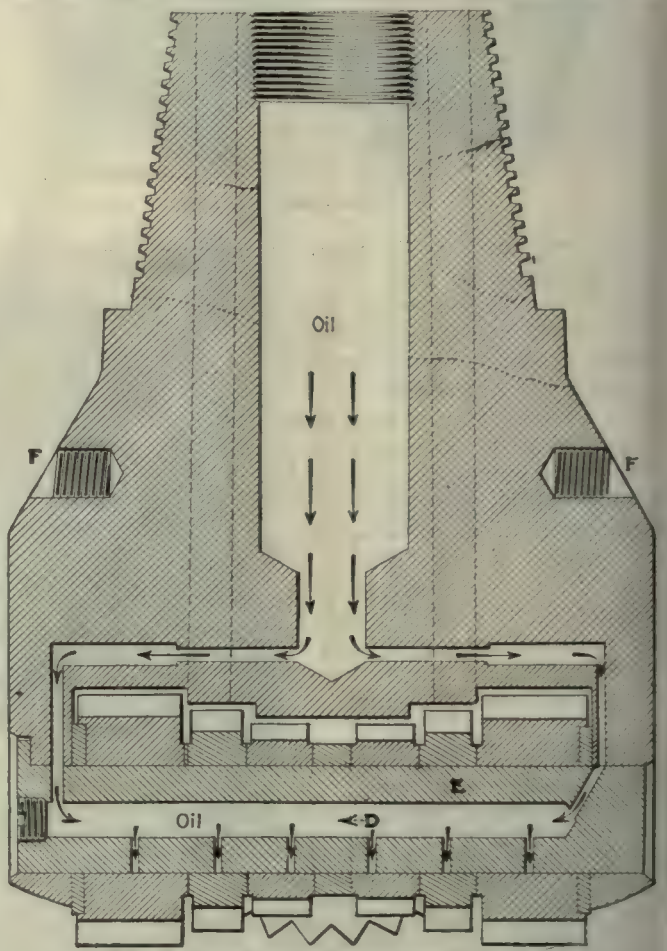


FIG. 9. THE OTHER SECTIONAL VIEW

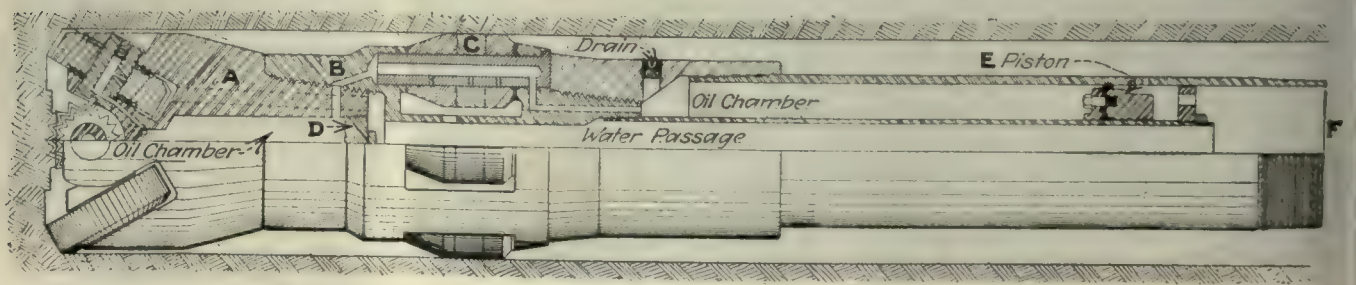


FIG. 10. THE REED BIT AT WORK

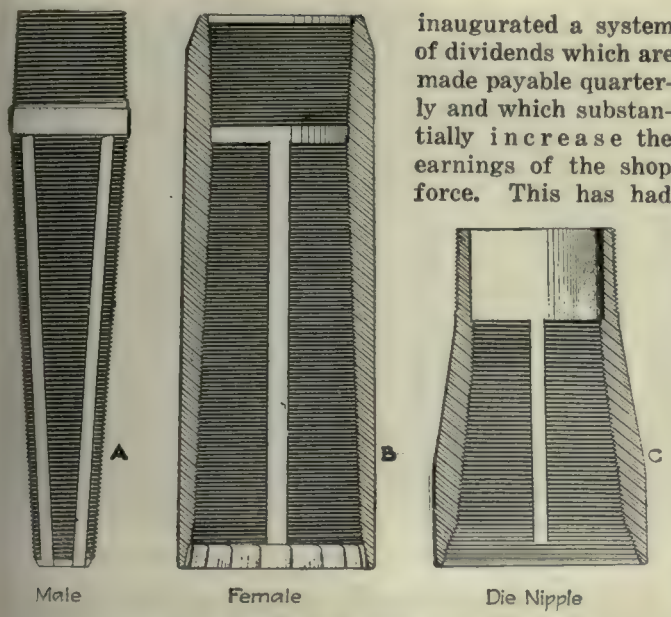


FIG. 11. TOOLS FOR REMOVING PIPE

inaugurated a system of dividends which are made payable quarterly and which substantially increase the earnings of the shop force. This has had the desired effect of stimulating interest in the shop and its production, and is part of a larger plan to make every employee feel that he or she is directly interested in the success and, consequently, in the production of the whole shop.

The Reed Roller Bit Shop

Another interesting shop in Houston and one which is growing at a rapid rate, is that of the Reed Roller Bit Co., makers of the Reed (Caddo type) roller bits. These bits have been developed especially to meet the various conditions that exist in the Texas oil fields but that will be found in other oil fields as well.

Those of us who are not familiar with oil-well boring tools and who consider them as being rough pieces of machinery, do not appreciate the care with which they are designed and constructed. An excellent example of a modern roller bit is shown in Figs. 8 and 9, which give sectional views of the Reed roller bit, known as the "Caddo" type. This bit consists of a substantial one-piece steel head casting *A*. This head has pockets cast in it for the angular cutters *B-B*, the pockets being carefully faced for the hardened steel washers shown on each side. The studs are made with an eccentric head to prevent their turning, so as to insure the oil passages shown being always in position. The studs are held in position by the block *D*, also shown in Fig. 9, the block forming the center bearing for the transverse cutting tools which lie across the face of the bit.

This block essentially prevents any movement on the part of the studs *C-C*, and is itself held in position by the shaft *E*, which also has an eccentric head to hold it in position so as to keep its two oil holes, by which the supply of lubricating oil enters, in their correct position. These two views serve to show the general construction of the boring bit. Fig. 8 shows the passages for both water and oil, the first to wash the cuttings away and force them back up the pipe, and the second to supply a constant stream of lubricant to all of the working parts. The water passages are purposely restricted in the head so as to give velocity to the stream and wash out all particles of rock, both to clear the hole and to prevent abrasion. The side holes *F*, Fig. 9, are drilled and tapped solely for convenience in handling the bit on the derrick frame.

How This Bit Works

The way in which the bit works, and in which oil and water are supplied to it, is shown in Fig. 10. The rolling bit itself, which has already been explained in detail, is shown at *A*. Screwed on this, by means of a sharp taper Acme thread, is the reamer portion *B*. The reamer body carries four sets of cutters as shown at *C*, which act as reamers and assist in making the hole straight and of full diameter. The way in which the oil is conducted from the oil chamber above, through the shafts which carry the reaming cutters, and from there to the oil chamber in the bit itself, is of interest. The lower oil chamber is closed by the cap *D* so as to prevent the water in the central pipe from entering. Its only outlet is through the long drilled holes shown in dotted lines, and more clearly in Fig. 8.

The main oil chamber carries a piston *E* with a cup-leather packing. Above the packing is a baffle plate *F*, which allows the water pressure to act on the annular piston, and so force the oil through the restricted openings, insuring positive lubrication to every cutter. This annular oil chamber has a very large capacity, so as to insure thorough lubrication of the cutters during the longest run. A special heavy oil is required, as the ordinary lubricating oils are easily squeezed out of the bearings, and do not provide proper lubrication.

Some Special Tools

A few other special tools used are shown in Figs. 11 and 12. The tap at *A*, Fig. 11, is used for fishing for broken pipe, being mounted on the end of a string of pipe, and the point enters in the pipe which has disappeared down the well. If it is possible to enter the end of the pipe, the top is threaded into the broken or damaged pipe, and used in pulling it out of the well. This refers to the pipe used in driving the boring tools, rather than the well casing, unless it happens to be one of the places where one case is put down inside the other.

At *B*, Fig. 11, is a coupling or die which has milling teeth cut in the end, and which is lowered over the pipe it is desired to remove. This is necessary in case the

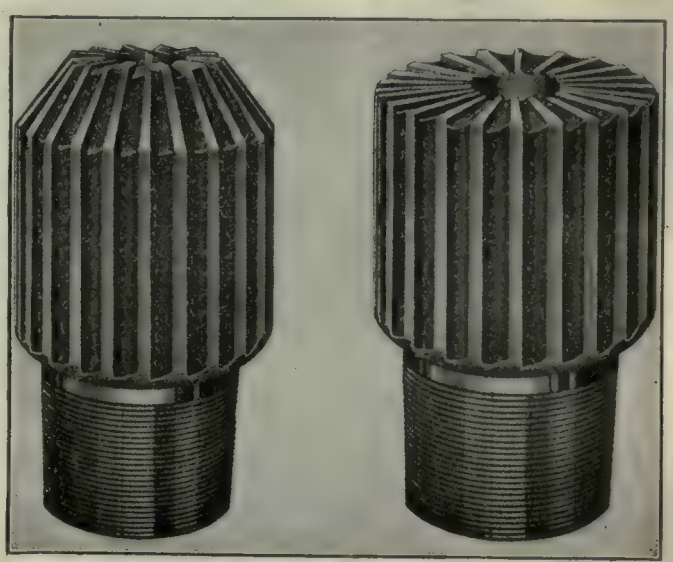


FIG. 12. CUTTERS FOR RECOVERING PIPE

pipe has been crushed so that the tap will not enter. Another form of this tool is shown at *C*, it being used in a socket instead of on the end of a pipe string, as is shown at *B*.

The milling tools shown in Fig. 12 are for cutting

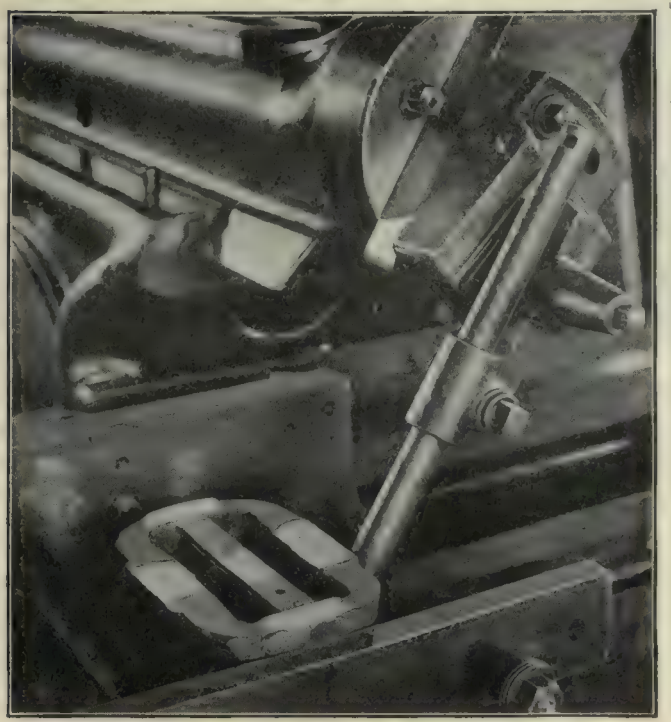


FIG. 13. SHAPING SLOTS FOR CUTTERS

away damaged pipe, it being sometimes necessary to do this before any of the tools shown in Fig. 11 can be used. These tools are practically large milling cutters running up to 12 in. in diameter, and are sometimes necessary for work of this kind.

Coming to the manufacturer of the Reed boring bits, Fig. 13 shows the planing of the pockets for the side or angular rollers. It shows the lower end of the boring head, clamped to a special bracket on the shaper. A boring tool with its holder is used and is so set in the toolhead of the ram as to relieve itself on the return stroke. It will be noted that a central bar or strip is left in the head for laying out purposes, but this is afterward removed to make room for the gang of boring cutters, which fit into the long central pocket.

The special fixture shown in Fig. 14 is clamped over the head of the bit and used for boring the angular hole for the side-cutter studs. The whole piece is then turned so as to bore the corresponding hole on the other side by means of the bushing *A*. The same fixture guides the drill for the long end shaft, one of the bushings being shown at *B*.

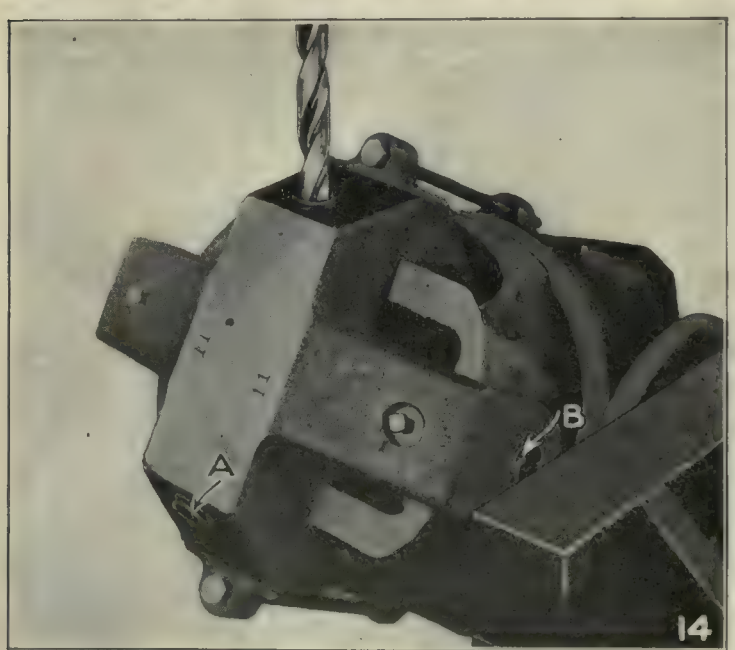
Fig. 15 shows the counterboring of the hole, for the eccentric head on the shaft which carries the cutters. The counterboring cutter, has a pilot which is guided by the plate *A*, being held in position by the screw jack *B* and located by the two pins shown at *C*.

Part of the lathe department is shown in Fig. 16, the lathes being all Lodge & Shipley machines and motor driven.

Fig. 17 shows another department with a radial drilling machine and a milling machine in the foreground and includes one of the drilling fixtures at *A*, while at *B* can be seen the same drilling fixture as was shown in Fig. 14. This view also shows some of the cutters at *C*, which resemble spur gears, except for the shape of the teeth.

More drilling is shown in Figs. 18 and 19, while Fig. 20 shows part of the new lathe department. It will be noted that all these lathes are motor driven in the approved style.

Figs. 21 and 22 show one end of the heat-treating room. The cutters and their supporting shafts and studs are made of carefully selected steel and heat-treated to secure the desired hardness and structure.



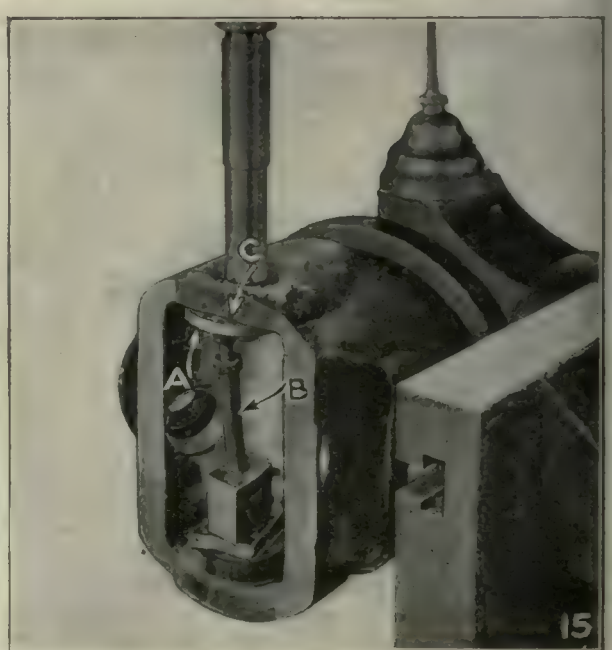


FIG. 14. DRILLING FOR CUTTER SHAFT. FIG. 15. COUNTERBORING FOR ECCENTRIC HEAD

Figs. 19 and 20 show a complete drilling and reaming bit, the former being a side view and the latter an end view, showing the arrangement of the cutters. As can be seen, the bits are of very substantial construction, as is necessary in order for them to force their way through rock of varying hardness.



FIG. 16. ENGINE LATHE DEPARTMENT



FIG. 17. MILLING AND DRILLING



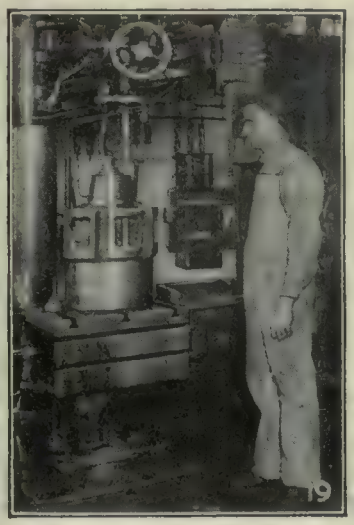




FIG. 18. DRILLING FOR ANGLE CUTTERS. FIG. 19. DRILLING A LARGE HEAD. FIG. 20. MOTOR DRIVEN LATHES

Just to show what sort of work is expected of oil-well drilling tools, the following is copied from a letter sent to the Reed company by a contractor in western Texas:

Started at surface with fish tail bit	13 ft. soil	
Reed rock drill bit	2 ft. flint rock	12 hr.
" "	6 " "	12 hr.
" "	4 " "	15 hr.
" "	14 " lime rock	15 hr.
" "	4 " rock	
" "	17 " yellow clay and rock	12 hr.
" "	22 " hard rock	16 hr.
Reed rock drill bit	24 ft. hard rock	16 hr.
" "	16 " "	24 hr.
" "	3 " "	
Fish tail bit	12 " blue clay	24 hr.
" "	7 " "	
Reed rock drill bit	9 "	12 hr.
Fish tail bit	17 " blue clay	
Reed rock drill bit	3 " rock	18 hr.
Total feet with fish tail bit		49 ft.
Total feet with reed rock bit		124 ft.

This drilling contractor used only one set of cutters to make the above-reported hole, and stated the cutters were not worn out but would be used in the well again. The drill head was not damaged or worn.



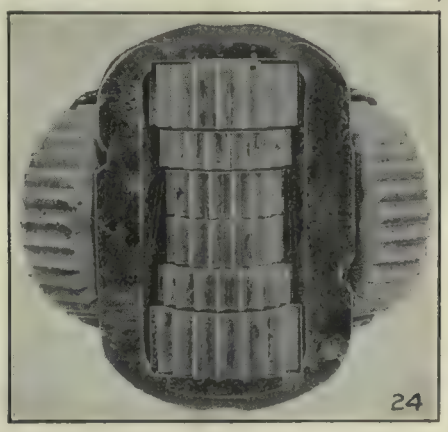


FIGS. 21 AND 22. THE HEAT-TREATING ROOM

In another well in the Goose Creek (Tex.) district, hard rock was encountered at 1,800 ft. below the surface, and 26 ft. was drilled in 3 hours. This work was, of



FIG. 23. SIDE VIEW OF REED BIT
FIG. 24. END VIEW OF REED BIT



course, much less difficult than the flint before referred to. These instances are cited to compare them with the milling-cutter problems of work-tool builders.

Yes! "Design" Jigs and Fixtures

By C. H. Dengler

Messrs. Frederick and Grant have hit the nail on the head many times in their remarks on pages 26 and 580 of *American Machinist*, on the subject "Should Jigs and Fixtures be Designed?" As one who has worked under both systems (if the slip-shod way of having the tool designed as it is being constructed can be called a system) I feel it my duty to add a word or two.

I well remember when, quite a few years back, I broke into the "profession." The place was a small automobile company, and before I joined the force the engineering office had handled all the tool designing. In odd minutes tools had been roughly laid out on thick manila paper by one of the busy engineers and shoved along to the shop. These crude drawings were but rough assemblies; the details being left to the patternmaker and toolmaker who were given the job. Many times when the engineer was too busy and a crude drawing was unavailable, the superintendent or toolroom foreman would explain to the toolmaker what was wanted, give him an odd bit of casting and let him puzzle it out himself. The result was generally a puzzle to the machine operator. Rough, crude and cumbersome, its only virtue was that it worked and helped production to some extent.

As a beginner in this place, my first job was to design tools systematically under the watchful eye of the tool superintendent. These were likewise crude drawings—merely assemblies of the work with the tool blocked around it and with figures and other data spread around the sheet. They were better aids, however, to the patternmaker and toolmaker, especially as all tools were actually drawn. This plan worked well when the work was given to a bright toolmaker and production was certainly helped a good bit.

Still these tools were slow and costly to build, as too much thinking was left to the toolmaker; not that he cannot think as well, if not better, than the average draftsman, but that many jig and fixture parts can be standardized and thus much repetition both in the design and the toolroom can be eliminated. A thousand or more parts need standardization in the same way that such work is carried out by the Society of Automotive Engineers for automobile parts; such parts as bushings, jig feet, clamping parts, locking devices, etc., and one, instead of half a dozen, kinds of tapers. This standardization means hours saved not only in designing but in building the tools, for in slack times these parts can be made and stored up for the rush time.

During the late war I was fortunate enough to work in one of the big war plants that encouraged production by all the means available. The shop, the toolroom and the designing rooms were called upon to do their bit. All our tools were "designed" and detailed and checked. And, although it was a very costly and elaborate system, the engines that we produced and the interchangeability established justified it.

Take the Browning gun, for example, with which most people are acquainted; every part is machined to be interchangeable with another, and this is accomplished only by having all parts manufactured under supervision by means of tools designed in the office.

To my mind the proposition boils itself down to how fine shall the work be manufactured and in what quantity, as to whether we shall design the tools or let the shop handle the job with the best means at its disposal. A quantity and quality producing factory will be equipped with a tool design room and capable designers.

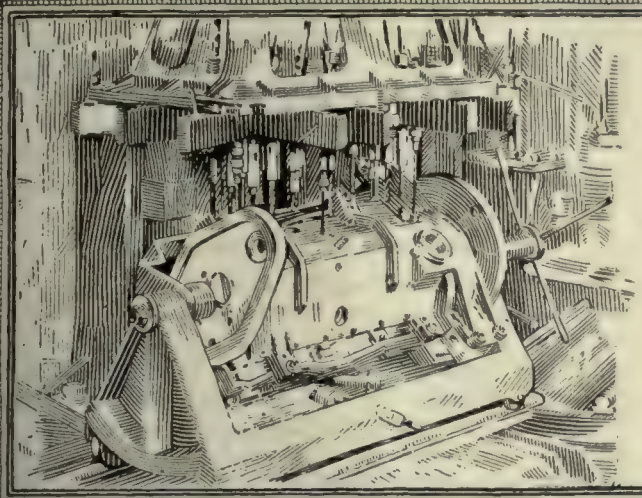
Now while on this subject a word as to the caliber of the designer would not be out of place. Having worked along with hundreds of designers (real and fancied) the best men that I have known have been those with actual shop experience. The shorter the time they had worked in the shop, to a certain degree, the longer they took to plan a tool or machine or operation. Not an awful lot is needed to make a good tool designer; but it is imperative that he should have worked in the shop and on a number of different machines or his work will consist more of inventions than of horse-sense.

One trade is enough for any man to master. Why some will try to combine tool making with tool designing I cannot see. As to having the patternmaker plan the tools as suggested, it is too absurd to even consider seriously. The average patternmaker is at home in his own line, but to ask him to plan a tool to be used on a machine that he knows nothing about, has never run, and probably could not run, is preposterous.

One thing more, while on this toolmaker controversy. Many toolmakers I have known receive the same if not more than many tool designers; so designing cannot offer them any inducements from a pecuniary viewpoint. If manufacturers demand a higher class of tool designers I can see a more livable salary ahead for designers.

Night school drafting is fine, but it would not carry one very far in the average progressive factory designing room unless diligently pursued. They demand a more finished drawing than a tired body and restless brain is capable of producing in the few hours that may be devoted to it at night.

Tool and machine designing seems to be coming to that stage of the game where it is fast taking on the dignities of a worthy profession, and I would not be surprised to see some college incorporate such a course, with a degree at the end of it, in its curriculum.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Drill Jig Design Continued—Standard Jigs and Components—Jig Bodies—Standardization of Jig Posts and Thumb Screws—Jig Feet—Locating Plugs—Types of Bushings

THERE are many parts of jigs and fixtures in common use that can be standardized either to obtain uniform design or to enable a factory to make them up in quantities. There are some parts that are seldom used but the general design and proportions of which are so well established that drawings can be made of various sizes to cover practically all conditions. There are also many accessories such as thumbscrews, hand knobs, ejectors, jig bodies and jig leaves, which can be made in certain sizes and carried in stock so that the toolmaker can use them whenever they are shown on a tool drawing without having to make up each one as he requires it. In addition to the parts mentioned it is possible to standardize bushings so that they also can be made up in quantities. However, this is not frequently done as there are so many sizes to take into consideration.

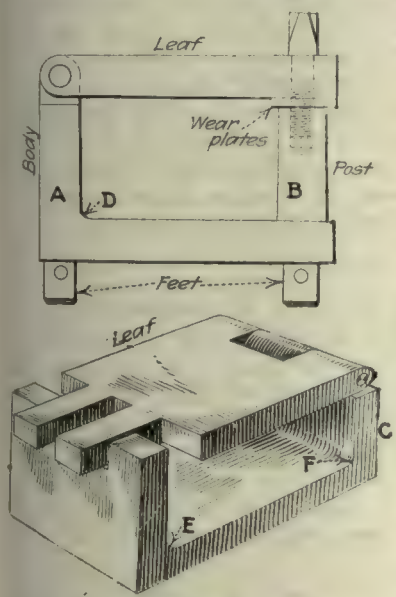


FIG. 55. STANDARD ANGLE AND CHANNEL IRON JIG BODIES

Standard Jig Bodies

There are two varieties of standard jig bodies, the angle-iron form and the channel-iron form; of these varieties the angle-iron form is the more common and is frequently found both in steel and cast iron. The channel-iron jig body is less common except in certain classes of work where a great many parts of small and comparatively uniform sizes are to be jigged. Referring to Fig. 55 a standard steel angle-iron jig body is shown at *A*. The usefulness of such a jig body is very apparent and it has the advantage of being made up cheaply for a variety of usages. For small parts requiring leaf jigs, many combinations can be made with angle irons of this variety. It is easily possible to build up a post like that shown at *B* and fit a leaf with thumbscrew and wear plates, as indicated, to suit a great number of conditions. The jig feet can be screwed into place as shown and can be put in wherever they are needed. Another advantage of this type of jig is that the angle iron can be made in a long strip and planed up accurately and then cut up into sections which may or may not be standardized for width according to the requirements. A great many factories carry angle iron in stock ready for use when needed.

On certain classes of work a channel-iron body may be found a great advantage. For example the channel-iron body *C* may be made up in a number of sizes and may be standardized for width, depth and length. Assuming that three or four sizes are carried in stock it is evident that a leaf may be fitted in; a V-block or locating pin inserted; clamps put on; or other appliances fitted to suit a great number of cases. In the standardization of jig bodies the manufacturer must be governed by the relative size of the components in his product.

It may be well to state in passing that it is advisable to provide good fillets on all angle-iron and channel-iron

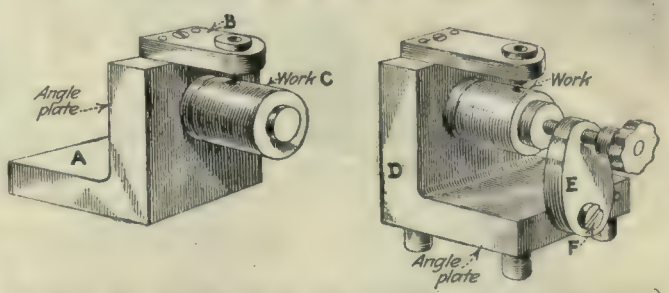


FIG. 56. ANGLE IRON JIGS MADE OF CAST IRON

castings or forgings as shown at *D*, *E* and *F*, to make the sections as strong and serviceable as possible. If it is necessary at any time to fit blocks or other parts around the fillets, it is advisable to chamfer the block rather than to cut out the fillet, so as not to weaken the fixture.

For the authors' forthcoming book. All rights reserved.

The utility of an angle-iron jig is indicated in Fig. 56. The angle irons are of cast iron. There is shown at *A* an angle plate made into a simple jig by applying the bushing plate *B* and a locating stud on which the work *C* is held. This is a very simple form of jig in which the work is held in place by hand while drilling.

Another application of the angle iron jig is shown

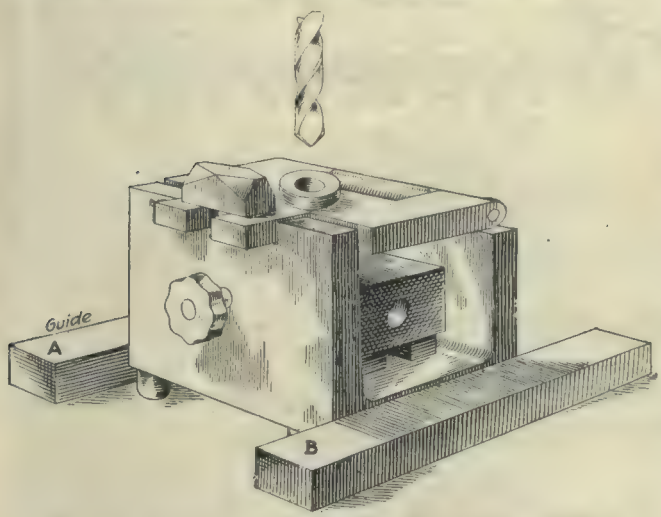


FIG. 57. STANDARD JIG USED BETWEEN GUIDES

at *D*. A bushing of similar form is to be drilled in such quantities that it is advisable to provide a means of clamping the work. The clamp *E* is pivoted at *F* so that it will swing out of the way when not in use, thus allowing the work to be removed from the stud without difficulty. Other applications of angle iron jigs will be mentioned in a subsequent article.

Advantages of Standard Jigs

Another advantage of a standard size and form of jig is in the location of the jig when in use on the drilling machine. Let us assume that a number of different jigs are used from time to time and we know that it takes a little time for the operator to arrange the machine so that each jig will be conveniently handled. By the use of standard jigs it is possible to clamp or screw down guides, as indicated at *A* and *B* in Fig. 57, so that jigs of a standard size can be readily slipped between the guides when changing from one part to another. In the standardization of jigs

In taking up the various components which are used in built-up jigs we must not forget the jig post and the frequently used quarter-turn screw. Several examples are shown in Fig. 58. Example *A* is not generally considered good practice because there is no locating provision made to take care of abuse or wear in the leaf. The quarter-turn screw *B* does not assist in locating the leaf, and the accuracy is entirely dependent upon the hinge construction.

Jig Posts and Thumbscrews

It is much better to make a jig post as shown at *C* and to allow the leaf to locate on the sides *D* and *E*. Provision for wear may be made as indicated at *F*, in which the same type of jig post is used as that shown at *C*, but provided with wear plates of hardened steel at *G* and *H* so that the accuracy of the leaf fitting is assured. The post can be turned and threaded at its lower end as indicated at *K* and a suitable dowel provided at *L* to make location positive.

A type of jig post sometimes used, shown at *Q*, can readily be made so that it will screw onto the body and it can be furnished with wear plates at *R* and *S* if desired. In addition the leaf can be provided on the sides at *T* and *U* with plates that can be hardened and ground to an accurate fit.

Quarter-turn screws are frequently used in leaf jigs; several varieties are shown in the figure. When screws of this kind are used it is necessary to turn them so that they are in alignment with the slot in the leaf when loading or unloading the jig. A refinement which makes it possible for the operator to turn the screw the right amount every time is shown at *M*. The underside of the thumbscrew is cut away and the pin *N* acts as a stop for the screw. Another method which gives the same result is shown at *O* where the stop pin *P* is fitted to the leaf instead of in the jig post.

Jig Feet

There are several things to be considered in the design of jig feet. They should be made long enough so that there will be room to take care of an accumulation of chips under the jig body, yet not long enough to be fragile. They may be screwed to the jig body, a hole being provided, as indicated at *A*, Fig. 59, in which a pin can be placed to assist in the operation. Occasionally it is desirable to force in the jig feet, instead of screwing them in place, and when this is done it is

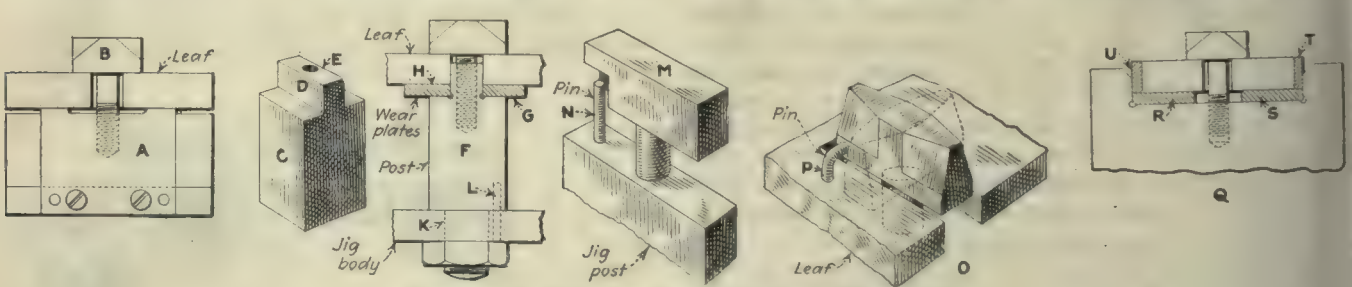


FIG. 58. JIG POSTS AND QUARTER TURN SCREWS

other applications will be found which will prove profitable in the actual processes of manufacture.

The same idea of using guides can be applied on large cast-iron jigs providing the sides of the jig are finished so they will pass between the guides. In progressive drilling an arrangement of this sort will be found to be a great advantage.

advisable to use a construction similar to that shown at *B* in which flats are provided to assist in assembling.

A very excellent method of fastening jig feet in place is shown at *C*, a system frequently used when a jig has to be turned or if feet are provided on each side. The nut *D* can be used to draw the foot tightly into position and its location and accuracy can be assured

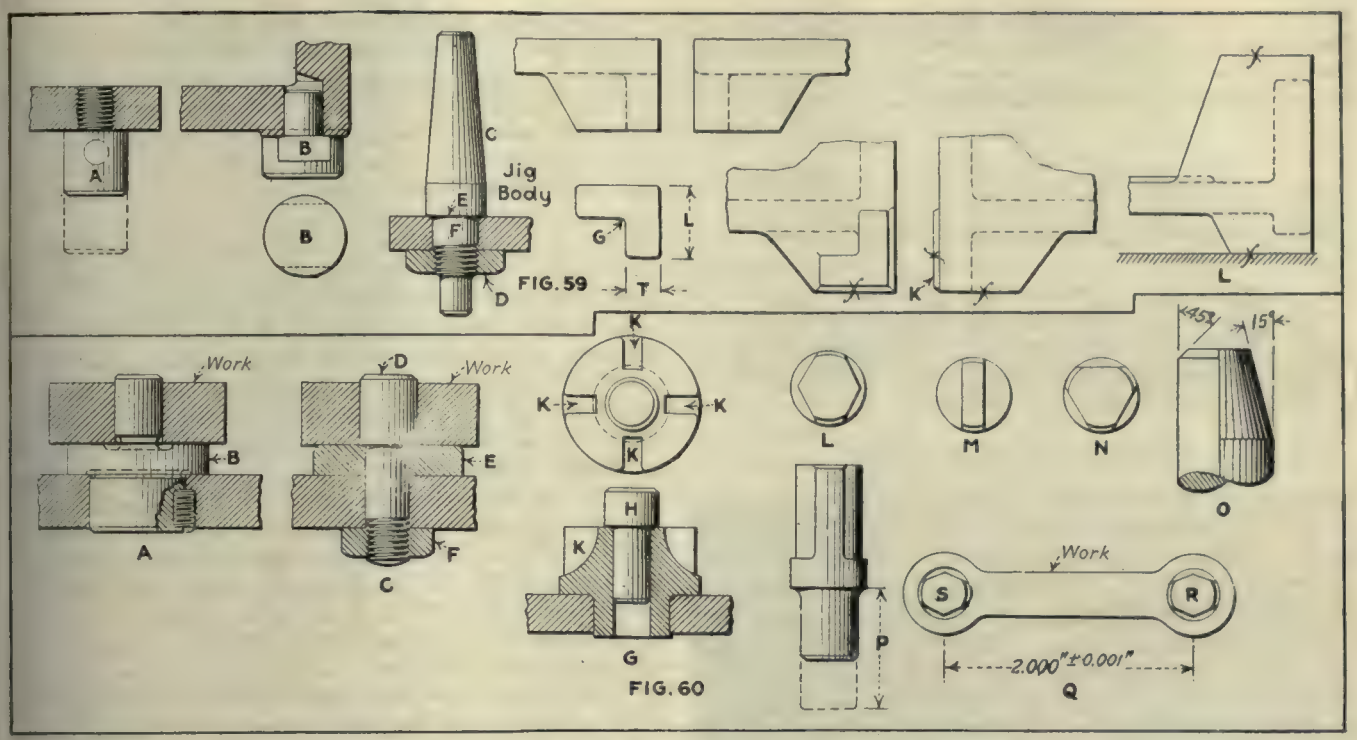


FIG. 59. EXAMPLES OF JIG FEET. FIG. 60. LOCATING PLUGS

by the squareness of the face *E* and the accuracy of the fit on the shank of the foot at *F*. It is advisable to provide means for locking the nut, consequently the thread on the shank should be of fine pitch.

When jig feet are of cast iron it is well to make the thickness *T* of the foot equal to the wall of the jig and the length *L* about two and one-half times the thickness.

It is well to make jig feet for cast-iron jigs in the form of an angle as indicated at *G*. Attention should be paid to the proportions of this angle, if the jig is a small one, in order that it may be large enough to overlap any hole in the drilling machine table. A construction, such as that shown at *H* is recommended when work is to be drilled from two sides of a cast-iron jig; it will be noted that a pad is placed at *K* at right angles to the jig foot, yet on this side of the jig the foot is not built up high because it would make an awkward construction and one that might very easily be broken. When jig feet come opposite each other it is well to make the design similar to that shown at *L*, a construction that is strong and that gives ample clearance for chips.

Locating Plugs

Several designs of locating plugs are shown in Fig. 60. In sketch *A* the plug *B* is made of one piece of steel, a construction requiring considerable labor. It is much better to use a construction similar to that shown at *C* in which the plug *D* is used in connection with a hardened and ground washer *E*. The locating plug is drawn up tightly by means of the nut at *F*.

Care must be taken when a piece of work rests on a flat surface to furnish little space for dirt and chips to accumulate. In sketch *G* a plug is shown at *H* and the work rests on *K*, cut out in four places to give less bearing surface and to provide clearance for the drill after it has run through the work. The slots could be made somewhat larger and thus leave less chance for dirt and chips to accumulate. In making up locating plugs for use in a round hole it is advisable to relieve them so that they will not completely fill the hole. They can be relieved as shown at *L*, *M* or *N*, depending upon circumstances. The methods shown at *L* and *N* are much to be preferred to that shown at *M*. The latter tends to weaken the plug so that it is easily broken. All plugs that are made a drive fit in a jig or fixture must have sufficient stock that they will not loosen easily when in use. The length of drive should be from two and one-half to three times the diameter as shown at *P*.

In chamfering the top of a plug which is to receive a piece of work the angle of the chamfer should be as long as can conveniently be made. It can be from 45 to 15 deg. on the side, but it is much better to approach the 15-deg. angle rather than the 45-deg. angle, as the work will assemble much more easily and will not tend to "cock." A diagram showing a method used in locating a piece of work on two plugs is shown at Q. This is a connecting rod in which the holes at the ends are held within limits of ±0.001 in. The two plugs shown are relieved but not correctly. The plug *R* can remain as it is, but that at *S* should be turned around 90 deg. in order to allow for possible variations in the work.

Types of Bushings

Fig 61 shows a number of types of bushings used in jig construction. Bushing *A*, a common type having no head, is used almost exclusively by some factories, but the majority prefer bushings with heads and we believe this type to be better in the majority of cases on account of the abuse to which bushings are subject. The bushing shown at *B* is undercut at the shoulder. This is not good practice; it is much better to round the bushing slightly as shown at *C* and chamfer the casting a trifle as in this way a bushing is obtained that is stronger and is less likely to crack or break either in use or when hardening.

In the design of slip bushings the knurled form shown

at *D* is frequently used. It is well to state at this point that all slip bushings should be provided with hardened liners as indicated at *E*. A screw bushing, as shown at *F*, is very bad and should never be used. When it is

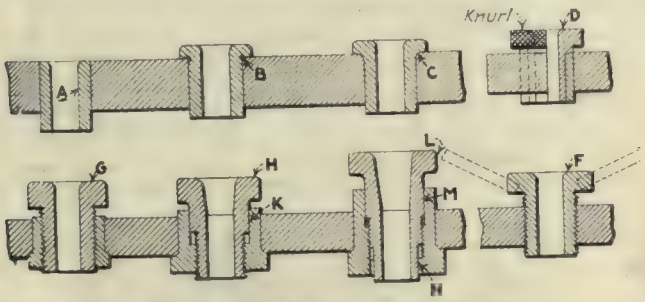


FIG. 61. TYPES OF BUSHINGS

necessary to make bushings so that they will screw into a jig a hardened liner should be provided as indicated at *G*. The head of the liner bushing is on the inside of the jig so that when pressure is exerted on the bushing there will be no tendency to force out the liner.

Screw bushings are used in some cases where a clamping action is needed on the work at the point where the bushing is used. If it is found that no other means of clamping can be used, a much better form of construction is that shown at *H* in Fig. 61. The accuracy of location in the slip-bushing is assured by the cylindrical bearing at *K* and the threaded portion is made a loose fit. An additional refinement is found in bushing *L* which has a cylindrical bearing at *M* and *N* and a thread in the middle. This type insures as high a degree of accuracy as is possible for screw bushings.

Provision should always be made to insert a pin in bushings of this kind in order to facilitate removal. The matter of spring in the jig leaf must also be considered when a screw bushing is used, as it generally is, for clamping. The jig leaf should be re-enforced sufficiently to take care of the strain incurred.

A Loose-Leaf Mechanical Encyclopedia

By P. A. Fredericks

Under the above title on page 385 of the *American Machinist*, C. V. Lovell describes a system of filing cut-outs from mechanical journals. In common with most other mechanics the writer has had a long and bitter experience with trying to file such material to obtain the results listed by Mr. Lovell, and has almost come to the conclusion that "there ain't no such" results possible except at the sacrifice of more time than the average person is able or willing to expend. The most of them work out perfectly well in theory, yet fall down in practice because of the frailty of human nature.

Taking the system described, we are to first read the index and mark our items. Usually halfway down we run across an article we want very much to read *right now* and our system is hung up while we read it. By this time something else has come up and we set the magazine aside to be finished later. Next time we have better luck and finish our index and start marking the articles of interest. In the course of several days and many interruptions we get them marked and lay the magazine to one side to have the holes punched and there it lies indefinitely until the lady of the house informs us that spring housecleaning is about to start and we've got to get rid of those old magazines. We clutch them protectively and start to the basement to bore our holes and if good luck attends us, are not interrupted. We now take them back upstairs in time to help take down the curtains and this done we start hunting for the pliers to draw the staples. The pliers were last seen in the possession of Jimmy who violently disclaims any knowledge of them and maintains that he fixed his roller skates last time with the hand saw, and that he put *that* back.

This an exaggeration? Well, perhaps, but I have seen many systems started in good faith come to grief over just these obstacles or similar ones.

So I am a pessimist. When I find an article that interests me I draw out my trusty paper cutter, jack knife or whatever may be handy and operate at once. The clippings are then placed in a folder with similar articles in an old correspondence file, though this last is merely a refinement and quite unnecessary. The folders are labeled on the tabs and filed alphabetically. A while ago they had to be indexed because there were so many titles and subdivisions that I couldn't remember if I had a folder for the unusual articles, but this concession to complication in my filing system was only added after much throught and crossing of fingers, for my first system and worst failure was all index. Many are the good articles that were lost to me completely by being snatched into the jaw of that all devouring index, and it was a good index at that. I spent most of my waking leisure hours on it and it *had* to be good. I am still of the opinion that it was good, too good for this earth, of human frailty. Anyway it didn't work, and was number one in the list of my failures.

My present system works very well, it isn't perfect, and does not always give me "what I want, when I want it, and where I expected to find it," but taken as a whole, when I have read and filed an article I can go and get it again in most cases, and out with it comes all the other articles of similar nature that I have read for the past ten years, which is a big help as I have an excellent "forgetter."

I sometimes do have to decide if I wish to save an article on bearings from the one side of the leaf or one on wage payment from the other, but I harden my heart and put one or the other of them out of my mind, for the good of my lack of system. Knowing that I cannot possibly file all the available human knowledge and that my files therefore will never be quite complete, I usually find that I don't miss that particular article.

Using Up the Short Pencils

By H. S. Trecartin

There is a great satisfaction in using a new, full-length pencil, especially when drawing or sketching free hand. After the pencil has been used down to half its original length, it cramps the hand, and handicaps execution. Even if one likes the metal devices for holding pencils, with their hard ridges and bulky weight, they are seldom at hand, or are attached to other pencils.

I grew tired of the stubs, and collecting a half dozen of them I made an experiment. I mixed a little flour paste and cut a dozen strips of light wrapping paper about 6 x 3 in. I smeared the paste over one side of a sheet and then rolled it into a cylinder 6 in. long. I put about ¾ in. of the the end of one of the short pencils in the cylinder as I rolled it.

In an hour I found that the cylinders of paper were so stiff that it was impossible to tell where the pencils stopped inside them, and they made a light, solid, close-fitting extension.

Saving Materials in Railroad Shops

Recovering Lining Metal from Worn Car Journal Bearings—Lining and Boring Bearings—Large Amounts of Old Bolts and Air Hose Salvaged

BY FRANK A STANLEY

ONE of the many important items of saving in the railroad shop is the reclamation of lining metal from old journal brasses, shoes and wedges, etc. And the melting out of the old and worn lining from journal bearings also allows the old brass in many instances to be relined and put into service again, thus effecting an economy besides the simple saving of lining metal. In one railroad shop during a certain month the brasses lined included 3,000 old brasses and 4,500 new ones. In other words, 40 per cent of the total number of bearings were old ones relined. The lining department pours about one ton of babbitt a day, including new and old work. The saving effected by the melting out of old metal is considerable.

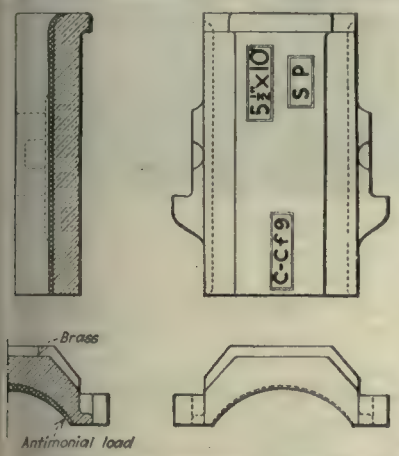


FIG. 1. CAR JOURNAL BEARING

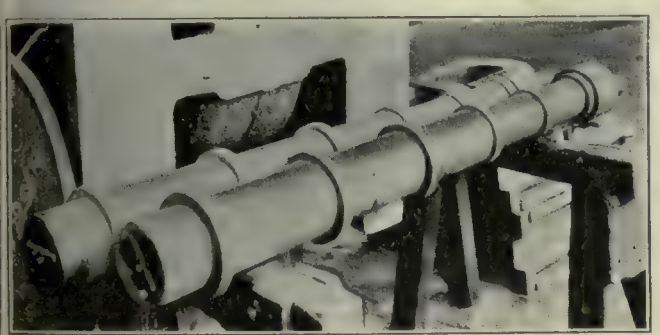


FIG. 2. GAGES FOR TESTING BEARINGS

Fig. 1 shows a standard 5½ x 10-in. journal bearing and Fig. 2 shows a pair of gages used for testing such bearings. The method of mounting such gages is illustrated in Fig. 3.

The gage is an iron casting and the ends are turned down to form necks which are fitted in cradles at the top of the brackets that form the supports for the device. Bolts through the gage neck and bracket top hold the cylindrical casting firmly in position.

As shown in Fig. 3, the gage has five sections, each used for a different size of bearing. The range of the gage diameters illustrated is from 4⅜ to 6¾ in. All babbitting mandrels for brasses are made ⅛ larger in diameter than the gaging diameters given on the drawing. The gage proper is cast with cross webs at the ends which allow center holes to be drilled and countersunk directly in the casting to permit it being mounted in the lathe.

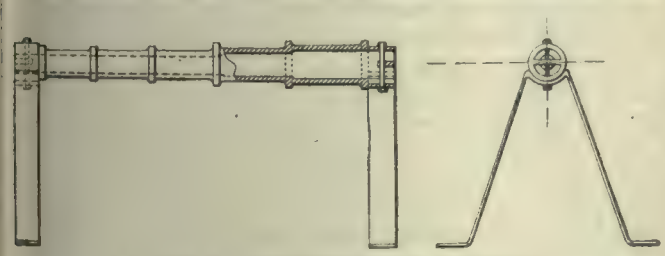


FIG. 3. MOUNTING FOR GAGES

In service the wear on the brasses or bearings comes

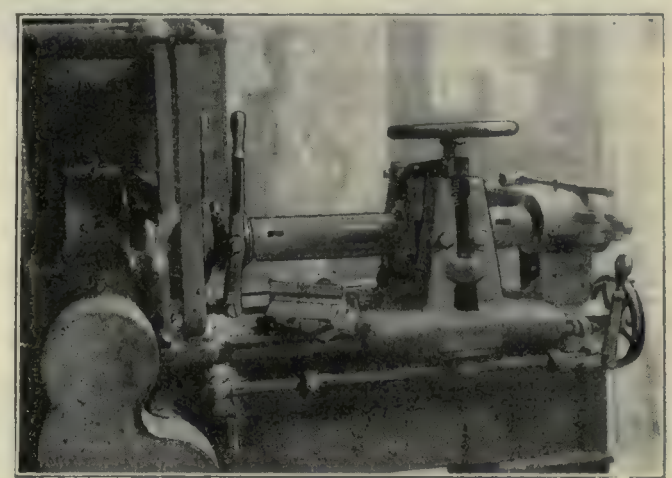


FIG. 4. BORING BEARINGS AFTER LINING

both on the lining diameter and on the over-all length. The gages are made to allow for a certain latitude in both diameter and length to determine whether the brass is to be scrapped or relined.

The babbitting arbor has a flanged base upon which it stands upright, two boxes being clamped to opposite sides. The average amount of metal poured in relining brasses is about 3 lb. each.

Some car brasses last for years and with occasional



FIG. 5. OLD BOLTS TO BE RECLAIMED

relining have been known to run for as long as ten years before being sent to the scrap heap. All new brasses, after pouring, are bored to size. Old brasses are not bored but are relined by pouring on an arbor closely to size.



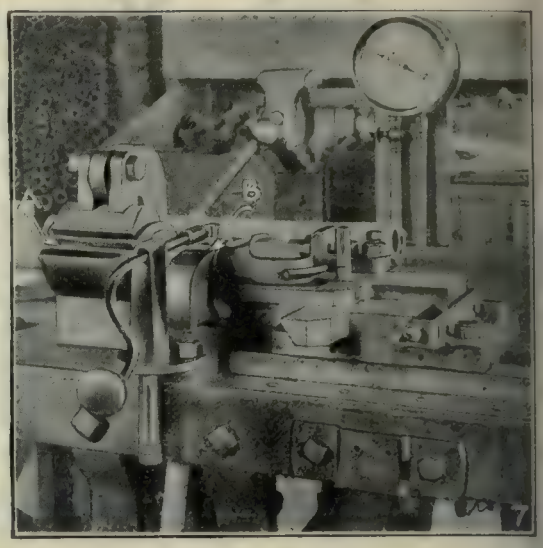


FIG. 6. USED AIR HOSE IN STORAGE. FIG. 7. PUTTING COUPLINGS ON AIR HOSE

A double-end boring machine is used for this work, one end being illustrated in Fig. 4. The spindles are driven by gearing at the center of the machine and the outer ends of the boring bars are supported in the housing seen at the right. Two brasses are carried in a fixture forming part of the carriage on the machine ways and the two brasses are secured by a clamp bar operated by the handwheel at the top. The boring bars carry flat cutters for boring and for facing the ends. The old lining melted out of brasses is analyzed for content and new metal added to bring the mixture up to the required specifications.

Salvage From the Scrap Yards

The manner in which old bolts of all kinds accumulate in the scrap yards is indicated in Fig. 5. Such bolts are sorted out, taken to the reclamation shops, cut off, straightened, re-threaded and put into condition for service. Similarly nuts of all kinds are salvaged by sorting and retapping. The extent of salvage is indicated by such figures as cover the retapping of nuts, say, for a single month which have totaled up to 75,000.

Reclaiming Airhose

Air hose, like other parts, is reclaimed in great quantities, and Fig. 6 illustrates a storage space for this material at the scrap docks. Fig. 7 shows a bench machine for mounting air-hose connections.

This apparatus receives the hose with the clamp on the end. The length of hose is placed in the bench fixture and the coupling or connection placed on a sliding member located at the right-hand end of the outfit. The hose length is gripped between two jaws at *A* (shown closed) operated by a lever at the rear which is actuated by means of an air piston under the bench. When air is admitted to the cylinder the hose is gripped and at the same time the slide at the right is operated to force the connection tight into the end of the hose. The operation is very rapid and as quickly as it is performed it is followed up by a closing action of the pair of narrow jaws *B* at the extreme right-hand end of the hose. These jaws close upon the clamp and enable it to be easily tightened in place by means of the crank-operated wrench shown projecting from the front. This wrench is like a bit stock in form and is always carried in convenient manner by a swivel bracket through which it passes freely.

The methods described and tools illustrated are from the shops of the Southern Pacific Company at Sacramento, Cal.

Some Standards of the Last Century

By F. P. Terry
Belfast, Ireland

I have read with interest the contribution of L. L. Thwing, under the above heading, on page 224 of the *American Machinist*, and think that the writer has not grasped the real state of affairs existing at that time; and it is somewhat difficult to use them as a comparison or contrast with the present state of affairs.

Referring to Mr. Thwing's remarks on the cost of planing as recorded by Mr. Clements it must be remembered that this machine was worked by man power and was one of the first, if not the first planer constructed.

The troubles of James Watt, inadvertently given as happening in 1879 instead of 1779, were not the cost of machinery but lack of good mechanics and tools.

Mr. Thwing's views on the wages paid at that time are also seriously at fault when he records that "after working several years for Bramah, Maudslay's pay was increased to only 7½d per week (nominally 15 cents), probably with board." The actual facts were that Bramah sent for Maudslay to obtain advice on the production of his locks, and was so impressed by Maudslay's sensible reasoning that he made him a handsome present and an offer of employment, which Maudslay accepted, and, soon after, we find him walking to Woolwich every Saturday night to hand over part of his wages to his mother.

After a few years Maudslay became head foreman and found 30s per week not enough; so he decided to start in business on his own account. This sum was about double the ordinary mechanic's wage at that time, and it may be safely assumed that Maudslay's initial salary was 15s without board or any other emoluments.

No doubt then, as now, wages varied considerably, as soon after, we find that Bramah engaged Joseph Clements as chief draftsman for five years with a salary of £3 per week to start with, rising by annual increases of 4s per week; while by way of contrast Edward Harland (afterward Sir Edward Harland, and founder of the firm of Harland & Wolff Ltd.) admitted that in 1852, when chief draftsman in a Glasgow shipyard, his wages were £1 per week.

Magnetic Chucks



DRAWN DEVELOPMENT CONSTRUCTION

Ellsworth Sheldon
ASSOCIATE EDITOR AMERICAN MACHINIST

VIII.—Persons-Arter Chuck

The Persons-Arter a Single Magnet Chuck—Simple Construction — But One Coil Used—Experiments with Various Forms of Chuck—Filings Test to Show Presence of Magnetism

THE latest entry thus far into the field of manufacture of the magnetic chuck is the Persons-Arter Machine Co., of Worcester, Mass., maker of grinding machinery. Mr. Arter, the engineer-member of the firm, being an expert electrical engineer, incorporated in the design of his machine the special holding device now known as the Persons-Arter Magnetic Chuck, the feature of which is simplicity of construction. Characteristically it is the single-magnet chuck and does not differ in principle from others of that designation.



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FIG. 130. THE FINISHED CHUCK. FIG. 131. THE PARTS

At the time when the Persons-Arter rotary surface grinding machine was designed, the magnetic chuck had already given ample demonstration not only of its capability but almost of its indispensability as a work table for such machines; therefore, the designer was not so much concerned with the possible ultimate holding strength of the device, as with the distribution of that strength evenly and in small areas over the entire surface, so that it would hold firmly a full load of comparatively small pieces.

Even Distribution of Holding Power Difficult

To thus distribute the holding power over a surface that is bounded by a circle and in a manner that provides small magnetic areas without corresponding areas that are disproportionately large, necessitated a somewhat intricate pattern that would ordinarily involve comparatively high production costs. Mr. Arter's objective was then to so co-ordinate these opposing factors as to combine, as far as possible, even distribution with simplicity of construction.

A standard rotary magnetic chuck of the Persons-Arter design may be seen in Fig. 130. The concentric circles and the four radial divisions do not represent actual division in the chuck, but are shallow grooves cut with a tool after the chuck is otherwise completed. Their purpose is to assist in keeping the work-holding surface clean and clear of particles of grit or abrasive material by providing channels into which such particles may fall and be washed out by the solution with which the work is usually flooded. The concentric grooves also aid in locating work centrally on the chuck, and the radial grooves provide a convenient place for the insertion of a pointed tool with which to lift off heavy pieces or to start a thin piece that may be held, to some extent, by suction.

The central hole to be seen in this cut serves two purposes: It provides for the chucking of circular pieces having a projecting hub; and it furnishes a setting for a plug upon which to center work that must be ground concentrically. It is bored in solid metal, as a reference to Fig. 131 will show, and does not penetrate to the interior of the chuck.

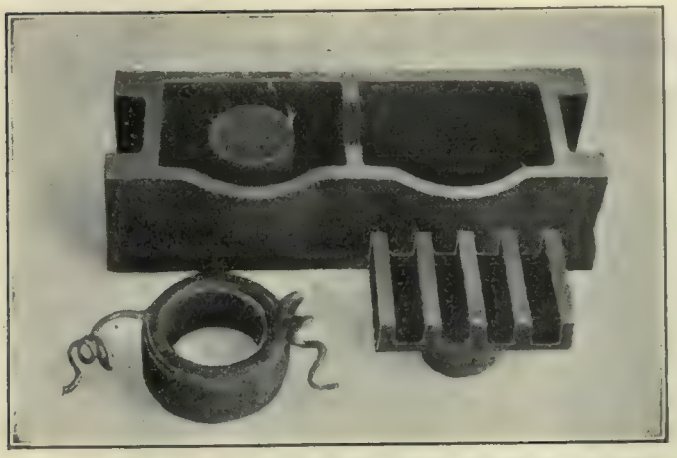


FIG. 132. SOME PARTS OF THE RECTANGULAR CHUCK

The area beyond the magnetic surface is an annular ring of cast iron, hollow underneath and slightly flaring on its circumference. It is not essential to the working of the chuck nor permanently a part of it,



FIG. 133. SHELL AND POLEPIECE BEFORE FITTING

being pressed on after the chuck is finished and occupying a position slightly below the level of the magnetic surface, so that it does not interfere with the holding of pieces that may project over the edge. It is called the water-guard, or sometimes the "skirt," and its

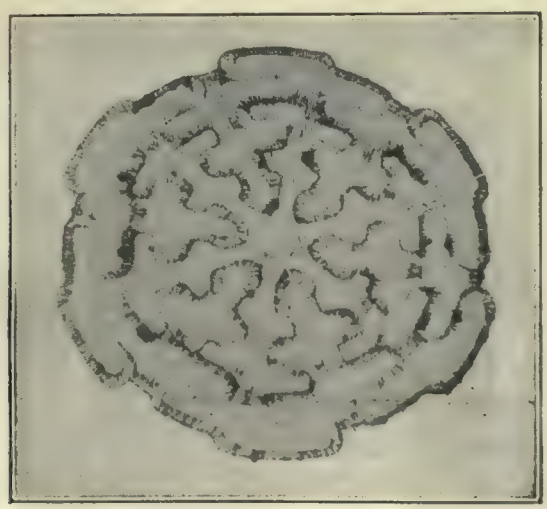


FIG. 134. PERSONS-ARTER CHUCK UNDER THE FILINGS TEST

purpose is to protect the spindle bearings of the machine from particles of abrasive, by throwing the water outside a permanent guard ring which is cast integral with the hood or basin that, in the Persons-Arter grinding machine, surrounds the chuck and work. If the chuck is to be used on other machines a differently shaped water-guard would be needed; or if adapted to horizontal spindle and used without water, the guard would be taken off.

Claims Cover Rectangular Form

Though the claims of the Arter patent cover rectangular chucks as well as rotary ones, it is with the latter form that the designer is principally concerned. Simplicity of construction being an important desideratum, the number of parts used to make up the chuck has been kept as low as possible. There are but three pieces of metal used to make up the magnetic circuit and these, together with the other parts, are shown in Fig. 131.

The body of the chuck is a cylindrical shell of cast steel, shown at *A*, one end being entirely open and the other partly closed by a web about 1¼ in. thick, in which is the irregularly shaped opening to match the opposing polepiece. This polepiece *B* is also a steel casting and has its branches cast integral with a solid hub, the diameter of which corresponds to the internal diameter of the coil *C*. When the polepiece is set in its proper position and the non-magnetic material is poured, thus binding the two parts into one while at the same time permanently separating them magnetically, the hub *B* is flush with the rim of the shell *A* and the round flat plate *D*, closing and sealing the open end of the shell, makes magnetic contact with both of them and forms the necessary "back-bar" through which the magnetic flux passes.

Cover Makes Water-Tight Joint with Body

The cover *D* is a steel casting having no projection on either side, and is, therefore, a very simple piece to finish by grinding. Attached to both hub of pole piece and rim of shell by screws, it effectually seals the chuck against the intrusion of water, at the same time making the job of disassembling the chuck, in case it becomes necessary to take out or repair the coils, a very simple one.

Only Circular Coils Used

There is but one shape to the coil of a Persons-Arter chuck, though each size of chuck, of course, requires a corresponding size of coil. This is true of the rectangular, as well as of the rotary chuck, the rectangular chuck being designed purposely so as to take the round coil and thus avoid multiplicity of parts.

The makers of this chuck do not attempt the coil winding themselves. As the coils are practically identical with those used in certain standard types of electrical machinery, Persons-Arter finds it more satisfactory to purchase them from a firm that makes coil winding its sole business.

In Fig. 132 may be seen the main parts of a small rectangular chuck showing how it is adapted to the round coil. This chuck is shown inverted and without the bottom plate. One of the polepieces is set in place and the other is left outside (and in reversed position) to show its shape. Chucks can be made to any desired length by increasing the number of compartments in the shell and using a corresponding number of coils and core-pieces.

In mounting a rotary chuck upon the machine for which it is intended, the designer interposes a magnetic insulator in the shape of the bronze disk *E*, Fig. 131, between the bottom plate *D* of the chuck and the cast-iron driving plate *F*, by which the chuck is secured to the spindle of the machine. The driving plate is attached to the bottom plate *D* of the chuck by bronze screws passing through the separating disk. In similar manner the rectangular chuck is provided with four, six or more "feet" of bronze, which prevent the chuck itself from coming in magnetic contact with the machine upon which it is used.



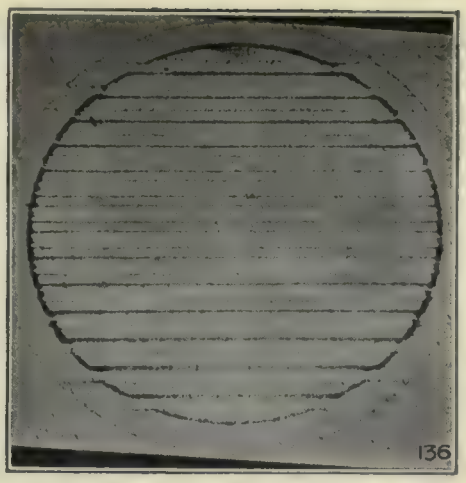


FIG. 135. THE FACE OF THE CHUCK. FIG. 136. AS IT APPEARED UNDER THE FILINGS TEST

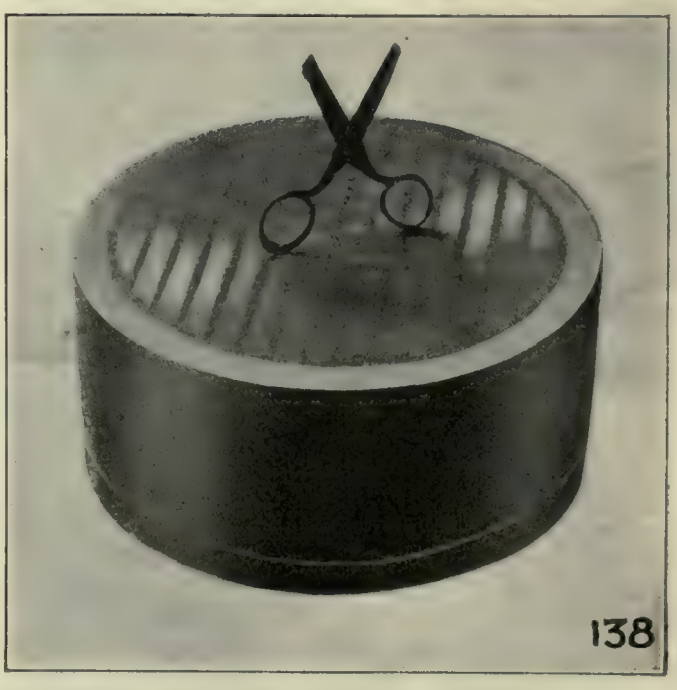
In all probability there is no more reason why stray lines of force should escape from the body of a properly designed single-magnet chuck and find their way back through machine, spindle and cutting tool to the opposed pole on the work-holding surface, than that they should follow the same path when other forms of chucks are used. In either case an ample and direct path is provided within the chuck itself. However, the designer of this one is taking no chances.

Electric current is conducted to the coil of a rotary chuck through two fingers of spring brass, shown at *G* in Fig. 131, upon the ends of which are mounted pieces of carbon that make contact with the bronze collector rings *H*. These rings are attached to, but insulated from, the bottom plate *D* by a bakelite ring, also shown at *H*. Electrical connection between these collector rings and the coil is established by soldering the lead wires of the coil to the rings. The wires pass through micarta-bushed holes in the triangular shaped depression to be seen in the bottom plate.

As the construction of the Persons-Arter chuck is so very simple it naturally follows that there are no unusual methods employed in its manufacture. The first operation upon the castings is the facing on both shell and polepiece of the surface that is to become the holding surface of the chuck, for this chuck uses no extra top plate or other auxiliary device, except in special cases where the work is not flat. The facing is done either in lathe or grinding machine, according to which may be most convenient at the moment, there being little if any difference between the two means in point of production cost.

The second operation is the fitting of the polepieces to the opening in the shell. No tools are needed but a bench vise and file. If sand-molded castings could always be depended upon to come true to pattern, this operation would be superfluous, but there are always slight irregularities and lumps in the castings that must be removed in order to make certain that parts of opposed polarity do not come too close together and thus cause excessive leakage of magnetic flux with its consequent loss of holding power. In Fig. 133 may





FIGS. 137 AND 138. EXPERIMENTS WITH A SIMILAR CHUCK

be seen a shell and a polepiece set together, face upward.

After this fitting is satisfactorily completed, and there is an even and unbroken space around the contour, the parts are placed face downward on a surface plate, arranged in their respective positions, and the metal divider, which is in this case a hard babbitt, is poured. From this point onward it is handled as one piece, being turned, bored, faced, and the hub turned to size exactly as would be done with a single piece of similar shape.

When the metal divider is poured it is allowed to fill above the branches of the core, or polepiece, so that upon looking down into the inverted body of a chuck the bottom appears to be a sheet of lead, unbroken except for the central hub. The entire inner surface is machined true for the sake of securing a condition of running balance.

Precautions Against Admitting or Retaining Moisture Within the Chuck

The designer of the Persons-Arter chuck believes that sweating, due to the vaporization of moisture contained within the shell, is the cause of the trouble sometimes experienced by users of magnetic chucks from the breaking down of the coil, and therefore takes elaborate precautions to minimize it. Not only are the top plates made as nearly water-proof as possible, but channels are provided within the chuck body that will tend to eject, by centrifugal force, any water that may find its way in and a series of inclined vents in the shell keep a current of air circulating within it.

The Filings Test to Show Presence of Magnetism

Leading up to the present distinctive pattern, by which his chuck may be recognized at a glance, Mr. Arter conducted some interesting experiments to demonstrate the relative value of variously shaped polepieces as distributors of magnetism. This problem is not as difficult as it might seem at first. All the paraphernalia needed, besides the experimental chuck, is a handful of dry iron filings, a sheet of white paper and a fan of the palm-leaf or similar variety. To apply the test, lay the paper on the chuck so as to cover the whole surface, sprinkle the filings on the paper, and turn on the current. One wave of the fan will serve to clear the central area of each section of the polepieces and drive the particles of metal (such of them as did not go there when the current came on) to the edge of the poles.

An illustration of the test applied to a standard Persons-Arter chuck is shown in Fig. 134. To the casual observer it would appear that the only part of the magnetic surface that is really magnetic is the lead division lines between the poles. This appearance is caused by the attraction of the iron particles to where the flow of the magnetic current is strongest; viz., where it passes across the dividing lines from one pole to another; and the filings will group themselves in such manner as to bridge this gap. By trying to fan the filings from one place to another the observer will quickly discover where they cling most tenaciously and where not at all. It is necessary only to consider the molecules of a piece of work on the same chuck as a mass of iron filings, impelled to do just what the actual filings have accomplished but failing because of their immobility, in order to determine the value of that chuck as a work holder for the pieces under consideration.

This test was tried upon many experimental chucks before Mr. Arter finally adopted the present design. Some of them were of the single-magnet type and others were not, but of them all the one shown appeared to the designer to more nearly meet his requirements. It may be noted in Fig. 134 that the actual circumference of the chuck does not attract the iron filings; indicating that there is practically no leakage of magnetic flux at this point.

One of the experimental chucks is shown in Fig. 135 and its behavior under the filings test in Fig. 136. The body of this chuck is a forged ring of machine steel. The central pole is a mushroom-shaped piece of soft steel, the upper part nearly filling the shell while the stem accommodates the coil.

Narrow slots, represented in the cut by the parallel bars, were milled clear across the top surface of the chuck; the slots in the core being made wider and deeper than where they crossed the rim of the shell, to provide space for the white metal that separates parts of opposed polarity.

Narrow steel strips were then forced into the slots in the shell and the white metal divider poured in around them where they crossed the central portion.

The filings show an almost normal condition except that one side of each crossbar is much less strongly magnetic than the other, and this condition was unerringly shown after repeated trials, so that it could not have been an accidental disposition of the filings. The filings also indicate a very weak chuck whereas the chuck was a more than ordinarily powerful one, but with very peculiar characteristics. Some of the joints where the crossbars were driven into the shell show magnetic flux where, so well was the mechanical work done, no joint was visible to the naked eye, and where there should have been no magnetism even though the joints were badly made. Further, a test with the dipping needle showed some of the bars almost neutral and others of the wrong polarity; a condition which the filings would not indicate.

The chuck seemed to be surrounded by a strong flow of conflicting magnetic currents that were capable of making their influence felt at a distance of several inches. Figs. 137 and 138 show two casual experiments with a smaller chuck of similar construction. The piston ring, laid upon the chuck in a certain place would rise to the position shown when the current was turned on, while in some others it would be strongly held in normal manner and in still other positions would hardly be held at all. The scissors could not be made to rise from a horizontal position, but when placed as shown in Fig. 138 would not only stand upright but would sway to and fro when blown with the fan. A needle suspended by a thread could be made to float horizontally at a distance of four to five inches above the surface upon the invisible flow of magnetism as a cork floats upon water. If pushed a fraction of an inch below the neutral point it would be drawn to the surface; if raised a similar distance it would float entirely clear from the chuck and in falling would be drawn sharply back in an elliptical path to the side of the chuck.

As a magnetic chuck, this experiment was a pronounced failure, but as a demonstration of what magnetism will do when there is an unknown condition present it was very interesting.

Danger of Compulsory Metric Standards

From the Report of the Standardization Committee of the American Supply and Machinery Manufacturers Association at Atlantic City, May 17

By H. S. DEMAREST
Greene, Tweed & Co., New York

WE THINK that it might be well to point out in this connection the danger of any hasty consideration and compulsory adoption by our Government of the metric system of weights and measures, as there are some very active advocates of the metric system now bringing pressure upon Congress to adopt it in all Government work, with the expressed intention of making that the entering wedge leading to the universal use of the metric system throughout this country.

I should like to quote from a very exhaustive paper prepared and read by Henry R. Towne before the American Society of Mechanical Engineers, entitled "Our Present Weights and Measures and the Metric System."

"In the United States, the Federal Constitution, according to Act 1, sec. 8, par. 5, gives to Congress the power, 'To fix the standard of weights and measures,' although, as pointed out by Hallock and Wade in their recent volume, 'The Evolution of Weights and Measures,' this is, 'almost the only power expressly and specifically conferred on Congress, which that body has refrained from exercising down to the present time.'

"By an Act passed July 28, 1866, Congress provided that 'it shall be lawful throughout the United States of America to employ the weights and measures of the metric system.' Although it has thus been lawful for more than forty years, for any one who so desires to use the metric system of weights and measures in the United States, the people have not seen fit to avail themselves of the permission, but, in their industry and commerce, have adhered, with absolute uniformity, to their established standards."

Necessity of Investigation

No such changes, however, even where they do not affect the base of the system, should be adopted until, after exhaustive investigation, the effect of the proposed changes, on all industries and interests concerned, shall have been duly ascertained, nor until all interests which would be affected thereby have had due opportunity to submit their views and to explain the difficulties, if any, which they believe would arise from the proposed action.

What France chiefly needed and sought was uniformity, as is shown by the decree sanctioned August 22, 1790.

Germany, also in chaotic condition, each of its 40 states having its own standards, followed the example of France by appointing a commission in 1860, and by the adoption in 1871 of the metric system.

But neither the United States nor Great Britain has any such need or motive for change. Each already has that which other countries chiefly sought in making the change, uniformity, and by changing they would lose it.

In the case of the United States no such impelling necessity exists. We now possess fixed standards and national unity. In other words, we already have those blessings the want of which has led other nations to adopt new standards. Still more, we have also international unity (except as to measures of volume) with the whole of the British Empire, with commercial China and with many other countries, all of which we would sacrifice, temporarily, if not permanently, in case we should abandon our present system.

We now have uniformity. Should we not hold it as a priceless treasure?

The old units would exist in every machine, in every structure, and in innumerable articles of daily use, and no matter how superior the new system might be to the old, the impossibility of immediately bridging the gulf between the two would remain.

A law so revolutionary in its character should only be enacted in response to a clear, if not an overwhelming, public demand. No evidence is adduced to show that any such demand exists.

The Cost to Manufacturers

As stated by Henry R. Towne, when a witness at one of the recent hearings before the House Committee on Coinage, Weights and Measures, "One thousand millions of dollars would not cover the ultimate cost to the manufacturers of the United States of the compulsory adoption of the metric system in the resulting changes in their equipment of machinery, tools and gages." It would hardly be an exaggeration to state that in some cases such an enforced change would mean bankruptcy to the manufacturer.

France in 1801 had no such conditions to deal with, nor did Germany even in 1871. Modern industry, especially in the United States, is largely the creation of the last fifty years. What might have been easy in 1801, or feasible in 1871, has become almost impossible today. The proposed change would vitiate all existing Anglo-Saxon engineering literature.

It is urged, as a chief argument in favor of the metric system, that it would promote our export trade. Has the non-use of the metric system retarded the growth of our exports of manufactures? Has the non-use of English measures by France and other metric countries operated to decrease our imports of manufactures from such countries? If they should abandon the metric system tomorow, and substitute for it the British-American system, would our purchases of their manufactures thereby be increased?

As a matter of fact there is no recognized or visible demand from our export merchants, or from the foreign merchants to whom they sell, that we should discard our present system of weights and measures and adopt the metric system.

It is Henry R. Towne's conviction that our adoption of the metric system would not perceptibly increase our exports to metric countries and that it would handicap our export trade to other countries which offer us the largest markets. So long as England maintains her present standards we would need to maintain our existing units of measurement, wholly or in part, for all goods made for British markets.

Turning now to the effects of such a change on the business transactions of the Government itself, the fol-

lowing may be pointed out as conditions which should at least be studied carefully before we commit ourselves to such a momentous change, viz.: (1) It would disqualify for a long time probably 95 per cent of the present army of Government clerks from doing their work efficiently; (2) it would for many years add greatly to the time and cost of all Government accounting, and to the army of Government employees; (3) it would greatly increase the tendency to error; (4) it would make the Government reports for a long time unintelligible to the people; (5) it would preclude comparison of past with future records and statistics; (6) it would preclude ready comparison of our statistics with those of the British Empire; (7) it would make void the engineering and technical formulas which our Government engineers (Army and Navy), naval constructors, architects, etc., have used all their lives; (8) it would compel the Government or the seller, in every transaction, so long as the metric system was used by the Government only, to express every detail of such transaction in terms of both systems; (9) it would compel the Government, in order to obtain commercial products, to describe them in alien terms but in interminable fractions.

Effects of the Change

The proposed change would greatly increase the operating expenses of all departments of the Government, would almost destroy the value of Government statistics for popular use, and would bring no compensating benefit of any kind. It would substitute confusion for the perfect uniformity which now prevails.

No other nation in the world, save Great Britain, enjoys today such absolute uniformity as to weights and measures as the United States.

The change, if made and if enforced, ulimately would involve a loss or injury to American manufacturers of probably more than $1,000,000,000, with no compensating benefit which they can perceive.

We think that these salient points brought out by Mr. Towne in his paper will furnish you with abundant food for thought on this important subject.

Disposing of Scrap Without Trouble

"Every now and then when I see an advertisement featuring a nice high wire fence," remarked the Old Scout, yesterday, "I think of the old Wilson shop in Kokomo, Ind., where I worked some fifteen years ago.

The machine shop stood right on the edge of one of the small but deep stone quarries with which that section is infested, and this quarry was filled with water to a depth (according to the oldest inhabitant) of about forty feet. The shop windows were open most of the time, and wire gratings for windows were a thing of the future, so far as that shop was concerned. The result was that when a piece of work was scrapped, it just simply vanished. A couple of steps in the general direction of the south side of the shop, zowie—splash! That's all. The foreman even caught one of the men on the night gang as he was just about to consign a warped crankshaft, flywheel and all, to the mighty deep of that quarry.

"If that hole has never yet been cleaned out, now would be a good time to do it. There's enough scrap metal in that quarry to pay John D. Rockefeller's income tax."

Women as Business Correspondents

By Rita Smith Remington

The writer has noted with interest J. T. Bartlett's article "Correspondence Supervision" on page 94 of the *American Machinist*, especially that part dealing with women as correspondents.

Within certain limitations women may become good correspondents. It is true that they have as a rule but little knowledge of or interest in machinery. The writer, for example, after twenty-five years of business dictation, much of it in regard to patents and the intimate details of machinery, never takes down the phrase "dogs under the table" without a momentary wonder as to what the dogs are doing there and why they don't come out! Of course she has finally learned, theoretically, that a "dog" is an iron or steel contraption on the end of a whatdoyoucallit, but nevertheless her first thought is as above. One of the good features of shorthand is that one can take down whole pages of dictation and transcribe it accurately, if one has been adequately trained, without the least idea of what it is all about!

We are apt to think of a man's knowledge of tools or machinery as inborn. More often it is acquired. The boy begins to follow his father about and to handle his tools and imitate his actions, driving a nail, planing wood, etc., and by the time he enters school has a fair knowledge of the names of many simple tools (from having been sent on errands after them so many times) and of their uses. His sister, on the other hand, has been with her mother, and knows more about sewing, washing dishes, etc. Her knowledge also, is not inborn; it is acquired. Even so, we have all of us met men with a good working knowledge of housekeeping, and other men who can't put up a curtain so it will stay, or fix the loose knob of a door or set up a stovepipe.

In the large machine shop where the writer is employed the young men starting to work for the company are encouraged to go about the shops, to acquire a knowldge of the company's product, so that they may be able to write a good snappy advertisement, or to dictate correspondence. Why not arrange tours for new stenographers, personally conducted by a competent machinist, who can point out the various machines with their working parts, not exhaustively, but so that the girls may have an idea of what is being dictated, and not labor under the impression that a "dog" must necessarily be the kind named Fido, or Rover? It should be understood that the girls are just as "busy" while on such tours, as if they were typing at their desks. If a stenographer must hurry back to her desk every time she leaves it, what chance has she to learn anything about the machines? She may do as the writer did, pass a group of machines several times each day for four years, without even noticing that there were really two groups of them, until finally enlightened by someone telling her that they were "punch presses and drill presses." Now when she takes a dictation about presses a mental picture of those out in the adjoining room "flashes before her inward eye," and she knows what she is writing about. Woman's natural curiosity, with which she is so widely credited, seems to fail her in a machine shop; she passes machines for years without any hope or expectation of ever knowing anything about them.

If tours as sketched above, with elementary instruction as to the nature and purpose of the machines shown, were arranged for stenographers, "Elsie Snowden" may more than fulfill the expectations of "S. L. Betts."

Slip of Involute Gear Teeth

By A. B. COX

(Continued from last week's issue.)

FOR the internal gear, formulas similar to the preceding are found in this way: In Fig. 5 the origin has been taken at O', and the length of L_g found as follows:

$$x^2 + y^2 = \rho'^2_A = \left(R - \frac{1}{p}\right)^2$$

$$= R^2\left(\frac{N-2}{N}\right)^2 \text{ from equation of circle.}$$

The equation of the line of action is $y = R - x \tan \phi$.

$$y^2 = (R - x \tan \phi)^2.$$

Substituting this value of y^2, we have

$$x^2 + R^2 - 2Rx \tan \phi + x^2 \tan^2 \phi = \frac{R^2}{N^2}(N^2 - 4N + 4).$$

$$x^2N^2 + N^2R^2 - 2N^2Rx \tan \phi + x^2N^2 \tan^2 \phi = N^2R^2 - 4NR^2 + 4R^2.$$

$$x^2N^2 \sec^2 \phi - 2N^2Rx \tan \phi + 4R^2(N-1) = 0.$$

$$x = \frac{2RN^2 \tan \phi \pm \sqrt{4R^2N^4 \tan^2 \phi - 16N^2R^2 \sec^2 \phi\,(N-1)}}{2N^2 \sec^2 \phi}$$

$$= \frac{R}{\sec \phi}\left[\sin \phi + \sqrt{\sin^2 \phi - \frac{4}{N^2}(N-1)}\right].$$

The quantity within the brackets has been represented for convenience by Z_I.

$$L_g = x \sec \phi = RZ_I = KrZ_I. \quad (46)$$

$$\rho_A = \sqrt{r^2 + L_g^2 - 2rL_g \cos(90 - \phi)}$$

$$= \sqrt{r^2 + K^2r^2Z_I^2 - 2Kr^2Z_I \sin \phi}.$$

$$H_A = \sqrt{1 + K^2Z_I^2 - 2KZ_I \sin \phi}.$$

$$\theta'^2_A = [(1 + K^2Z_I^2 - 2KZ_I \sin \phi) \sec^2 \phi - 1].$$

$$\theta_A^2 = [(K^2Z_I^2 - 2KZ_I \sin \phi) \sec^2 \phi + \tan^2 \phi].$$

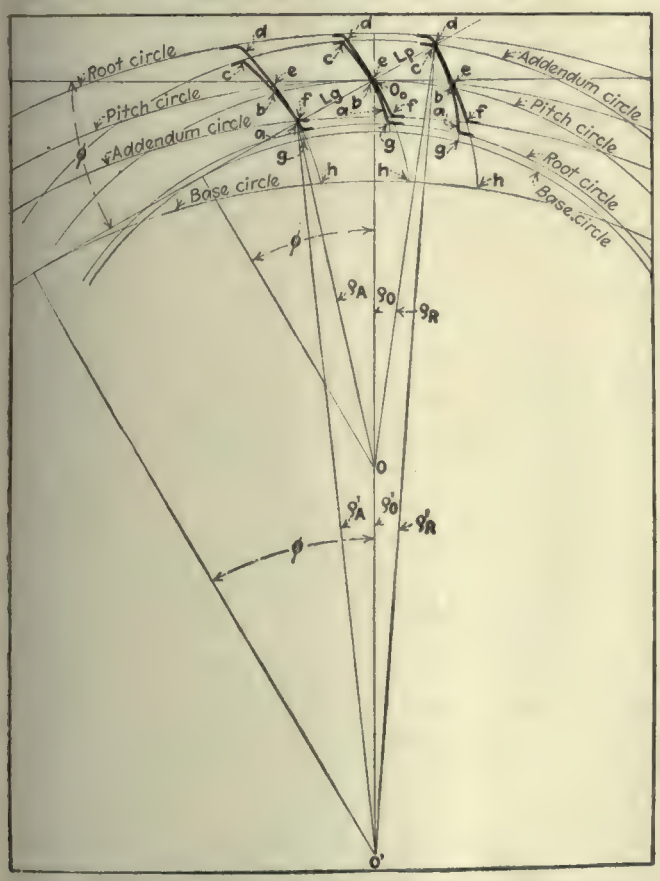


FIG. 5. DIAGRAM FOR INTERNAL GEAR FORMULAS

Length of involute ag

$$= \frac{r \cos \phi}{2}[K^2Z_I^2 - 2KZ_I \sin \phi) \sec^2 \phi + \tan^2 \phi]. \quad (47)$$

Length of involute $bg = \frac{r \cos \phi}{2} \tan^2 \phi.$ (48)

Length of involute $ab = bg - ag.$

$$= \frac{r \cos \phi}{2}\left[\tan^2 \phi - (K^2Z_I^2 - 2KZ_I \sin \phi)\sec^2 \phi - \tan^2 \phi\right]$$

$$= \frac{r \sec \phi}{2}[2KZ_I \sin \phi - K^2Z_I^2]. \quad (49)$$

$$\rho'_A = R - \frac{1}{p} = R\frac{(N-2)}{N}.$$

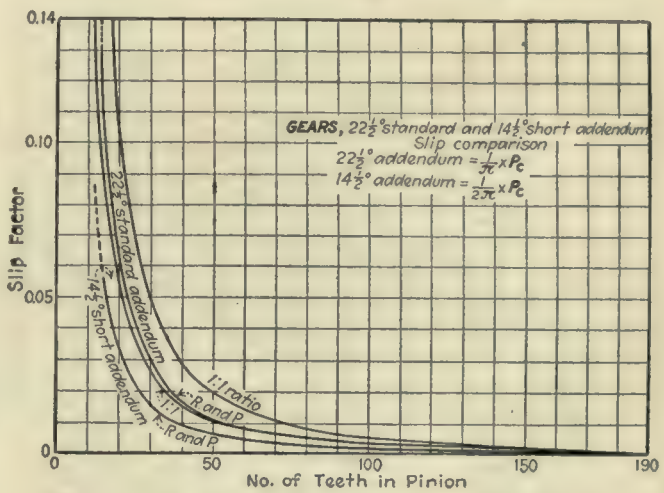


FIG. 6. SLIP COMPARISON, 14½-DEG. AND 22½-DEG. INVOLUTES

$$\theta'^2_A = \left(\frac{N-2}{N}\right)^2 \sec^2 \phi - 1.$$

Length of involute $hf = \frac{R \cos \phi}{2}\left[\left(\frac{N-2}{N}\right)^2 \sec^2 \phi - 1\right]$

$$= \frac{R \cos \phi}{2}\left[\left(\frac{N^2 - 4N + 4}{N2}\right)\sec^2 \phi - 1\right]$$

$$= \frac{R \cos \phi}{2}\left[-4\frac{(N-1)}{N^2}\sec^2 \phi + \tan^2 \phi\right] \quad (50)$$

Length of involute $eh = \frac{R \cos \phi}{2} \tan^2 \phi$ (51)

Length of involute $cf = eh - hf.$

$$= \frac{R \cos \phi}{2}\left[\tan^2 \phi + 4\frac{N-1}{N^2}\sec^2 \phi - \tan^2 \phi\right]$$

$$= \frac{R \sec \phi}{2}\left[\frac{4(N-1)}{N^2}\right]$$

$$= \frac{r \sec \phi}{2}\left[\frac{4K(N-1)}{N^2}\right] \quad (52)$$

Slip of approach $= ef - ab$

$$= \frac{r \sec \phi}{2}\left[\frac{4K(N-1)}{N^2} - 2KZ_I \sin \phi + K^2Z_I^2\right] \quad (53)$$

$$L_p = rZ_p = \frac{RZ_p}{K}.$$

$$\rho'_R = \sqrt{R^2 + L_p^2 - 2RL_p \cos(90 + \phi)}$$

$$= \sqrt{R^2 + \frac{R^2Z_p^2}{K^2} + \frac{2R^2Z_p}{K} \sin \phi}.$$

$$H'_R = \sqrt{1 + \frac{Z_p^2}{K^2} + \frac{2Z_p \sin\phi}{K}}.$$

$$\theta''_R = \left[\left(1 + \frac{Z_p^2}{K^2} + \frac{2Z_p \sin\phi}{K}\right)\sec^2\phi - 1\right].$$

$$\theta''_R = \left[\left(\frac{Z_p^2}{K^2} + \frac{2Z_p \sin\phi}{K}\right)\sec^2\phi + \tan^2\phi\right]$$

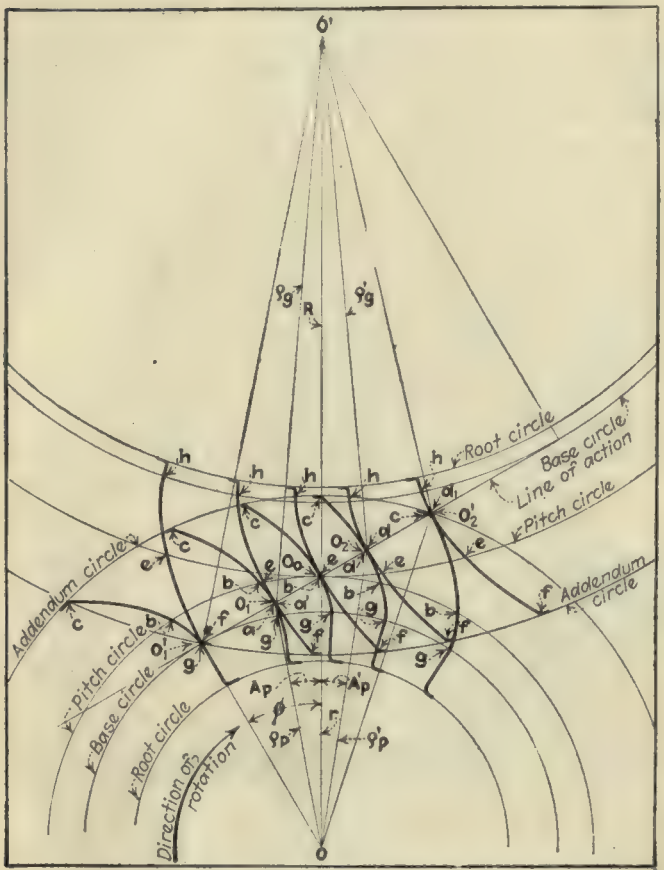


FIG. 7. DIAGRAM FOR CALCULATION OF SLIP FORMULAS

Length of involute dh

$$= \frac{R\cos\phi}{2}\left[\left(\frac{Z_p^2}{K^2} + \frac{2Z_p\sin\phi}{K}\right)\sec^2\phi + \tan^2\phi\right] \quad (54)$$

Length of involute $he = \frac{R\cos\phi}{2}\tan^2\phi$ (55)

Length of involute $de = dh - he$,

$$= \frac{R\cos\phi}{2}\left[\left(\frac{Z_p^2}{K^2} + \frac{2Z_p\sin\phi}{K}\right)\sec^2\phi + \tan^2\phi - \tan^2\phi\right]$$

$$= \frac{K\,r\sec\phi}{2}\left[\frac{Z_p^2}{K^2} + \frac{2Z_p\sin\phi}{K}\right]$$

$$= \frac{r\sec\phi}{2}\left[\frac{Z_p^2}{K} + 2Z_p\sin\phi\right] \quad (56)$$

Length of bc is same as (40) $= \frac{r\sec\phi}{2}\left[\frac{4(n+1)}{n^2}\right]$ (57)

Recess slip $= bc - de$

$$= \frac{r\sec\phi}{2}\left[\frac{4(n+1)}{n^2} - \frac{Z_p^2}{K} - 2Z_p\sin\phi\right] \quad (58)$$

Total slip = (53) + (58)

$$\text{Total slip} = \frac{r\sec\phi}{2}\left[\frac{4(n+1)}{n^2} - \frac{Z_p^2}{K} 2Z_p\sin\phi + \frac{4K(N-1)}{N^2} - 2KZ_I\sin\phi + K^2Z_I^2\right]. \quad (59)$$

The net length of rolling contact $= ab + de$

$$= \frac{r\sec\phi}{2} 2KZ_I\sin\phi - K^2Z_I^2 + \frac{Z_p^2}{K} + 2Z_p\sin\phi\Big]. \quad (60)$$

(59) and (60) were divided by r to obtain the factors of sliding and rolling contact and these were also plotted in Fig. 3, and the ratio of rolling to sliding contact plotted in Fig. 4. It is interesting to note that this ratio is much greater than external gear ratios of rolling to sliding contact and is also a straight line.

If the addendum "A" be expressed as a fraction "q" of the circular pitch, $A = qPc = \frac{2\pi qr}{n}$, the formulas (31) and (42) become:

$$1 \text{ to } 1 \text{ total slip} = 4r\sec\phi\left[\frac{2(n\pi q + \pi^2q^2)}{n^2} - Z\sin\phi\right] \quad (31\text{-a})$$

$$\text{or } 4r\sec\phi\, Z^2 \quad (31\text{-b})$$

where $Z = -\sin\phi + \sqrt{\sin^2\phi + \frac{4}{n^2}(n\pi q + \pi^2q^2)}$,

and rack and pinion total slip =

$$\frac{r\sec\phi}{2}\left[\frac{\pi^2q^2\operatorname{cosec}^2\phi}{n^2} + \frac{n^2 + \pi q}{n^5} - \frac{Z\sin\phi}{2}\right]. \quad (42\text{-a})$$

Since "q" for standard length teeth $= \frac{1}{\pi}$ these reduce to (31) and (42) when $\frac{1}{\pi}$ is substituted for "q." In Fig. 6, the slip factors for 14½-deg. involute gears with $q = \frac{1}{2\pi}$ have been plotted together with similar curves for 22½-deg. involute standard length teeth to afford some sort of comparison between the effect of decreasing the slip of gearing by using greater angles of obliquity for the line of action and by decreasing the length of addendum. The former method, of course, increases the pressure on the bearings, a disadvantage which the latter method does not have.

The slipping of the teeth is, of course, not at the same rate through the whole arc of contact, it being greatest at beginning contact, zero on the line of centers, and greater again at leaving contact. In order to show this in curve form, the slip formulas have been developed

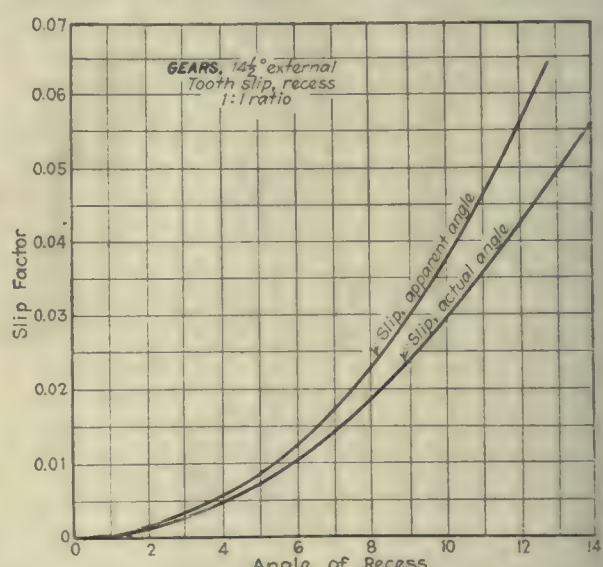


FIG. 8. SLIP FACTORS PLOTTED AGAINST ANGLES OF RECESS FOR 14½-DEG. GEARS OF 1 TO 1 RATIO

in another way. Referring to Fig. 7, this is done as follows:

The pinion tooth first makes contact with the gear tooth at point O'_1, and leaves contact at point O'_2.

Points O_1 and O_2 are any positions of the point of contact of the teeth as it moves along the line of action when the pinion is driving the gear in the direction shown. A line $Ob = \rho_p$ drawn to point O_1 makes an angle A_p with the line of centers OO^1.

The angle $OO_2O_1 = 90 - \phi$ (63)

and angle $OO_1O_2 = 180 - (90 - \phi) - A_p = 90 + \phi - A_p$.

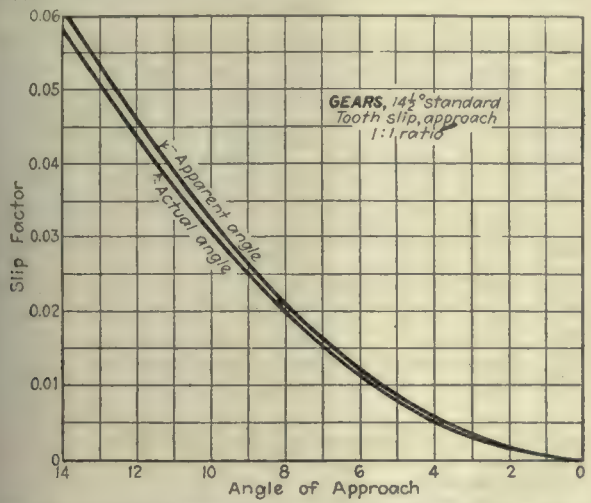


FIG. 9. SLIP FACTORS PLOTTED AGAINST ANGLES OF APPROACH FOR 14½-DEG. GEARS OF 1 TO 1 RATIO

By trigonometry

$$O_1O_2 = L_g = \frac{r \sin A_p}{\sin [90 + (\phi - A_p)]},$$

$$L_g = \frac{r \sin A_p}{\cos(\phi - A_p)}.$$

Angle $O_1O_2O' = (90 + \phi)$.

$$\frac{\rho_p = r \sin (90 - \phi)}{\sin [90 + (\phi - A_p)]} = \frac{r \cos \phi}{\cos (\phi - A_p)}.$$

$$H_p = \frac{\cos \phi}{\cos (\phi - A_p)} = \frac{\rho_p}{r}.$$

$$\theta_p^2 = H_p^2 \sec^2 \phi - 1 = \left[\frac{\cos^2 \phi \sec^2 \phi}{\cos^2(\phi - A_p)} - 1\right]$$

$$= [\sec^2 (\phi - A_p) - 1] = \tan^2 (\phi - A_p).$$

Length of involute $ag = \frac{r \cos \phi}{2} \tan^2 (\phi - A_p)$. (64)

Length of involute $gb = \frac{r \cos \phi}{2} \tan^2 \phi$. (14)

Net length of acting involute $ab = gb - ag$

$$= \frac{r \cos \phi}{2} [\tan^2 \phi - \tan^2 (\phi - A_p)]. \quad (65)$$

$$\rho_g = \sqrt{R^2 + L_g^2 - 2RL_g \cos (90 + \phi)}.$$

$$R = Kr.$$

$$\rho_g = \sqrt{K^2 r^2 + \frac{r^2 \sin^2 A_p}{\cos^2(\phi - A_p)} + \frac{2K r^2 \sin \phi \sin A_p}{\cos (\phi - A_p)}}$$

$$= r \sqrt{K^2 + \frac{\sin^2 A_p}{\cos^2 (\phi - A_p)} + \frac{2 K \sin \phi \sin A_p}{\cos (\phi - A_p)}}.$$

$$H_g = \frac{\rho_g}{R} = \frac{\rho_g}{Kr} = \sqrt{1 + \frac{\sin^2 A_p}{K^2 \cos^2 (\phi - A_p)} + \frac{2 \sin \phi \sin A_p}{K \cos (\phi - A_p)}}.$$

$$\theta_g^2 = \left[\left(1 + \frac{\sin^2 A_p}{K^2 \cos^2 (\phi - A_p)} + \frac{2 \sin \phi \sin A_p}{K \cos (\phi - A_p)}\right)^2 \sec^2 \phi - 1\right]$$

$$= \left[\left(\frac{\sin^2 A_p}{K^2 \cos^2 (\phi - A_p)} + \frac{2 \sin \phi \sin A_p}{K \cos (\phi - A_p)}\right)^2 \sec^2 \phi + \tan^2 \phi\right].$$

Length of involute $ha' =$

$$\frac{R \cos \phi}{2} \left[\left(\frac{\sin^2 A_p}{K^2 \cos^2 (\phi - A_p)} + \frac{2 \sin \phi \sin A_p}{K \cos (\phi - A_p)}\right) \sec^2 \phi + \tan^2 \phi\right] \quad (66)$$

Length of involute $he = \frac{R \cos \phi \tan^2 \phi}{2}$ (67)

Length of acting involute $ea' = ha' - he$.

$$\frac{R \cos \phi}{2} \left[\left(\frac{\sin A_p}{K^2 \cos^2 (\phi - A_p)} + \frac{2 \sin \phi \sin A_p}{K \cos (\phi - A_p)}\right) \sec^2 \phi + \tan^2 \phi - \tan^2 \phi\right]$$

$$= \frac{r \sec \phi}{2} \left[\frac{\sin^2 A_p}{K \cos^2 (\phi - A_p)} + \frac{2 \sin \phi \sin A_p}{\cos (\phi - A_p)}\right] \quad (68)$$

Approach slip = (68) — (65)

$$\frac{r \cos \phi}{2} = \left[\left(\frac{\sin^2 A_p}{K \cos^2 (\phi - A_p)} + \frac{2 \sin \phi \sin A_p}{\cos (\phi - A_p)}\right) \sec^2 \phi - \tan^2 \phi + \tan^2 (\phi - A_p)\right]. \quad (69)$$

Similarly $\rho'_p = \frac{r \sin (90 + \phi)}{\sin [90 - (\phi + A'_p)]} = \frac{r \cos \phi}{\cos (\phi - A'_p)}$.

$$H'_p = \frac{\cos \phi}{\cos (\phi + A'_p)}.$$

$$\theta'^2_p = \left[\frac{\cos^2 \phi}{\cos (\phi + A'_p)} \sec^2 \phi - 1\right] = \sec^2 (\phi + A'_p) - 1$$

$$= \tan^2 (\phi + A'_p).$$

Length of involute $gd' = \frac{r \cos \phi}{2} \tan^2 (\phi + A'_p)$ (70)

Length of involute $gb = \frac{r \cos \phi}{2} \tan^2 \phi$. (71)

Acting length of pinion involute $bd =$

$$\frac{r \cos \phi}{2} \left[\tan^2 (\phi + A'_p) - \tan^2 \phi\right] \quad (72)$$

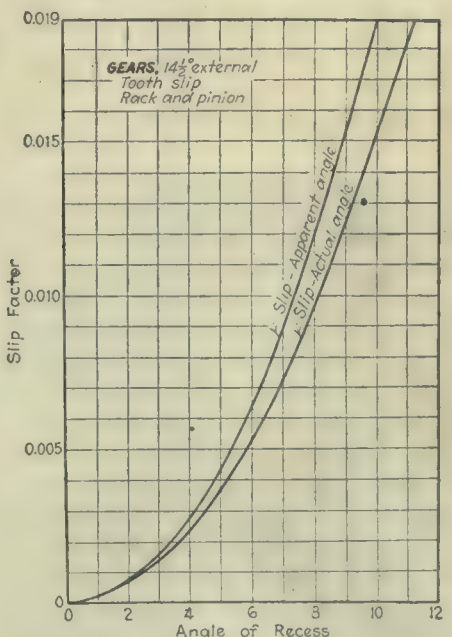


FIG. 10. SLIP FACTORS PLOTTED AGAINST ANGLES OF RECESS FOR 14½-DEG. RACK AND PINION

By trigonometry

$$O_1O_2 = L_p = \frac{r \sin A'_p}{\sin [90 - (\phi + A'_p)]} = \frac{r \sin A'_p}{\cos (\phi + A'_p)}.$$

$$= \rho'_g \sqrt{R^2 + L_p^2 - 2RL_p \cos (90 - \phi)}$$

$$= \sqrt{K^2 r^2 + \frac{r^2 \sin^2 \phi}{\cos^2 (\phi + A'_p)} - \frac{2 K r^2 \sin \phi \sin A'_p)}{\cos (\phi + A'_p)}}$$

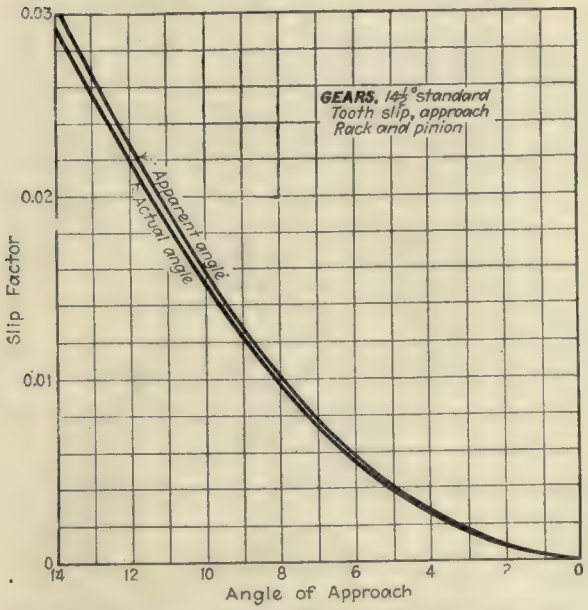


FIG. 11. SLIP FACTORS PLOTTED AGAINST ANGLES OF APPROACH FOR 14½-DEG. RACK AND PINION

$$H'_\varrho = \frac{\rho'_\varrho}{R} = \frac{\rho'_\varrho}{Kr} = \sqrt{1 + \frac{\sin 2 A'_p}{K^2 \cos^2 (\phi + A_p')} - \frac{2 \sin \phi \sin A'_p}{K \cos (\phi + A'_p)}}.$$

$$\theta'^2_\varrho = \left[\left(1 + \frac{\sin^2 A_p}{K^2 \cos^2 (\phi + A'_p)} - \frac{2 \sin \phi \sin A'_p}{K \cos (\phi + A'_p)} \right) \sec^2 \phi - 1 \right]$$

$$= \left[\left(\frac{\sin^2 A'_p}{K^2 \cos^2 (\phi + A'_p)} - \frac{2 \sin \phi \sin A'_p}{K \cos (\phi + A'_p)} \right) \sec^2 \phi + \tan^2 \phi \right].$$

Length of involute hd' =

$$\frac{K r \cos \phi}{2} \left[\left(\frac{\sin^2 A'_p}{K^2 \cos^2 (\phi + A'_p)} \right) - \frac{2 \sin \phi \sin A'_p}{K \cos (\phi + A'_p)} \right) \sec^2 \phi + \tan^2 \phi \Bigg] \quad (73)$$

$$\text{Length of involute } he = \frac{K r \cos \phi}{2} \tan^2 \phi \quad (74)$$

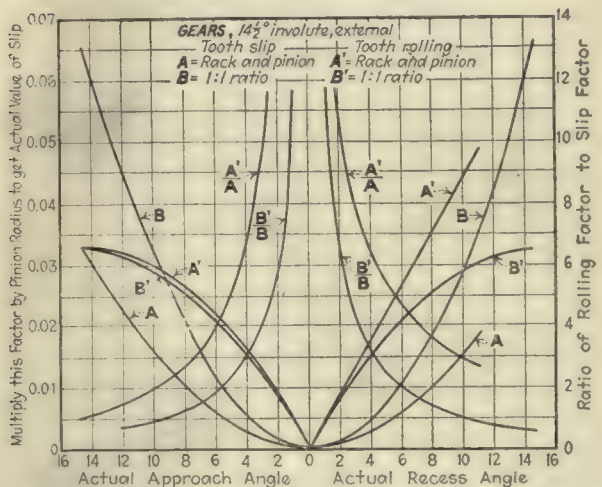


FIG. 12. CURVES OBTAINED BY CORRECTING THE CURVES IN FIGS. 8 AND 9 TO ACTUAL ANGLES OF APPROACH AND RECESS

Length of acting involute = $he - hd' = d'e$

$$= \frac{Kr \cos \phi}{2} \left[\tan^2 \phi - \left(\frac{\sin A'_p}{K^2 \cos^2 (\phi + A'_p)} - \frac{2 \sin \phi \sin A'_p}{K \cos (\phi + A'_p)} \right) \sec^2 \phi - \tan^2 \phi \right]$$

$$= \frac{r \cos \phi}{2} \left[\frac{2 \sec^2 \phi \sin A'_p \sin \phi}{\cos (\phi + A'_p)} - \frac{\sin^2 A'_p \sec^2 \phi}{K \cos (\phi + A'_p)} \right] \quad (75)$$

Recess slip = (71) — (75)

$$= \frac{r \cos \phi}{2} \left[\tan^2 (\phi + A'_p) - \tan^2 \phi - \left(\frac{2 \sin A'_p \sin \phi}{\cos (\phi + A'_p)} - \frac{\sin^2 A'_p}{K \cos^2 (\phi + A'_p)} \right) \sec^2 \phi \right]. \quad (76)$$

Formulas (69) and (76) were divided by the pinion radius r, successive values of A_p' assumed and curves plotted in Figs. 8 and 9 for the standard 14½-deg. tooth for 1 to 1 ratio. By referring to Figs. 3 and 4 (in "Angles of Approach, Recess and Contact of Involute Gears," *American Machinist*, vol. 54, page 559) these curves were corrected to actual angles of approach and recess and the resulting curves plotted in Fig. 12.

For the case of rack and pinion, $\frac{1}{K} = O$, and (69) becomes:

$$\text{Approach slip} = \frac{r \cos \phi}{2} \left[\frac{2 \sin \phi \sin A_p \sec^2 \phi}{\cos (\phi - A_p)} - \tan^2 \phi + \tan^2 (\phi - A_p) \right] \quad (77)$$

and (76) becomes:

$$\text{Recess slip} = \frac{r \cos \phi}{2} \left[\tan^2 (\phi + A'_p) - \tan^2 \phi - \frac{2 \sec^2 \phi \sin A'_p \sin \phi}{\cos (\phi + A'_p)} \right] (78)$$

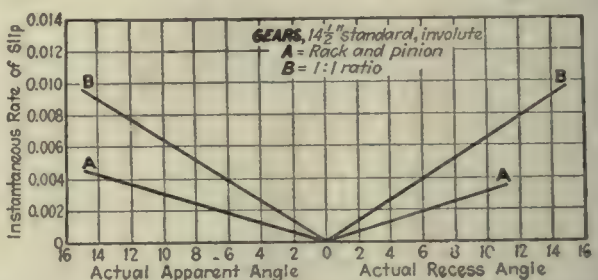


FIG. 13. INSTANTANEOUS RATE OF SLIP PLOTTED AGAINST ACTUAL ANGLES OF APPROACH AND ACTUAL ANGLES OF RECESS FOR 14½-DEG. RACK AND PINION AND GEARS OF 1 TO 1 RATIO

Approach rolling contact = ab (65)

and recess rolling contact = de (75)

For 1 to 1 ratio, approach rolling =

$$\frac{r \cos \phi}{2} \left[\tan^2 \phi - \tan^2 (\phi - A'_p) \right] \quad (79)$$

and recess rolling =

$$\frac{r \cos \phi}{2} \left[\frac{2 \sec^2 \phi \sin A'_p \sin \phi}{\cos (\phi + A'_p)} - \frac{\sin^2 A'_p \sec^2 \phi}{\cos^2 (\phi + A'_p)} \right] \quad (80)$$

For rack and pinion, approach rolling =

$$\frac{r \cos \phi}{2} \left[\tan^2 \phi - \tan^2 (\phi - A'_p) \right] \quad (81)$$

$$\text{and recess rolling} = r \tan \phi \frac{\sin A'_p}{\cos (\phi + A'_p)} \quad (82)$$

These have been plotted similarly to (69) and (75) in Figs. 10, 11 and 12 and the ratio of rolling to slipping plotted against angle of approach and recess.

It will be noted that the length of addendum and the number of teeth of pinion or gear do not appear in these latter formulas. Hence they are good for any number of teeth and any length of addendum.

The ordinates of these curves show the total slip of approach or recess for any set of gears having the particular value of approach and recess angle at which the ordinates are read. The curves have been differentiated to obtain the instantaneous slip as plotted in Fig. 13.

Curves for other gear ratios will of course fall between those shown for 1 to 1 ratio and for rack and pinion.

In conclusion, it may be said that the methods and formulas here used may be extended to cover various other problems of gearing, but the foregoing have seemed to be of more general interest. The theoretical efficiency of gearing can be calculated by using the factors of slip and rolling contact and the number of teeth in contact from Fig. 3 (see "Derivation of a Formula to Determine Number of Teeth in Contact of Two Meshing Gears," *American Machinist*, Vol. 53, page 899) with the coefficients of rolling and sliding frictions plus bearing friction. The pressure on the bearings will, of course, be affected somewhat by the tooth friction. The formula for curvature of the involute is quite simple (radius of curvature $= r_n\theta$).

The outstanding lessons of the data and curves here worked out are that the efficiency can be greatly increased and the wear as greatly decreased by simply choosing large numbers of teeth. The use of shorter addendum gears, or greater obliquity of the line of action reduces slip and increases the percentage of rolling contact, or, stated in another way, allows smaller numbers of teeth—coarser pitches—with the same wear. The gain in efficiency from increasing the angle of obliquity is more and more offset by the increased friction losses in the bearings as the angle increases. The shortest addendum possible and the smallest angle of obliquity consistent with the pitch demanded for strength of teeth would seem to be the most nearly ideal solution. It should be noted in this connection that the strength of short addendum teeth is very much greater than standard addendum teeth and correspondingly finer pitches can be used.

The Stanley Steam Car Power Plant

Flexible Power Plant—Welded Tubes and Head in Wire Wound Boiler—Grinding Reversing Links—Test Stand for Finished Engines

By Fred H. Colvin
Editor, *American Machinist*

STEAM automobiles of various kinds have come and gone and it is significant that the only one which has survived the test of time is the pioneer of them all, the Stanley steamer, as it is familiarly known. This is built by the Stanley Motor Carriage Co., Newton, Mass., in the original location but with greatly enlarged buildings and increased equipment.

The flexibility of the steam driven car is secured by two simple steam cylinders having 4-in. bore and 5-in. stroke. These cylinders are double acting and give as many impulses per revolution as an 8-cylinder, 4-cycle internal combustion motor. A steam pressure of from 575 to 600 lb. is normally carried, giving ample power under all conditions. The two essential features are, therefore, the boiler and the engine, which will be shown in some detail.

The boiler is of the fire tube type having a drawn shell, as shown in Fig. 1. This view shows drilling the holes for the tubes, about 650 in all, in the solid end of the shell by means of a plate j g. A tube plate is welded in the other end of the shell after both are drilled and properly lined up.

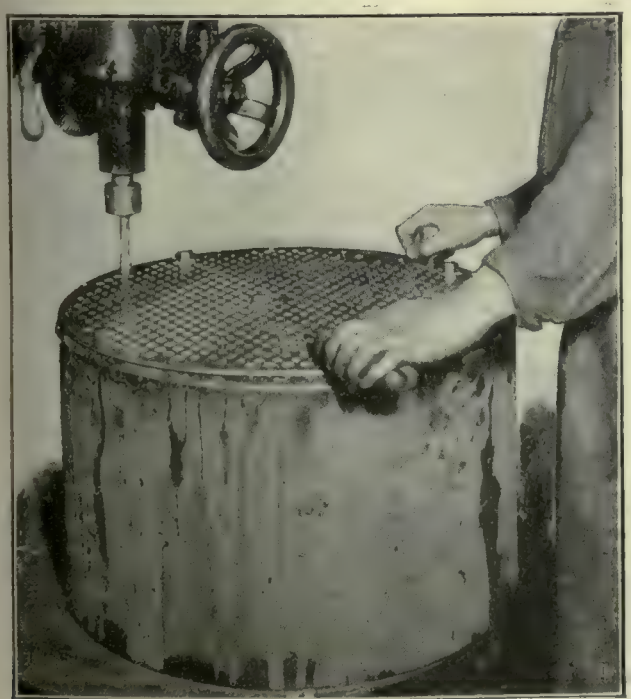


FIG. 1. DRILLING THE SOLID HEAD OF BOILER



FIG. 2. WELDING REINFORCING RING AND TUBES

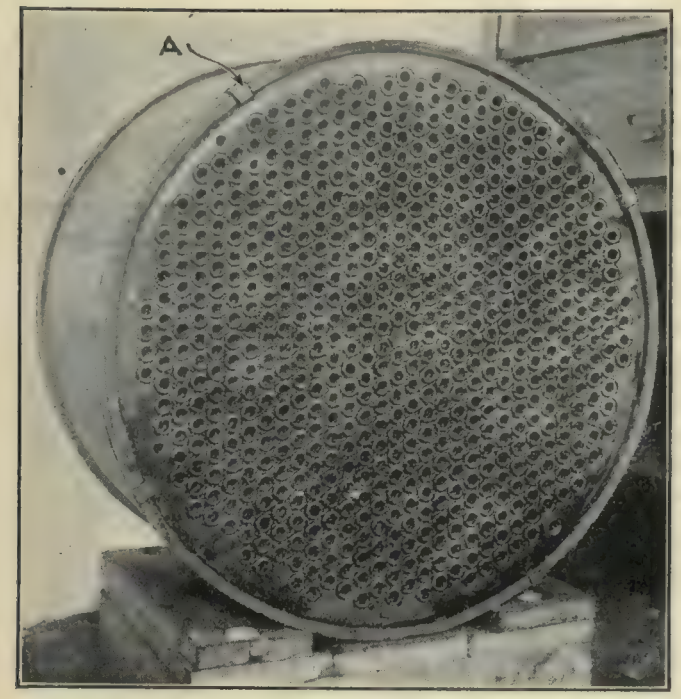


FIG. 3. BOILER WITH TUBES WELDED

The boiler tube holes in the solid head and in the plate are easily lined up by placing the boiler on its side, putting the plate in position and inserting two rods through similar holes in both head and plate. These rods project at each end and it is an easy matter to determine when the holes are in line. The plate is then welded in position with an oxyacetylene torch.

Heads Are Reinforced

Both heads are reinforced by steel bands as shown in Figs. 2 and 3. Fig. 2 shows the reinforcing bands at the open end of the shell being welded into position. Fig. 3 also shows the boiler tubes welded in place and it will be noted that the ring on this end (which is the one drawn solidly with the shell) has four retaining plates, as at *A*, which are also welded to the shell. The band at this end of the shell is shrunk in place and is not welded to the shell.

It will be noted that the bottom tube sheet has been recessed around each tube hole. This allows the metal from the welding wire to flow into the recesses and make the tube practically a part of the sheet itself.

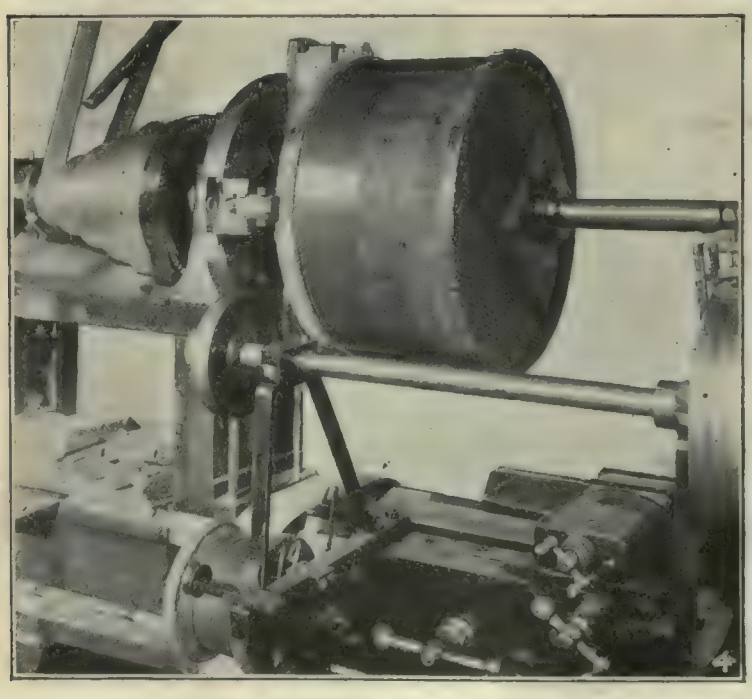
The other ends of the boiler tubes can be seen in Figs. 4 and 5. These tubes project through the top head and are reinforced with steel bushings, after which they are flanged, making it impossible for them to pull through the head. It must also be remembered that each of the boiler tubes acts as a sort of safety valve in itself, as the tube will collapse and leak at a pressure less than one half of that necessary to rupture the boiler. The tubes are Parkerized to prevent rust.

Winding Wire on Boiler

One of the special features of the Stanley boiler is the winding on the outside of the shell with a wire of very high tensile strength, about what is known as piano wire in most shops, similar to cannon construction. This wire is approximately 0.050 in. in diameter and is wound on in a lathe specially rigged up for this work, as shown in Fig. 4. This view shows the first layer being wound. There are three layers in all, using approximately a mile of wire on each boiler. Suitable tension is provided and the wire is fed along by the carriage so as to insure an even layer in each case. The winding is about twenty-two layers to the inch and the reinforcement gives the boiler a combined strength greater than if it was built of $\frac{3}{8}$-in. steel.

After the boiler has been completely wound and the end of the wire tacked in place it goes to the testing room, where it is filled with water and subjected to test over a burner mounted on a suitable stand, as can be seen in Fig. 5. Each boiler is subjected to the test of 900 lb. of steam pressure and 1,600 lb. of water pressure before being passed for assembly in the chassis. This test allows for a good factor of safety and boiler explosions never occur.

As before stated, the motive power is a simple two-cylinder double acting steam engine, the Stephenson



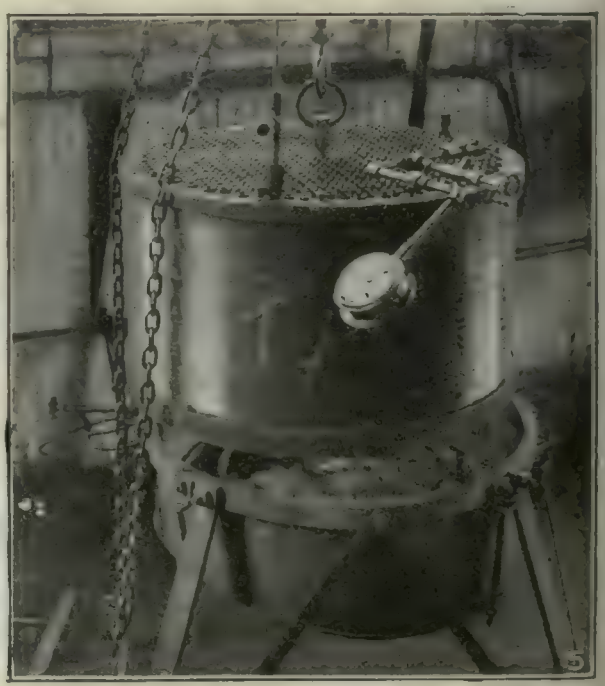
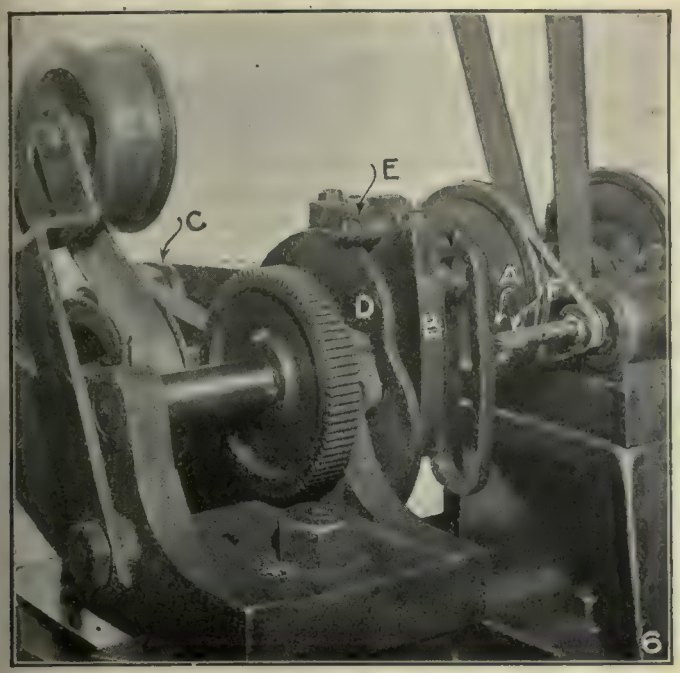


FIG. 4. WINDING THE BOILERS FIG. 5. TESTING BOILER UNDER STEAM PRESSURE



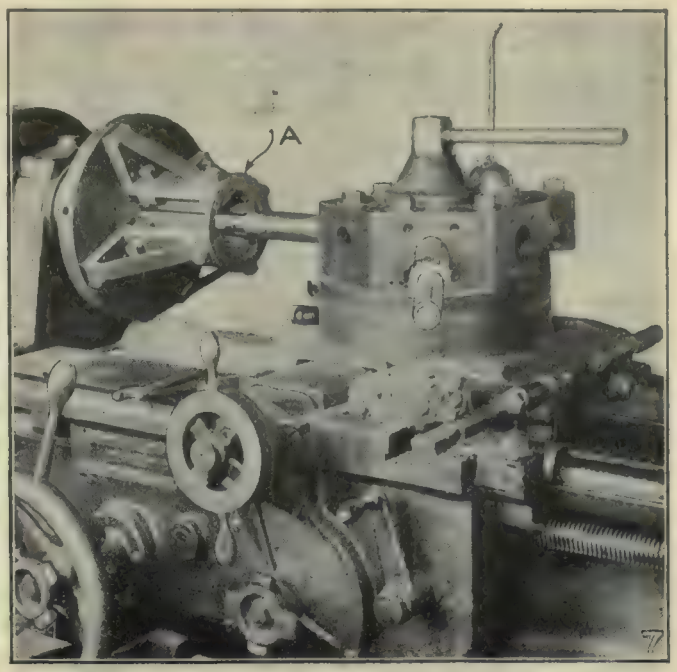


FIG. 6. GRINDING THE LINKS. FIG. 7. BORING THE CROSSHEAD GUIDES

link and slide valve being used for steam distribution. The method of grinding this link is shown in Fig. 6 and is interesting because of its simplicity. The link *A* is a forging which is located on the plate *B* by the eccentric rod holes. This plate is pivoted at *C* and is free to move up and down under control of the heart-shaped cam *D*. The roller *E* simply rides on the edge of the cam. The whole link carrying mechanism is supported in the toolblock of a lathe and can be adjusted back and forth for grinding both of the curved surfaces of the link.

The grinding wheel is mounted on a separate block bolted to the lathe bed. The lathe carriage is moved lengthwise on the bed to bring the work in contact with the small grinding wheel *F*. In operation the link swings up and down past the grinding wheel as the cam *D* revolves. The cam is driven by the belt and gearing shown at the left, while the grinding spindle is driven by its own belting, as can be readily seen.

The crosshead guides are bored in the fixture shown in Fig. 7. The guides are bolted to the jaws on the face plate, the outer ends being supported by the ring *A*, which prevents spring and adds to the general steadiness during the operation. The fixture carries two pairs of guides which are held in the same relative position as in the engine frame.

The burner is a cast-iron plate of special section as shown in Fig. 8 and contains about 4,500 holes, made with a No. 54 drill. This job is a serious problem in production as the drill breakage is fairly high, being from eighteen to twenty-four drills per plate. While the plate shown is being drilled with a single spindle, a gang drilling machine is used where it is advisable to do so.

The indexing of the burner is accomplished by the two slides *A* and *B*, which give motion in both directions. Cross motion is secured by the indexing crank C, the index plate being in the form of a five pointed star.

Longitudinal motion from one hole to the next is accomplished by the treadle *D*. The combination gives the operator complete control of the burner so far as locating the holes is concerned.

Testing the Engines

The completed engine is shown in Fig. 9, mounted on the test stand, where it is run for three hours under load before being assembled in the chassis. This view shows the general construction and the way in which the load is applied to the engine by means of the prony brake at *A*. The test stand is arranged to take several engines at once, each being supplied with its own brake. The engine frame consists of the four rods *B*, *C*, *D* and

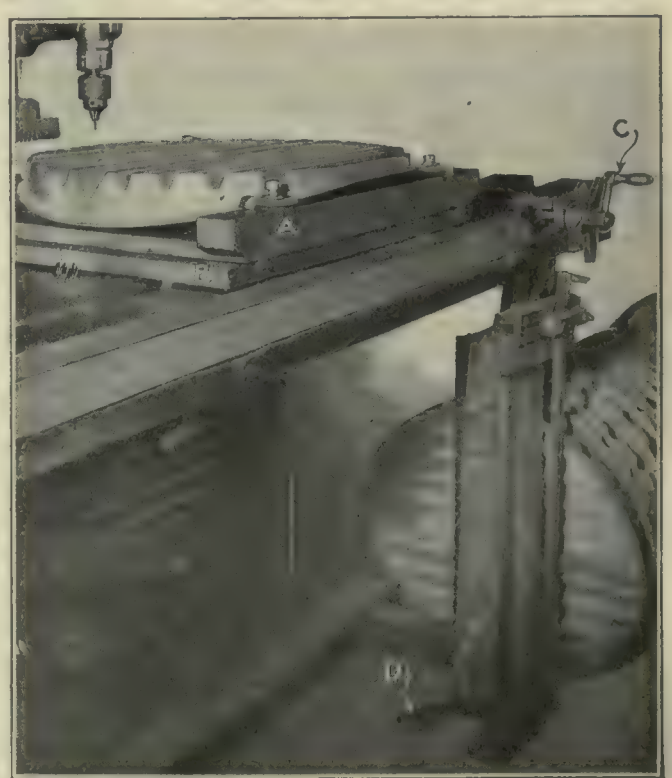


FIG. 8. DRILLING THE BURNER

E, which carry the main bearings for the crankshaft and also fasten the engine to the rear axle. The rods are threaded for about half their length, and by the use of check nuts easy adjustment is secured in both

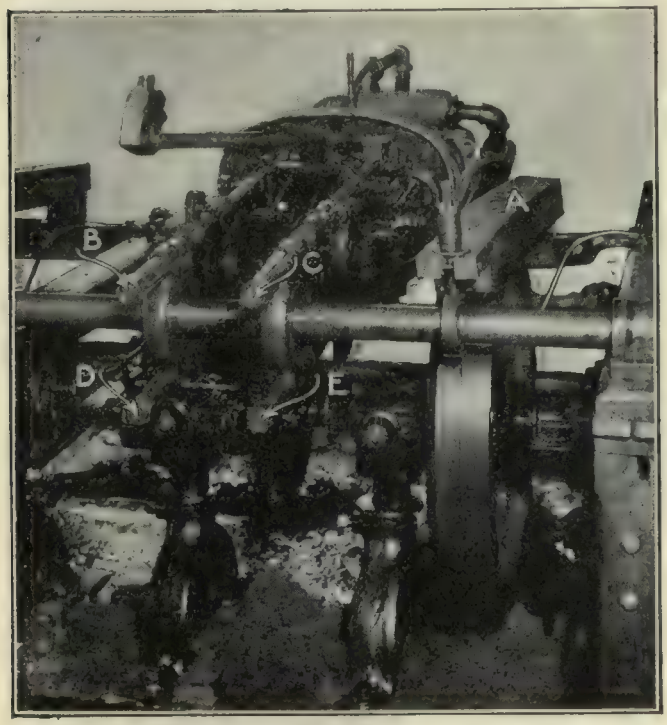


FIG. 9. RUNNING TEST OF COMPLETED ENGINE

places. The meshing of the driving gear on the crankshaft with the driven gear on the rear axle is easily controlled in this way.

An oil tight case surrounds the engine and the central portion of the rear axle, which carries the differentials, so that the engine and gears run in an oil bath at all times. The simplicity of the motor and the driving mechanism is one of the attractive features of this type of automobile power plant. Incidentally, the success of the Stanley car is a good example of the advantages of sticking to one thing and not scattering one's interest in too many directions. It is no small distinction to be a successful survivor.

Wasting Time by Failure to Be Specific

By R. W. Burgess

The following advertisement recently appeared in a technical paper:

> Man wanted, thoroughly acquainted with the manufacture of fans and blowing machinery. Address with full information.

After reading the above seemingly serious advertisement the writer marvels at the range of positions it covers. To answer the same one need only be one of the following: A shop clerk, cost accountant, production engineer, time study man, designer, draftsman, machinist, toolroom or shop foreman, superintendent or general manager.

When the Want Ad writer learns to be specific he will probably hasten the time when the employer and employee will be able to get together to their best possible advantage.

Charles Steinecke's article, *American Machinist*, page 548, shows the proper spirit. BE SPECIFIC.

A Question in Factory Management

By Otto Vogetzer

In an article under the above title on page 422 of the *American Machinist*, L. L. Thwing handled the subject well, and I will endeavor to make a few suggestions in the line of a remedy for the conditions pointed out.

The writer has had opportunity to study the general behavior of young men in the mechanical field after they had been graduated from a technical institution of some kind and were just starting out upon their careers as mechanical engineers or factory managers, with more or less hope of realizing their ambitions.

The young man who falls by the wayside is not necessarily lacking in ambition, he gets into the slough of despond because he is handicapped from the start; he believes himself to be a finished product upon leaving "Tech." He may possess knowledge in abundance but has not had the opportunity to acquire experience and judgment, without which his knowledge amounts to nothing. This state is perfectly natural, but he is ignorant of it; he has been deliberately misled and has started at the wrong end.

The future executive should enter the shop first and after rubbing elbows with the different types of men for a few years and getting first-hand the inside dope of a manufacturing organization, he will have laid a foundation sufficiently solid to weather the storms of disappointment in the future. He will have acquired a determination in proportion to his ambition which he could not acquire in school.

Entering a technical institute after a few years of shop life, the young man is prepared to take his studies seriously, realizing how much is required of the successful executive. After being graduated he has a definite plan of attack because of his previous experience, and is not a total stranger, so to speak. Our embryo executive will not start out with the idea that the world awaits the graduate with open arms and a fat salary. Right here is where some young men receive the hardest blows of disappointment from which so few recover.

The present-day graduate departs from the seat of learning with a valuable fund of information or knowledge, according to his ability of absorbing (to fail to admit this, would be unfair to teacher and student) but he still has to learn how to apply and use the information and formulas, which is not the easy task it appears to be at first.

Something may be said here about the raw material for future executives. We have all heard the following about a man—"He is a born leader." I hate that remark; it means nothing. If we knew the truth about this born leader of men, it would probably turn out that he has acquired most points that make a leader by self-training, by patient application of principles, and by hard work. I do not claim to be able to state all the tangible and intangible qualities a good executive should possess, but I do know that the man who habitually shirks responsibility will never amount to anything, regardless of any good points that he may have and I defy anyone to contradict that statement.

Who has not met the fellow who always says: "It was not my fault," or "I couldn't help it, the machine is at fault" and so on? Anything and everything is wrong except him. That man is doomed to failure. He who is willing and anxious to be responsible for anything he undertakes to do will succeed. Slackers and shirkers please note.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Why Some Motors Give Trouble

By Frank C. Hudson

There is one point in the building of internal combustion motors that is not always given the consideration it deserves. And that is the boring and grinding

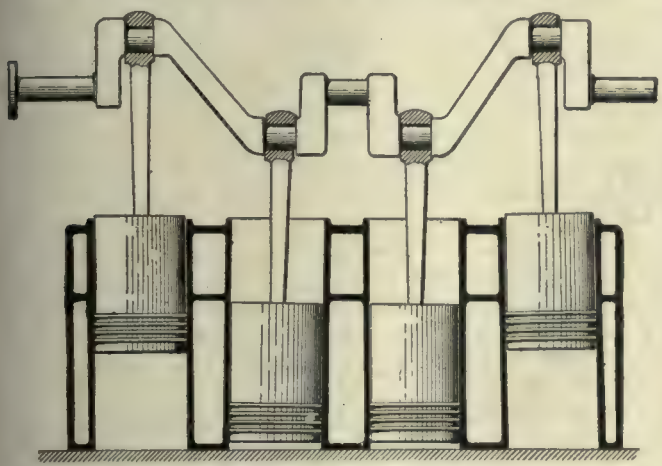


FIG. 1. EFFECT OF CYLINDERS OUT OF SQUARE

of the cylinders square with the crankshaft, particularly in the fore and aft direction. Of course the same thing is true with a steam engine or any combination of a crank and sliding motion, but it applies especially in the case of the automobile motor.

It only takes a glance at the figure, which shows an exaggerated case of the cylinders being out of line. The side stresses on the pistons and connecting rods and the alternating stresses on the crankshaft, all cause unnecessary friction, which means wear, loss of power and trouble.

Of course every maker is sure that this error cannot exist with his motor. But the experience in many large repair shops and in the army, shows that it is a real trouble. It only takes a few thousandths of an inch out of square to produce considerable wear and this means that the internal friction is much higher than it should be. Army experience showed that after this error was eliminated in the repair shops, the motors were much better and ran much longer before requiring repairs.

The remedy is not quite as simple as it may seem. In the case of an engine base and separate cylinder block it means first getting the crankshaft bore parallel with the cylinder surfaces and, second, getting the cylinder holes square with the face of the cylinder block. A little dirt under the face in either the boring or grinding fixture, will throw it out of square.

It is also necessary to see that the slides of the boring and grinding machines are in line with the spindles, and the fixture faces set square with the spindles and ways. An error of a few thousandths of an inch in this direction is more disastrous than a like amount in either diameter, roundness or uniformity of bore. The rings will take care of some variation if the piston moves squarely with the crankshaft.

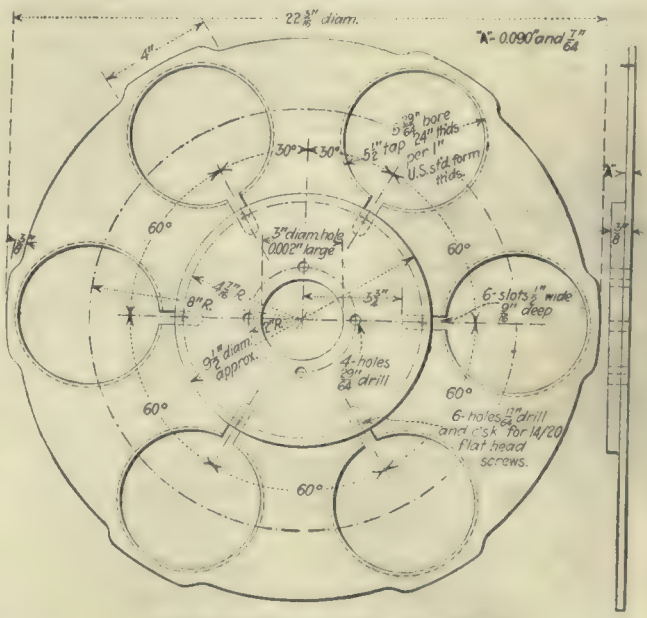
Individual cylinders remove one source of error as the face can be surfaced square with the bore at the same operation, and also ground at the same setting if necessary, by using a special wheel. The chance of error comes in the engine base. Motors with the bases and cylinder blocks cast solid have but one chance of error but this one chance should be carefully watched.

Radial squareness, that is the bores of the cylinders not having sidewise inclination, is of little consequence. Even a variation of the cylinders with each other in this respect is not important, although that is not likely to occur. But squareness lengthwise can not be watched too carefully. It well repays in the life and satisfactory performance of the motor.

How Would You Machine This Disk?

By P. Arter

We are having some difficulty in machining the brass disk shown in the accompanying sketch, and it has occurred to us that some of the readers of the *American Machinist* may have had a similar problem on their



BRASS DISK TO BE MACHINED

hands which they have solved more satisfactorily than we have.

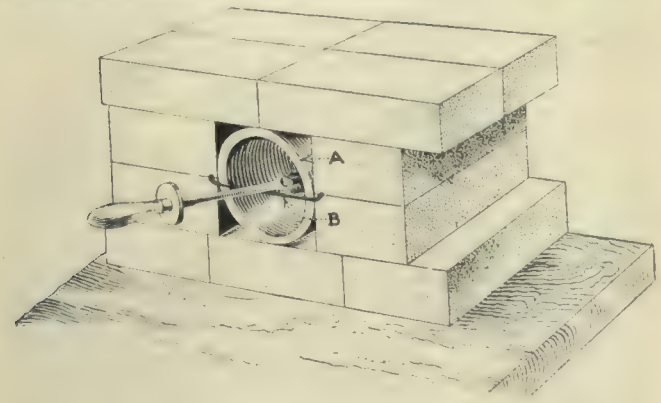
The disk is machined on both sides, which must be as nearly parallel as possible.

We will be glad if any of the readers of the *American Machinist* can tell us of a good way to machine the disk without distorting it.

A Muffle for Heating Soldering Irons

By Frank C. Hudson

A neat method of heating soldering irons was recently seen in a garage at Point Pleasant, N. J. An old Ford piston was surrounded by bricks as shown



HEATING SOLDERING IRON IN GARAGE

in the illustration at *A*. This brickwork was built against the side of the shop and on the work bench.

A heavy piece of wire fastened across the open end of the piston between the bricks at *B* supports the shank of the iron as shown. By placing a gasoline blow torch so that the flame plays on the copper head, the iron is heated with little loss of heat. The hollow piston acts as a muffle, the solid head preventing the flame reaching the side of the building.

Broaching Lock Cylinders

By Carl H. Briggs

One of the interesting applications of the broaching process is the machining of the keyslots in lock cylinders of the general type shown at *A* in the illustration. The design of the slot may differ for the various makes of locks but the method of broaching remains the same.

The fixture used is shown in the accompanying illustration. The fixture is mounted on the face of the broaching machine by the plug *B* which fits the hole in the faceplate of the machine. The over-hang, nearly 2 ft. in length, is supported by the leg *C* which extends to the floor.

The machine used is of the pull type and two of the cylinders are slotted at each pass of the broaching tool.

The cylinders are inserted between the movable jaws *D* and the fixed jaws *E*. The movable jaws are actuated by a cam clamping device at *F* which in turn is operated by turning the clamping spindle *G*. The springs at *H* open the jaws for the removal of the work, when the clamping mechanism is released.

The broach is made up of several component parts; the body *I*, the two blades *J*, and the taper gibs *K*, which clamp the blades rigidly in place in the body. The body is made of cast iron and the entering end is turned and slotted to fit the drawhead of the broaching machine. The whole unit composed of body, blades and gibs, is guided in the ways at *L*. The blades are very thin, being but 0.100 in. thick on their backs.

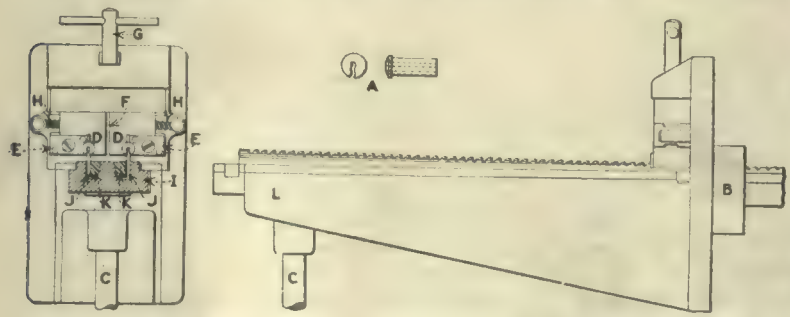
The slots in the cylinders are 0.340 in. deep as measured from the circumference of the cylinder and it will be noticed that these slots have a number of projections from the sides. These projections overlap each other, making it necessary that the broach start its cut at the extreme circumference of the work. For the depth of 0.340 in. a broach 60 in. in length with the teeth spaced $\frac{3}{8}$ in. apart is used. This allows approximately 0.002 in. of material to be removed per tooth.

Because of the delicate design of the blades and their great length they are made in sections, each blade composed of ten 6-in. sections. This procedure has various points in its favor. The short sections are easily machined, the tendency to spring is lessened, excessive distortion in the heat-treatment is guarded against, and in event of several of the teeth being broken in use but one section need be replaced. The blades are machined to the contour of the slots in the cylinders by means of special formed milling cutters.

The cutting speed of the broach is 7 ft. per minute and a production of 100 pieces an hour may easily be maintained. The cylinders are of brass and no lubricant is used in the operation. The broach blades are of 120-point carbon steel.

Three of the short sections that make up the complete blade are shown in the side view of the illustration. The illustration also shows the finish end of the broach as it is passing through the guiding ways.

The broaching of these lock cylinders differs from the usual broaching practice in that no roughed hole or slot is machined in the work preparatory to broaching, the broach forming the slot from a solid piece of material.



MACHINE FOR BROACHING KEY SLOTS IN LOCK CYLINDERS

Cyanide Hardening for Color

By R. McHenry

Considerable difficulty is experienced by some when attempting to caseharden small tools, screws, nuts, etc., for colors by the cyanide process. The mystery is removed and good results assured without special equipment if a few simple rules are followed.

First, have the work brightly polished with dry emery cloth and free from grease and finger marks. Heat slowly to a dull cherry red—*no hotter.*

Apply cyanide without removing work from furnace or forge. This may be neatly done by holding a fresh lump of the chemical in a second pair of tongs and rubbing or wiping the piece to be hardened.

The cyanide is then allowed to "boil in" for a few seconds. Also, if the work is small and becomes cooled by the application it is kept in the fire until the dark cherry red heat returns to it.

The article treated is now dipped very quickly, to avoid contact with the air and agitated violently in clear water, until cold. Brightening the surfaces with a little machine oil completes the operation and gives the desired case of mottled brown and blue without scale.

Lathe Fixture for Facing Pump Packing Rings

By A. C. Cole

There is a difference of opinion as to how cylinder packing rings for various kinds of duty should be finished; some hold that grinding on a magnetic chuck is the only proper way to insure a true face and others say that facing one side at a time in a split bushing gives the best results, but from a close observation of both methods it will be determined that chucking the casting from which the rings are cut necessarily distorts it. After the rings are cut off with an allowance of stock for finishing, the chucking strain is relieved and the result is a warped ring. Now, if this ring be drawn down on a magnetic chuck and faced, the same warp will appear when the magnetic influence is withdrawn. The principle is exactly the same as though the ring were crowded into a split bushing and faced. When the holding force of the bushing is relieved the ring will be more or less warped and will rock on a faceplate. The sketch shows a device that overcomes all these objections by facing both sides of the ring at the same time without chucking strains. In Fig. 1 is shown a sectional view of the assembled fixture. The plate *A* fits the lathe spindle and is bolted to it by means of the fitted bolts *E* and the parts *B*, *C* and *D*. Segments *C* are free to move radially by means of the steel ferrules *G* which keep same from seizing.

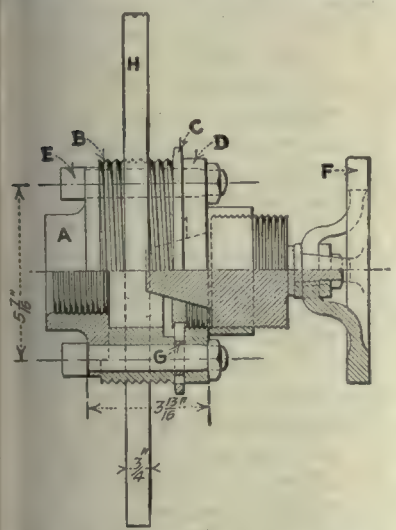


FIG. 1. ASSEMBLED LATHE FIXTURE FOR FACING BOTH SIDES OF PUMP PACKING RINGS SIMULTANEOUSLY

The operations necessary to chuck a ring are as follows: Revolve faceplate *H* on disk *B* so as to square up packing ring which is placed over the segments *C*. Tighten ring by turning wheel *F* clockwise. When the packing ring is sufficiently tight, start the lathe and back the faceplate *H* toward the headstock of the machine; this will allow both inside and outside faces of the packing ring to be cut at the same time by means of a forked tool properly secured in the toolpost. The

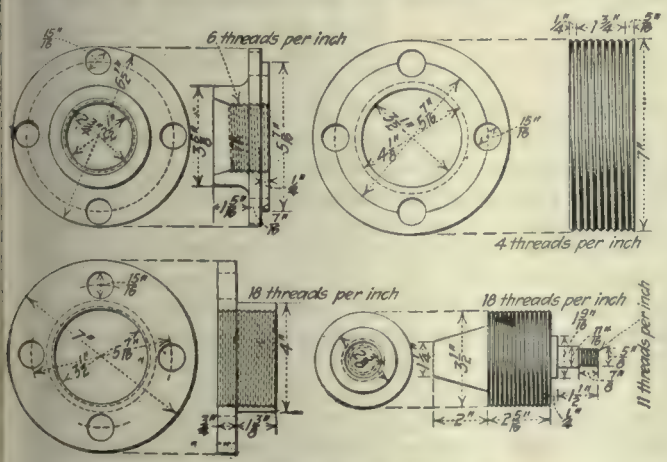


FIG. 2. DETAILS OF FIXTURE

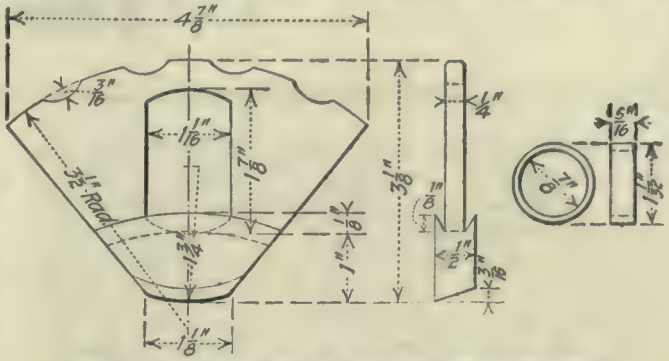


FIG. 3. ONE SIZE OF CLAMPING SEGMENT SET

segments *C* are constructed as shown in Fig 3, so that the width is 1/16 in. less than the finished width of the packing ring; this will give sufficient tool clearance and allow for inaccurate chucking.

Such a fixture will produce from 200 to 250 rings in 10 hours and each will gage perfectly in any position, thus insuring a perfect fit in the piston grooves. The fixture will hold a number of sizes by making a set of holding segments for each diameter of rings to be machined.

Making Pins With Rolled Heads

By A. A. Karcher

The sketches herewith show the screw machine operations for making pins having rolled heads, one of which is shown in Fig. 1.

Cold-rolled stock of the diameter of the pin body was

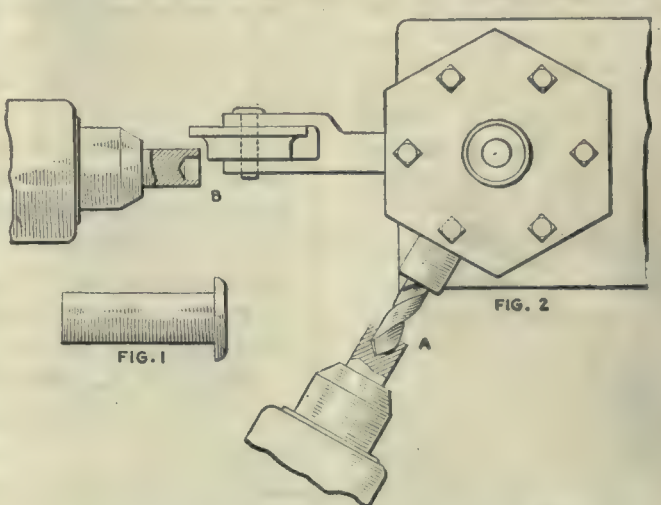


FIG. 1. A PIN WITH A ROLLED HEAD. FIG. 2. TOOLS AND SET UP FOR FORMING THE HEAD

used and the first operation was to drill a shallow hole in the end as shown at *A*, Fig. 2, leaving the walls about 1/16 in. thick. The size and depth of hole should be governed by the diameter of the stock and the size of the head wanted.

The second operation was to form the head by rolling as shown at *B*. The roller was made of tool steel, hardened, and was about 2 in. in diameter. During rolling a copious flow of cutting solution was used and the result was a highly finished head.

There was practically no waste of material except that required for cutting off.

IN THIS ISSUE

A SURVEY of this week's issue will show that our major articles deal with the following general subjects: Management, manufacturing, design, railroads, automotives.

The first article deals with management, giving the advice of Morgan G. Farrell, of Miller, Franklin, Basset & Co., on "How the Shop Manager Can Use an Appraisal." Mr. Farrell does not go into detail on regard to the method of arriving at values, because, as he sees it, such items as tangent assets, patent rights, financing expenses, etc., "have very little real interest for the executives of industrial plants whose principal care is to produce a suitable return on investments, and who, therefore, want to know in common-sense terms how the fixed portion of their investments stands and how it analyzes for each operating department and each machine." He says further, that an appraisal properly made and used will have a daily value in guiding the policies of the business.

Colvin found an unexpected development of quantity manufacture of oil-well tools in Texas. Beginning on page 932 there are described in his manufacturing article some of the tools used in drilling for oil. The matter of going down for a distance of a mile or so with a drill and still being able to rotate it and make it cut rock would appear to offer more than an average amount of difficulty, and it has, indeed, called forth the ingenuity of those designers who have had the task of producing bits that would do the work. The article shows very clearly the design of these bits and how they are used and it gives a clear idea of the shop requirements necessary to turn them out in quantity and at a moderate cost.

In the current installment of their design article, "Tool Engineering," page 939, Dowd and Curtis furnish more of their very thorough information on drill jig design. This installment includes the design of jig bodies, posts, feet and thumbscrews, as well as locating blocks and types of bushings. A great deal of emphasis is placed upon the fact that many parts of jigs and fixtures can be standardized with the object of obtaining a uniform design or to enable the factory to make them up in quantity which, of course, is necessary in keeping the cost of production of the product down where it should be and in eliminating design expense.

We have been advocating further economy and more efficient equipment in the railroad shops for a long time. Our efforts to effect improvement have been constructive, as we have published, almost weekly, articles that deal with time and labor saving methods in railroad shops. This week, on page 943, there is an article by Stanley which bears the very expressive title, "Saving Materials in Railroad Shops." It deals with recovering lining metal from worn car journal bushings, the methods of lining and boring bearings, and the salvaging of old bolts and air hose. Stanley obtained his data in the shops of the Southern Pacific at Sacramento, Cal.

This week's installment of Ellsworth Sheldon's "Magnetic Chucks" series describes the chuck of the company which he terms the latest entry thus far into the field of manufacture of the magnetic chuck, namely the Persons-Arter Machine Co., Worcester, Mass. Characteristics of the Persons-Arter chuck are its simplicity of construction, its use of a single coil and a distinctive pattern which is shown by the photographs.

The continuation of A. B. Cox's design article on "The Slip of Involute Gear Teeth" begins on page 951. The first part was published last week. It will be remembered that it is the author's intention to show how the efficiency of gears may be increased and the wear decreased, also how to reduce the slip and increase the percentage of rolling contact.

The automotive article which is by Colvin, page 955, describes the power plant of the Stanley steam-driven automobile. The arrangement of the power plant units is explained, the methods of constructing some of them are gone into and the engine tests that are used are described.

The extract from the report of the Standardization Committee of the American Supply and Machinery Manufacturers Association, page 949, is a very clear statement of the danger of adoption by our Government of metric standards, the use of which would be compulsory. The arguments are sound and should serve to strengthen, if possible, the present conviction of our readers that compulsory adoption, as several times heretofore advocated, is not for us.

Coming Features

A short series, unusual in intent and scope, will be begun in out next issue. H. H. Manchester has been delving into history to the extent that he feels that he now can, with confidence, predict what the trend of conditions in the near future will be. He is basing his predictions on what happened after previous wars, giving due consideration to the facts that there never was a war the size of the one just over, nor one that had so many phases. He has called his series "A History in Post War Crises."

Among the several complete articles will be "Heat-Treatment of Thor Tool Parts," by Hunter; "Improved Method of Machining Steel Gears," by Richardson, of the Midvale Steel and Ordnance Co.; "Jig and Fixture Storage," by Colvin; and an article on the installation of motor drives or old railroad shop tools.

There will be installments of "The Foreman and His Job," "Metal Cutting Tools," and "Tool Engineering."

EDITORIALS

Equalization

FOR many months the cry has been for lower prices and a return to normal living. We don't hear so much of lower prices now, everybody is calling for "equalization."

The farmer knows what lower commodity prices mean to the producer and he is strong for having the prices of manufactured goods reduced proportionately. Equalization is vital to his existence. Either the prices of the things he buys must drop to the level of the prices of the things he grows or else the price of farm products must go up again.

Labor in many cases has taken the rather moderate reductions demanded of it in a philosophical way. Where the reduction has been resisted the result is only postponed and will be the same in the end. Wages will not go back to pre-war rates and their decline will be slow. Few employers like to reduce wages and as a consequence the unpleasant job is put off as long as possible.

With supply running far ahead of demand in most lines and wages still high it is only natural that most shops have had to go on short time. It would, of course, be better for the workman to accept a lower wage rate and work full time. He would fare as well for the present and the reduced cost of production would allow his employer to market his product at a lower price, to increase his sales and thus keep his plant running. But with human nature constituted as it is there is small chance that we can get on such a basis very soon.

In the meantime the manufacturer must look elsewhere for an opportunity to lower his production costs. Eliminating the cost of labor as a factor, he must necessarily either reduce the costs of sales and distribution, or increase the productiveness of his equipment. One look at the sales end eliminates that from consideration. From the beginning of the war until a year or so ago the hardest work of the sales force was to fill out the order blanks. No expense was necessary to secure business, it came unasked. But in a buyer's market things are vastly different. Sales expense, then, will go up rather than down.

Distribution costs are probably at their peak now. A little relief may result from the readjustment of rates that seems likely to follow the railroad wage cut promised by the Labor Board, but it will be slight at best and in any case is outside of the control of the manufacturer.

The only salvation, then, seems to lie in an attack on overhead and machinery costs. The tool that costs fifty per cent more but produces three times as much work is a good investment and a real money saver and business producer. Modern shop equipment of every sort must be studied with the utmost care to determine how savings can be accomplished. The design of the product may have to be modified somewhat to take advantage of short cuts but it will be well worth doing.

The key men in this attack on production costs are the designer of the product, the engineer who puts it into production and the machine-tool builder who supplies the machines to turn it out. They must co-operate to the fullest extent if we are to maintain our position as a leading manufacturing country. It must be realized that these statements refer not only to the product "machinery," but to all products made by machinery, because, if traced back far enough, the influence of the machine tool will be found.

As an example of this sort of team work we hear from an automobile plant that a machine tool has at last been conceived to machine a certain part economically that had had to be left partly finished before. As a result the designer has changed the assembly which includes this part and the production engineer is enabled to secure three times the production with the same number of men and a smaller floor space.

If these key men fail, the equalization which is bound to follow will be the increase of commodity prices until a balance is reached. We cannot help but feel that this is not the sort of equalization that is best for the American people. After all, a nation can only exist on the principle of striving for the greatest good for the greatest number of its citizens.

The Balance of Trade Goes Against Us

LAST month's figures show an apparent trade balance against the United States of some seven millions of dollars. This is an occurrence that has long been desired by those who look at economic matters from a world-wide point of view.

Our tremendous export balance which reached into the billions after the war could have but one effect on exchange—the dollar kept climbing to dizzy heights and foreign customers found it ever harder to buy American goods, other than dire necessities, with their depreciated currency. Every machinery manufacturer who formerly had an export market knows this to his cost.

The reversal of the balance means that the world has begun to pay its debts to us and that as a consequence sterling, francs and lire will rise in value until our foreign customers are able once more to purchase the American machinery they so badly need.

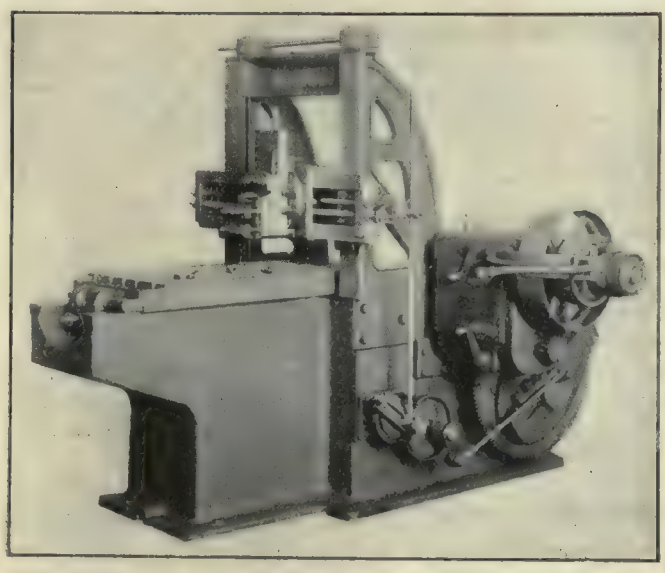
There is no doubt but that as the wheels of industry gather momentum, the world will once more enter upon an era of productiveness. There are cities and factories to be rebuilt, raw and semi-raw materials to be furnished, tools and machinery to be supplied. Countries which before the World War took no great part in the world's commerce, are now developing their industries to the end that they may earn a place in international business. And this means business for American manufacturers and work for American workmen, not only in the final stage of fabrication, but all the way back to raw materials. With it will come stimulation of other lines and another step back to normal business for all.

Too much hope should not be attached to this rather slender thread, for all of Europe is poor and it will be many years before they can hope to reach stability. But there are certain machines and tools that can only be bought here and they represent at least a small volume of business. In times like these every little bit helps.

Shop Equipment News

Woodward & Powell 24 x 24 x 24-Inch Crank Planer

The Woodward & Powell Planer Co., 97 Webster St., Worcester, Mass., has recently placed on the market the crank planer shown in the illustration. The machine



WOODWARD & POWELL CRANK PLANER

Specifications: Stroke, 0 to 24½ in. Height between table and cross-rail, 25 in. Width between housings, 25 in. Table working surface, 40x21 in. Countershaft: tight and loose pulleys, 15 in. in diameter, for 5-in. belt; speed, 240 r.p.m. Strokes per minute of table, 10, 17, 29 and 48. Horsepower of motor required, 5. Ratio of return to cut speed, 1.4 to 1. Floor space required: gear box drive, 80x120 in.; cone drive, 70x120 in. Approximate weight, 8,000 lb.

has a working capacity of 24 x 24 x 24 in. It combines the rigidity of the planer with the ability of the shaper to plane to a line and to operate with short, rapid strokes. It is said to be especially adapted to forge shop and railroad-shop work, handling die blocks, gibs, shoes, wedges, crossheads and slide valves.

The bed, housings and cross-rail are massive and well ribbed, to give rigidity. The table has large flat bearing surfaces on the top of the bed, and is gibbed its full length. The stroke is adjustable for length by a removable crank operating a screw in the crank disk, which is located in the rear of the machine on the shaft of the large driving gear. Any length of stroke up to 24½ in. can be taken over any portion of the table, the position of the stroke being adjusted by means of a shaft at the front end of the table. This adjustment can be made while the table is in motion, if desired. The machine can also be furnished with a stroke of 28½ inches.

The housings are lipped on the bed, and extend down on the sides of it. The arch rests on top of the housings, as well as between them. The head can be swiveled to either side for angular planing, and is graduated in degrees. The saddle is lipped over the cross-rail. The crank can be applied to either end of the rail screw and rod for hand movement. The feeds for cross, vertical, and angular travel are operated by hand or automatically by power and take place on the return stroke.

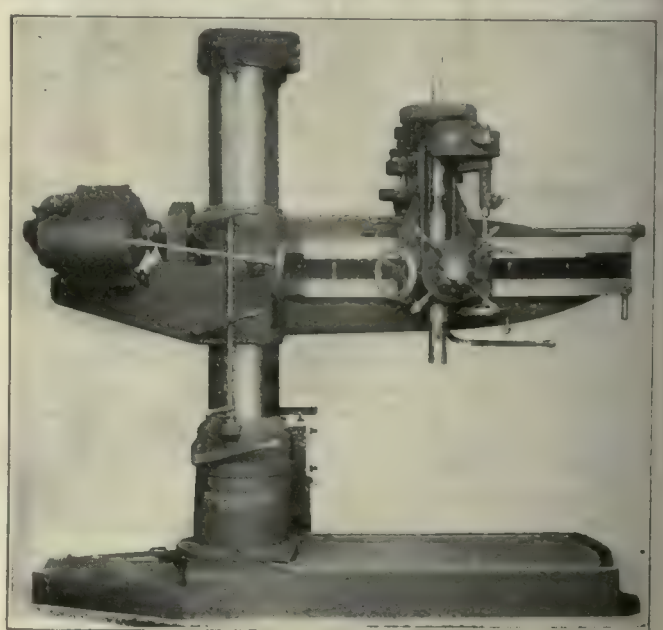
The planer can be operated by belt on a single pulley connected to a four-speed gear box, as shown; or this pulley can be replaced by a gear, and a motor mounted on top of the gear box with a pinion to mesh with the driving gear. A four-step cone pulley can be mounted in place of the gear box. The handle for operating the starting and stopping clutch of the gear-box-driven planer also operates a brake for stopping the table when the clutch is thrown out. All gears and revolving parts are thoroughly guarded, these guards having been removed from the machine illustrated in order to show the working parts to better advantage.

Dreses Motor-on-Arm Drive for Radial Drilling Machine

The driving arrangement shown in the illustration has recently been put on the market by the Dreses Machine Tool Co., 227 West McMicken Ave., Cincinnati, Ohio. The motor, shown fitted to a 5-ft. radial drilling machine made by the concern, drives the drill and also raises the arm. It is mounted on an extension of the arm, so as to partially balance it; and it is placed on a sub-base, so that different makes can be fitted without a change of the arm.

The driving mechanism is very simple. The pinion on the motor meshes directly with a large gear on the horizontal back shaft of the arm. The arrangement thus eliminates two pairs of bevel gears, three spur gears, eight bearings, two long shafts and one short shaft, used in the driving mechanism when the motor is mounted on the machine base. The total friction is said to be reduced to about one-half, so that a motor of one-third less capacity than required on the base of the drill can be used.

The controller is placed in front of the motor, and by means of a universal joint shaft and bracket, the controlling handwheel is brought within easy reach of the operator. The handwheel rim is beveled at an angle of



MOTOR-ON-ARM DRIVE FOR DRESES RADIAL DRILLING MACHINE

45 deg. and graduated to show the spindle revolutions at the different stations of the controller. A fixed pointer, reaching over the handwheel, serves as an indicator. By this arrangement, four sprocket wheels with chains, several brackets with bearings, two bevel gears, and a long shaft, which are necessary when the controller is placed in the rear of the motor and arm, are eliminated.

Powers Duplicating Drilling Machine

The drilling machine shown in Fig. 1, designed by James Powers, has recently been placed on the market by the Sterling Tool and Machine Works, Inc., 205 West 19th St., New York, N. Y. Although adaptable to ordinary drilling, the machine is intended chiefly for the performance of drilling work either requiring the duplication of a part already made, or done directly from a templet or drawing.

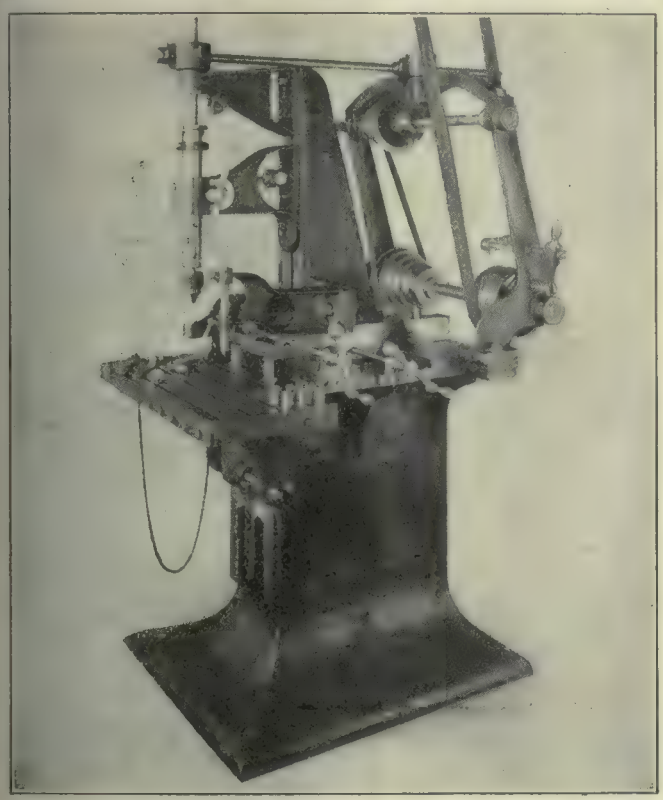


FIG. 1. POWERS DUPLICATING DRILLING MACHINE

Specifications. Capacity, ¼- to ¾-in. drill. Spindle: diameter, 2 in.; taper hole, No. 2. Morse; feed, 5 in. Travel of spindle head: longitudinal, 15 in.; transverse, 8 in. Table: size, 12¾ x 30 in.; vertical movement, 12 in. Speed changes, 5. Height to top of helical gear housing on spindle, 5 ft. 10 in. Floor space, about 3 x 4 ft.

The rectangular table can be adjusted vertically on dove-tailed ways by means of a crank and can be locked in place. Sufficient room is thus allowed for working upon jigs. The head or column carrying the spindle is mounted on ways and can be moved both longitudinally and transversely by means of ball cranks at the right side of the machine. The cranks are fitted with graduated collars, so that the position of the head can be accurately adjusted; and clamps are provided to hold it in position. The screw for the transverse movement is operated through helical gears.

The machine is driven by a belt on tight and loose pulleys, and cone pulleys are provided to afford changes of speed. Because of the fact that the spindle moves in two planes, it is driven through a splined horizontal shaft fitted with helical gears, so that the movement of the spindle is not constricted.

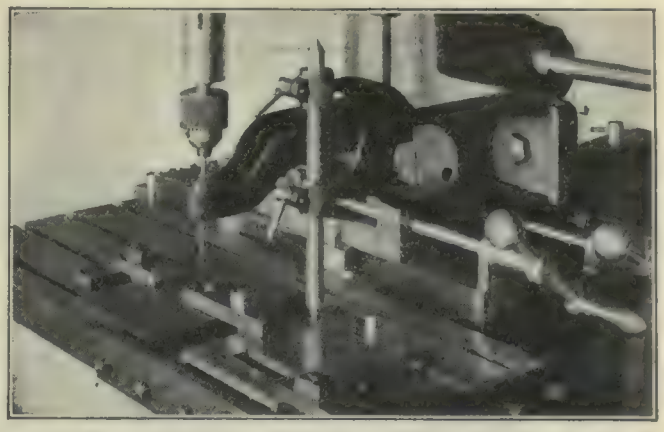


FIG. 2. DUPLICATING THE HOLES IN A JIG PLATE

The spindle is fed by hand and is provided with an adjustable stop. It is counterweighted and carries an adjustable drill chuck. The arm holding the quill can be moved vertically on the column. Another arm carries a bushing for steadying the drill. At the right of the spindle is an arm mounted on the column and holding in two bearings the vertical pilot bar.

The pilot bar is shown in use in Fig. 2. The master plate is clamped on the table under the pilot, and the work to be drilled under the spindle. By positioning either the conical point of the pilot bar or the stud end, bushed if necessary, in the holes of the master plate in turn, and moving the table and the spindle by means of the controls, the holes in the work can be made to duplicate those in the master. This method is said to be very effective for toolroom work and for small quantity manufacture, eliminating the necessity for jigs and fixtures.

In work such as making models, the drawing can be laid directly on the table and the positions of the holes transferred. When duplicating a part to replace a worn or broken one, the holes in the new part might be located by clamping the old part under the pilot and working from it. Holes can be accurately laid out by the ordinary method of buttoning, the buttons being properly positioned with relation to each other and then clamped on the table. The pilot is brought over the buttons in turn, so that the holes can be drilled in the work.

The maker emphasizes the universality of the machine. It may well be used for removing stock from irregularly shaped die blocks. A fixture for drilling holes on the circumference of a circle can be supplied. The machine can be furnished in various sizes to suit different classes of work, the specifications being given for the first model of the machine.

Changes in Pratt & Whitney Measuring Machines

The Pratt & Whitney Co., Hartford, Conn., has added several features to the well-known measuring machines which it manufactures.

A changed design of pedestal for the 36- and 48-in. machines, shown in Fig. 1, retains the rigidity of the older form in a much lighter construction besides furnishing support to the hardwood shelf in front of the machine so that the shelf, while providing a convenient place for the operator to lay tools or pieces upon while

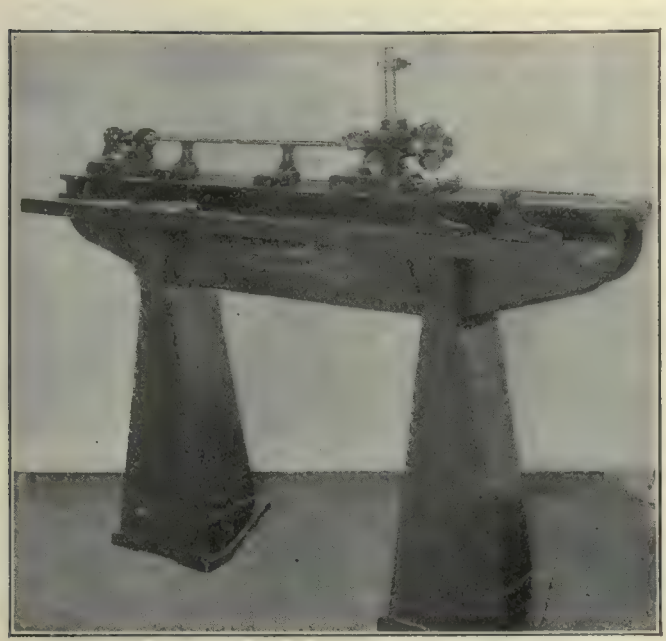


FIG. 1. PEDESTAL FOR PRATT & WHITNEY MEASURING MACHINES

he is engaged, does not at any point come in contact with the bed of the machine.

The measuring head, which may be seen in detail in Fig. 2, is fitted with a clamping arm moved by a tangent screw in the adjustment block so that when the graduation on the dial is brought almost to line, the clamping screw may be tightened, binding the arm to the dial, and the final adjustment made by means of the tangent screw. An adjustably mounted vernier has been added, and also a permanently mounted glass for reading the dial and vernier, thus enabling the operator to make the most minute settings with ease and accuracy.

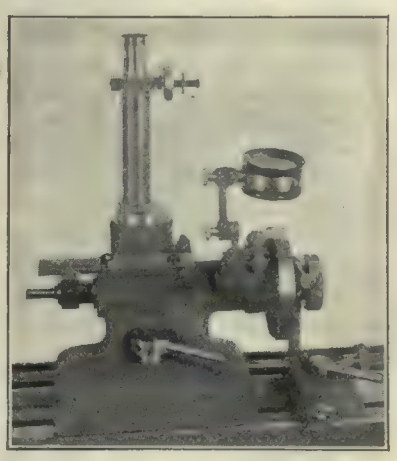


FIG. 2. IMPROVEMENTS TO FACILITATE SETTING

Improvements have also been made in the microscope by means of which the readings from the longitudinal scale are obtained. The eye-piece has been extended and at the lower end of the tube an enclosed electric light is so arranged as to illuminate the graduations on the bar.

Anderson Double Spindle Automatic Nut Tapping Machine

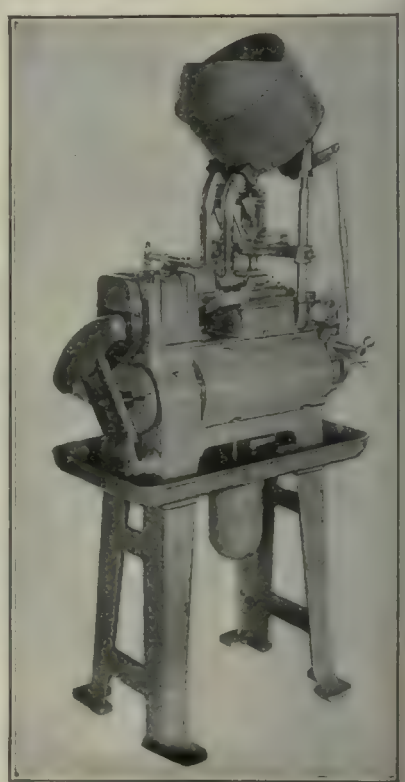
A double-spindle automatic nut tapping machine has been completed by the Anderson Die Machine Co., Iraniston Ave., Bridgeport, Conn., and is now ready for the market. This machine incorporates new features in the reversing type of machine in that it is entirely automotive and has no clutches.

Nuts ranging in size from $\frac{1}{16}$ in. to $\frac{5}{8}$ in. across the flats, from $\frac{1}{16}$ to $\frac{1}{2}$ in. thickness, and any size of hole up to 10-24 may be tapped at a rate of production of from 112 to 136 pieces per minute. The nuts may be either square or hexagon.

The work is dumped into the hopper shown above the machine in the illustration, and by means of an agitator operated by a crank movement at the rear end of the mainshaft, is fed through the curved chutes, the lower ends of which are fitted with shutters that hold the nuts, one at a time in each chute, in tapping position. The nuts do not leave the chutes until tapped.

A vibrator in the shape of an unbalanced disk running at a high rate of speed, keeps the nuts moving in the chutes and forestalls "hanging up" before the tapping position is reached.

The forward and back rotative movement of the tapping spindles is accomplished by means of a gear and pinion meshing with the reciprocating gear segment which may be seen on the front end of the machine. The segment is reciprocated by the adjustable pin in the crank disk behind it, and the amplitude of the movement is adjusted to give the required number of revolutions of the spindle to insure a full thread in the work.



ANDERSON DOUBLE SPINDLE AUTOMATIC NUT TAPPING MACHINE

The segmental gear in connection with the crank disk and sliding block constitutes a Whitworth crank movement that gives a comparatively slow rotative speed while the taps are cutting and a much higher speed for the withdrawal.

The endwise movement of the spindles is under the control of cams on the mainshaft, which extends through the machine. The cams, however, are so designed as to present the taps to the work and release them at the time they start to cut, so that the spindles may float during the time the taps are in the thread. The return cam picks up the movement as soon as the taps are fully withdrawn and carries them back out of the way while the tapped nuts are dropped out of the chutes and others take their place. No special taps are required.

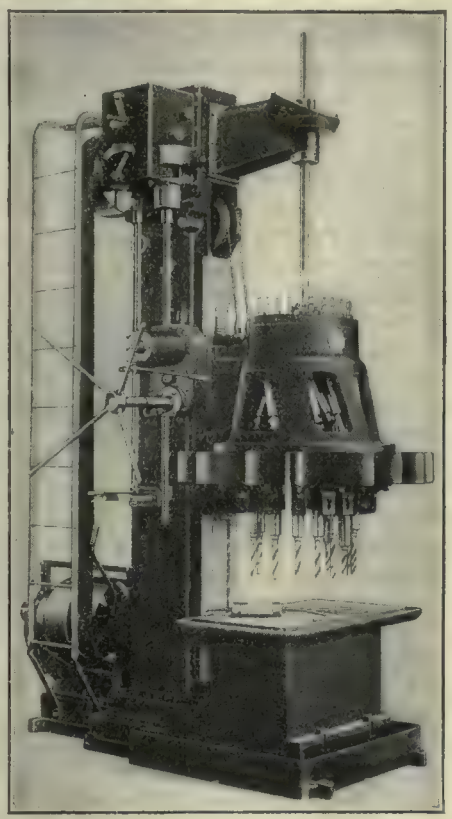
Oil is fed to the taps by a pump in the base of the machine, through hinged spouts so arranged that when they are turned back out of the way for purposes of adjustment the flow of oil is automatically cut off.

The machine is driven by a $\frac{1}{4}$-hp. motor that can be furnished either for alternating or direct current, 110 or 220 volts. The drive is through the medium of a worm with wormwheel keyed directly to the mainshaft.

The net weight of the machine is 500 lb., and it occupies a floor space of 18 x 24 in. The height from floor to center of spindle is 43$\frac{1}{4}$ in., total height 66 inches.

Fox D-32 Multiple-Spindle Drilling Machine

The machine shown in the illustration is the size D-32 which has been added to the line of the Fox Machine Co., Jackson, Mich. In designing the machine provision was made for raising and lowering the spindle head by power, using an Ingersoll-Rand four-cylinder air motor mounted on the head. An interlocking device on the valve controls the air motor so that it is impossible to engage it and the power feed at the same time.



FOX TYPE D-32 DRILLING MACHINE

The machine is shown with a 20-in. round head with twelve spindles, each 2 in. in diameter. However, the machine can be furnished with any one of a variety of heads giving a large range in drilling areas and for many sizes of spindles. The head has been mounted on a saddle in order to obtain a longer bearing on the column ways, and this arrangement aids in absorbing the strains created in forcing the drill into their work.

Sliding gear transmissions are used for feed and speed changes, the gears being of hardened steel and used with shafts mounted on Hyatt roller bearings. The gears are flooded with oil by a pump located at the base of the column. The head can be furnished with two speeds to each spindle and the speeds of all spindles can be independently varied, or when not in use can be thrown into a neutral position. The feed is engaged by a saw-tooth clutch that is automatically disengaged when the head reaches an adjustable stop.

The machine can be equipped with an automatic tapping attachment that has been built so that it is possible to reverse the spindle at any time during the tapping operation, and then instantly change the rotation back to the original direction. The design has been arranged to take the load off from the entire machine and taps when the spindle reversal takes place, in order to make the tapping of blind holes an easier operation and eliminate the shock from the machine. The head of the machine is furnished with a power feed in either direction equal to the lead of the taps, and the direction of the feed is controlled directly by the direction of the spindle rotation.

Rotary tables can be furnished for the machine so that loading can be done at the same time that drilling is progressing under the head. The machine varies in weight from 9,000 to 12,000 pounds.

H. S. & G. Heavy Triple-Geared Lathe

The Houston, Stanwood & Gamble Co., Cincinnati, Ohio, has recently placed on the market a 60-in. heavy triple-geared lathe as shown in Fig. 1. The bed of the lathe, which is 42 ft. long, is made in one section. The large steadyrest shown at the end of the lathe has a capacity of 23 to 37 in., and the smaller steadyrest has a capacity of 2 to 23 in. Both are equipped with bronze shoes on the jaws. The carriage is equipped with a rapid power traverse. The lathe as shown is equipped with a 35-hp. Westinghouse Type SK variable-speed motor, 220 volts, direct current.

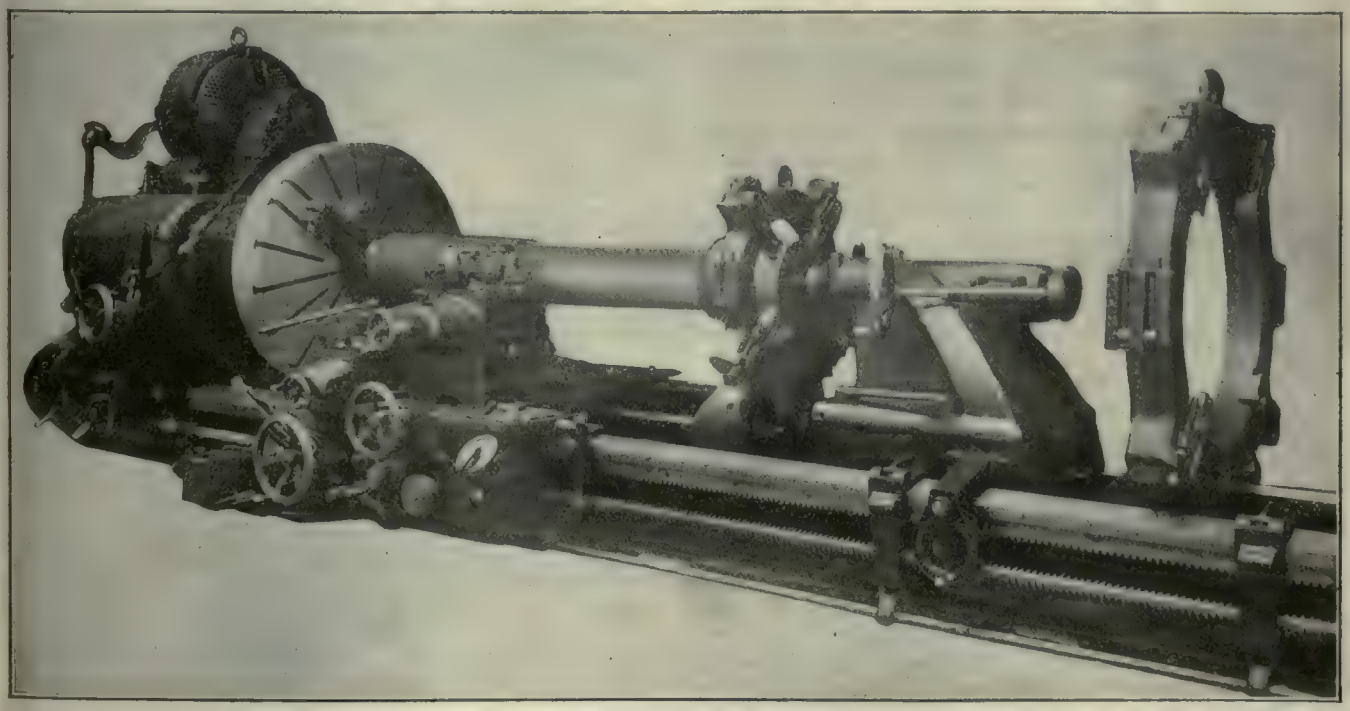


FIG. 1. H. S. & G. TRIPLE-GEARED LATHE

Every lever in this lathe is made of steel casting, as are also the reverse plate and quadrant. The gears are all made of 0.50 carbon steel and nearly all of them are made with the 20-deg. pressure angle stub tooth. Lubrication of the headstock is accomplished by means of a pump mounted at the rear of the lathe where it will be accessible for repairs. In order that the operator may see that the oiling system is functioning properly, an oil gage is mounted on the front of the headstock and an oil indicator in the line from the pump.

The apron is made with front and back walls, which are tongued and grooved through the center in male and female sections, also doweled and bolted together.

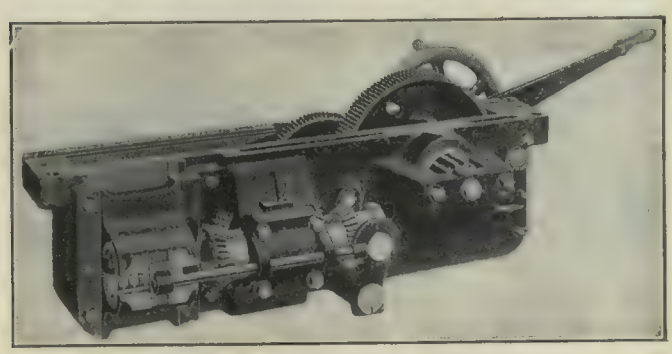


FIG. 2. REAR VIEW OF APRON

This construction precludes the possibility of bearings shifting out of alignment. The back wall is nearly as heavy as the front wall. All gears are made of steel with coarse pitch and wide face. The feed mechanism in the apron is driven by a positive angular tooth clutch, which can be seen in Fig. 2. The construction of this clutch allows the operator to engage or disengage the feeds instantly under heavy cuts. This view also shows the interlocking mechanism between the half nuts for screw and bevel feed gears. The rack pinion and rack are of high-carbon steel, heat-treated, and have stub teeth with a 20-deg. pressure angle.

At the right-hand side of the apron can be seen the motor controller bracket and dial by which the starting, stopping and reversing of the main motor are controlled. The action is transmitted through the horizontal shaft shown near the bottom of the lathe, thence through a chain and sprockets to the controller, which is at the back of the lathe out of the way. Adjusting studs are provided to eliminate slack in the chain.

The long ratchet at the left end of the apron is used when it is desired to exert great power on hand adjustment of the carriage, or for the purpose of feeding the carriage along the bed under heavy cuts. A tool rest for full swing work is mounted on the apron at the left of the carriage, as are also the rapid traverse motor and controller. Power traverse can be obtained by means of the lever directly back of the handwheel, which engages the friction clutch. Moving this lever toward the operator engages the positive clutch, allowing the carriage to be traversed by hand.

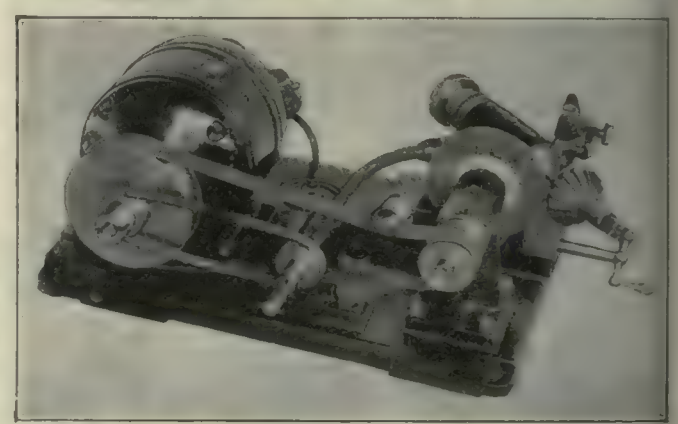
At the extreme right of the illustration can be seen a recently patented support for the lead screw and controller rod. One of the chief advantages of this support is that it can be removed from the lathe in a few seconds and replaced at any position along the bed in a similar length of time. This advantage is particularly in evidence when it is desired to move the support from one side of the tailstock bracket to the other side. Weight, complete on skids, 80,000 pounds.

Franklin Portable Repair-Shop Grinding Machine

The Franklin Machine and Tool Co., Springfield, Mass., has recently placed on the market a portable grinding machine for general use in automobile repair plants. The machine is known as the Model "B" repair-shop unit, and is intended chiefly for grinding valves, sharpening reseating cutters and reamers, and for driving wheels, wire brushes or drills on the end of a flexible shaft.

It consists of a flat base, on which is mounted a ½-hp. motor, a grinding wheel running in bronze bearings and driven by a belt from the motor, an idler being provided to keep the proper belt tension. A compound slide, operated by means of screws and ball cranks, carries a swiveled head fitted with draw-in chucks for holding the valve or the cutter pilots. The slides are scraped and fitted with adjustable gibs in order to provide adjustment for wear. The spindle in the head is driven by means of a worm and worm wheel through a round belt and a flexible shaft from the motor, so that the position of the head can be changed without interfering with the driving mechanism.

In the illustration, a double-ended valve-reseating tool is shown in position for grinding, this tool being used for machining the valve seats on the cylinder castings. A spring stop is provided in order to properly index the tool. The valve itself can be mounted in the same head for grinding, and since it is not necessary to change the position of the head, the same angularity can be obtained on the valve and on its seat. It is stated that valves can be very quickly ground, and that



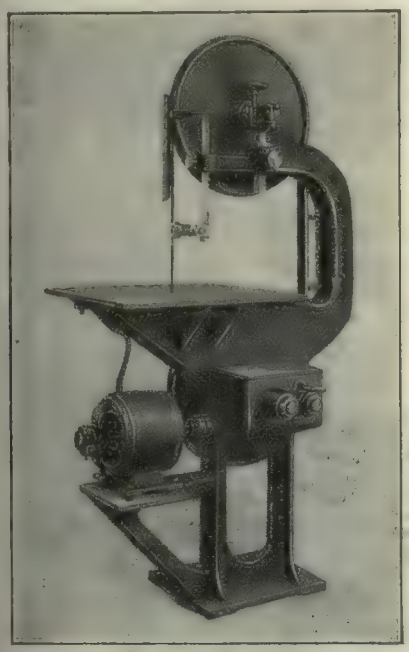
FRANKLIN MODEL "B" PORTABLE REPAIR-SHOP GRINDING MACHINE

they fit so closely that only a small amount of grinding with compound, with the valve in place on the seat, need be done afterwards.

The machine can be adapted to other uses. Attachments or adaptors may be fitted to the end of the spindle for holding breaker arms while regrinding. A wheel-dressing attachment is also furnished. When used with a flexible shaft directly connected to the end of the motor shaft, different types of tools can be driven. Either small grinding wheels or wire brushes can be used on the end of the shaft, or an attachment for holding drills can be furnished. This attachment is provided with a handle having a pistol grip, so that the drill can be easily held and guided. Because of the fact that the whole machine may be easily moved from one place to another, it has a very wide range of adaptability.

Clark Metal Cutting Bandsaw

The illustration shows the metal-cutting bandsaw which has been placed on the market by the Clark Machine Works, Belmont, N. Y. This machine was built to meet demand for a compact sprue-cutting saw for use in brass foundries and shops having to cut brass, bronze, aluminum or any of the softer metals which can be fed up to the saw by hand. The machine is ball bearing throughout, the bearings being so designed that they require no oiling. The upper wheel bearing is packed in grease and is said to run for months without any attention. All other bearings are lubricated from the gear-box. The drive is direct through a worm gear running in a special lubricant, the motor being controlled by a snap switch conveniently located on the under side of the table. It has a sliding-gear speed change operated by a handle on the outside of the gear-box, all gears running in an oil bath.

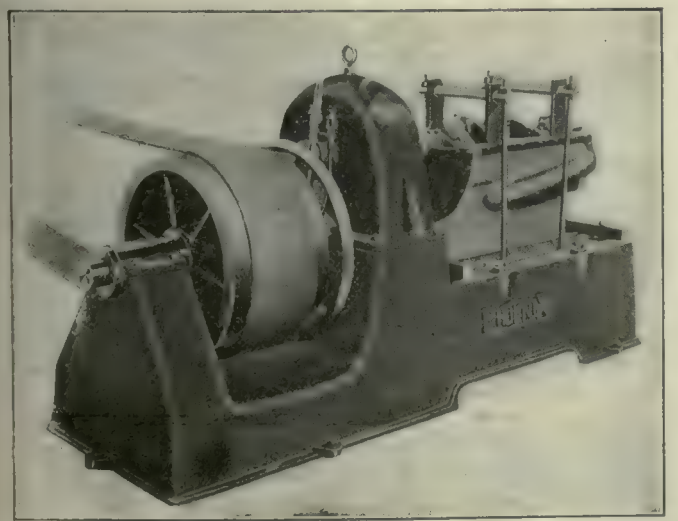


CLARK METAL CUTTING BAND SAW

The wheels are of web construction provided with a flange on the front side which obviates the necessity of wheel guards. It is said that the machine cannot get out of order and will operate successfully with practically no attention.

Phoenix Burning-in and Running-in Machine

The machine shown in the illustration is a combination running-in and burning-in machine which has been placed on the market by the Phœnix Manufacturing Co., Eau Claire, Wis. This machine was designed to burn-in and run-in the main bearings on all makes of motor cars, trucks and tractors. The power is transmitted through a three-to-one gear reduction. The burning-in operation is done at a speed of 200 r.p.m., and the running-in at 600 r.p.m. The machine can be operated from either side. An especial feature is the solid Fibroid cone self-adjusting clutch, said to be especially adapted to the severe strains existing during the burning-in operations.



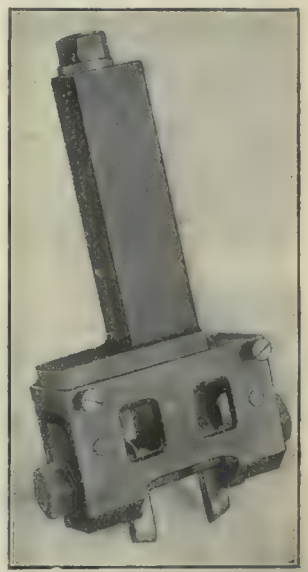
PHOENIX BURNING-IN AND RUNNING-IN MACHINE

The machine is of heavy construction, being ribbed and reinforced. Ford and Fordson fixtures are furnished and other fixtures for different types of motors can be supplied. The machine weighs 2,200 lb. Height, 34½ in. Floor space occupied, 29 in. x 78 in.

Dusenbury Duplex Planing Tool

A planing tool that cuts in either direction, thus making it possible to take advantage of the ordinary idle stroke of a planer table, is being manufactured by the Waltham Machine Works, Waltham, Mass., under the name of the Dusenbury duplex planing tool.

The cage, seen at the lower part of the tool in the illustration, swivels upon the long bolt which passes lengthwise through the shank, and can be clamped in any desired position by the nut at the upper end of the latter. The amount of the swivelling movement can be regulated and adjusted by means of four small screws. Within the cage are two "clapper blocks," similar in principle to the corresponding part of a planer, so mounted as to swing toward each other, thus bringing the two cutting points fairly close together and avoiding the necessity for a long over-run at the end of each table stroke.



DUSENBURY DUPLEX PLANING TOOL

The studs that hold the tools pass through the swinging blocks and are drawn up by easily accessible nuts on the outside. Standard high-speed-steel toolbits are used. The tool may be used in any position, being intended for surfacing, for planing down the side, or for undercutting at an angle. The swiveling feature enables the operator to divide the amount of cut equally between the two cutting points, one for roughing and the other for finishing.

The clapper block of the planer is held down by a taper pin through the lower part of the block and box; or, if it is not desirable to make this slight alteration, a device for accomplishing the same purpose without the necessity for making an addition to the planer will be furnished by the maker of the tool.

Where the duplex tool is to be used continuously upon one planer, it is advisable to so change the pulleys upon the countershaft as to secure equal cutting speed in either direction; but this is not a necessity, as the work may be divided between the tools by swivelling the cage to throw the heavier cut upon the tool operating on the slower speed. All parts of the tool are case-hardened and accurately fitted, so as to be interchangeable between different tools.

The Knebel Self-Tightening Drill Chuck

A drill chuck that is somewhat different in principle from the standard construction has been patented by the Knebel Manufacturing Co. of Middletown, Conn.,

In Fig. 1 may be seen the three principal parts before assembling. A spider, mounted on ball bearings, turns

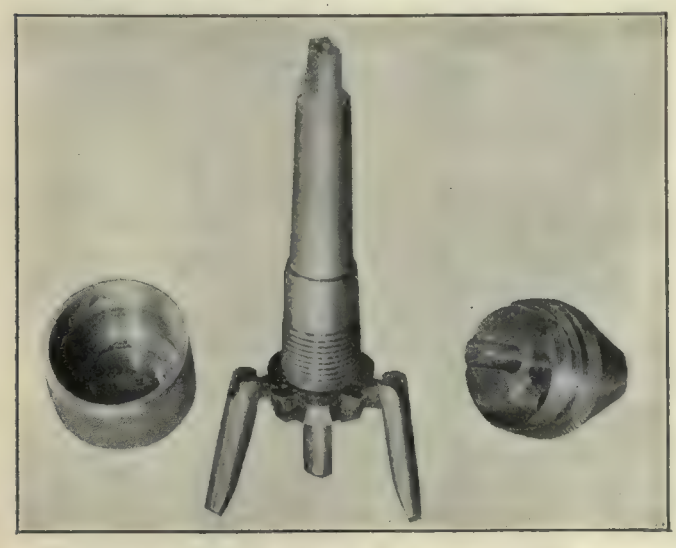


FIG. 1. THE KNEBEL CHUCK DISASSEMBLED

freely upon the central portion of the chuck, and the three jaws are attached to this spider by means of toggle joints.

The shell is in two parts, the upper part, seen at the left in the picture, being threaded to the central part or hub, by a substantial square thread, by means of which the chuck is tightened on a drill. The lower part of the shell is screwed to the upper part by a fine pitch V thread.

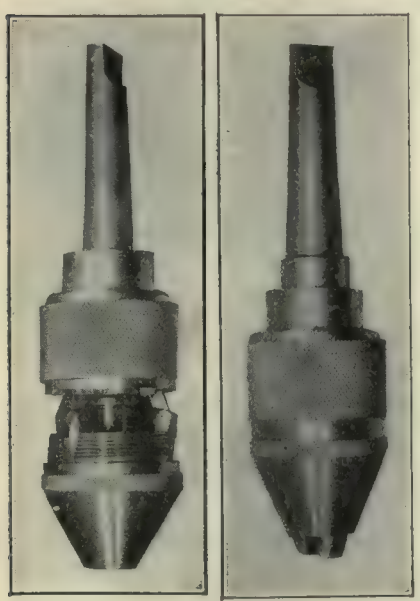


FIG. 2. SHOWING THE SHELL DRAWN APART TO EXPOSE THE TOGGLES.
FIG. 3. THE KNEBEL CHUCK ASSEMBLED

The three holes for the jaws in the lower parts of the shell are round, and by reason of their angular position with reference to the axis of the chuck they cause the jaws to close in as the shell is turned back on the large square thread. Due to its construction, long life for the wearing parts and high gripping power is claimed for this chuck.

In Fig. 2 the chuck is shown with the lower part of the shell unscrewed and drawn forward to expose the toggles. In Fig. 3 may be seen the completely assembled chuck. The chuck may readily be taken apart for cleaning, and there are no loose parts to be mislaid or to be wrongly re-assembled. The chuck is now made in two sizes: To hold 0 to $\frac{3}{8}$ in. and 0 to $\frac{1}{2}$ in.

Marburg "All-in-One" Steel Figure Stamp

Marburg Brothers, Inc., 90 West St., New York, N. Y., has recently placed on the market the "All-in-One" steel figure, or numbering set, for stamping figures on metals. The device, as shown by the accompanying illustration, contains all ten steel figures on the periphery of a steel disk, the figures being hand cut.

It is said to be easy to align the figures properly on the work being stamped, because of the fact that they are held on a disk. The arrangement of the figures enables the operator to stamp any figure which he desires without the necessity of picking it separately from a box, as is necessary with figures placed upon individual bars. The proper figure may be easily selected without looking at the cut figure itself, because of the fact that the figures are stamped on the side of the disk, both next to and opposite the cut figures. Thus,

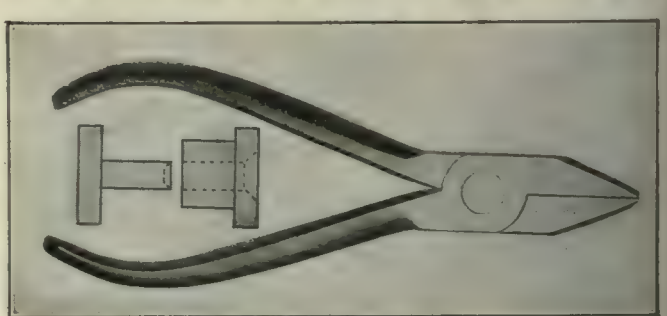


MARBURG "ALL-IN-ONE" STEEL FIGURE STAMP

that figure will be stamped on the work which is shown at the top of the disk when in use, or next to the point where the hammer strikes. It is claimed that, besides enabling the operator to do better stamping work, much time may be saved by the use of the device.

Lindquist Plier

The Lindquist Engineering Works, Portland, Conn., is marketing a plier in which the joint is somewhat different from the usual construction. Instead of using a single rivet to hold the two parts of the plier together the rivet passes through a shouldered bushing. One plier-jaw is counterbored to receive the head of the bushing, which is just long enough to reach the bottom of the counterbore in the other jaw. A flat-head rivet



THE LINDQUIST PLIER

passes through the bushing, taking its bearing upon the end of the bushing instead of upon the jaw, so that no matter how tightly the rivet is drawn it cannot bind the jaws and cause them to stick. The method of construction is shown in the sketch.



NEWS SECTION

Westinghouse Earnings Total Nearly $160,000,000

The gross earnings of the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., from sales billed for the year ending March 31, 1921, were, as shown by the company's annual report, $150,980,000, which is an increase of $15,000,000 over the gross earnings of the previous year. The manufacturing and selling cost was $138,774,000; and the net income available for dividends was $12,618,000, or 16.8 per cent on the company's capital stock. Dividends at the rate of 8 per cent per annum were paid during the year on both the preferred and common shares of stock.

There is included in the cost, $5,315,000 for depreciation and adjustment of inventories, which were valued as of Dec. 31, 1920, at cost or market value, whichever was lower. An appropriation of $5,000,000 from surplus for a special contingent reserve has also been made to provide for further possible shrinkages and adjustments in the inventories.

The property and plant account shows an increase over the previous year of $9,361,000. The amount of unfilled orders on hand April 1, 1921 was $65,621,000.

French Duties on Ball Bearings

The *Journal Officiel* for April 3, 1921, contained a decree, dated April 1, which provided for a change in the French duty on balls for ball bearings and ball races, dutiable under item 633sept of the customs tariff. The new rates are 70 per cent ad valorem under the general tariff and 35 per cent under the minimum. The duty on balls for ball bearings was formerly from 66⅔ to 486 francs per 100 kilos, general rate, and from 45 to 324 francs per 100 kilos, according to the diameter of the balls. Ball races were classified as parts of cycles, parts of vehicles or machines or nickeled wares, whichever yielded the highest duty. Ball bearings of American origin are duitable under the general tariff. Goods proved to have been shipped direct to France prior to the publication of the decree may be admitted at the rate of duty formerly in force.

F. A. E. S. Sponsors National Public Works Department

In the consideration of the questions involved in the establishment of the Department of Public Welfare, L. W. Wallace, executive secretary of the Federated American Engineering Societies, has asked the Senate Committee now conducting hearings on that subject, to keep in mind the desirability of changing the name of the Interior Department to "The Department of Public Works" and grouping in it all of the engineering bureaus. The Federated American Engineering Societies represents about 150,000 engineers, technologists, architects and contractors. A portion of Mr. Wallace's presentation on the subject is as follows:

"The constituents of the Federated American Engineering Societies, being engineers and industrial executives have with some concern considered the very illogical and ineffective form of organization that the Federal Government has grown into. Being students of organization methods and procedure, as well as experienced practitioners in the same, they have advocated the establishment of a Department of Public Works, to supercede the Department of the Interior, and which Department of Public Works there would be centered all the major engineering, construction and research work of the Federal Government. In order that this might be done easily it would be necessary to place those bureaus that are not of an engineering, construction or research character that are now in the Department of the Interior, in other departments of the Government.

"The provisions of the bill for the Department of Public Welfare which is under consideration at this hearing provides for a number of such bureaus and activities. The purpose of our appearance is to point out this condition and to urge that the bill be so modified as to properly assign those bureaus that would not be included in the proposed Department of Welfare.

By so doing a material advance would have been made toward a redistribution of governmental bureaus and functions, which is so essentially necessary for the accomplishment of greater economy and despatch in the transaction of governmental business."

Hoover Gets $500,000 for Exports and Bureau of Standards

Quite contrary to the usual practice, the Committee on Appropriations of the House of Representatives acceded to the request of the Secretary of Commerce and allowed the full $250,000 requested for export industries. This fund is to be used principally in an effort to assist the twelve chief export industries, to wit: Cotton and cotton goods, paper and paper products, leather and leather products, chemicals (including dyestuffs), heavy machinery and machine tools, electrical goods, automobiles and accessories, lumber and lumber products, jewelry and silver, metal products, vegetable oils, and hardware.

In addition, the Committee approved the full amounts which Secretary Hoover asked for the Bureau of Standards, as follows: Testing structural materials, $50,000; industrial research, including elimination of waste, $100,000; standardization of equipment, $100,000.

These items are included in the second deficiency appropriation bill, which was reported to the House by the committee on May 18.

Destructive Fire at American Car and Foundry Shops

Fire which started when "spatter" from molten iron flew across the blacksmith and machine shops of the American Car and Foundry Co., at Terre Haute, Ind., on May 19, destroyed the two shops comprising about half of the entire plant and caused damage estimated from $100,000 to $200,000. The walls of the two shops, which were housed in a section of the plant about 150 ft. long, were all that were left standing. Expensive machinery and tools were ruined, and salvage of the metal will be the only saving from the fire. The fire was the second heavy loss suffered by the company during the last two years. In the fall of 1919 fire destroyed the west section of the plant, which later was rebuilt. Between twenty-five and thirty men will be out of work as a result of the fire, it was said by Joseph E. Parson, foreman of the blacksmith shop.

Business Conditions in Germany

By Our Berlin Correspondent

Berlin, May 2, 1921.

Germany has now entered into a phase which probably is one of the most critical in her history. No matter whether the present crisis develops into an acceptance of the imposed reparation conditions, or, what seems improbable, ends in their refusal, with an inevitable economical war following, she will find herself in an entirely new and most serious position. The momentous decision which the country has to face at present is largely an industrial problem, a foremost consideration being the question how far the industry in the interior of the country could continue its existence, in the case of losing control over the Ruhr district, after the economical detachment of the Rhineland and under the other effects of the sanctions.

The Government is, therefore, strongly leaning upon the advice of the country's industrial leaders, and no effort is spared on their side to influence the ultimate decision. The attitude of those circles is a peculiar one, considering that their own interests are primarily at stake. Your correspondent has lately interviewed several industrials of high standing. Their opinions are mostly of a sentimental nature. They entirely lack clear foresight and the only impression that can be gained from what they say is that the German industry as a body stands for refusing the imposed reparations, and for facing all the consequences. Whether or not this policy will be adopted by the Government, which is hardly likely, will be decided long before these lines come before your readers, but the attitude of the industry largely responsible for bringing the problem to this pass will no doubt be worth recording in any case. The opinions heard by your correspondent from industrial leaders vary so little that it is sufficient to quote one, that of Dr. Waldschmidt, president of Ludwig Loewe & Co., Aktiengesellschaft, a personage of influence in the engineering industry of the country.

Dr. Waldschmidt, when giving vent to his opinion that the London ultimatum should be refused point-blank, said that while the industry was well aware that the period ensuing would be fraught with distress and hardships, they would be the lesser evil. In his opinion—which coincides with that of most industrials—these hardships must be braved, trusting to the future and to the course of political and economical developments to set matters right. Even taking, he maintained, the worst aspect of the threatened occupation of the Ruhr district, and all the pressure which has been or still might be brought to bear on Germany, the industrial life in the interior could never be entirely suppressed. The greatest difficulty of course would be the loss of control over the coal supply, but considering the world's coal situation, no market could be found for the coal now consumed by Germany, and the worst that could happen, he says, is that the price of Ruhr coal for German consumption would rise to the world market standard, which does not differ now so greatly from domestic prices.

The Iron Supply

The same, he believes, would apply to the iron supply. As long as Germany can maintain her comparatively cheap and highly efficient labor, he believes that use for it will be found under any conditions, seeing how much the world stands in need of it. Of course he quite recognizes that industry and trade would suffer severely. He and his brethren, however, seem to be firm in their belief that such conditions could not last very long, and that the forces at work in the whole world to restore economical balance would in the course of time interfere in Germany's favor.

With regard to the question of accepting the London ultimatum, his mind is quite made up. Such acceptance would according to his idea be quite suicidal, as the tribute it would impose upon Germany is, he says, entirely beyond her economical strength. Instead of creating a basis of economical reconstruction, he believes that Germany's inability to fulfil her obligations would continuously call forth measures of reprisal, and perpetuate the atmosphere of unrest in Europe. This opinion is shared by the majority of German industrials, and as the financial obligations which Germany would have to take upon herself are largely based upon her industrial productivity, this carries great weight with the government and the general public. It is of course of a purely sentimental nature, no one in Germany being able to clearly recognize the limit of her present financial strength, or being equipped with sufficient foresight to estimate what the country might perform in the future.

To increase the present standard of industrial productivity is in Dr. Waldschmidt's opinion impossible, as he is convinced that the workmen have reached the maximum of efficiency which can be expected of them in their present physical condition. An improvement in the latter respect, he says, is out of the question, as the country will be impoverished further in any case, and consequently the standard of living will sink instead of gradually rising. Dr. Waldschmidt sees no possibility of increasing the productivity by specialization and by better organization of work, without further taxing the workmen's strength.

An Optimistic View

More optimistic in the latter respect is the view taken by Dr. Walter Rathenau, president of the A. E. G. Electric Company. His opinion is noteworthy insofar as it represents the first voice expressing with authority the belief that German production is still far from the acme of efficiency, and that there is a wide and hopeful road still to be traversed toward this goal. It is also a singular fact that Dr. Rathenau has been most firm in quite different views until not long ago, and that, therefore, his judgment has undergone a rather marked change. German methods of production, he says, are far from perfection, and the output of the industry is hardly commensurate with the efforts made for it. The German production is at present based on 32 billion working hours. By accepting the ultimatum, he asserts, each working hour would be taxed with two paper marks toward paying the country's obligations. To do this, and still go on producing at a reasonable margin of profit, can only be performed by eliminating every possible waste of time, labor and material. A complete transformation would have to take place if this aim is to be achieved, which would be the more difficult as, he observes, the public spirit and mental elasticity in Germany are perceptibly on the down grade. Rathenau, too, advocates the refusal of the ultimatum, but he evidently has not lost sight of the other alternative. His views on industrial productivity quoted above represent now the most advanced state of mind to be found in Germany, and the clearest foresight which may be encountered. The general run of manufacturers is far from accepting them.

Business Conditions

Business conditions are slowly but visibly depreciating. The opinions previously expressed in these columns, that a further aggravation of the business situation must be expected, are confirmed in a report recently made to the Ministry of Commerce, by the chambers of commerce of the country. From this report it becomes evident that the depression is deepening and spreading, and that its pinch is making itself felt everywhere more and more strongly. The number of unemployed gives little indication of such state of affairs, but it must be considered that in March and April a large decrease of unemployment as a rule takes place, due to the fact that the building and other open-air trades absorb unemployed from other trades. Taken absolutely, no material change is noticeable in the number of unemployed, but at the present season this amounts to an increase.

The critical conditions are more readily recognized by the fact that the number of shops reported to be "insufficiently employed," meaning very badly, has increased from March to April by 5 per cent.

Under such conditions it is rather surprising to note that, judged by the formation of new companies, and the

eue of fresh capital, industrial enter-rise not only continues, but has from arch to April even made further ogress. Not less than 64 new stock mpanies have been formed in April, mpared with 44 in March, with a total pital of 494 million marks. Twenty-ur of this number represent the in-rporation of existing concerns, while) are new organizations. Of this num-r 17, or 25 per cent, fall to the are of the machine-building industry. hirty-five machine-building concerns rt of a total of 141 have increased eir capital. Industrial investments of e industry during the first four onths of the year were as follows:

nuary	2,042,220,000 m
ebruary	2,397,290,000 m
arch	893,620,000 m
pril	2,558,840,000 m

It appears that investments in April xceed any of the previous months, lthough it must be considered that rge capital transactions in the chem-al industry, which in the above data re represented by some 800,000,000 m, ave inflated the April returns.

Business across the new customs rontier is still at the lowest possible oint. It is further minimized by hipping difficulties, the frontier sta-ons being clogged with goods trans-orts, owing to the fact that the new ustoms organizaion is not yet in work-ng order. A large machine-building anufacturer with a branch establish-ent in the occupied territory, whom our correspondent asked about his xperiences made with regard to ship-ing to and from his Rhenish plant, had o confess that he could not tell, because ctually there were no such shipments ade yet. Complete regulations for he occupied territory have now been ssued, and it has been noted with con-ternation that the Inter-Allied Rhine-and Commission has made shipments rom that part to the interior, and vice ersa, subject to export and import censes. In the general opinion this enotes that it is the desire of the ntente countries to detach the Rhine-and from the rest of Germany as much s possible, and to put it in close con-act with the adjoining Entente coun-ries. This is confirmed by the fact hat the frontier between those coun-ries has been opened to a number of roducts hitherto excluded from import nto Germany, and it is feared that uch products will find their way into he interior across the Rhine customs arrier. Shipments coming from the ccupied territory will, therefore, be trictly controlled on the German side s well, thus adding further to the ifficulties of intercommunication.

Prices for Machine Tools

In the machine tool business no material change is noticeable. Manufac-urers believe that the lowest point has already been reached. The demand, uch as there is, is mostly confined to small types, up to a price of from M10- to, M15,000. Larger sizes and more expensive types have a very lim-ted market. The situation is further aggravated by the number of dealers trying to clear their stocks at a greatly reduced price, often at a sacrifice. Originating from this source, price cutting is becoming the rule, especially among dealers. Only large factories of high standing staunchly keep up prices. No large specifications have come into the market, orders placed being mostly for single pieces, and after considerable haggling.

The second-hand trade is also making itself felt more severely, although it is now more or less in the hands of several potent organizations, able to preserve a certain balance in the market. Still, an increased pressure from this side is making itself felt, and numerous orders are going into the hands of the second-hand trade, which otherwise might have benefitted the manufacturer.

A sore spot in this respect is the clearing of the surplus stock of the government ordnance and ammunition works, still comprising approximately from 5- to 6,000 tools of various sizes and types. This stock has been placed, at ridiculously low prices, in the hands of one firm of second-hand dealers, which before the war occupied a modest position, and which now is one of the largest organizations of machine tool dealers in Germany. The name of this firm, J. Neuhöfer, and its enterprising chief partner, Kahn, have in connection with this contract been giving cause for many heated comments in public. So far this government stock has been wisely withheld from precipitous marketing, but it is now flooding the market in a dangerous degree.

The only good point of the situation is the reduction of iron prices, and in connection with it the decontrol of semi-finished material, but the relief afforded thereby is largely counteracted by the increased freight-rates. The coal supply, after the improvement of the last months, has again taken a more serious aspect, in connection with the political troubles in Silesia, and as a consequence of the discontinuation of the overtime shifts in the Ruhr district, which must now be considered as permanent. Most characteristic of the hopeless tone prevailing in the machine tool industry is the fact that many industries have reduced their selling organizations. Retrenchment is adopted as the safest policy everywhere.

Enterprise Lacking

Noticeably absent in the present business calmness is enterprise with regard to improved or new designs. With the exception of a few small specialties, nothing novel has been put on the market for more than six months. A number of machine tool builders are keeping up employment by contract work for manufacturers in other lines, mainly for railroad material. Even a firm of the standing of Loewe's is to a large degree employed by work of this kind for the affiliated Knorr-Bremse Aktiengesellschaft, a company making railroad brakes. On the authority of Dr. Waldschmidt, the president of Loewe's, the employment of the machine tool industry is at present approximately 25 per cent of normal.

Somewhat better conditions prevail with the small tool industry, which is not so overrun by competition, and which no doubt is profiting by the deteriorated quality of the tools, due to inferior steel used, resulting in rapid wear.

New Steamship Line to Near East

The steamship "Gul-Djemal," which sailed from New York on May 25, inaugurated a direct passenger and mail service with Constantinople. Heretofore there has been no direct passenger or mail service between the United States and Constantinople. With the opening of this service the United States will be placed in direct communication with the rich countries of the Near East. The sailing of this steamship with a full cargo and flying the pennants of the Interallied Commission and the United States Mail Service marks an epoch in the development of trade between the United States and the Near East.

The territory which is reached through Constantinople is one of the richest in the world in resources and commerce. It is a territory from which the United States imports annually many million dollars worth of products and in which American merchants and manufacturers may find a market for many million dollars worth of their products, foodstuffs and manufactured goods. The countries included are Turkey, Greece, Rumania, Bulgaria, Syria, southern Russia, the Black Sea District and other parts of the Near East.

Weingar to Address Engineering Bodies

W. H. Weingar, representing the Pratt & Whitney Co., of Hartford, Conn., will speak before an open meeting of the American Society of Mechanical Inspectors to be held in the Hotel Sherman, Chicago, on June 7. The subject will be "Manufacturing and Measuring in Millionths of an Inch." Superintendents, inspectors and others interested in close interchangeable manufacture are invited.

On June 6 Mr. Weingar will deliver the same address before the Western Engineering Societies, at Rockford, Ill.

A Correction

John W. Anderson, of Rock Island, advises us that our article on page 848 describing the new self-propelled gun mount built by the Holt Manufacturing Co., of Stockton, Cal., does not give proper credit for the design and building of the various parts. The gun itself was made at the Watervliet Arsenal and the mount and recuperator at the Rock Island Arsenal. We are pleased to make these corrections so that deserved credit may be given to the various parties concerned.

Summer Meeting of Society of Automotive Engineers Held at West Baden, Indiana

The weather man did his best to make the Summer Meeting of the Society of Automotive Engineers a seasonal affair, and he succeeded. The members arrived by special train and by automobile at West Baden Springs Hotel, on May 24, to find the mercury reaching for the top of the thermometer. The inside of the hotel was the coolest place in sight and the afternoon session of the Standards Committee, which opened the convention, was well attended.

Reports were made by the following divisions: Ball and Roller Bearings, Electrical Equipment, Parts and Fittings, Stationary Engines, Isolated Electric Lighting Plant, Screw Threads, Chain, Engine, Lighting and Truck. Chairman B. B. Bachman, vice-president, representing motor car engineering, presided and directed the rather warm discussion that arose over several disputed points. Of most interest to shop men was the extension of the standard specifications for roller chain sprockets as presented by the Chain Division and approved by the committee. This report will be published in a later issue.

The Sections Committee held a meeting at three o'clock at the call of the chairman, H. R. Corse, and the sports program got under way at the same hour with preliminary contests in golf, tennis, baseball and trap shooting. The semi-annual business meeting was held in the evening, at which were presented the president's address and the reports of the treasurer and the committees on standards, membership, sections and meetings. The members of the nomination committee were elected at this meeting. The business meeting was followed by moving pictures and informal dancing.

On Wednesday morning the session was devoted to Aeronautics, with Howard E. Coffin as chairman. The tournaments in golf, tennis, croquet, clock-golf and cards for the ladies were begun at the same time. The afternoon was devoted to inter-sectional baseball and the continuation of the various tournaments.

Wednesday evening was designated as Indiana night and the speaker of the evening was Mr. Lieber, State Conservation Commissioner. A burlesque lecture on a technical subject was delivered by Mark Smith, of the Indiana Section. Mr. Smith was introduced as Captain Morini of the Royal Italian Engineers. He was dressed for the part and carried the hoax through in real professional style.

A general research session was held on Thursday morning with papers on Industrial Research, by L. A. Hawkins; Lubrication, by C. W. Stratford; Clutches, by Herbert Chase; and Co-operation in Research, by W. E. Lay. An added session on Highway Transport was held later, with H. W. Alden as chairman.

The S. A. E. field day occupied everybody on Thursday afternoon, when all kinds of athletic events were contested by men, boys—and even the ladies. Some disappointment was expressed at the lack of facilities for water sports which have been a big feature of previous meetings.

On Thursday evening the entertainment consisted of a lecture by Stephen S. Johnson on Little Zion Canyon, a Rainbow of the Desert.

The session on Friday morning was devoted to combustion with Thomas Midgely, Jr., in the chair. Papers on Turbulence in Theory and Practice, by H. L. Horning, and on Flame by C. A. French, were presented. An abstract of Sir Dugal Clerk's paper on Cylinder Actions in Gas and Petrol Engines, was read by Daniel Roesch.

The afternoon saw the wind-up of the athletic competitions and the evening the grand ball and awarding of prizes.

The last session, which was held on Saturday morning, was devoted to Fuel Research, and was presided over by O. C. Berry. The papers were: Development of a High Compression Oil Engine, by F. E. Ziesenheim; Manifold Development, by G. P. Dorris; and Elements of Automobile Fuel Economy, by W. S. James.

Detroit Engineers Elect Officers

At the annual dinner of the Detroit Engineering Society, held in that city on April 29, the officers for the new year were announced.

M. W. Taber was elected president; J. R. McColl, first vice-president; A. L. Trout, second vice-president, and O. H. Dawson, secretary-treasurer.

The Detroit society is preparing to take an active part in the regional meetings of the American Society of Mechanical Engineers, to be held in Cleveland on June 13 and 14.

Meeting of Screw Thread Commission

The National Screw Thread Commission met at the Bureau of Standards, Washington, D. C., on April 18, and considered the progress report recently issued, and outlined a program for continuing the work of the commission.

The following program was agreed upon and will be carried out under the direction of sub-committees: (1) Specifications and tolerances for taps, dies, and tap drills; (2) standardization of bar stock for producing cut and rolled threads; (3) standardization of bolt heads, screw heads, and nuts; (4) standardization of instrument thread and threads cut on brass tubing; (5) standardization of acme, square, buttress, and other special threads, and (6) tolerances and allowances for Class IV, wrench fit.

The progress report is also to be further studied with a view to incorporating in it more information as to the specific class of fit and series of thread pitches to be used under different conditions.

Strict Retrenchment of Expenditures Advocated by Academy of Political Science

Featuring its one-day conference with a luncheon, at which President Harding was the guest of honor, the Academy of Political Science in New York held one of its most successful sessions on Monday, May 23, at Hotel Astor, New York City. Government reorganization with the object of financial retrenchment as the goal, was the whole sense of the meeting.

President Harding at the luncheon, discussed the subject "Business in Government and the Problem of Governmental Reorganization for Greater Efficiency." He made a plea for clean politics and showed his regard for the great power of popular opinion when he said—"No popular government will ever survive where the men who make it, fail to take an active and intelligent part in its administration." He decried governmental interference in business, but said that the principles of private business should be applied to government business.

The first session of the conference was opened with an address by Herbert D. Brown, chief of the U. S. Bureau of Efficiency, who argued for a reduction of armaments, saying that 88 per cent of our national expenditures were spent for military and naval establishments; reducing these would reduce taxes.

John T. Pratt, chairman of the National Budget Committee, spoke on the proposed budget system which is expected to be introduced into our national government system. He said that the present system is not the result of intelligent planning, but of piece-meal building and that re-grouping is necessary.

Ex-President William Howard Taft said that if we had had a budget system years ago, we would not have spent so much money on the late war. He lent approval to the suggestion of having the cabinet officers go before Congress and discuss their plans.

At the second session Edgar B. Davis, engineer, of New York, said that if the nations of the world had agreed on disarmament, six billions of dollars would have been saved last year. George D. Strayer of Columbia University, stressed the ever-growing necessity for education. He made an eloquent appeal for the support of the public schools, saying that knowledge is power, and that learning is a greater force in the perpetuation of world peace than all the programs of diplomatic councils put together.

No National Daylight Saving

It has been decided definitely by the Committees of Congress having jurisdiction over daylight saving bills that the subject is not to be given consideration. This puts an end to the hope that daylight saving might again be made national during the coming summer.

Spring Meeting of the American Society of Mechanical Engineers

Warm weather greeted the many members of the American Society of Mechanical Engineers who attended the spring meeting at the Congress Hotel, in Chicago, from May 23 to 26. This, however, did not interfere with the enjoyment of the members in the program provided and the meeting was very successful in every way. The first open session was the business meeting at which Morris L. Cooke presented his paper on "The Organization of an Engineering Society." Mr. Cooke has always advocated a broad foundation for engineering and a full appreciation by the engineer of his civic responsibility.

This paper was followed by a long discussion on the proposed new constitution of the society in which a number of suggestions was made for the consideration of the committee which is handling the revision. Among them was the proposal to give the vote to junior members.

On the 24th four sessions were held simultaneously, three being under the auspices of separate divisions, Fuel, Machine Shop Practice, and Management, the last in large part devoted to a discussion of Mr. Cooke's paper of the previous day.

The Influence of the Automobile

The papers presented to the Machine-Shop Practice division centered around the influence of the automobile industry on machine tools and machine shop practices. The session was presided over by F. O. Hoagland, and the papers were as follows: "Influence of the Automobile on the Machine Tool Industry in General," by F. A. Hendrickson; "Influence of the Automobile on Gear Cutting and Gear Cutting Machinery," by Henry J. Eberhart; "The Relation of Power Presses and Dies to the Automobile Industry," by Henry A. Hinde; "Influence of the Automobile on Lathe Practice," by Ralph E. Flanders; and "Fundamentals of Interchangeable Manufacture," by C. B. Lord.

Mr. Hendrickson divided the developments in machine-tool building as affected by the automobile industry under the following heads: Materials and Their Proper Distribution; Precision and Specialization; Power; Manipulation; Speed; Lubrication; and Safety Devices. The discussion brought out the statement by J. A. Smith of the General Electric Co. that the lack of proper lubrication was the cause of most machine-tool failures. Hence he advocated better provisions for oiling all bearings and the use of a reservoir when possible. C. B. Lord felt that most machine tools for production work are provided with too many feeds and speeds. Forrest E. Cardullo of the Gray Planer Co. pointed out that as all machine bearings did not require the same kind of lubrication, provision should be made for having machine tools oiled regularly and correctly by men assigned to that duty. He also pointed out that the demand for weight in new tools was not of itself an improvement unless it were properly distributed and that after sufficient weight had been put into a machine any additions simply increased the expense unnecessarily.

Gearing Not a New Subject

In his paper on "Gear Cutting," Henry J. Eberhart gave a brief sketch of the development of gear tooth forms, showing that great credit belonged to both Sang and Willis as well as to others who preceded them. Lantern slides showed extracts from publications of sixty to eighty years ago, which proved that they thoroughly understood the requirements of perfect gearing and that they designed tooth forms for both high and low pressure angles. They also showed how teeth of these forms could be generated in much the same manner as is done today. The discussion brought out interesting information regarding gearing having from 5- to 30-deg. pressure angles. The lower pressure angles have been found most advantageous in printing press machinery and in automobile timing gears, where quiet running is one of the essentials, and where it is necessary to have a slight variation in the gear centers.

In the paper on "Power Press Practice" many interesting points were brought out and some extremely good examples of cold drawn steel were shown. This paper elicited discussion both as to the work performed and the construction of power presses in general. The main criticism seemed to be that crankshafts usually had more throw than the work demanded and that the housings did not always have sufficient metal. It was further suggested that bearings be made more accessible.

Ralph E. Flanders prepared an elaborate paper showing the effect of the automobile on lathe practice which unfortunately was not received in time to be published for the meeting. The excerpts made by the publication committee could not do justice to the paper itself and as a result the meeting was deprived of much valuable information along this line.

Fooling Ourselves on Interchangeability

In his paper on interchangeable manufacture, C. B. Lord pointed out the many difficulties which always present themselves when interchangeability is attempted. He cited an instance in which 10,000 pieces were secured from each of four well-known manufacturers. The manufacturers themselves proposed the tolerance of 0.0015 in. and yet the pieces in each lot varied as much as 0.014 in. The most interesting point is that even with this variation, they were plenty good enough for the work in hand.

The following extract from Mr. Lord's paper will perhaps give the basis of his argument as clearly as can be done.

"Securing one very accurate dimension on a piece is a comparatively simple matter. The ease of securing two accurate dimensions, however, depends upon the relation of the second to the first. The figures given in the following table are based upon practice and general impressions, but the author believes them accurate enough to justify their publication for the purpose of showing the high cost of unnecessary accuracy:

No. of Dimensions on One Piece	Probable Number of Perfect Pieces	Per Cent Estimated Increase in Ratio of Cost per Operation
1	100	0
2	90	30
3	50	75
4	15	100
5	5	200
6	0	500

"In making the foregoing statements the author has in mind automatic and other machines where the close-dimension work is done at one setting and in manufacturing quantities. Some will dispute the figures given in the table and will declare that it is not good practice to attempt finishing pieces in the automatic, but that they should be roughed out there and finished on a shaving lathe or elsewhere. This brings us to our third fundamental and we may ask, Why should they not be finished complete when a good automatic must, in the nature of things, be (and is) as accurate as a single-purpose machine on a single accurate dimension? It is not accurate on several close ones, however, and accepted practice confirms this statement; and the reason why it is not and cannot be accurate is because of conflicting stresses."

The Management Division

There were presented before the management section papers on graphical methods, by W. E. Marshall and industrial waste, by L. W. Wallace, Executive Secretary of American Engineering Council. The evening session was devoted to the question of Training for the Industry and included three papers: "What the National Metal Trade Is Doing and Intends to Do in Industrial Education," by H. E. Smith; the "Engineering Industries and Education," by D. C. Jackson and M. W. Alexander; and "General Education of the Engineering Profession," by H. E. Miles. This session was of particular interest to those who feel the need of more highly trained mechanics.

The papers presented to the railroad division were: "Advantages of Large Freight Locomotives, Particularly 2-10-2, Type," by Albert F. Stuebing; "The Design of Large Locomotives," by M. H. Haig, and "The Necessity for Improvement in Design and Application of Present Day Locomotives," by H. W. Snyder. The session closed with a business meeting of this division.

What Machinists Are Doing for Disabled Ex-service Men

By J. W. Jefferis

President Harding's appeal to the nation, "unfailingly to express the gratitude of the Republic in a generous and practical way to its defenders in the World War," has been met by a hearty response on the part of the business men of the country, without whose co-operation the rehabilitation of the men who were disabled in service can never adequately be realized.

Thousands of disabled ex-service men are now studying mechanics in the trade schools and other technical institutions of the United States, and thousands more are serving as apprentices in machine shops, under the supervision of the Federal Board for Vocational Education. The present industrial situation renders especially urgent and imperative the closest and most sympathetic co-operation between these trainees, employers and the Government.

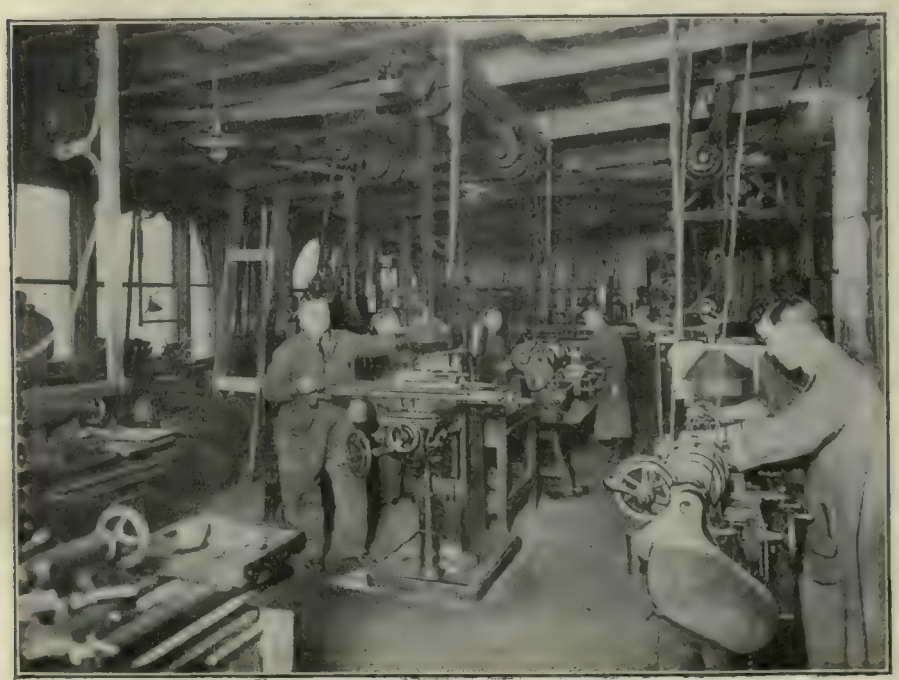
That employers are already earnestly helping to rehabilitate the men who forsook all to serve their country in its hour of need is evidenced by the fact that, in New York City alone, Federal Board trainees are now receiving placement training in seventy shops, including the Brooklyn Navy Yard which offers exceptionally high class instruction.

Complete details regarding the conditions of service and pay will be furnished by the Director of the Federal Board for Vocational Education, Uel W. Lamkin, 200 New Jersey Ave., Washington, D. C. Employing machinists with shops in New York City should address Federal Board for Vocational Education, 370 Seventh Ave., New York.

About half of the men who are selected for work in machine shops have received training in such institutions as Pratt Institute, Lincoln Institute, the College of the City of New York, and the best trade schools of the country. Only one-third of Federal Board trainees are green hands. Not less than 10 per cent of the men were machinists overseas. The majority suffer with disabilities which do not prevent them from working at the trade efficiently.

The retraining of disabled ex-service men is intrusted to the Division of Rehabilitation, in charge of Uel W. Lamkin, director, and R. T. Fisher, assistant director, who administer the duties of their office according to the recommendations of the Federal Board. Besides the central office in Washington, this division has fourteen districts established throughout the United States with staffs totaling about three thousand employees, engaged in the advisement, vocational training, and placement in positions of disabled soldiers, sailors and marines. Of approximately 80,000 men now in training, the cases of about 11,000 are on file in the New York office.

Employing machinists will also be interested to learn that the act of Congress passed June 2, 1920, providing for the training of all persons vocationally handicapped in *industry or otherwise*, numbering about 150,000 a year, will broaden to a notable degree the beneficent work of human salvage undertaken by the Government. This task has been committed to the Federal Board for Vocational Education, co-operating with the various states. Thus America is launched upon a program of uplift, the most significant and stupendous ever undertaken by any country.



DISABLED EX-SERVICE MEN IN TRAINING

Washington Notes

By Paul Wooton
Washington Correspondent

At the close of the Civil War, the United States was the military superior of any country in the world. Fifteen years later, the nation was as helpless as China. At the close of the World War, the United States was stronger from a military standpoint than was any one of the Allies. The problem now facing Congress and the General Staff of the Army is the prevention of another relapse into military impotence. The matter is being given the most active consideration as the debate on the Army Appropriation Bill discloses.

Munitions preparedness is to a very large extent a matter of mechanical preparedness. While the matter of maintaining a proper reserve of ammunition is an important problem, it does not compare in importance with the matter of maintaining a proper reserve of guns, unloaded projectiles and the other mechanical accouterments of war. War material under present day conditions will become obsolete more quickly than ever before has been the case. For example, it has been recommended, since the Armistice, that the ranges of all mobile guns be increased on an average of 50 per cent without material increase in weight. It already has been demonstrated that it is possible to meet that requirement. During the World War, tractor-drawn artillery succeeded animal traction. The advance in this respect has been so great that even now mobile guns of large caliber are being mounted on self-propelled caterpillar gun carriages, which have the speed of trucks on good ground and are able to cross country at nearly any point passable for infantry and at a much greater speed than infantry could move. No nation can afford, men of vision declare, to refuse to develop automotive artillery of the type that will be independent of roads. Roads are good targets and can be rendered impassable so easily that an army would be in a precarious position were it to depend on a transport limited to highways.

Washington is also giving careful study to the matter of industrial mobilization. It is recognized that there is the greatest need to have a plan prepared in advance with which all the necessary industrial establishments will be familiar. The lack of such a plan prior to our entry into the World War led to great confusion and the loss of most valuable time. As a matter of fact, the very first appropriation made by Congress for munitions was ten weeks after the United States had declared war. That amount was small and it was not until six months after war was declared that a substantial appropriation was made available. An intelligent munitions policy, it is held, would prescribe the rates of production required, would provide authority to contract or arrange otherwise for such production, the day war is declared. If an ideal plan were

adopted, each plant would be assigned in advance to manufacture its part of the munitions likely to be required. They would have on hand approved drawings of the articles which had been assigned to them for manufacture. They would know in advance to whom they might look for their raw materials and would know where the product would be shipped.

Such problems as these are even now being laid before the mechanical engineers of the country for their cooperation and support. It is such an important part of the national defense that it is believed Congress will take steps to prevent our present adequate reserve of munitions from becoming obsolete.

The Army bill which is about to be taken up by the Senate, as this is written, contains the following Senate amendment: "The Secretary of War is authorized in his discretion to sell to any foreign state or Government upon such terms as he may deem expedient, any material, supplies or equipment pertaining to the military establishment as, or may hereafter be, found to be surplus, which are not needed for military purposes and for which there is no adequate domestic market."

This provision is intended to relieve domestic manufacturers from the uncertainties which overtook their markets as a result of the efforts of the War Department to force all the surplus material on the domestic user.

The Army bill carries an appropriation of $19,200,000 for the Air Service. Among other things this appropriation was made available for the purchase of tools, machinery, repair shops and the operation and equipment of machine shops. The bill directs the Secretary of War to sell 10,000 motor trucks and 2,000 passenger carrying automobiles. The appropriation from which purchases of tools is made totals $2,900,000. The greater portion of that fund, however, must be expended for the many items making up the current expenses of the ordnance service. The sum of $150,000 is made available in part for the manufacture, test and maintenance of sighting devices for airplane bombs and devices for carrying and releasing such bombs.

The War Department has called for bids for 22,000 tons of shell steel, in the form of shell and shell forgings. The bids are to be opened June 6.

In 1869 the trustees of Stevens Institute of Technology were compelled by the collector of internal revenue to pay a collateral inheritance tax of $45,750, which was assessed upon the bequest of Edwin A. Stevens. It was not the intention of Congress to levy a tax on a bequest to an educational institution, as was demonstrated by the prompt amendment of the law under which the tax was collected. The trustees of the institution, however, have been trying unsuccessfully ever since to recover the amount paid. Until recently they have been contending for the principal and interest but only the tax was refunded.

Machine Tools at the Basle Fair, in Switzerland

SPECIAL CORRESPONDENCE

Supported by a confederation subsidy of 20,000 francs, the annual fair, the fifth of the series, was duly held in Basle, ending on April 26. Confined to Swiss products, it naturally included some examples of engineering, but was not by any means representative of that section of Swiss activities. And though machine tools certainly occupied their fair proportion of the 1,000 stands forming the total, yet they were not nearly so numerous as on the occasion of the last fair. The exhibits were not particularly outstanding, but mention may be made of the Zehnder universal tool and cutter grinder, with electric drive by two small motors, one by belt up the center of the column for the wheel, and also by belt on extended spindle of the same motor to a gearbox and then by flexible shaft and worm to the workhead, the other motor being for the longitudinal movement of the worktable. Generally speaking, in its mechanical features the machine is on a well-known model. Zehnder & Sons also exhibited magnetic chucks for direct current and for alternating current, the only chucks for that purpose being made in Europe. At Gränichen the firm is organizing two independent factories, one for each of their products. Grinding machines of one form or another were certainly a feature of the fair, including the Häberli tool grinder, the Studer universal machines, the Wunderli universal grinder, also intended for cutters, etc., and a small surface grinder by the same firm, with automatic reverse to the transverse movement. Machines of the Linisher type, that is, with emery band running on two horizontal pulleys, seem to have received rather unusual development by the Schweizerische Schmirgel & Schleif Industrie, the types including the ordinary band grinders of this type having the operative surface running horizontal a type in which it is vertical, the belt then running over two pulleys on horizontal spindles placed in line one above the other, and also a type in which the belt presents a vertical working face but runs horizontally, that is, is driven by two pulleys, one at each end on a vertical axis.

A machine apparently prepared specially for the exhibition, the design of which, it is admitted, must be further developed, was the Steffisbourg lathe for turning, grinding, etc., and also drilling polygon forms, the action of the tool carriage being controlled by former. A considerable number of lathes of the type associated with watch- and clock-making made by Buhlmann & Simonet and Schaublin-Villeneuve were shown, and Tornos automatics in which the job is taken to the tool, the latter being of plain form, may be noted, together with the Multipass automatic screw lathe by the Bechler firm. Very few machines were in operation. A commercial combination of a character with which English engineers are familiar is the Synergie concern, which, pooling experiences and avoiding competitive productions, unites Buhlmann & Simonet, of Soleure; Schaublin-Villeneuve, of Malleray; Usines Tornos, of Moutier; and J. Zehnder & Sons, of Gränichen, for the purpose of sales outside of Switzerland.

EMPLOYMENT CONDITIONS

In general conditions Switzerland is no exception to the rule, and the machine shops are for the most part working with reduced staffs on short time, though Alfred J. Amsler & Co., Schaffhouse, maker of many testing machines as well as planimeters, is on full time. At Oerlikon, on the machine-tool side, while the lathe factory is certainly running, any real activity is due to special machines. At Basle the business of Jaecklin Bros. has of course been acquired by the Burckhardt concern, who continue this department in its own separate works under the personal direction of R. and E. Jaecklin. The Burckhardt business is chiefly concerned with vacuum pumps and air compressors for extremely high pressures, while the Jaecklin machines are mainly for cutting, bending and working sheet metals. A stand at the exhibition combined the products of the two sides of the business.

Woodworking machinery was moderately represented at the fair, and it may be noted that the firm of Rauchenbach has been acquired by Fischer, of Schaffhouse. The Essaime firm, which exhibited a small press, has withdrawn from the Synergie combination and is closing at Tavannes in order to open a factory in France. The Tornos firm is also opening a French factory. The Pétermann firm in Moutier is moderately well engaged, also on automatics of the type in which the work moves to the tool, but the Société Genevoise d'Instruments de Physique finds no particularly urgent call and this is true also of the firm of J. Lambercier & Co., Geneva.

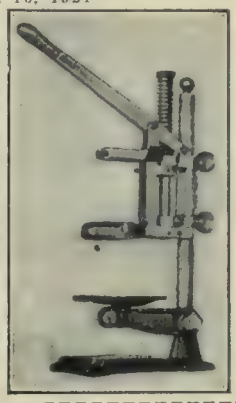
Southern Metal Trades Oppose Tariff Rates

William E. Dunn, Jr., secretary of the Southern Metal Trades Association, with headquarters in Atlanta, Ga., announces the adopting of resolutions at the recent meeting of the Western division of the association at Shreveport, La., protesting against a two-cent per pound tariff on imported manganese ore, and expressing opposition to a standard rate of pay for skilled workers. The division went on record in favor of a graded rate of pay according to the ability, experience and productive capacity of the workers. It was also decided at the meeting that the association as a whole will hereafter hold its meeting biennially, and divisional meetings at various intervals during each year. The association comprises in its membership many of the leading foundries and machine shops of the Southern states.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Stand, Electric Drill, Bench, Lever-Feed
Arnold Electric Tool Co., 114 Liberty St., New York, N. Y.
"American Machinist," March 10, 1921



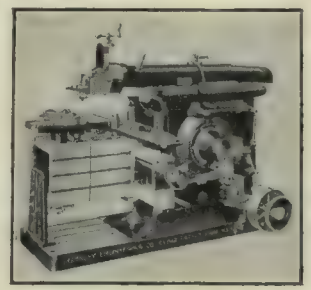
The device is intended to be used in connection with the company's portable drills, in order to make a lever-feed bench drill. A coil spring prevents the lever from dropping when the drill is not in contact with the work, or after the point of the drill has cut through. The head holding the drill can be shifted on the column, being clamped by means of thumbscrews. The table is 6½ in. in diameter, and can be pivoted in the table arm, which swings on the column. The distance from the center of the table to the column is 4⅝ in. The stand is furnished for two types of drills; the one for the Type B ⅝-in. drill weighing 40 lb. and the other for the Type C ½-in. drill weighing 55 lb. It is 23 in. high and has a feed travel of 2½ in.

Hobbing Machine, Pinion, Large
J. E. Reinecker, A.G., Chemnitz, Germany
"American Machinist," March 10, 1921



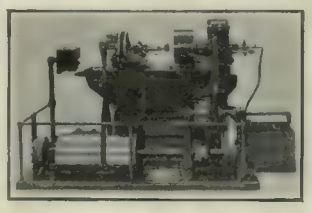
The machine is intended for hobbing the large pinions used in the reduction gearing of turbine-propelled ships. The toolslide swivels on the saddle, so that the hob may be adjusted to any desired angle. There is a continuous traverse of the hob so that the full cutting width is in service and wear is practically uniform. The motor is located at the rear of the bed. The driving gears are inclosed and run in an oil bath. The axis of the pinion being cut is placed horizontally, while it is vertical in the large gear-cutting machines made by the same concern.

Shaper, Heavy-Duty, High-Speed
Bertschy Engineering Co., Cedar Rapids, Iowa
"American Machinist," March 17, 1921



The shaper is built either with a cone-pulley drive or a single-pulley, gear-box drive. The standard sizes include 12, 16, 20, 24 and 32 in. shapers. The base of the machine has been extended beyond the sides of the table and around the column, in order to obtain ample foundation surface. The table can be supported at its outer end by braces on the end of the base. The power cross-feed is fitted with a friction safety device, to prevent damage due to feeding beyond the limits. On the cone-pulley driven machine, the pulley runs on a sleeve mounted on the column, thus eliminating the need of an outer bearing and taking the belt strain. The gear box on the single-pulley-driven shaper provides four changes of speed, thus, together with the two ratios in the bull-gear train, giving a total of eight speeds. The machine can be provided with a motor.

Grinding Machine, Internal, Motor Drive Attachment
Heald Machine Co., Worcester, Mass.
"American Machinist," March 17, 1921



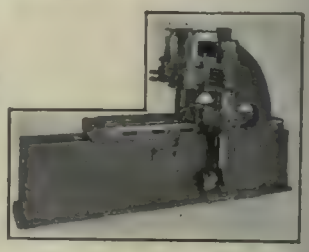
The motor drive attachment is adapted to the Nos. 70 and 75 internal grinding machines. The illustration shows a rear view of a machine equipped with the drive, the motor being at the front and left. The so-called "bass fiddle" casting is not employed. Instead of using the solid idler for the wheelhead, a flexible idler gives the proper tension to the wheelhead belt, as well as to the vertical belt between the drum and the idler. A swinging arm swivels on a bracket holding the driving cones, for varying the speed to the workhead. The swinging arm is connected to the workhead by a rod so fastened that it will allow the swiveling of the head either way and still keep the belt tight. Attaching the arrangement is said to be very simple, requiring only the removal of the standard guard over the workhead pulley, and the putting in its place a box containing the idler pulleys.

Hobbing Machine, Gear, 19½ Ft.
J. E. Reinecker, A.G., Chemnitz, Germany
"American Machinist," March 10, 1921



The machine is intended for hobbing the large gears used on turbine-propelled ships to obtain the speed reduction. Gears up to 19½ ft. in diameter and 6½ ft. in width, and weighing as much as 95 tons can be cut. The machine is not fitted for handling pinions, however. The revolving table is mounted on a spindle that rests on a large thrust bearing and is further supported and guided by a beveled ring of large diameter. A relieving device is located beneath the table support, so that the height of the table can be adjusted for varying loads by taking up the end thrust. The table spindle is hollow, so that work mounted on a shaft can be taken care of. The motor is located at the rear of the massive bed and is mounted on the box containing the driving gears.

Planer, Toolroom
Pratt & Whitney Co., Hartford, Conn.
"American Machinist," March 17, 1921



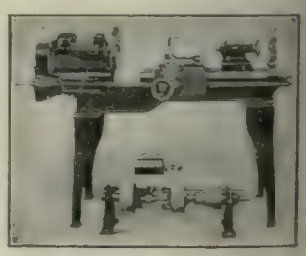
The planer has a bed of deep box section, extending to the floor, the top being cast closed except at the point where the bull gear engages the rack. The table is of box form, the bottom being closed and chips being removed through cored openings on the sides. Driving gears of the Maag form are used, the gearing being enclosed and running in oil. The table dogs can be quickly adjusted to position, a micrometer screw being provided on the front one for fine adjustment. The cross rail is clamped in position by means of a single lever mounted on the end of the rail. The machine is ordinarily belt driven, but can be driven by an adjustable-speed reversing motor connected directly to the drive shaft. The machine is made to take work up to 26 in. wide and 20 in. high, and in two stroke lengths, 6 and 8 ft.

Variator, Thread, Lead-Screw, Lathe
Precision and Thread Grinder Manufacturing Co., 1 South 21st St., Philadelphia, Pa.
"American Machinist," March 17, 1921



The device is intended for elongating or diminishing the normal lead on lathes, and also for correcting errors in the lead of the screw. It facilitates the use of an ordinary lathe for precision thread cutting. Metric threads can be cut without the use of translating gears. The variator is built in two sizes, Model A being adjustable to fit lathes having swings up to 12 in., and Model B to fit lathes of from 13 to 20 in. swing. The normal length of travel for the carriage is 6 in., but greater lengths can be provided. The variation in the lead is obtained by the rotation of a gear, in proportion to the angle at which the inclinable rack is set, as the nut is traversed by the action of the lead screw. In order to aid in setting the lead variator for either the normal lead of the screw or for a change of lead, a gage block is provided.

Lathe, Gap-Bed, "New Shepard"
Shepard Lathe Co., Rising Sun, Ind.
"American Machinist," March 17, 1921



The "New Shepard" 12-in. lathe is now made in a gap-bed style, in addition to the other models previously described in the American Machinist on page 917, Vol. 47, and on pages 90 and 136, Vol. 49. The swing is thus increased to 19 in. for a length of 5 in. in front of the faceplate. The section of the bed is reinforced at the the gap, and is said to be stronger there than at any other point of the bed. The carriage can over-run the gap without any lowering.

Clip, paste on 3 x 5-in. cards and file as desired

Business Items

The machinery of the new pressed steel car plant at the works of the Chickasaw Shipbuilding and Car Co. at Fairfield, Ala., is being placed and announcement is made by officials of the corporation that the new plant will probably start operations this month. The production will average twenty-five cars per day, the plant starting off with orders for nearly 1,000 cars, some of which are for the United States Steel Corporation and 600 for the Louisville & Nashville R.R. The works have been under construction for more than a year.

The Ross Heater and Manufacturing Co., Inc., Buffalo, N. Y., has announced the opening of a branch office for the New York district at 2 Rector St. The sales agency office has been discontinued. C. M. Hardin is in charge of the new office.

The Charleston Bolt and Forging Co. has been organized at Nitro, W. Va., and will be incorporated with a capital stock of $250,000. The company will manufacture rivets, spikes and bolts of all kinds, drop forgings and other iron products. The officers are C. M. Dunnarant, president; H. A. Warren, vice-president; W. S. Stork, secretary and general manager; A. Bennett, treasurer.

Notice has been received of the removal of the Soc. Anon Belge Alfred Herbert, Brussels, to 34 Rue Melsens. This building was formerly occupied by the Allied Machinery Co., an American firm.

The Risdon Manufacturing Co., Naugatuck, Conn., recently increased its capital stock to $800,000. The company manufactures tools, etc.

The Plainville Casting Co., Plainville, Conn., has been organized by H. S. Washburn of Torrington, Conn., and William Stewart and Charles F. Conlon of Plainville, Conn. The company will manufacture castings and metal products. The business has been incorporated with a capital stock of $50,000 and the owners plan the erection of a plant in the near future on a site soon to be selected in Plainville.

The Air Service Division of the War Department has awarded the order for 145 portable electric drills to the James Clark, Jr., Electric Co., of Louisville, Ky.

The Rees Manufacturing Co. is the name recently assumed by the Iron City Products Co., Pittsburgh, Pa. The reason for the change was to enable the clients of the company, which makes Rees jacks to properly identify the company with the product.

The Lapointe Manufacturing Co. of Hartford, Conn., has been incorporated under the laws of the State of Connecticut, to manufacture wrenches, tools, etc. The capital stock of the company is $150,000 and the officials are: President, D. H. Lapointe; secretary, J. H. O'Brien, treasurer, V. H. Dauphinais. The business address of the company is 75 Prospect St., Hartford.

The Fenton Foundry Supply Co. has been incorporated at Dayton, Ohio, with $15,000 capital stock. Directors are William Fenton, E. P. Fenton, and others.

The Bickford-Switzer Co., Inc., of Greenfield, Mass., has recently been incorporated to engage in the manufacture of machinery, small tools and implements, etc. The incorporators are Frank O. Wells, Greenfield, Mass., who was formerly president of the Greenfield Tap and Die Corporation; Bernard M. Switzer, and O. S. Bickford of Greenfield.

The Osborn Machinery Corporation, Clarksburg, W. Va., has just been organized under the state law of West Virginia. William F. Osborn of New York, Herbert Johnston, T. A. Stout, H. E. Crites and Francis A. Osborn of Clarksburg are the incorporators.

From Canton, Ohio, comes the report of a contemplated merger of the United Alloy Steel Corporation, the Berger Manufacturing Co., and the United Furnace Co. The combination will represent a $42,000,000 investment and will be known as the Berloy Company of Canton.

The Manley Manufacturing Co. of York, Pa., has purchased the entire stock of dies, jigs and fixtures, patterns and good will of the Ellis Smith Manufacturing Co. of Elmira, N. Y. No change in the manufacturing methods or the product will be made.

The G. E. Engineering Co., Inc., has removed its general offices to more spacious quarters at 449 West 42d St., New York City.

The Reliance Electric and Engineering Co., Cleveland, Ohio, announces the removal of its Chicago office to Room 2013. Edward F. J. Linberg is district manager in charge.

The George H. Gibson Co., consulting engineers, has moved from the Tribune Building to the Hide and Leather Building at 100 Gold St., New York City.

Wickes Bros., Saginaw, Mich, has opened a sales office at 501 Fifth Ave., New York City. E. Braun is in charge.

The Herberts Machinery and Supply Co., of Los Angeles, Cal., has leased a building adjoining its present establishment and will make alterations to suit the business. This additional floor space of 11,000 sq.ft. has been deemed necessary due to the rapid expansion of business.

The Clark-Turner Piston Co., of Los Angeles, Cal., has purchased fifty-eight heavy-duty Monarch lathes and ten Rockford lathes. The order was placed with the Herberts Machinery and Supply Co., of Los Angeles. The tools will be used in taking care of the increased demand for De Luxe pistons. It is said that this is the largest individual lathe order ever placed on the Pacific coast.

Personals

B. FORTUIN has been elected president of the Duke Steel Co., New York, N. Y., succeeding W. B. Dukeshire, who has retired from the business.

T. E. DROHAN, for twelve years a superintendent in the Schenectady works of the General Electric Co., has been appointed mechanical superintendent of the switchboard department of that company. He will supervise this work at the Schenectady, Philadelphia, and Baltimore works.

O. C. BERRY, formerly professor of automotive engineering at Purdue University and research engineer for the Hupp Motor Car Corporation, has joined the staff of the Wheeler-Schebler Carbureter Co., Indianapolis, Ind. He will be chief engineer.

D. C. PAUL, formerly of Gaul, Derr & Shearer, of Philadelphia, is now representing the Black & Decker Manufacturing Co., of Baltimore, Md., in charge of the Pittsburgh branch. Associated with Mr. Paul are Frank E. Marrion and J. A. Miller.

HAROLD P. CHILDS, general manager of the Charleston Industrial Corporation, Charleston, W. Va., has resigned to accept an important position in the executive offices of the General Electric Co. in New York City.

JOHN E. KING, production manager of the Nordyke & Marmon Co., Indianapolis, Ind., and well known to the machinery trade of the state because of his long experience in the business, was successful recently in the city primaries in his race for the Republican nomination as councilman from the sixth district. Mr. King has been committeeman of his precinct for seven years.

JOHN M. HILTY, foreman of the Altoona shop of the Peoples Natural Gas Co., of Pittsburgh, Pa., has been transferred to Woodlawn as foreman. He is succeeded in Altoona by James A. Sloan, of Portage.

E. D. JONES has been recently selected as manager of field sales for the Yale & Towne Manufacturing Co., of Stamford, Conn.

Forthcoming Meetings

The American Railway Association will hold the Spring meeting of its Purchases and Stores Section at the Blackstone Hotel, Chicago, June 9 to 11, and the Spring meeting of its Mechanical Section at the Drake Hotel, Chicago, June 15 and 16.

The 1921 annual meeting of the American Society for Testing Materials will be held at Asbury Park, N. J., on June 20 to 24, with headquarters at the New Monterey Hotel. C. L. Warwick, Engineers Club, Philadelphia, Pa., is secretary.

The eighth annual convention of the American Drop Forge Association and the Drop Forge Supply Association will be held at Chicago, Ill., June 22 to 24 with headquarters at the Congress Hotel.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Buffer, Electric, Heavy-Duty, Johnson

U. S. Electrical Manufacturing Co., Central Ave., at Third St., Los Angeles, Cal.

"American Machinist," March 17, 1921



The machine has an overall shaft length of approximately 5 ft., so that two men can work at the same time without interfering with each other. It was developed for use on pneumatic truck tires, but is adaptable to heavy-duty buffing of all sorts. The spindle is supported by a double set of ball bearings. One set of the bearings is placed at each end of the machine next to the wheels, with the other set at the center, to prevent periodic vibration of the rotor. A heavy pedestal supports the motor, guards being provided for the wheels, which can be up to 12x2 in. in size. The buffer is entirely inclosed, and can be furnished in various sizes for use in two or three-phase alternating current.

Brush, Wire, Rotary, Thor

Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill.

"American Machinist," March 17, 1921



The brush is intended for use on either the No. 71 portable pneumatic grinder or the No. 6 electric grinder made by the concern. The brush shown in the illustration attached to the No. 71 pneumatic grinder is 5 in. in diameter; but the brush intended for use on the No. 6 electric grinder is only 4 in. in diameter, because of the fact that the electric grinder runs at a higher rate of speed than the pneumatic tools. The device is intended particularly for the removal of paint, rust or scale, being adapted to such work as the cleaning of steel cars, automobile bodies and castings. The wires of the brush are 3 in. in length, being made of heat-treated steel and tapered at the end attached to the brush, so as to give greater strength at that point. They are held in a concave wooden back, which is fitted in a metal cover.

Toolholder, "Holds-Em All"

Simmons Economy Tool Corporation, Albany, N. Y.

"American Machinist," March 17, 1921

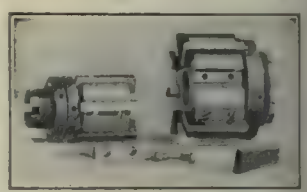


The toolbit rests in a right-angle groove, and is held in place by means of a clamping plate placed at an angle. The plate bears at its upper edge on the end of the shank, and is secured by means of a setscrew having a spherical bearing. A second small screw is provided, so as to furnish a third point of support for the clamping plate in case that the toolbit is very short. Toolbits or stock of any section can be securely held, it is stated. The holder is drop-forged. The tool is made in either straight, right-hand or left-hand style, and in eleven different sizes. The smallest holds bits from $\frac{1}{16}$ to $\frac{3}{16}$ in. in size, and its dimensions are $\frac{5}{8}$ by $\frac{3}{4}$ by $4\frac{1}{2}$ in. The largest holder is for bits from $\frac{3}{8}$ to $\frac{5}{8}$ in., and is itself $1\frac{3}{4}$ by 3 by 20 in. in size.

Reamer, Shell, Adjustable, Inserted-Tooth

Cleveland Cutter and Reamer Co., 1619 Merwin Ave., Cleveland, Ohio

"American Machinist," March 17, 1921



The backs of the blades are provided with corrugations placed at an angle and fitting corresponding grooves in the slots in the body. The reamer has a double adjustment. By screwing back the locknuts in the rear of the blades $\frac{5}{16}$ in. a diameter adjustment of 0.083 in. can be obtained. Placing the blades up one step in the corrugations adds another 0.083 in. to the diameter of the reamers, so that the locknuts can be moved forward. This action can be continued until the blades are worn out, when they can be replaced. The reamers are regularly made with the blades set straight in the body as shown; but reamers with helical blades can be furnished. The standard sizes range from 1 to 6 in. in diameter. The overall length varies from $2\frac{1}{4}$ to $3\frac{1}{2}$ in. and the diameter of the hole in the large end from $\frac{3}{8}$ to 2 in.

Die-Head, Self-Opening, Style-H

Modern Tool Co., Erie, Pa.

"American Machinist," March 17, 1921



This tool has supplanted the Style-B head in all sizes from Nos. 1 to 6 inclusive. The head is intended for general threading work, and can be used on the turrets of hand or automatic screw machines. It can be fitted with a closing device, so that it may be used on a drill press or other revolving-spindle machine. The chasers are supported at their outer edge by a cam ring which, it is claimed, makes it impossible for the chasers to change position while working. The die heads are made of hammered tool steel. The chasers are made by the hobbing method and are interchangeable only by sets. A floating device is incorporated between the body and shank of the die-head to compensate for inaccurate adjustment of the turret. The small lever at the shank end is used for changing from the roughing to the finishing size, and vice versa.

Furnace, Annealing

Bellevue Industrial Furnace Co., Detroit, Mich.

"American Machinist," March 17, 1921

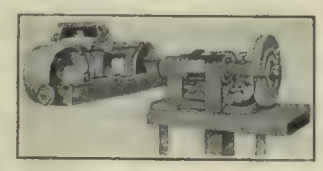


The furnace is of the semi-muffle type and can be heated by either oil or gas. It is equipped with a hand-operated chain mechanism for raising or lowering the door, the weight of the door being suitably counter-balanced. Two of the company's standard oil-burners are ordinarily used for heating the furnace and are located at the front, where they are easily available for adjustment. The gas burners can be substituted if desired. The furnace is built in six sizes, the muffles being from 56 to 78 in. wide, 60 to 120 in. deep, and 8 to 24 in. high, the dimensions of the minimum and maximum sizes being given.

Surfacing Machine, "Junior"

Peerless Surfacing Machine Co., Inc., Troy, N. Y.

"American Machinist," March 17, 1921

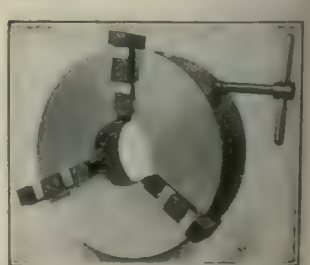


The machine is small and compact and intended for the surfacing of small work. An arm, swinging around the drive shaft, carries two pulleys, on which the abrasive belt runs. The arm can be clamped in any position, as can the small rest for holding the work on the belt, thus making it possible to grind the work at any angle desired. The machine is of the bench style, so that it can be mounted in a number of different ways. When attached to a small table it can readily be moved around the shop from one job to another. It can be driven from a countershaft or by a separate motor, either belted to it or connected directly to the end of the shaft. Tight and loose pulleys with a belt shifter are provided. A grinding wheel or disk plate up to 11 in. in diameter can be carried on the shaft. A work rest is provided.

Chuck, Self-Centering

H. Spillman, Zurich, Switzerland

"American Machinist," March 17, 1921



The chuck is operated by worm gearing in connection with a scroll plate which differs from the usual construction of such members, inasmuch as the scroll proper is not an integral part of the plate. The scroll has slightly more than one convolution, so that but one tool in any chuck-jaw is engaged at one time except when it is in position where the ends of the scroll overlap. This construction makes it possible to have all the teeth in the jaws of such shape as will insure a good bearing on the scroll. In addition, the scroll is very heavy, is let into a groove in the plate and is hardened and ground. The jaws are made of steel and are hardened and ground.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

N. Y., New York (Borough of Brooklyn)—E. B. Stimpson, 68 Franklin Ave., presses V. & O. make sizes 2½, 3, 4 and 5 for machine shop.

N. Y., New York (Borough of Manhattan)—The Halpern Wein Co., 110 West 40th St., would like catalogues and prices on machine tools for railroad shop and locomotive works in Sweden.

N. Y., Syracuse—The Mellrun Gabrielson Corp., Industrial Bldg., manufacturer of milling machines, A. Mellrun, Purch. Agt.—general machine shop tools and machines, machinery, etc.

Ill., Chicago — The Precision Metal Workers, 3100 Carroll Ave.—equipment for making 5⅞ in., 6 in. and 6⅞ in. metal discs, of 22 gauge metal.

Ill., East St. Louis—C. O. McCasland, 6225 Easton St.—drill press and lathes, for garage to be erected on 11th and State Sts.

Mich., Benton Harbor—The Benton Harbor Forging Co.—die sinking machine for drop forgings.

Mich., St. Joseph—The St. Joseph Iron Wks., 606 Water St.—1 vertical boring mill, milling machines, lathes, 1 keyseater, drill presses and grinding wheels for proposed addition.

Que., Montreal—W. Mahoney, 162 Anger St.—2 lathes and other machine shop equipment.

Que., Montreal—M. Roberts, 570 Dorchester St., East.—lathe and other garage repair equipment.

Ont., London—The London Motors Ltd., W. Stansell, Pres.—machinery for the manufacture of autos.

Machinery Wanted

O., Columbus — The North Columbus Lumber Co., Penn R.R. and Mack Rd., L. Koons, Genl. Mgr.—entire planing mill equipment including sander, sticker, planing mill, frame machines, moulding machines, etc.

Wis., Milwaukee—The Amer. Metal Products Co., 671 Kinnicinnic Ave.—foundry equipment.

Wis., Milwaukee—The South Side Wet Wash Laundry, 641 15th Ave.—laundry equipment.

Mo., Joplin—The Duplex Tire & Rubber Co., 71 New Jates Hotel—machinery.

Que., Montreal—The Fire Proof Crushed Stone Co., Inc., 2650 Masson St.—crushing plant machinery.

Que., Montreal — The North West Side Oil Co. Ltd—Keystone drills and other well drilling equipment. W. H. Butler, Pres. of the Canadian Car & Fdry Co. Ltd., Dir.

Que., Montreal — H. Peladeau Ltd., 1211 Ontario St., East.—complete planing mill equipment.

Ont., Carleton Place—C. F. Burgess—flour and feed grinding machinery.

Ont., Ottawa—The Retail Grocer's Association—bakery machinery.

Metal Working

NEW ENGLAND STATES

Conn., East Hartford—(Hartford P. O.) Popp & Wespiser, Springfield, Mass., will soon award the contract for the construction of a 1 story garage and service station on Main St. and Burnside Ave. Estimated cost, between $30,000 and $40,000. Private plans.

Conn., Hartford—J. D. Bossen, 771 Asylum St., has awarded the contract for the construction of a 1 story, 60 x 60 ft. garage.

Conn., Hartford—J. B. Kauffman, 432 Windsor Ave., is having plans prepared for the construction of a 1 story, 50 x 110 ft. garage. Estimated cost, $25,000. B. A. Sellew, 721 Main St., Archt.

Conn., Hartford — W. H. Roberts, 22 Chapel St., will build a 1 story, 35 x 100 ft. garage. Estimated cost, $10,000.

Conn., Norwalk — A. I. Crandall has awarded the contract for the construction of a 1 story, 97 x 150 ft. garage and service station on West Ave. Estimated cost, $60,000.

Conn., Waterbury — I. N. Albert, 268 South Main St., will soon award the contract for the construction of a 1 story, 50 x 185 ft. garage on North Main St. Estimated cost, $40,000. F. A. Wenzel, 6 Glen Ridge St., Archt. Noted May 19.

N. H., Maplewood—The Maplewood Hotel Co., Bethlehem, has awarded the contract for the construction of a 1 story, 30 x 60 ft. garage. Estimated cost, $10,000.

Mass., Boston—The Y. D. Service Garage, c/o Funk & Wilcox Co., Archts., 294 Washington St., is having plans prepared for the construction of a 6 story garage on Newbury St. Estimated cost, $600,000.

Mass., Dorchester—Bichekas & Maharas, 1226 Massachusetts Ave., will soon award the contract for the construction of a 1 story, 40 x 66 ft. garage. Estimated cost, $10,000. Stebbins & Watkins, 164 Federal St., Boston, Archt.

Mass., Gloucester—Perkins & Corliss Co., Middle St., has awarded the contract for the construction of a 2 story, 60 x 150 ft. garage on Western Ave. Estimated cost, $50,000.

Mass., Lowell—Katz Bros., 202 French St., will build a 1 story, 97 x 99 ft. garage on Brooking St. Estimated cost, $25,000.

Mass., Springfield—E. T. Davis, 67 Bliss St., will build a 1 story garage on Bliss St. Estimated cost, $22,000.

Mass., Springfield — A. Freedman, 27 Church St., will build a 1 story machine shop on 7th St. Estimated cost, $15,000.

Mass., Springfield—J. G. Riga & Sons Co., 699 Main St., has awarded the contract for the construction of a 2 story, 40 x 58 ft. auto sales and garage building on Dwight St. Estimated cost, $40,000.

Mass., Worcester—The G. E. Duffy Mfg. Co., 1511 Main St., has awarded the contract for the construction of a 1 story garage to cover 6,000 sq.ft. of floor space. Estimated cost, $25,000.

R. I., Providence—Kelman & Lagovitz, 32 Ash St., will build a 1 story garage and service station on Willard Ave. and Hilton St. Estimated cost, $10,000. Noted May 19.

R. I., Providence — The Narragansett Electric Lighting Co., Turks Head Bldg., will soon award the contract for the construction of a 2 story, 114 x 172 ft. garage and boiler house on Melrose St. Estimated cost, $200,000. Jenks & Ballou, 735 Grosvenor Bldg., Archts. and Engrs.

MIDDLE ATLANTIC STATES

N. J., Bordentown—C. Soden, 3d St., plans to build a garage on Park St. Architect not selected.

N. Y., New York—(Borough of Manhattan) The Knickerbocker Ice Co., 1480 Bway, has had plans prepared for the construction of a 1 story, 120 x 130 ft. garage on West 167th St. Estimated cost, $25,000. DeRosa & Cavalieri, 370 East 149th St., Archts. and Engrs.

N. Y., New York—(Borough of Manhattan) The Moranis Realty Corp., c/o J. S. Maher, Archt. and Engr., 431 West 14th St., is having plans prepared for altering a 4 story garage at 108 West 50th St. Estimated cost, $50,000.

N. Y., Syracuse — The Mellrun Gabrielson Corp., Industrial Bldg., manufacturer of milling machines plans to build a 2 story, 70 x 150 ft. factory on West Lafayette St. Estimated cost, $300,000. Architect not yet selected.

SOUTHERN STATES

La., New Orleans—The F. H. Koretke Brass & Mfg. Co. Ltd., 922-26 Magazine St., plans to build additions to its brass foundry. W. E. Gosselin, Vice-Pres. and Mgr.

MIDDLE WEST STATES

Ill., Chicago—The Atlas Copper & Brass Mfg. Co., 2734 High St., plans to construct a 1 story, 50 x 125 ft. addition to its factory at 2736 High St. Estimated cost, $20,000. L. Ehle, 3810 Bway, Archt. and Engr.

Ill., Chicago—I. Engel, 3058 Armitage Ave., will soon award the contract for the construction of a 1 story, 60 x 150 ft. garage at 3515 Armitage Ave. Estimated cost, $40,000. H. I. Dalsey, 2321 West North Ave., Archt.

Ill., Chicago—T. J. Keriman, 5859 South Prairie Ave., will soon award the contract for the construction of a 1 story, 75 x 160 ft. garage at 5825 Prairie Ave. Estimated cost, $35,000. J. J. Kocher, 6250 South Halsted St., Archt.

THE WEEKLY PRICE GUIDE

This Week's Market

Business in the steel trade is extremely light. Warehouses report that deliveries from mills are poor, owing to reduced production. Orders are so small that mills accumulate them until there are enough to warrant changing rolls.

The metal market is a little stronger than earlier in the week, especially with regard to copper, which is now 14⅜c. per lb. Domestic buying is light, but foreign orders have already raised the price of copper. Copper and brass products are up ¾c. in New York.

The market for shop supplies is very weak, and prices in New York are useful only as a guide.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$27.50
Northern Basic	25.32
Southern Ohio No. 2	27.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	34.26
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	26.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	*25.00
CHICAGO	
No. 2 Foundry local	23.00
No. 2 Foundry, Southern, sil 2.25@2.75	28.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	23.50
Basic	21.75
Bessemer	24.00

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.23	$3.33	$3.09	$3.23
Soft steel bars	3.13	3.23	2.99	3.13
Soft steel bar shapes	3.13	3.23	3.48	3.13
Soft steel bands	4.18	4.28	6.25	
Tank plates	3.23	3.33	3.78	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	4.25	4.00	4.13
No. 12	3.15	4.30	4.05	4.18
No. 14	3.20	4.35	4.10	4.23
No. 16	3.30	4.45	4.20	4.33
Black				
Nos. 17 and 21	3.75	4.80	4.80	5.20
Nos. 22 and 24	3.85	4.85	4.85	5.25
No. 25 and 26	3.90	4.90	4.90	5.30
No. 28	4.00	5.00	5.00	5.40
Galvanized				
No. 10 and 11	4.00	4.75	5.00	5.70
No. 12 to 14	4.10	4.85	5.10	5.80
Nos. 17 and 21	4.40	5.15	5.40	6.10
Nos. 22 and 24	4.55	5.30	5.55	6.25
No. 26	4.70	5.45	5.70	6.30
No. 28	5.00	5.75	6.00	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$4.73	$4.63	$4.25
Flats, squares and hexagons, per 100 lb	5.23	4.63	4.75

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55%
Cleveland	50%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 5/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7¾c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.50	8.00	8.25
Spring steel (light)	8.00	7.00	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.20
Hoop steel	3.64	3.69	3.83
Cold rolled strip steel	6.00	8.25	7.90
Floor plates	5.30	3.09@3.40	5.78

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of April 13, 1921:

BUTT WELD

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
1 to 3	62½	50	¼	33½	18½
			1 to 1½	35½	20½

LAP WELD

2	54½	41	2	30½	16½
2½ to 6	58½	45	2½ to 4	34½	22½
7 to 12	54½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	60½	49	1 to 1½	35½	21½
2 to 3	61½	50			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	52½	41	2	31½	18½
2½ to 4	56½	45	2½ to 4	34½	22½
4½ to 6	55½	44	4½ to 6	33½	21½
7 to 8	50½	37	7 to 8	24½	12½
9 to 12	45½	32	9 to 12	19½	7½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	14.37½
Tin in 5-ton lots	33.00
Lead	5.50
Zinc	5.75
ST. LOUIS	
Lead	5.10
Zinc	5.35

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	21.75	22.00	23.50
Copper wire (carload lots)	15.75	17.50	20.00
Brass sheets	17.00	21.00	20.75
Brass pipe	20.75	24.00	24.50
Solder (half and half) (case lots)	24.00	22.75	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	15.00
Cleveland	18.00
Chicago	18.75

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	41
Electrolytic	43

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots..... 10.00

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	12.15	12.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.00
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	$9.50
Copper, heavy, and wire	9.00	9.50	8.50
Copper, light, and bottoms	8.00	8.00	7.65
Lead, heavy	3.25	4.00	3.00
Lead, tea	2.00	3.00	2.85
Brass, heavy	6.00	6.00	9.00
Brass, light	4.50	5.00	4.50
No. 1 yellow brass turnings	5.00	5.00	5.00
Zinc	3.00	3.00	3.00

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.4	25.50@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.75
Chicago	20.50
Cleveland	22.50

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	43.50	35.00
Commercial	30.00	15.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$2.00	1.60
Hot pressed hexagon	List	2.00	1.60
Cold punches hexagon	List	2.00	1.60
Cold punched square	List	2.00	1.60

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	50%
Cleveland	75–10%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50–10%	60–10%	50%
1¼ and 1½ in. by 3 in. up to 12 in	50%	50–5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $4.00 Chicago..... $4.00
For cast-iron washers, ¾ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $3.75 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
¾ by 6 in. and smaller	40%	50–10%	40%
Larger and longer up to 1 in. by 30 in.	40%	50%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	50%	60%	45%
Tinned	45%	60%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.65 Cleveland...$4.60 Chicago....$4.88 Pittsburgh..$3.70
Boiler, same sizes:
New York...$4.75 Cleveland...$4.70 Chicago....$4.98 Pittsburgh..$3.80

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	25.50
Brass	20.00	23.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ⅜-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$7.00 per 100 lb.; New York price is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	9.00@12.00	12.50	14.25
Colored mixed	6.50@ 9.50	9.50	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$3.50@$4.25
Prompt foundry	4.50@ 5.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.80	$0.75	$0.82
5-gal. cans	.83*	.85	1.07

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

Ill., Chicago—B. T. Olsen, c/o C. Hatzfeld, Archt., 7 South Dearborn St., is having plans prepared for the construction of a 1 story, 85 x 180 ft. garage on Catalpa Ave. and Bway. Estimated cost, $30,000.

Ill., Chicago—W. F. Pagels, Archt., 1412 Berteau Ave., will soon award the contract for the construction of a 1 story, 100 x 125 ft. garage at 4535 North Kedzie Ave., for T. H. Kibling, 4523 North Kedzie Ave. Estimated cost, $35,000.

Ill., East St. Louis—C. O. McCasland, has awarded the contract for the construction of a 1 story, 65 x 93 ft. garage and repair shop on 11th and State Sts. Estimated cost, $50,000.

Ill., Rockford — The Petroleum Motors Corp., c/o R. C. Dale, 220 South State St., Chicago, has awarded the contract for the construction of a 1 and 2 story, factory to consist of 3 units to be 270 x 720, 75 x 220 and 50 x 100 ft. Estimated cost, $2,000,000. Noted May 5.

O., Cleveland—The Ohio Ice Machine Co., Columbus Rd., has awarded the contract for the construction of a 1 and 2 story, 60 x 110 ft. machine shop on Madison Ave. and West 58th St. Estimated cost, $40,000.

O., Cleveland—P. Tolaro, 2645 East 110th St., has had plans prepared for the construction of a 1 story, 40 x 110 ft. garage on Woodland Ave. and East 110th St. Estimated cost, $40,000. F. A. Azzorello, 2403 East 9th St., Archt.

O., Cleveland Heights—(Warrensville P. O.) The Heights Battery Co., 2777 Mayfield Rd., is having plans prepared for the construction of a 1 story, 50 x 100 ft. garage. Estimated cost, $40,000. R. H. Hinsdale, Bangor Bldg., Cleveland, Archt.

O., Columbus — The Columbus Forge & Iron Co., Ft. of West First Ave., will receive bids about June 20 for the construction of a 1 story, 70 x 200 ft. and a 1 story, 110 x 123 ft. factory buildings. Estimated cost, $80,000. Brown, Fleming, Knollman & Prior, 233 South High St., Archts.

Mich., Detroit—The Street Ry. Comn., 320 Murphy Bldg., plans to build a 1 story, 250 x 350 ft. car repair shop on St. Jean, Lillebridge and Warren Aves. W. C. Markham, 20 Murphy Bldg., Engr.

Wis., Milwaukee—The Amer. Metal Products Co., 671 Kinnicinnic Ave., has awarded the contract for the construction of a 1 story, 80 x 200 ft. foundry and machine shop on Burnham St. Estimated cost, $65,000.

Wis., Milwaukee—Imanski & Gehrmann, 1078 23d Ave., have awarded the contract for the construction of a 1 story, 46 x 112 ft. garage. Estimated cost, $42,000.

Wis., Milwaukee—The Magnetic Mfg. Co., 764 Windlake Ave., has awarded the contract for the construction of a 1 story, 92 x 120 ft. machine shop on South Pierce St. and 23d Ave. Estimated cost, $40,000.

STATES WEST OF THE MISSISSIPPI

Mo., St. Louis—Nolte & Nauman, Archts., Fullerton Bldg., will soon award the contract for the construction of a 1 story, 100 x 270 ft. garage and machine shop on Hodiamont Alley East and Taylor St., for the Davie Motor Car Co., 1900 Washington St. Estimated cost, $40,000. A. F. Davie, Pres. Noted May 5

Mo., Trenton—The Chicago, Rock Island & Pennsylvania R.R., 137 Van Buren St., Chicago, Ill., plans to build a 1 story, 87 x 100 ft., car repair shop. Estimated cost, $60,000. A. T. Hawk, Archt.

CANADA

Ont., London—The London Motors Ltd. plans to build a 1 story auto factory on Hale St. Estimated cost, $75,000. W. Stansell, Pres.

Ont., London—Warren Bros., 314 Talbot St., plans to build a 1 story machine shop. Estimated cost, $25,000. M. Warren, Mgr.

General Manufacturing

NEW ENGLAND STATES

Conn., Danbury—C. Rider, 11 New St., has awarded the contract for the construction of a 2 story, 36 x 90 ft. addition to his creamery building. Estimated cost, $20,000.

Conn., New Britain—E. R. Hitchcock & Co., 303 Main St., is having plans revised for the construction of a 3 story, 45 x 95 ft., printing and bindery plant on Chestnut St. Estimated cost between $40,000 and $50,000. D. K. Perry, 27 West Main St., Archt. Noted March 17.

Conn., Norwalk—Fletcher-Thompson, Inc., Archts. and Engrs., 542 Fairfield Ave., Bridgeport, will soon award the contract for the construction of a 1 story, 90 x 200 ft. factory for the manufacture of windshields and other glass products on Main St., for C. H. Harris, Inc., 136 West 24th St., New York City. Noted May 26.

Mass., Fitchburg—The Parkhill Mfg. Co., River St., will soon award the contract for the construction of a 2 story, 35 x 80 ft. addition to its factory for the manufacture of gingham goods. Estimated cost, $25,000. Private plans.

Mass., Malden — The Malden Knitting Mills, 62 Franklin St., will build a 4 story, 45 x 140 ft. addition to its factory. Estimated cost, $60,000.

Mass., Natick—C. W. Dean & Co., North Main St., has awarded the contract for the construction of a 3 story, 42 x 170 ft. addition to its shoe manufacturing plant, etc. Estimated cost, $100,000. Noted March 10.

Mass., North Andover—M. T. Stevens & Sons Co., has awarded the contract for the construction of a 5 story, 60 x 155 ft. addition to its woolen mill. Estimated cost, $150,000.

Mass., Somerville—The Winchester Mfg. Co., 611 Cambridge St., Cambridge, is having plans prepared for the construction of a 2 story, 55 x 125 ft. factory for the manufacture of novelties on Beacon St., here. Estimated cost between $40,000 and $50,000. Tuck & Gilman, 34 School St., Boston, Archts. and Engrs.

R. I., Pawtucket—A. Poirier, Bway and North Main Sts., has awarded the contract for the construction of a 1 story, 92 x 40 ft. laundry on Bway. Estimated cost, $15,000.

MIDDLE ATLANTIC STATES

N. J., Penns Grove—The General Preserving Co., Chester, Pa., plans to build a canning factory. Architect not selected.

N. Y., New York (Borough of Brooklyn)—The Cheek & Neal Coffee Co., Cummins Station, Nashville, Tenn., has awarded the contract for the construction of a 5 story factory on 40th St. and 2d Ave. Estimated cost, $175,000.

Pa., Altoona—The Schwarzenbach Huber Co., 8th Ave. and 24th St., plans to build a 2 story, about 100 x 200 ft. silk mill at East End. Estimated cost, $75,000. R. Brupbacher, Supt.

Pa., Johnstown—The Johnstown Ledger Publishing Co., 221 Franklin St., plans to build a 1 story, 60 x 120 ft. newspaper plant on Main and Walnut Sts., to replace the one recently destroyed by fire. Estimated cost, $75,000. H. Hesselbein, Owner.

Pa., Pittsburgh—The North Pole Ice Co., 1218 West Carson St., will receive bids until June 9 for the construction of an ice storage plant on Carson St. W. Griesser, 224 Meyron Ave., Archt.

Pa., Scranton—The Scranton Dress Co., c/o Lockwood Greene & Co., Archts. and Engrs., 101 Park Ave., New York City, has awarded the contract for the construction of a 1 story factory at 100 South Webster Ave. Estimated cost, $350,000.

SOUTHERN STATES

N. C., Salisbury—The Paul Rubber Co. has awarded the contract for the construction of a 2 story, 60 x 100 ft. auto tire factory. Estimated cost, $30,000.

MIDDLE WEST STATES

Ill., Chicago—Ludgin & Levinton, Archts., 53 West Jackson St., will soon award the contract for the construction of a 3 story, 35 x 45 ft. addition to the glove factory at 1915 Milwaukee Ave., for the J. A. Dukow Glove Co., 1911 Milwaukee Ave. Estimated cost, $35,000.

O., Cleveland—The Knoble Refining Co., c/o L. A. Ritzman, 607 Canal Rd., will soon award the contract for the construction of a 1 story factory and boiler house on East 99th St. and Elk Ave. Estimated cost, $80,000. L. C. Scott, c/o Owner. Archt.

O., Columbus—The Lilles Laundry, 1011 West Rich St., has awarded the contract for the construction of a 1 story, 44 x 88 ft. addition to its laundry. Estimated cost, $5,000.

Wis., Black Creek—The Ontagamie Limestone Co., 75 30th St., Milwaukee, is having preliminary plans prepared for the construction of a quarry plant. Estimated cost, $200,000. H. O. Weldon, 10 South La Salle St., Chicago, Ill., Engr.

Wis., Marshfield—Blum Bros., West 9th St., have awarded the contract for the construcion of a 2 story, 62 x 178 ft. cheese box factory on Main St. Estimated cost between $25,000 and $30,000.

Wis., Milwaukee—The South Side Wet Wash Laundry, 641 15th Ave., has awarded the contract for the construction of a 2 story, 32 x 60 ft. addition to its laundry. Estimated cost, $40,000. Noted Jan. 20.

Wis., Neenah—G. Danke, Main St., is having plans prepared for the construction of a 2 story, 40 x 80 ft. creamery on South Commercial St. Estimated cost, $40,000. Auler & Jensen, F. R. A. Bldg., Oshkosh, Archts.

Wis., Sheboygan Falls—The Falls Roller Mills, c/o E. Gonzerbach, Mgr., will build a 5 story, 80 x 140 ft. flour mill on Main St. Estimated cost, $75,000. Noted April 7

STATES WEST OF THE MISSISSIPPI

Ia., Cedar Rapids—The Peterson Baking Co., 316 6th Ave. East, has awarded the contract for the construction of a 2 story, 60 x 140 ft. factory on 3d St. East and 6th Ave. Estimated cost, $46,035. Noted May 12.

Mo., Joplin—The Duplex Tire & Rubber Co., 71 New Jates Hotel, is having preliminary plans prepared for the construction of a 3 story, 100 x 300 ft. tire factory on 7th St. Estimated cost, $100,000.

Mo., Springfield—The Welsh Packing Co will soon award the contract for the construction of a 3 story, 120 x 160 ft. packing plant. Estimated cost, $100,000. M. P. Burt & Co., Falls Bldg., Memphis, Tenn., Archt. Noted April 21.

Neb., Omaha—The Baker Ice Machine Co., 19th and Nicholas Sts., has awarded the contract for the construction of a 1 story, 100 x 280 ft. factory. Estimated cost, $150,000.

CANADA

Ont., Exeter—The Ontario Flax Mill is preparing plans for the construction of a 1 story, 50 x 100 ft. flax mill. Estimated cost, $25,000.

Ont., Kingsville—Brown & Wigle plan to rebuild their woolen mill which was recently destroyed by fire. Estimated cost, $500,000. E. A. Brown, Mgr.

Ont., London—W. T. Rawleigh, 55-65 Liberty St., Freeport, Ill., plans to build a 6 story, 75 x 200 ft. factory for the manufacture of drugs and stock food, on Adelaide St. Estimated cost, $150,000. G. W. Corbett, Adelaide St., London, Mgr.

Ont., New Liskeard — Black, Fasken & Hennessey, c/o A. Fasken, Pres., Excelsior Life Bldg., Toronto, plan to build a ground wood pulp mill on Dixon Creek, here. Estimated cost, $500,000.

Ont., Ottawa—The Ottawa Grouse Associated, 333 Elgin St., plans to build a bakery on Breeze Hill Ave. Estimated cost, $50,000. Architect not selected. Address B. G. Crabtree.

Ont., Ottawa — The Retail Grocer's Association plans to build a bakery on Breeze Hill Ave. Estimated cost, $45,000. T. W. Collins, 317 Wilbrod St., Secy. Architect not selected.

Ont., Ottawa—The Slinn Bread Co., 451 Catharine St., has awarded the contract for the construction of a 2 story, 66 x 110 ft. bakery on Catherine St. Estimated cost, $80,000. Noted April 7.

Ont., Toronto—The Ideal Bread Co., Ltd., 183 Dover Court Rd., has purchased a site and plans to build a bakery. Estimated cost, $100,000. Architect not selected.

Alaska, Ketchikan—The Ketchikan Cold Storage Co. has awarded the contract for the construction of a 5 story cold storage and ice plant. Estimated cost, $100,000.

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A History of Post-War Crises—I

A Resumé of Commercial, Industrial and Financial Crises from 1337 to 1860—"Bubbles" of Two Centuries Ago—The First Panics, Their Causes and Effects

By H. H. MANCHESTER

WHERE are prices and wages going? When are they going to reach there? What is going to happen afterwards? Is there going to follow a long period of stagnation, or another period of brisk business?

These are live questions in which we are all vitally interested. To answer them with certainty one would have to be truly a prophet, but it is always possible to reason about the future, even though the conclusion must be based on insufficient data and various "ifs."

What emboldens me to approach the subject is the fact that about a year ago I made a study of the evolution of wage and price levels which was in part published in the *American Machinist*, Vol. 53, page 1123, and Vol. 53, page 389. In these articles, I brought out the fact that the really great changes in wage and price levels in the past had been produced by more permanent causes than wars, and that when the cause ceased to act the effect likewise subsided. In the case of certain catastrophies and wars, I showed that prices had returned to a level about three years afterwards and that this level had usually been about one-third higher than the former basis; while within the same period wages again dropped back but retained more of the rise than prices. From this I argued that we might expect to see wages and prices reach a new level by the beginning of 1922, about one-third higher than in 1914. This article was written when prices and wages were practically at their peak, but both have since shown such a tendency to follow the course outlined that I am encouraged to apply a similar line of reasoning to another forecast.

In my first article I followed the great steps in price and wage levels, which as I have mentioned were found not to be especially post-war effects. In the present article I want to note what actually followed the greatest wars and see if this will not suggest what will take place in the next few years. The finding of a few panics need not worry us, as we have gone through the worst of the present period without a panic and it is morally certain that there is none in sight.

After the Hundred Years' War

There are not so very many wars of world-wide importance and in order to get plenty of examples before us to judge by it will be best to start with the first great war between modern nations, the Hundred Years' War, which was waged between England and France more or less consecutively throughout the century between 1337 and 1436. This ended with the seating through the help of Joan of Arc, of Charles VII on the throne of France. There followed an almost immediate, though comparatively brief, rise in prices and boom in commerce. Wheat jumped from 60 cents a bushel in 1437 to $1.17 in 1438, but receded to 88 cents in 1439 and dropped back to 37 cents in 1440. Thus the period of doubled prices lasted only two years.

In England also, a similar phenomenon took place. In 1436 the price of wheat was 16 cents a bushel; the next year 28 cents and in 1438 it jumped to 44 cents. The next year it dropped back to 23 cents and in 1440 to 11 cents. Other commodities showed an advance though not so strikingly. Wrought board nails, for example, rose from 80 cents a thousand in 1437 to $1.05 in 1438. There is not so very much evidence to judge by in that period, but it is possible that it shows the same sudden, though short-lived, rise after the war which we shall find after other conflicts.

In the Time of Henry of Navarre

Though the religious wars in France which were ended with Henry of Navarre assuming the throne were civil conflicts affecting principally France, it is worth noting that the year after Henry assumed the title of King of France wheat rose from 95 cents a bushel in 1589, to $1.70 in 1590, and to $2.45 for the next two years. It receded to $1.24 in 1594 but in that year the wars were finally settled by Henry's becoming a Catholic and we find another big jump in prices along with a wonderful increase in commerce. Wheat in 1595 rose suddenly to $3.27 a bushel, more than 2½ times what it was the year before. In 1596 it was $3.07 a bushel but the next year dropped back to $1.50.

Following the Thirty Years' War

The next great war, and one which finally included all Europe, was the Thirty Years' War, which began in 1618, and was ended by the Peace of Westphalia in 1648.

In the latter part of the war after Holland had made the treaty with France against Spain, which the Dutch felt practically assured their independence, there occurred in the Netherlands, between 1634 and 1638, one of the most amazing speculations that the world has ever known. A mania for the tulip led to such mad demands for it, that the price of tulips rose to 5,500 florins each. Contracts for them made up the chief business of the country, the rage lasting for four years.

Finally the boom burst in 1638 and the nation plunged into a whirlpool of bankruptcy, the effect of which lasted for several years.

While the greatest effect of the war was experienced in Germany, we find a definite rise in prices after it in France. Wheat, for example, increased gradually from $1.07 a bushel in 1648 to $2.19 in 1651 and dropped back to $1.30 in 1653.

In England this period corresponded to that of the

Puritan Revolution. It is curious that we have a rise in prices in 1646, the year after the battle of Naseby, when it became evident that parliament would win, and another one in 1661 upon the recall of Charles II. Wheat, for instance, rose from $1.04 in 1645 to $1.55 in 1646, and from $1.55 in 1660 to $3.12 in 1661. In 1662 it dropped back to $1.37 a bushel.

Bubbles of Two Centuries Ago

This brings us to the first of the well-known panics which have from time to time disturbed commercial life since the development of the banking and credit system which is so essential to modern business.

The end of the Wars of the Spanish Succession in 1714 left France with an empty treasury and a debt of $500,000,000. The Duke of Orleans, who became regent the next year on the death of Louis XIV, gave John Law, a Scotchman, the right to found a bank and issue notes payable at sight in money at the weight and value of the date of issue. This was the first paper money in France. The plan was at first a great success and helped business in Paris to boom. In 1717 Law formed the Louisiana Company and began to sell shares in it at 500 livres each. New Orleans was founded in 1718 and in December the bank was made a government institution with Law as director. Other companies were united with it and the shares rose to 50 per cent premium. Law made arrangements to take over the national debt and in October, 1719, the shares rose to 8,000 livres. Millions of paper profits were made in speculation and the mania spread to all classes. In 1720, however, it was found that the company could not make profits enough to pay the interest and the crash came. Law was removed as director and fled from France in December.

This might be taken as an isolated case if a similar speculation had not taken place at the same time in England. In 1711 the South Sea Company was formed by Harley to help take up the public debt in return for rights in the South Seas. In 1717 the company began to exchange its stock for short annuities and to loan the proceeds to the government. This at first promised great success and two years later the company offered to buy $800,000 more of the debt a year. The stock rose to 400 and for the first six months of 1720 England was a madhouse of speculation. Many other companies were formed, some of the most amazing character. One was for a purpose which was to remain secret and the shares were sold out in a day.

According to the "Annual Register" of 1720: "The several sums intended to be raised by these airy projects amounted to little less than Three Hundred Million Sterling, a sum so immense that it exceeds the value of all the lands in England."

The South Sea shares reached a price of 1,060 on June 25, but in September the bubble burst and values vanished into air.

The common facts in these developments in France and England seems to be that the close of the war promised an opportunity to exploit new sources of wealth in America which were to relieve the debt created by the war, and that the boom and collapse together occupied only about three years.

After the Seven Years' War

After the war of the Austrian Succession (1740-1748) we find a 40 per cent rise in prices in France which extended over about three years, but a more definite crisis is recorded as taking place after the Seven Years' War, which ended in 1763. This was followed by a remarkable number of failures in Amsterdam, Hamburg, and other great commercial centers of the continent. The crisis extended to England, and Adam Smith says that the Bank of England was compelled to extend support to merchants of more than a million pounds.

It has not been sufficiently emphasized that a crisis occurred both in England and in the United States almost immediately after the American Revolution. It will be remembered that Cornwallis surrendered in 1781 and that peace was signed two years later. In 1782, according to Macleod, the "unfortunate war with America" was terminated, and immediately an immense extension of foreign commerce took place. The Bank of England increased its issues more than 50 per cent between 1780 and 1782, and then became alarmed and violently contracted them. A rapid drain of specie followed, which in 1783 alarmed the directors for the safety of the bank. They continued to contract their loans till October, 1783, when their specie was reduced to 473,000 pounds. Then at last the exchange turned in their favor and specie began to flow in from abroad. As soon as this movement was assured the directors advanced freely on the government loan and to the merchants. Times picked up soon afterwards and exports and imports doubled in the next ten years.

In the United States, according to Weeden, ordinary commerce with the West Indies and Europe was resumed with a rush as soon as peace was assured. Glut succeeded famine and in the autumn of 1784 the importing and commission stores were filled with unsold European goods. In Boston imported wares were offered freely at two or three per cent over cost and charges, and by the summer of 1785 the goods were lying idle, customers could not pay for their purchases, and responsible merchants were getting their debts extended in England.

An important effect of this was the passage of protective tariff acts by Rhode Island, Massachusetts, and Pennsylvania, which perhaps helped times to pick up at the end of 1786. This crisis had an epoch-making result in convincing the states of the confederation of the necessity, for economic reasons, for a more efficient union; and as a matter of fact times were much improved after the forming of the Constitution in 1789.

The Hamburg Crisis of 1799

A serious panic took place in England in 1793, but as this was caused by the beginning of the war with the French Revolutionists, rather than an event subsequent to any war it is outside of our subject. So are likewise several more or less serious crises which took place during the Napoleonic Wars.

There was a crisis in Hamburg in 1799, however, which from our present viewpoint deserves especial notice. This crisis was caused by the French occupation of Holland in 1795 which threw into the hands of Hamburg the continental trade which had previously gone to Holland. This caused a tremendous speculation, rise in prices and extension of credit in Hamburg, which lasted for four years. Then the crash came and 82 houses failed.

A good account of conditions immediately following the termination of the Napoleonic Wars, is preserved in Tooke's "History of Prices," and runs in part as follows:

"While the events were in progress which led to the

restoration of the Bourbons and the peace of Europe in the spring of 1814, the speculation in exportable commodities which had its first rise in the dawning prospects of the emancipation of the Continent at the close of 1812 and the beginning of 1813, reached its height. The prices of all colonial produce and of other articles of export including . . . many descriptions of manufactures which had long been waiting a market advanced very considerably, some beyond all precedent. The extraordinary demand arising out of that speculation for the manufactures of this country occasioned such an extra employment of workmen in the manufacturing districts as entitled and enabled them to command a considerable advance in wages.

". . . A reverse from speculations so entered into and conducted . . . was inevitable.

"The shippers found to their cost when it was too late that the effective demand on the continent for colonial produce and British manufactures had been greatly overrated; for whatever might be the desire of the foreign consumers to possess articles so long out of their reach, they were limited in their means of purchases, and accordingly the bulk of the commodities exported brought very inadequate returns. The low prices which alone the consumers abroad were able to pay, were still further reduced in value by the advance in our exchanges. . . . And it is a well-known fact that the losses upon a large proportion of the goods shipped to the Continent were . . . not less than fifty per cent."

As Lord Brougham put it, the exported goods "were selling for less in Holland and Germany than in London and Manchester; while in most cases they were lying at dead weight on the market without any sale at all." As a consequence 6,616 failures took place, and many thousand workmen were thrown out of employment.

Times got better at the end of 1817 and during the next year, only to be followed by another crisis which was so severe that the Bank of England was again forced to suspend specie payments.

In the fall of 1820, however, business recovered. Specie payments were resumed by the Bank of England May 1, 1821, and the annals of the time show that England continued to be highly prosperous until 1825.

In the United States the termination of the Napoleonic Wars coincided with that of the War of 1812. This was followed by conditions which in many ways were the parallel of those in England. "The very moment the blockade was lifted," according to MacMaster, "a mass of domestic produce poured forth on the markets of Europe long waiting to receive it. . . .

"Sure that a time of prosperity was coming, the merchants, before the contents of the treaty were known . . . began to prepare for an immense trade. Crews were engaged, ships were chartered, cargoes were advertised for, and calkers, riggers and sail makers were in such demand that four dollars for ten hours' pay was freely offered in the great cities."

Toward the end of May great fleets of ships began to come in with huge quanities of silks, satins, muslins, brocades, hardware, tools, coffee, tea and other things which must still be had from abroad or not at all. These were hurried to the auction block, where enormous prices were secured in consequence of the buyers bidding against each other. Eventually, however, the demands were satisfied and the eagerness to buy began to subside with the result that a stimulus was given in the form of credit.

This over-competition shut up many of the American factories which had been established during the war, while at the same time customers could not pay for the goods they had bought. The consequence was disastrous to both England and the United States. Business improved in 1817 and 1818, but nevertheless remained on a precarious foundation.

Conditions were made much worse by the wildcat paper money which was issued by the banks without any security behind it. Combined with overspeculation in the new lands in the Middle West, this produced a panic in 1819 which closed many of the banks and reduced both prices and wages.

The Crisis of 1825

At first sight it might seem that the crisis of 1825 in England was not an after-the-war effect, unless perhaps it was a "second-barrel" explosion following ten years after the close of the Napoleonic Wars. Detailed accounts of the period, however, indicate that it was a direct result of the revolutions in South America which freed the colonies there from Spain.

The crisis became severe in November 1825 and was made worse by the failure of two large banking houses on Nov. 29. A panic was precipitated when the great banking institution of Pole, Thornton & Co. in London stopped payment. The failure of sixty-three country banks followed. At first the Bank of England was too niggardly in its advances, but on Dec. 14 it totally changed its policy, and began to discount liberally on good security. The London panic stopped in two days.

The panic was still under way in the country towns, but the Bank of England luckily found an almost forgotten chest of between 600,000 and 700,000 one pound notes which it sent to the country banks. These notes were remarkably successful in allaying the panic in Scotland and outside of London, and in banking circles the worst of the trouble was over in a few months.

In industry, however, the recovery was slower. The king's speech in parliament of Nov. 21, 1826, said of the situation: "The depression under which the trade and manufactures of the country have been laboring, has abated more slowly than I thought myself warranted in anticipating."

Of 1827, the "Annual Register" spoke more favorably: "The internal state of the country at the opening of 1827 was much more cheering . . . the different monied and manufacturing interests of the kingdom likewise were rallying from the confusion of the preceding eighteen months by a progress, which though slow, was sensible and sure."

Conditions were apparently much improved in 1828, as the failures in England numbered only 1,223 as against 2,583 in 1827.

In the United States there was no crisis in 1825 comparable with that in England. The slump in conditions there, nevertheless seriously affected the cotton industry here, which after a boom in the first part of 1825 was hard hit at the end of the year.

The difficulty of the English woolen manufacturers led them to ship vast quantities of goods to the United States. As in 1816, these goods were sold at auction for what they would bring. Such competition for example forced down the price of broadcloth from $4.50 in 1824 to $2.60 in 1826 for the same quality and almost prostrated the woolen factories here. The indirect result was the high tariff of 1828 which led to an attempt at nullification by South Carolina.

There was a severe crisis in both England and the United States in 1837, but it was not a post war crisis. In the United States it was largely due to speculation in canals and western lands and was made much more severe by the unsecured paper money of the wildcat banks. The hard times continued until after 1840.

In England there was heavy speculation in canals, joint stock banks, and the newly introduced railroads. The crisis there was increased by the failures in the United States, and was probably worst in 1839.

The crises of 1847 in England followed a tremendous speculation in railway and other improvements. Sixty-five railway bills were pased in one day in 1845, and concession was the business of the hour. The panic was over in 1848, and trade was again normal in 1849.

The British Crisis of 1857

Trail, in his "Social England," states that the War of England and France against Russia produced a period of speculation in England which left her open to a crisis. In his words: "The Crimean War (1854-56) gave an artificial stimulation to trade, and in 1855 confidence passed far beyond the bounds of prudence. Credit began to be recklessly given. Many large operators kept practically no reserve, trusting to the Bank of England to help them."

The crisis came on suddenly. As stated by the "Annual Register": "When parliament was prorogued at an unusually late period in the summer, it was little thought any occasion would arise for its reassembling before the customary time in the following year. But late in the autumn of 1857 . . . a monetary crisis of great severity . . . spread embarrassment and consternation among the mercantile classes of the comunity." On Nov. 9, the Western Bank of Scotland failed with its ninety-eight branches. The bank act of 1844 had to be suspended, and the Bank of England permitted to issue one million pounds more in notes than the law would have allowed. A crash in prices followed which affected all industries.

The recovery from this crisis must have been rapid, because the *London Times* said of 1858, "Never were there more threatening contingencies than on the first of January, 1858, yet they have all disappeared, and we commence the new year (1859) without a single point of disturbance."

The Crisis in Europe

A similar crisis also took place in France, Germany, Austria, Belgium, and Scandinavia. In several of these countries the foundation was laid by the speculation during the Crimean War, but the crises was made worse by the panic in the United States.

In the United States the crises of 1857 was undoubtedly caused by the over expansion of the railways, of which 16,000 miles were constructed between 1850 and 1857, and is, therefore, outside our subject. It may be noted, however, that prices dropped 30 per cent. The recovery the next year was slow. The *Bankers' Magazine* of January, 1859, stated: "A gradual improvement has taken place, and the manufacturing interests of the country are again awakening to a more profitable condition." By 1860 the recovery must have been complete, for the *Bankers' Magazine* declared of the months before the election, "No previous year has exhibited stronger indications of prosperity among merchants, manufacturers, capitalists, and the great agricultural interests."

Handy Polishing Sticks

By W. T. Elzinga

While serving my apprenticeship in instrument making, my employer and teacher used a kink for polishing that has proved to be very useful in the machine shop, toolroom and pattern shop. It is more economical and workmanlike than the old method of holding a strip of abrasive cloth on a file or glueing it to a stick. It may not be new to men of the old school; to others it may be of help.

Make an assortment of sticks from $\frac{1}{2}$ in. to 2 in. wide, $\frac{3}{4}$ in. to 1 in. thick and 16 in. long. Round up 5 in. to fit the hand comfortable. Plane the working surface of the other 11 in. about $\frac{1}{16}$ in. convex lengthwise and bevel sides and end from 5 to 10 deg. For polishing undercut surfaces, bevel sides as much as needed.

Put a coat of beeswax on the working surface by rubbing it with a lump of this material, spreading it evenly. For polishing metals, cut off a strip of emery cloth the width of the stick and the whole length of the sheet (11 in.) or use roll aloxite or sandpaper when working in wood.

Place this strip on the working surface, rest the abrasive on a piece of about 1-in. cold-rolled steel and roll it back and forth a few times, while pressing it evenly, and you have an excellent polishing file for flat and curved surfaces. It is not very good for lathe work unless used very carefully.

To replace the abrasive simply tear off the worn strip and roll a new one in place.

This scheme works equally well on wooden polishing disks on the speed lathe, except that one must use a metal or wooden roller held in a forked handle to press the abrasive cloth in place.

Are Hollows Worn in Hammer Handles by the Fingers of the User?

By L. L. Thwing

Some time ago I saw an advertisement in one of our popular weeklies, showing a ball pein hammer, the handle of which showed three or four hollows. The accompanying reading matter stated that the hammer from which the photograph was taken had been through the war, and had seen long and severe service in France; in proof of which it pointed to the hollows in the hard hickory handle where the user had worn the impression of his fingers.

Recently I read an article recounting the average length of continuous employment in a certain factory. One of the workers—a glass setter—showed the writer of the article a hammer which had been used so long that deep grooves had worn where his fingers gripped the handle.

Now, while I am very skeptical about the possibility of any such wear as this actually happening, and I certainly never saw a hammer handle so worn, it is not impossible under some circumstances, as, for instance, where a man's hand was continually covered with some gritty substance.

In the case of the first mentioned hammer handle I am quite sure that the notches were cut to prevent slipping when held in a greasy or cold-stiffened hand; and in any case the proper way to hold a hammer is not to grip it as hard as possible, but rather quite the contrary.

Has anyone seen a hammer handle that showed finger prints or other wear from the friction of the hand?

An Improved Method of Making Steel Gear and Wheel Blanks

Producing Parts from Steel Ingots—Making a High-Grade Steel Gear Blank in One Minute —Utilizing the Hydraulic Ram for Production Work

BY GEORGE ATWELL RICHARDSON
Midvale Steel and Ordnance Co.

MODERN mechanical equipment must stand up under service conditions that tax even the best of materials, and the search is ever for something still better. The object of this article is to describe an improved method of manufacturing gear blanks, industrial wheels, car wheels, automobile flywheels and similar uniform circular sections that are of superior quality in every way and will meet the most severe service requirements.

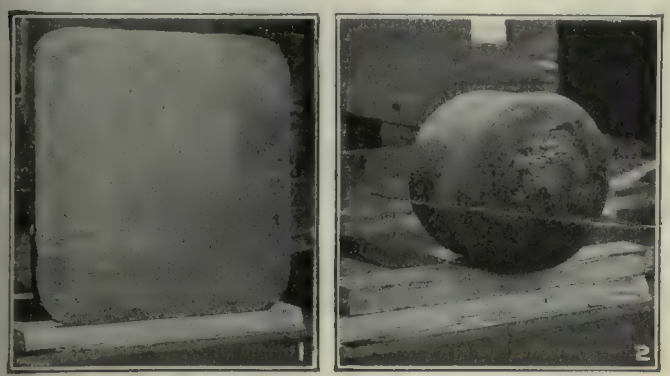


FIG. 1. CROSS-SECTION OF 22x22-IN. INGOT BEFORE ROLLING. FIG. 2. BLOCK SHEARED FROM BLOOM PRODUCED BY ROLLING 22x22-IN. INGOT

It is a recognized fact that thorough working at the proper temperature is one of the most important factors in improving the quality of steel. This thorough working in the present method is largely, though not entirely, secured by the combination of a rolling and forging operation in one machine.

The best way in which to describe the manufacturing operations is to begin at the beginning and follow through step by step.

A 22-in. x 22-in. ingot, a cross-section of which is shown in Fig. 1, is rolled down into a large round or bloom, the diameter of which will ordinarily be 11 in. to 15 in., according to the section to be made. Right here at the start there is a reduction in area amounting to from a maximum of about 80 per cent of original area to a minimum of about 65 per cent. This bloom, while still hot, is then cut up into cylindrical blocks or blanks (see Fig. 2) with the aid of rotary shears, the size again depending on the section that is to be made. The rotary shearing machine, with a bloom (which has just been rolled from the ingot) ready to enter, is shown in Fig. 3.

A chipping operation is now performed, after which the blocks are carefully inspected and then taken to a re-heating furnace where they are brought to the proper forging temperature. Then follows a minor operation which consists in punching one end of the blocks as shown in Fig. 4, for the insertion of a mandrel or rolling pin used to hold them in place during the next

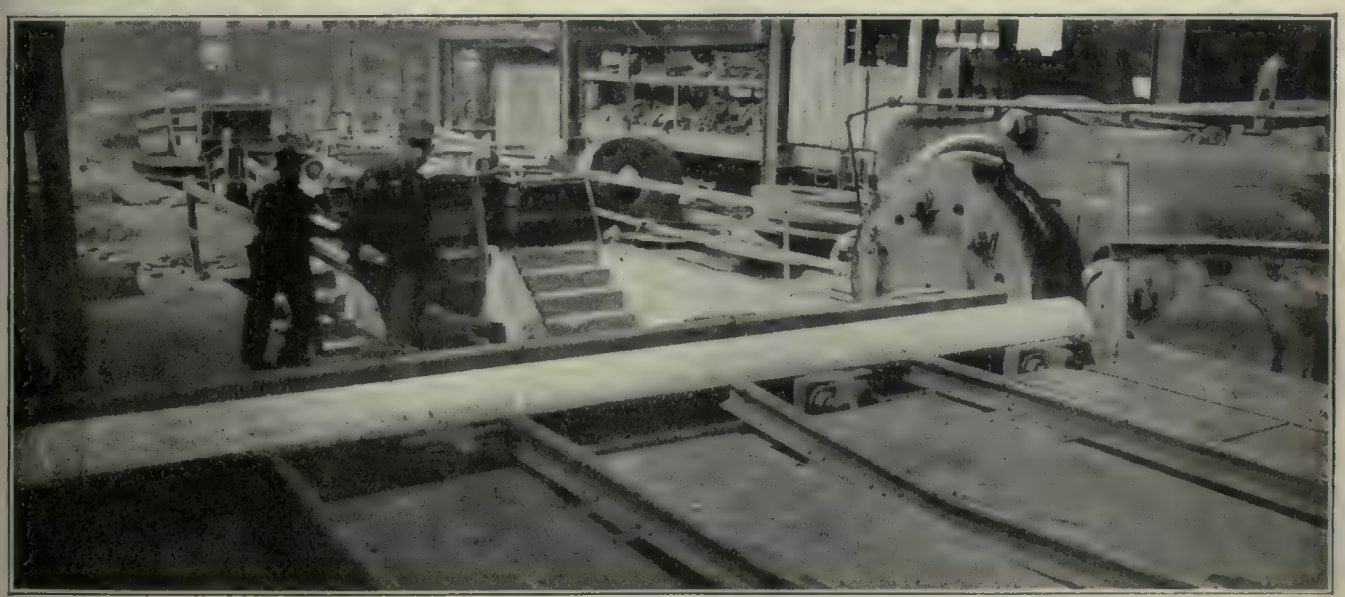


FIG. 3. ROTARY SHEAR WITH BLOOM READY FOR SHEARING

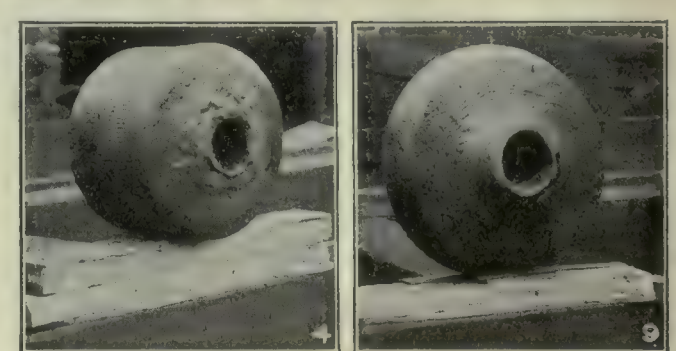


FIG. 4. BLOCK PIERCED FOR INSERTION OF MANDREL. FIG. 9. FIG. 9. BLOCK AS IT APPEARS AFTER START OF ROLLING OPERATION

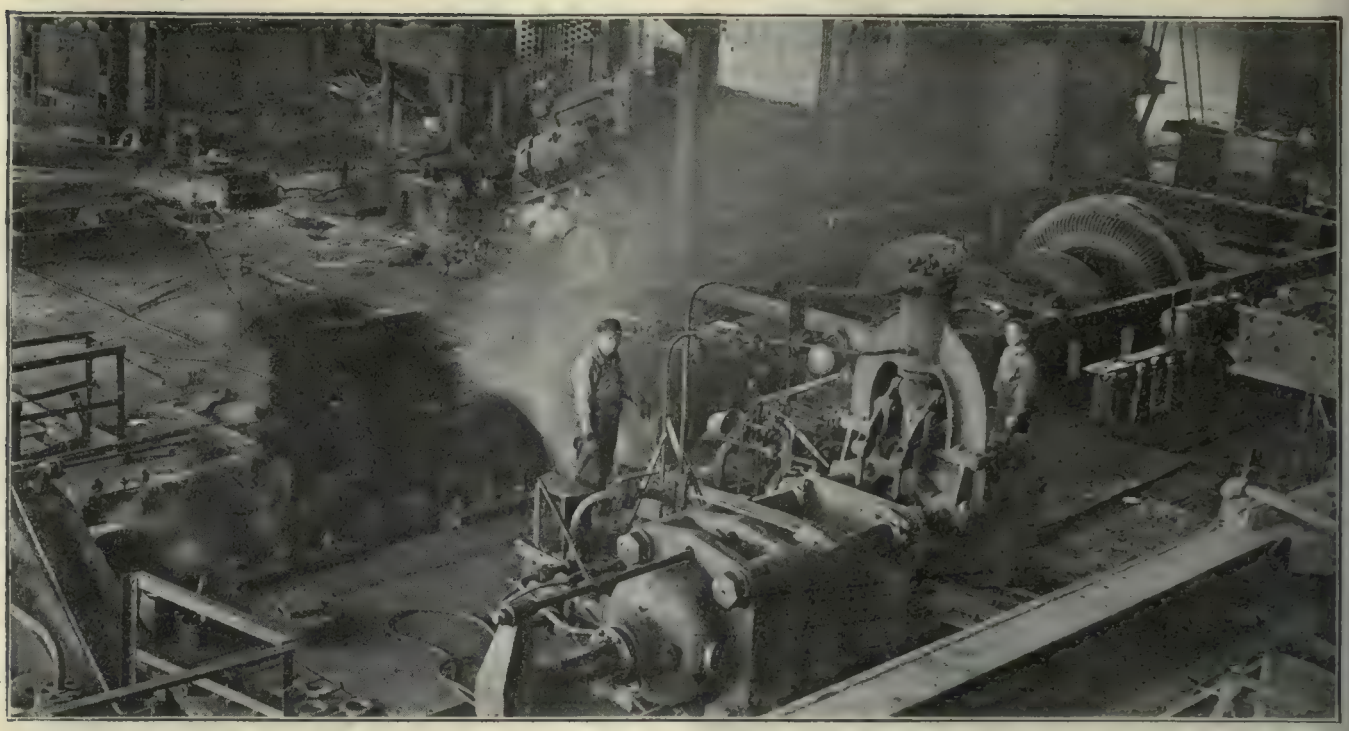


FIG. 5. GENERAL VIEW OF EQUIPMENT; HORIZONTAL PUNCH PRESS IN FOREGROUND; HYDRAULIC RAM AND DRIVING MECHANISM SHOWN; RAM END IS INDISTINCT, DUE TO VIBRATION

stage of manufacture. This stage is the most important one in the method described, but before taking it up in detail, it is necessary to give a short description of the special machine or mill used.

This tremendous piece of mechanism, which is illustrated in Fig. 5, has an overall length of 70 ft., width of 18 ft. and height of 14 ft. It consists of the following important parts, the relative positions of which are shown on the drawing in Fig. 6.

B is a die which is mounted on the end of an hydraulic ram *A* in such a manner that it is free to rotate. *C* is a second die with its axis of rotation at a small angle to that of *B*. This second die is mounted on shaft *D* which is driven by a 2,000-hp. electric motor.

The ram has a pressure plunger 38 in. in diameter, developing a maximum pressure of 3,000,000 lb. The cylinder housing is about 18 ft. wide by 14 ft. high overall and weighs more than 50 tons. The total weight of the entire mill without motor or driving mechanism is 400 tons. These figures give a good idea of the massiveness of the equipment and prepare the reader for the description of the actual manufacturing operation which follows:

The block, which has not had a chance to cool from the forging temperature since punching, is placed in position between the dies, and then by a combined rolling and pressing operation, the metal is gradually worked out until it fills the dies and takes on the shape

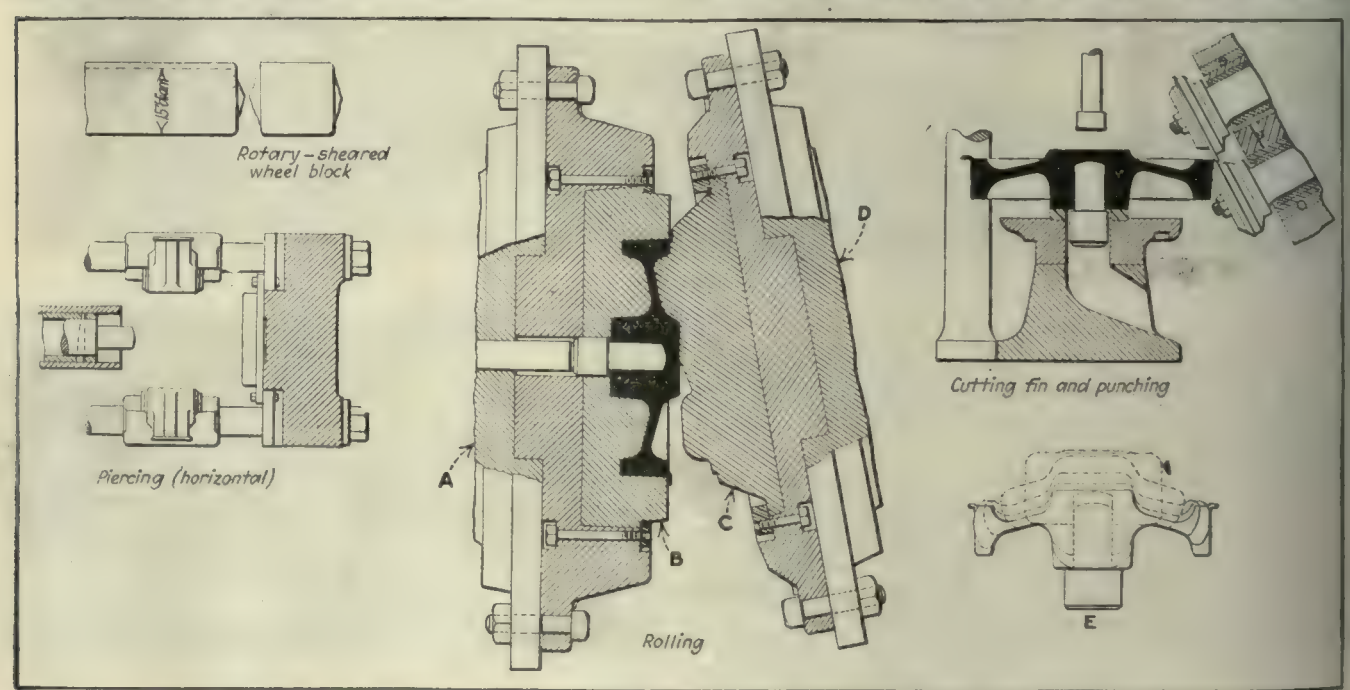


FIG. 6. DIAGRAM SHOWING PROCESS OF MAKING PARTS WITH HYDRAULIC RAM

desired. Die *C*, which is the driven die, rotates the block and die *B* in turn by friction. Die *B* is fed forward by the hydraulic plunger. The angularity of the dies is for the purpose of producing the rolling or kneading action, the rolling and pressing as mentioned proceeding at the same time. Fig. 7 shows the mill with a blank in position ready for pressing and rolling, and Fig. 8 shows the same blank after it has been rolled. The total operation on this mill takes from 30 sec. to 1 min. according to the size of the piece being made. The blank as it appears during the different stages of the foregoing operation is shown in Figs. 9, 10 and 11.

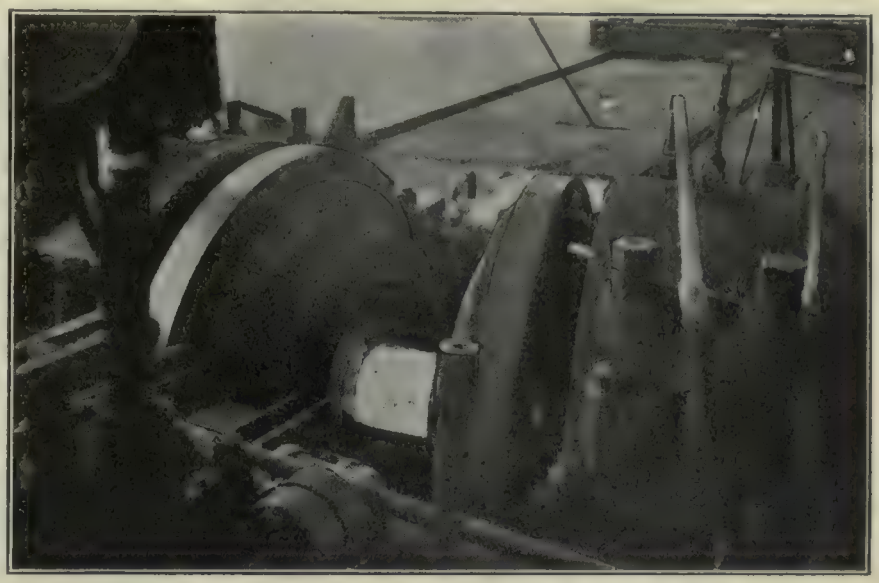


FIG. 7. MILL WITH BLANK IN POSITION READY FOR PRESSING AND ROLLING

The blank is now practically in the completed condition except for a few minor operations. These include shearing a thin fin which extrudes, punching the hub, stamping identification marks and a certain amount of machining which depends on the customer's specifications. Fig. 12 shows a completed blank with the fin sheared off, and another, on which some of the rough machining operations have been performed is shown in Fig. 13.

It is difficult to visualize the exact flow of the metal between the dies during the manufacturing operation but diagram *E* in Fig. 6 gives some idea of the transition from block to blank. In general it can be said that as the metal is squeezed down it flows out from the middle in a parobolic path. As can be seen the steel receives an unusual amount of working in this one operation alone.

Advantages and Disadvantages

These few facts very briefly describe the methods of manufacture. No attempt has been made to go into great detail, only those things being mentioned that give a good idea of the size and character of the equipment and the actual working that the steel receives.

Several questions that arise are the following: (1) What sizes and kinds of sections can be made by this method? (2) What are the advantages? (3) What is the comparative cost?

A general statement as to sections rolled is that any uniform circular section weighing not less than 100 lb. can be made by this method. Sections lighter in weight cannot be economically made, and there are inherent manufacturing difficulties as well. The maximum limits are variable. Turbine bucket wheels up to 48 in. in diameter have been successfully produced although for car wheels 30 in. is the maximum diameter recommended for making by this method. Among the various sections which can be rolled are: Automobile flywheel blanks, band wheel flange blanks, bevel roller blanks, gear blanks such as bevel, spur and gear ring blanks, mill and railway motor blanks, blanks for truck and tractor transmissions, etc; car wheels, industrial wheels, double-flange crane track wheels, pipe flange blanks, piston blanks, shaft coupling blanks.

The advantages of using blanks made by this method are numerous and include the following:

(1) First and most important is the fact that the steel receives an unusual amount of working at the proper temperature, which puts it in the best possible condition.

(2) The steel is of uniform density throughout, thus insuring superior static and dynamic balance when blanks are machined.

(3) The metal is homogeneous. There are no blow holes, shrinkage cavities, etc., to contend with.

(4) As compared to castings, there is no scrap loss due to defective pieces.

(5) There is no hard or sandy scale to contend with. Machine shop costs are thus materially reduced.

(6) That part of the steel which receives the most working is at the circumference where the actual service is sustained.

(7) The center of the bloom always remains parallel to the center of the original ingot and since any piping



FIG. 8. MILL SHOWING BLANK AFTER IT HAS BEEN ROLLED

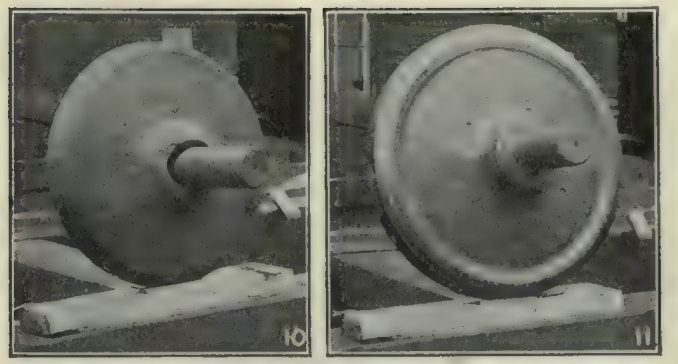


FIG. 10. BLOCK WHEN ROLLING IS HALF COMPLETED
FIG. 11. BLOCK AS IT APPEARS WHEN METAL JUST BEGINS TO TOUCH EDGE OF DIE

or segregation is in the center of the ingot it also is in the center of the bloom and of the blocks cut from the bloom. This is due to the fact that the ingots are rolled longitudinally. In shaping the block, the flow of metal as mentioned is outward from the center, the least movement being at the center. Thus the piped or segregated material remains in the hub and is either punched out or is in a position where it does no harm.

(8) Steel of any ordinary range of carbon content or specification can be used, thus making it possible to provide for oil hardening or other special treatment with the resultant advantages.

(9) There are no shrinkage stresses to cause breakage due to shock in operation.

(10) Blanks made by this method have the inherent superiority of steel that has been forged and worked.

Some Interesting Tests

In this connection some interesting experiments were made recently which throw some light on the superiority of gears made from blanks manufactured by the method described. The first test was made to compare the strength of the teeth of a cast-iron gear, a steel gear as rolled and a steel gear which had been heat-treated. The second test was a drop test—a cast-iron gear and a steel gear made from the blank as rolled but without any heat-treatment being used.

The gears were all 21½ in. in diameter and identical in size, shape, style of teeth, etc.

In the first test the results shown in the table were obtained:

Gear tested:	Breaking Strength of Teeth First Test	Second Test	Remarks
Cast-iron	7,515 lb.	10,720 lb.	Teeth would not bend.
Steel gear, steel as rolled	32,395 lb.	34,310 lb.	Teeth bent at these loads.
Steel gear, heat-treated	40,750 lb.	42,600 lb.	

In the drop test equally interesting results were obtained. The cast-iron gear was tested under a drop testing machine with a 200-lb. tup falling from a height of 6 ft. The gear broke into four pieces on the first blow of the tup.

The steel gear in which the steel was in the natural condition, that is, not heat-treated, was tested in the same manner. After dropping the weight twenty times from a height of 6 ft. there was a deflection of about ⅜ in. and some distortion of the rim but no signs of breaking had appeared.

From these tests it will be seen that there is a remarkable difference in strength between the cast-iron gears and the steel gears.

The Question of Costs

What is the comparative cost of sections made by this method? This is a question that cannot be given a general or off-hand answer, because so many factors

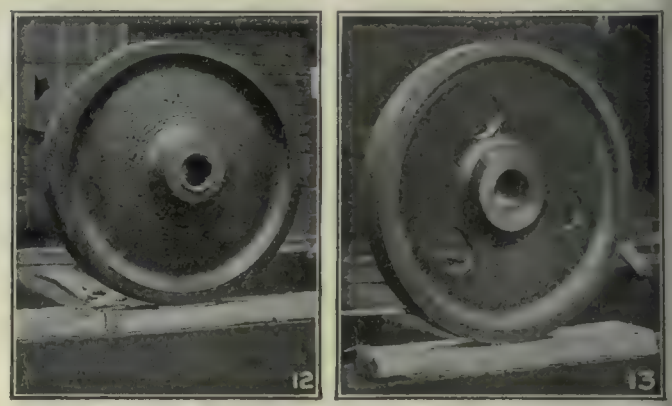


FIG. 12. COMPLETED BLANK WITH FIN SHEARED OFF
FIG. 13. BLANK AFTER ROUGH MACHINING

must be considered. The shape and size of the blanks, the number required and other like things necessitate giving each proposition considerable individual attention. As might be expected, the first cost is naturally larger than that of castings, but the final cost after machining and getting ready for use is what counts.

As a rule when the elimination of scrap losses, reduced machining required, etc., are considered, the finished cost is very nearly, if not quite, as low as that of castings. In fact, some manufacturers have gone so far as to say that they make the finished pieces at less cost. In this connection it must not be overlooked that the longer life and superior service given have a very definite if intangible value in the way of advertising and satisfied customers.

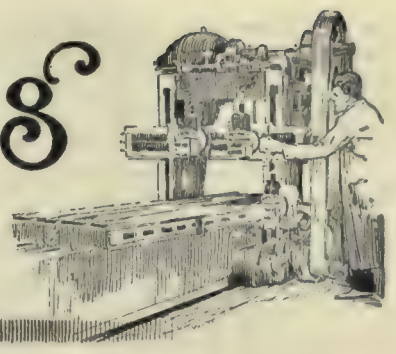
On the whole, the arguments are all in favor of this method. The general trend in modern design is helping in this direction, and it seems certain that the worked steel parts will supersede cast parts in many forms of mechanism where service and stand-up ability are of prime importance.





Metal Cutting Tools.

By A.L.DeLeeuw



XI. Cutter Sharpening—Characteristics of Cup and Disk Wheels—Importance of Correct Angles—Cutter Grinders—Hob Grinding

PROPER sharpening of cutters is of as much importance as their design, or the material of which they are made. The requirements for good cutter sharpening are much the same as those for the grinding of other tools, with some features added. It will be taken for granted in this article that the reader is familiar with the methods commonly in use, and the machines used for the grinding of cutters, so that only those points will be mentioned which are not entirely obvious.

As with other tools care should be taken to get the angles correct. Until a few years ago it was necessary to go through a good deal of trouble to set the machine so that the desired angle would be produced, but nowadays machines may be had which permit of setting up for any clearance desired without any preparatory calculations.

The first question presenting itself is the shape of wheel to be used. Is it better to use a cup or a disk wheel? To answer this question intelligently let us see what happens when we use either of them.

Fig. 176 shows a section of a cutter of which part of the tooth has been shown in a diagrammatic way. The tooth has been deflected so as to present the proper clearance angle to the cup wheel. Fig. 177 shows the same cutter but another tooth is shown besides the one to be ground. Instead of the cup wheel a line *XY* is shown. This line represents the intersection of the plane of the front of the cup wheel with the plane of the paper. As the drawing shows it, the cup wheel

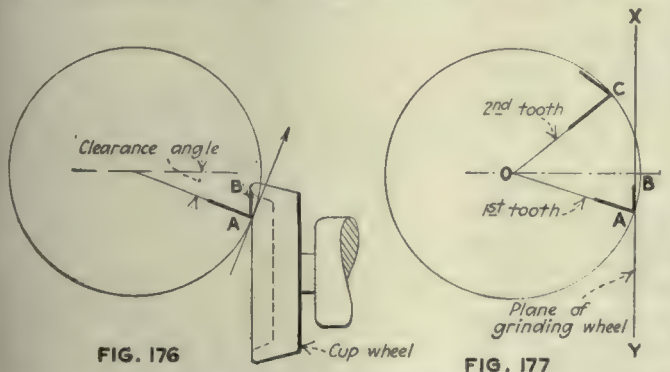


FIG. 176. CUTTER AND CUP WHEEL. FIG. 177. DIAGRAM TO SHOW RELATION BETWEEN TOOTH SPACING AND CLEARANCE ANGLE

would grind tooth *A* but would clear tooth *C* so that it would not make any difference whether we set the cup wheel high or low. In order to have this condition angle *COB* must be greater than the clearance angle *BOA*. In other words, angle *COA* must be greater than twice the clearance angle. This angle *COA* is the angle between two adjoining teeth, so that we may say that as long as the angle between the teeth is more than twice the clearance angle we do not need to pay attention to the height of the cup wheel. In other words, at whatever height we may set the wheel, it will grind a tooth without interfering with another.

If, on the other hand, the angle of spacing between the teeth is less than twice the clearance angle, we must take care that the top of the cup wheel comes below the next tooth. This is so simple, and is so easily seen by the man who grinds the cutter, that it would not have been mentioned here but for the fact that it has important bearing on the result of the grinding. In Fig. 179 a cutter is shown under the conditions of Fig. 177, that is, under conditions where the cup wheel cannot interfere with the next tooth. The portion *ACBD* is that portion of the tooth which is being sharpened by the wheel. The wheel being made up of little grains cannot possibly make a smooth edge but will produce an edge somewhat like that shown in Fig. 179A. Of course, the matter is grossly exaggerated in the illustration, and the serrations will be much smaller and less regular in size, but the main fact remains that there will be a serrated edge as the result of the grinding.

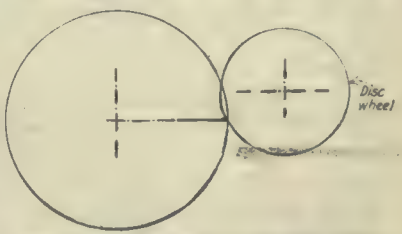


FIG. 178. LARGE CUTTER AND SMALL DISK WHEEL

These serrations, if not too coarse, do no harm. As a rule, they are not deep enough to weaken materially the edge of the cutter, so that we may say that with a cup wheel set in such a manner that its center is in the same horizontal plane as the edge to be ground, satisfactory results will be obtained. This matter becomes entirely different if we have to set the wheel somewhat as shown in Fig. 176, where the center of the wheel is below the edge to be ground. The serrations are no longer at right-angles to the cutting edge, but are as shown in Fig. 180. In order to see if this will make any difference in the action of the cutter, we will take a strong magnifying glass, and examine the serrated edge produced under these conditions.

Fig. 181 shows this edge looked at in the direction of the arrow in Fig. 176, the full lines showing what

*For the author's forthcoming book. All rights reserved.

we would see at *A*, and the dotted lines what we would see at *B* (see Fig. 176). The full line, being the outline of the cutting edge, will reproduce itself when a cut is taken. The dotted line, being the section further back, should clear the work. As the imaginary diagram shows, it does clear the work at some, but not at all, points. Where the full and dotted lines of Fig. 181 cross there will be interference; in other words, the cutter will act at those points as if it had no clearance, or rather, as if it were made with negative clearance. Such a condition would cause the breakdown of the cutter at that point. It makes no difference that the serrations are very small and that there is negative rake at a few points only, the result will be the same as if this condition existed on a large scale. We find, then, that the wheel should be central with the edge to be ground, at least nearly so. If we wish to grind a cutter with 8-deg. clearance, the angle between two adjacent teeth should be more than 16 deg. In other words, the cutter must not have more than 22 teeth. This happens to be the case in all wide spaced cutters of ordinary size, only cutters of very large size would have more than that number of teeth. It follows, then, that a cup wheel can be used for all ordinary plain milling cutters. What will be the case, however, when we wish to grind a spiral cutter?

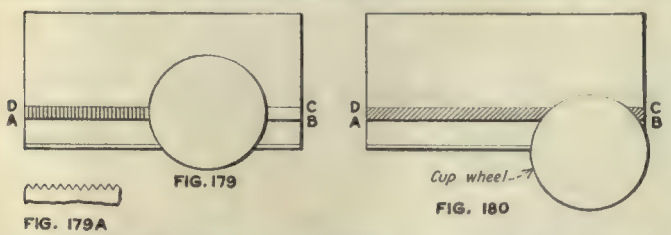


FIG. 179. SIDE VIEW OF CUTTER AND WHEEL, WHEEL CENTER IN LINE WITH GROUND SURFACE. FIG. 180. SAME BUT WITH WHEEL CENTER BELOW GROUND SURFACE

What will happen in this case is shown in Fig. 182 in diagrammatic form. The cutter is being ground at the point *M*. The outside of the rim of the cup wheel is represented by the full circle, while the inside of the rim is shown by a dotted circle. The next tooth is represented by *PQRS*, and, as we have seen, point No. 1 of that tooth will clear the wheel. Point No. 2 might also clear the wheel and so might point No. 3, but finally a point would be met, somewhere on tooth *PQRS*, which would interfere with the wheel if the wheel were solid. As the wheel is hollow, it makes the chance of interference less, but does not entirely avoid it; so that it is possible that the wheel would touch tooth *PQRS* somewhere. If this happens at point No. 6, which is located on the same horizontal line as point *M*, no harm results, but if it happens anywhere above that line, a point of tooth *PQRS* would be ground to a smaller diameter than the one desired.

Whether this will actually happen or not depends on the distance between the teeth, the angle of spiral, the diameter of the cutter, and also the length of clearance we aim to produce. A small angle of clearance, a small number of teeth, a small angle of spiral and a small cup wheel will minimize this danger. If such an interference occurs it is necessary to lower the center of the wheel and slanting scratches will be produced.

Now let us see what conditions we will meet if we use a disk wheel. This set of conditions is diagrammatically shown in Fig. 183, where the circle *O* represents the cutter, and circle *F* the disk wheel. Angle *AOB* is the desired clearance angle. It will readily be seen that the wheel will clear the next tooth if the

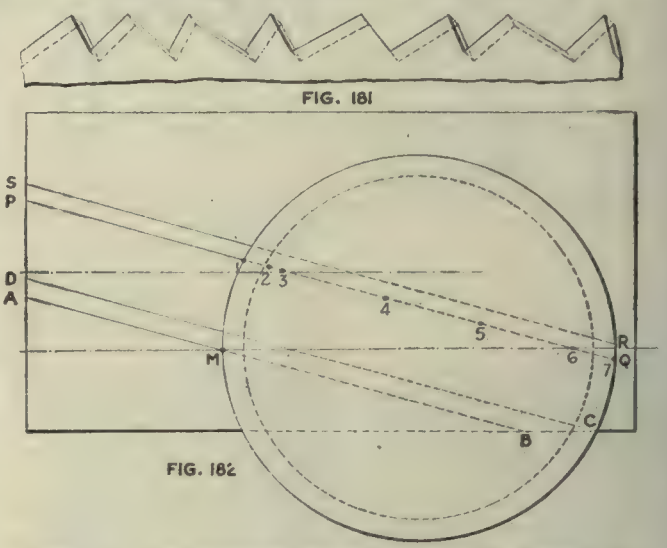


FIG. 181. MAGNIFIED VIEW OF EDGE GROUND AS IN FIG. 180. FIG. 182. SPIRAL CUTTER GROUND BY CUP WHEEL

clearance angle is less than half the angle of the spacing of the tooth. This condition is even better than with the cup wheel, because the circumference of the wheel retreats from the cutter, so that, with an angle of clearance not less than, but equal to, half the angle of spacing, there would still be no interference. Furthermore, all we would have to do, if such interference took place, would be to use a smaller wheel.

When a spiral cutter must be ground the disk wheel shows up still better in this matter of interference. The cup wheel caused trouble because it had considerable width at the point where the grinding took place. A disk wheel, such as is used for cutter sharpening, is narrow, generally not more than $\frac{1}{8}$ in. and hardly ever more than $\frac{1}{4}$ in. wide, so that there is no danger that it will strike a point on the spiral of the next tooth.

If nothing else but interference had to be considered the disk wheel would have the advantage all along the line. Furthermore, the disk wheel does not make slanting scratches, so that, here again, the advantage lies with it. However, there are other considerations which, as will be seen, modify the relative advantages of cup and disk wheels.

Fig. 178 shows a relatively large cutter and small disk wheel. It shows the concave form of the edge of the tooth. If the tooth were somewhat wider there would be created a condition where the back of the tooth would be the same, or even of larger diameter, than the front of the tooth, so that the back of that tooth would interfere with the work. This is, of course, exaggerated, and such a condition would not be found in practice, but what is found, and quite often, is that the clearance between the back of the tooth and the work has been materially reduced and that the concave tooth acts as a kind of reservoir for fine chips. In other words, the cutter does not keep itself clean, and the tendency for small chips to weld themselves into the tooth is much greater when the cutter is ground with a disk than with a cup wheel. This is a very important item, especially when cuts are taken in tough steel which has a tendency to bring the temperature of the cutter up to a point where this welding can

take place. This one item alone is of enough importance to prefer grinding with a cup wheel, provided it can be done without making the slanting scratches.

The next question to be answered is in regard to grade and grit of the wheel to be used. This question cannot well be answered without looking, at the same time, at one of the other things. If it were merely a question of removing a certain amount of metal, a rather soft wheel with medium grit would be about right. However, such a wheel would not produce a desirable finish and, besides, would lose its size so quickly that it would be very difficult to grind the cutter so that all the teeth would be on the same diameter. As in most other things, a compromise must be reached here. The grit must not be so coarse as to produce deep scratches nor must it be so fine as to require a long time to remove the metal, not only would this be a loss of time, but the cutter would be heated too much and the temper might be drawn at the edge. As to grade, it must neither be so soft as to lose size quickly, nor must it be so hard as to have a tendency to clog, for that again would cause loss of time and heating of the cutter. The best practice is to move the cutter rapidly past the wheel taking a shallow cut, and not to try to remove too much metal at one stroke. This method has more than one advantage.

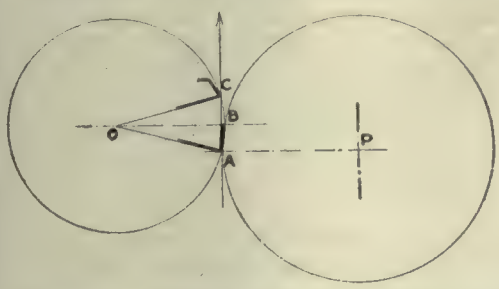


FIG. 183. SMALL CUTTER AND LARGE DISK WHEEL

In the first place, it prevents local excessive heating; in the second place, it prevents gouging, and best of all it keeps all the teeth all the time of even diameter, so that the final cut can be a finishing cut in the true sense of the word.

The tooth to be ground is supported against a tooth-rest, and the direction of rotation of the grinding wheel is such as to force the cutter against the tooth-rest. This makes it easy and convenient for the operator of the grinding machine, but it does not produce the best results so far as the cutter is concerned. Inspection under the magnifying glass will show that a burr is raised at the cutting edge. Furthermore, as the wheel passes the edge to be ground, it carries the heated particles with it. These particles come from the back of the tooth, and are carried toward the cutting edge. The cutting edge is of delicate section and not well adapted to carry off heat.

Fig. 184 shows a tooth in section, the arrow showing in which direction the wheel passes the cutter. The first point struck by the wheel is point No. 1. At this point there is a large cross-section of the tooth to carry off the heat generated. Nevertheless, it must not be forgotten that this section while carrying off the heat becomes hotter itself, and that this heat is conducted in all directions and therefore also to the cutting edge. Besides, the hot particles of metal, the sparks, are compelled to pass this cutting edge heating it still more.

By the time a given point of the wheel reaches point No. 2 the tooth is heated up and the heat generated at point No. 2 must be carried off by a smaller section which is already heated, so that a greater portion of the heat generated at point No. 2 is conducted to the cutting edge. All the time the sparks have been passing this edge, so that it will have reached a high temperature before this edge itself has been touched by the wheel. When finally the wheel acts upon the cutting edge, heat is being generated at a point where there is a very small section to carry off this heat, and where, besides, that section itself is heated to a high temperature. The result is that the edge is softened and this again assists in raising a burr. Examining a cutter after grinding it will often be found that the burr is merely a feather edge, a hair-like strip of metal, pushed off the tooth by the action of the wheel. However, it will be found equally often that the burr is of a much more substantial character, and that it is in reality a rib raised on the inside of the tooth by the pressure of the wheel against the softened metal of the edge.

The shaded section of Fig. 184 represents the amount of heat which must be carried off at the different points of the surface to the ground. As will be seen, the largest amount of heat must be carried off by the smallest cross-section. At *A* is shown the nature of a burr raised when there has been no excessive heating of the edge, while *B* shows what happens when this edge has been overheated.

The very unequal performance of a cutter after various grindings may be attributed to the nature of the cutting edge as it comes off the grinder. The burr at *A* does not do much harm though, of course, it would be better if there were none, but the burr at *B* is very objectionable. The grinder hand, or milling machine hand, on noticing the burr will probably try to remove it by stoning, but this is bad practice as stoning always leaves a rounded edge. Furthermore, though stoning may remove the burr at *B*, it cannot remove the fact that the metal under the burr is soft.

All of the above is merely an argument in favor of reversing the common practice of sharpening cutters. The grinding wheel should enter at the cutting edge, notwithstanding the fact that, in so doing, there is a tendency to push the cutter away from the tooth-rest. The pressure of the wheel against the cutter is not great and the operator can easily counteract this pressure by keeping his hand on the cutter or by hanging a weight from a strap wound around the arbor on which the cutter is mounted. Attention was called to the scratches which the wheel produces on that surface of the cutter tooth which is being ground. Fig. 185 shows a cutter tooth in front view. On a part of that tooth scratches, such as are made when sharpening, are shown in greatly exaggerated proportions. On another part of the same tooth serrations are shown, which are supposed to exist on the underside of the tooth. These serrations are not caused by the grinding wheel, but were made when the teeth were milled in the body of the cutter. These irregularities may have any conceivable shape and are not made any more regular by the subsequent

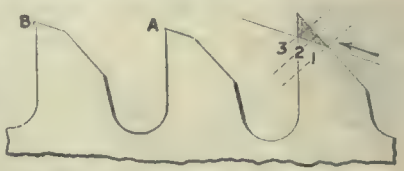


FIG. 184. ILLUSTRATING THE FORMATION OF A BURR

hardening. Their effect, however, is at least as bad as the scratches in the front of the teeth made by the wheel. It is almost certain that there will be negative clearance somewhere along the length of the tooth, not to any great depth, it is true; but it should be kept in mind that if clearance is required anywhere at all it is right at the cutting edge. For this reason it is to be recommended that the front of the tooth should be ground before the cutter is put to work. As the grinding marks can be made to run parallel to the axis of the cutter, scratches made by the wheel would cause no trouble. Not only should the front of the teeth be ground, but it is recommended that they be ground to a polished finish so as to diminish the friction between the front of the teeth and the chips.

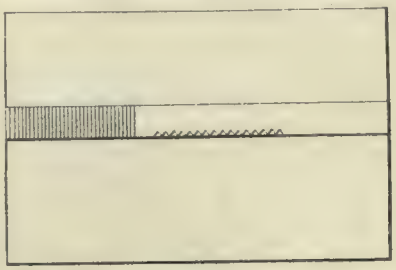


FIG. 185. FRONT VIEW OF CUTTER TOOTH

The Sharpening of Cutters

Instructions for the sharpening of cutters can be found in almost any catalog describing commercial cutter grinders, so that it is not necessary to go into details here concerning the setting up and manipulating of a cutter to be ground. There is one item, however, so important that special attention should be called to it. This is the providing of proper clearance angle to the cutter teeth. It is only in recent years that the importance of this item has begun to be realized, and even now the clearance angle is a matter of guess and chance in a great many shops. Experience has shown that the lasting qualities of the cutter are largely influenced by this angle. Differences in hardness of material and even in the manner of holding the work may affect this angle. Where manufacturing in quantities is done it would pay to carry on a certain amount of experimentation to determine which is the best clearance angle to use. Of course for jobbing work compromise angles are used, such as have been mentioned in the previous articles. As this clearance angle is of such great importance, it stands to reason that proper facilities should be furnished for grinding a cutter to the proper angle.

Formerly there was only one way of setting a cutter for the proper angle. In case a cup wheel was used the tooth to be ground was first set central and then turned downward until it had reached a height of so and so many thousandths of an inch below its original position. Referring to Fig. 176, the point *A* had to be dipped down an amount equal to the radius of the cutter times the sine of the clearance angle, so that, in order to get the correct setting it was necessary to measure the cutter and carry out some calculation. As a rule this was not done. When a disk wheel was used, see Fig. 178, the tooth of the cutter was again set central and then the disk wheel was raised an amount equal to the radius of the wheel—*not the cutter*—times the sine of the clearance angle. There was again the necessity of measuring and calculating. Besides, the man who sharpened cutters only occasionally was very apt to make a mistake and use the radius of the wheel when he should have used the radius of the cutter or vice versa.

The writer's patent, embodied in the cutter grinder made by the Cincinnati Milling Machine Co., provides direct means for setting the clearance angle independent of the diameter of the cutter or wheel, and without requiring any calculation. If the cutter is mounted on an arbor which can be held in the taper socket of the grinder head spindle, or if an end mill with taper shank is to be ground, a tooth of the mill is set central and, in case a disk wheel is used, the center of the cutter is brought to a level with the center of the wheel. This last operation is not necessary when a cup wheel is used. The graduated collar of the grinder head is set to zero and fixed in that position by a set-screw. The spindle of the grinder head is now turned through the desired number of degrees, and this furnishes the proper clearance angle. In case a disk wheel is used the cutter tooth is once more brought to a level with the center of the wheel.

Where a cutter is held on an arbor which must be placed between centers, a special dog is provided which temporarily secures the arbor to the spindle of the grinder head after which the same method is followed. We cannot very well speak of setting the tooth of a spiral mill to the same level as the center of the grinding wheel. We can only place one single point of a tooth in this position and we select a point immediately opposite the grinding wheel. We also take care that we set the center of the tooth-rest under that point.

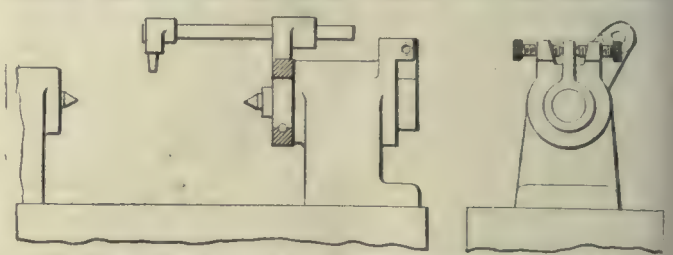


FIG. 186. FIXTURE FOR GRINDING FORM-MILLS

The matter of grinding various kinds of cutters, such as end mills, face mills, spiral mills, etc., involves no difficulties, though it requires some skill and attention on the part of the operator. There are now many cutter grinders on the market which provide all the necessary adjustments for the grinding of practically all standard cutters. When it comes to the grinding of form-mills, hobs and helical cutters, we are confronted with a somewhat more difficult problem.

We have seen, in the article dealing with form-mills, that it is essential to grind the cutter in the same way in which it was made; that is, if the teeth were made radial, we must grind radially and if the teeth were made off-set so as to be tangent to a circle $\frac{1}{2}$-in. in diameter, we must grind the teeth so that after grinding they shall be again tangent to that same circle.

Grinding a plain or spiral mill we feed the wheel into the work by means of the cross adjustment and keep on doing so until the wheel takes a cut on every tooth. We cannot do this with form-mills, for if we did, a radial tooth would no longer be radial after grinding. In the article dealing with form-mills it was pointed out how desirable it is to have the back of the teeth ground when the cutter is new, so that we can put the tooth rest against the back of the tooth. If we do so, and make the tooth-rest a part of a swinging frame which will push the cutter forward around its axis, we will have all the requirements for proper grinding of

form-mills. Fig. 186 shows this arrangement in diagrammatic form.

If a large amount of metal must be ground off the teeth of a form-mill, there will be so much wear of the wheel that at the end of the grinding operation we would have the teeth of the cutter as many thousandths of an inch forward of their proper position as the wheel had worn. In order to overcome this difficulty, we should grind the cutter all around and then take a final cut, and before taking this final cut we should again make sure that the wheel is either radial or tangent to the given circle. This last adjustment should be made with the crossfeed. See Fig. 187.

Form-Mills and Hobs

The same considerations which apply to form-mills apply equally to hobs. There is one point of difference, however, which should be kept in mind. Fig. 187 shows a dished wheel of which the flat side is used for grinding a form-mill. Such a wheel can also be used and in the same manner if the gashes of the hob are parallel with the axis, but if the gashes are spiral, then a dished wheel used in this manner would interfere. In order to grind such hobs the bevel side of the dished wheel to be used should be trued up so as to make a portion of the bevel side with a straight section or contour. The hob should be set in such a relation to the wheel that this straight portion of the wheel points toward the center of the hob. As a rule the spiral of the gashes is of long lead and almost any size of dished wheel can be used without the danger of interference, but occasionally one will meet a hob with a short lead spiral and then it becomes necessary to select a wheel of sufficiently small diameter to prevent such interference.

The backs of the teeth of parallel gashed hobs can be ground for the same purpose for which the backs of form-mills are ground. It would be equally possible to grind the backs of the teeth of spiral gashed hobs, but this would serve no purpose as it is not practical to use the backs of the teeth of such a hob for a guide. In order to grind such hobs with positive assurance that all teeth will be ground to the same diameter, we will either have to indicate the hob after grinding or else do the following: Make a solid former with the same lead as the lead of the hob; grind the backs of one set of teeth of the hob in the same manner as the backs of form cutters are ground; mount the hob and the former on the same arbor; grind the front of the teeth of the former in relation to the ground backs of the hob teeth; use this former every time this particular hob must be ground, taking care to mount it in the same relation to the hob as when it was ground. It will readily be seen that, for the highest accuracy obtainable, each hob must have its own former.

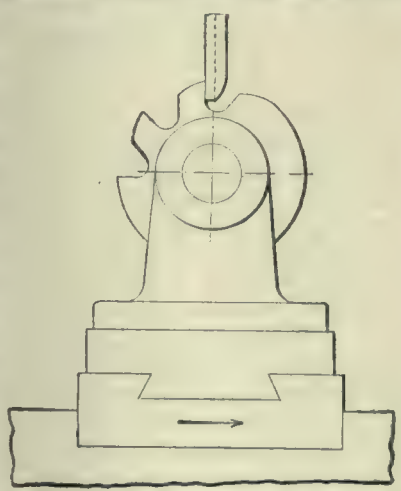


FIG. 187. ILLUSTRATING FINAL ADJUSTMENT OF CUTTER FOR FINISH GRINDING

This is not so much of a drawback as might appear at first glance. The irregularities which exist in the teeth of a hob will not exceed a few thousandths of an inch. So long as we can use the hob we can also use its former, and when finally the hob is worn out and we must start a new one, we can easily regrind the former so as to make it correspond to the new hob.

Grinding hobs with spiral gashes and using a former for guide introduces a slight error. The former rests against an ordinary tooth-rest, whereas the shape of the grinding wheel is a cone. The size as well as the angle of the cone is variable and indefinite. In order to get a perfect job, the tooth-rest would have to be of the same shape as the grinding wheel. However, in practically all cases the cone of the grinding wheel is of such large size, relatively speaking, that for all practical purposes the element of the grinding wheel in touch with the hob is comparable to the element of the tooth-rest in contact with the former. Though the error will be very slight, yet it is well to remember that this arrangement does not make a theoretically correct job.

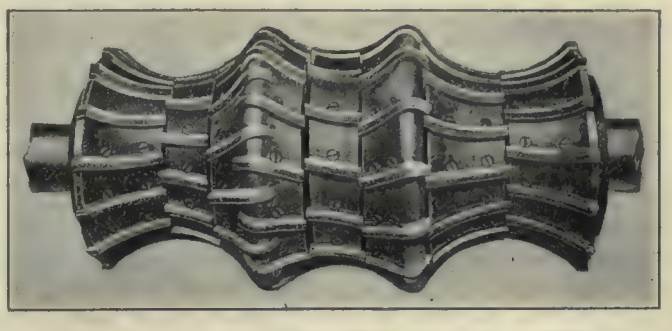


FIG. 188. LARGE COMPOUND FORMED CUTTER

Mention was made of form-mills which are not backed off, and of which the contour must be ground. There are several machines in existence at the present time arranged for grinding these contours. The principle of this system of grinding is the copying of the contour of a former or templet, either by a pantographic movement provided by the arrangement of the machine itself, or by mounting the cutter to be ground on a jig or fixture which also holds the templet, and then moving this fixture with its templet past a fixed pin in the machine. When the templet passes the pin the cutter passes a grinding wheel which sharpens the cutter teeth, maintaining the original form.

If the tooth to be ground is on the same level with the axis of the grinding wheel and if the edge of the grinding wheel has the same section as the pin against which the templet slides, the contour generated by the wheel will be an exact duplicate of the contour of the former. However, in doing so, we would get a cutter without any clearance. To provide this clearance we must either lower the cutter or raise the wheel; so that the horizontal plane going through the center of the cutter will no longer go through the center of the wheel. If the normal section of the rim of the wheel is a half circle, then the intersection of this horizontal plane with the wheel will be half an ellipse. It is this half ellipse which would act on the cutter. As the pin along which the former slides is of circular section and the acting part of the wheel has an elliptical section, the outline generated by the wheel would no longer correspond to the outline of the templet. In order to overcome this difficulty it is necessary to give the wheel such a shape

that it will have a semi-circular section at the point where it acts on the cutter, and this is provided for in such machines by having a trueing device which always acts at the height of the center of the cutter and gives to the wheel at that height a section corresponding to that of the pin.

It will readily be seen that this mode of grinding offers considerable difficulties. Where, for instance, a form-mill has part of its outline parallel to the axis and joins another part at right angles to the axis, a wheel must be used at this particular point with a sharp corner; for other junctions between different lines a wheel may be needed with a very small radius, where as for still other portions a more rugged wheel with larger radius can be used. It might, therefore, be necessary to change wheels several times for the grinding of one cutter; and, furthermore, when doing so, one is confronted with the difficulty of making a perfect joint on the cutter where the action of one wheel has stopped and another one begins. On the other hand, such a mode of producing the proper contour may be useful for very large cutters, as illustrated in Fig. 188.

As a rule cutters are used until they are too dull to be used any more. It will often be found that one or more teeth are badly damaged because they have been used beyond the point where they were in proper shape for cutting. In such a case it may be necessary to remove a large amount of metal by grinding. Not only does this require a great deal of time for grinding but the cutter is soon used up under such conditions. Cutters are expensive tools and every effort should be made to make them last as long as possible. It has been found that the destruction of a cutter tooth takes place during a very short period of time. A cutter may have been used six hours and be in practically perfect shape, and yet after 6 hr. and 5 min. it may be so dull that it is necessary to remove $\frac{1}{16}$-in. per tooth. For this reason it is recommended to regrind the cutter while it is still sharp.

Where pieces are manufactured in large quantities, it would pay to do some little experimenting in order to find out how many pieces can be milled with one grinding of the cutter, and then to make it a rule to regrind the cutter before this point is reached. If it is found, for instance, that the cutter will last 7 hr., it would be good policy to establish the rule that the cutter must be taken out of the machine and reground every five hours. Not only does this method save the cutter, but it also makes the workman feel safe in the use of higher speeds or feeds, or both. He is naturally inclined to cut down feed or speed when he finds that his cutter is badly damaged or dull after a certain length of time. If, however, he finds his cutter is still in good shape at the end of the specified period, he will not hesitate to use the highest practical feed or speed.

Data on Depths of Cuts on Big Work

By William K. Stamets

The writer, who handles machinery in the Pittsburgh district, recently sent out a questionnaire to a number of representative concerns, in which the master mechanic or shop superintendent was asked to give his best opinion as to what is considered good practice as to the size of cuts which might be carried on a 36-in. and on a 60-in. triple-geared standard engine lathe. These sizes of lathes were chosen as fairly representative and as covering a considerable range. It was suggested that the work be assumed to be forgings of 0.50 carbon steel 18 or 20 in. in diameter. The information contained in the replies received was tabulated and is shown in the accompanying table.

SIZE OF CUTS WHICH MAY BE CARRIED ON 36 AND 60-IN. STANDARD ENGINE LATHES (TRIPLE GEARED) ON 18 TO 20 IN. DIAMETER FORGINGS OF 0.50 CARBON STEEL

	36-In.				60-In.			
No.	Depth Cut In.	Feed In.	Cutting Speed Ft.	Pounds per Hr.	Depth Cut In.	Feed In.	Cutting Speed Ft.	Pounds per Hr.
1	$\frac{1}{4}$	$\frac{1}{4}$	.....	.....	$\frac{3}{4}$	$\frac{3}{32}$	.....	.....
2	$\frac{1}{4}$	$\frac{1}{4}$	25	590 lb.	$\frac{3}{4}$	$\frac{1}{16}$	25	885
3	$\frac{1}{4}$	$\frac{1}{4}$	20	270 lb.	.....	.....	.....	.....
6	$1\frac{1}{4}$	$\frac{1}{16}$	35	705	$1\frac{1}{2}$	$\frac{1}{16}$	35	710
8	$\frac{1}{2}$–$\frac{3}{4}$	$\frac{1}{4}$	40	1,080 to 1,620	$1\frac{1}{2}$	$\frac{1}{4}$	40	2,700
14	$\frac{1}{4}$	$\frac{1}{16}$	.....	.....	.....	.....	.....	.....
16	$\frac{1}{2}$–1	$\frac{1}{8}$	40–50	810 to 1,350	$\frac{1}{2}$–1	$\frac{1}{8}$–$\frac{1}{5}$	40–50	810 to 1,350
17	$\frac{1}{8}$	$\frac{1}{4}$	25–30	420 to 504	1	$\frac{1}{8}$	30–40	810 to 1,080
20	1	$\frac{1}{32}$	.....	.....	.....	.....	.....	.....
21	$\frac{1}{2}$–1	$\frac{1}{4}$	.....	.....	1–$1\frac{1}{2}$	$\frac{1}{4}$	.....	.....
25	$\frac{1}{4}$	$\frac{1}{4}$	20	405	1–$1\frac{1}{2}$	$\frac{1}{4}$	20	540–607
28	$\frac{1}{4}$	$\frac{1}{4}$	60	1,418	$1\frac{1}{2}$	$\frac{3}{32}$	50	2,110
29	1	$\frac{1}{16}$	35	1,390	$1\frac{1}{2}$	$\frac{1}{16}$	35	2,085
31	1	$\frac{1}{4}$	20	540	1	$\frac{1}{4}$	20	1,080
32	$\frac{1}{8}$	$\frac{1}{32}$	16	336	$\frac{3}{4}$–$\frac{7}{8}$	$\frac{3}{16}$	12	360–420
34	$\frac{1}{4}$	$\frac{1}{16}$	.....	.....	1	$\frac{1}{4}$	.....	.....
37	$\frac{1}{2}$–$\frac{3}{4}$	$\frac{3}{32}$ to $\frac{1}{4}$	30–40	300 to 810	1–$1\frac{1}{2}$	$\frac{3}{16}$ to $\frac{1}{4}$	30–40	1,215 to 2,700
39	$\frac{1}{4}$	$\frac{3}{32}$	.....	.....	1	$\frac{1}{4}$	.....	.....
41	$\frac{1}{2}$–1	$\frac{3}{32}$ to $\frac{1}{16}$	.....	.....	$\frac{1}{2}$–1	$\frac{3}{16}$ to $\frac{1}{16}$	.....	.....
43	$\frac{1}{4}$	$\frac{1}{4}$	30–35	1,215 to 1,417	$\frac{1}{4}$	$\frac{1}{4}$	30–35	1,215 to 1,417
44	1	$\frac{1}{16}$	.....	.....	$1\frac{1}{2}$	$\frac{3}{32}$	.....	.....
45	$\frac{1}{4}$	$\frac{3}{32}$	.....	.....	$1\frac{1}{2}$	$\frac{3}{32}$	.....	.....
46	$\frac{1}{4}$	$\frac{1}{4}$	.....	.....	$1\frac{1}{2}$	$\frac{1}{4}$	.....	.....
47	...	....	.....	.....	$\frac{3}{4}$	$\frac{1}{4}$	35	1,417
48	...	....	.....	...	$1\frac{1}{2}$	$\frac{1}{4}$	15	1,518

One of the statements occurring frequently in the replies was that the present day heavy lathes have greater strength than the cutting tool and that the latter either loses its cutting edge or the tool breaks off. The statement was also made that greater trouble is experienced with the apron drive of the carriage than with the headstock drive. It has been the observation of the writer that this is quite generally true of engine lathes when performing heavy work.

Reference to the table will show, in the case of the 36-in. lathe, a depth of cut varying from $\frac{3}{8}$ to $1\frac{1}{2}$ in., feed per revolution varying from $\frac{3}{32}$ to $\frac{1}{16}$ in., cutting speed per minute varying from 16 to 60 ft., and rate of removal of material per hour varying from 270 to 1,620 lb. In the case of the 60-in. lathe, the table shows corresponding quantities as follows: depth of cut, $\frac{3}{4}$ to $1\frac{3}{8}$ in.; feed per revolution, $\frac{1}{8}$ to $\frac{1}{16}$ in.; cutting speed per minute, 12 to 50 ft.; material removed per hour, 360 to 2,700 pounds.

One manufacturer advises that on specially designed hogging lathes he was able to maintain in continuous service a rate of removal of material approximately 1,000 lb. per hour, but that on standard engine lathes such as are regularly sold, his observation led him to believe that for durability it should not be expected to remove material in the case of the 36-in. lathe faster than 450 to 500 lb. per hour, and in the case of the 60-in. lathe, 500 to 600 lb. per hour.

Some of the higher rates of removal of material shown in the table are probably based on the idea of using both front and rear cutting tools, thereby reducing by one-half the cross-section of the cut and greatly reducing the pressure on the point of the cutting tool. Some of the smaller rates of removal of material were doubtless presented by individuals in whose practice there is little occasion for rapid removal of large amounts of material. On long forgings it becomes convenient to employ a second carriage which increases the rate of removal of material in proportion as the additional cutting tools are kept at work.

Heat-Treatment of Thor Tool Parts

Efficient Methods of Heat-Treating Pneumatic Tool Parts—Remarkable Control System to Check Workmen—Up-to-Date Equipment in Shop and Laboratory

By J. V. HUNTER
Western Editor, *American Machinist*

THE heat-treating methods for pneumatic tools require the closest scrutiny in order to produce the quality of materials that are demanded for this class of tools. Pneumatic tools, and particularly



FIG. 1. FURNACE AND TESTING BENCH IN METALLURGICAL LABORATORY

hammers, are subjected to intense and rapidly repeated vibrations and shocks. These tend to produce the so-called crystallization of the microstructure of the steel that usually develops from minute flaws that are the result of improper treatment of the steel either during its manufacture or subsequent heat-treatment. Proper heat-treatment can reduce to a minimum the possibility of trouble occurring from these flaws. In the variety of work and multiplicity of materials to be handled, the tool plant has many problems. The handling of such problems has led to the development of special methods in the Aurora plant of the Independent Pneumatic Tool Co., Chicago, Ill.

There are few parts used in the makeup of this company's various lines of product that are not subject to heat-treatment of one form or another. The material composition of the parts is so different and their uses so diverse that a wide range of treatments is required to handle all of the varying conditions. Each batch of steel that comes in is carefully tested before it goes into process in the shop. It is frequently found that slight changes must be made in the methods of heat-treating apparently almost identical batches of steel of the same grade, in order to obtain the uniform physical properties that are required.

All shipments of special steels are first subject to chemical analysis to determine whether the material meets the specifications. The physical testing in so far as it pertains to heat-treating is handled in a laboratory connected with this department. A small portion of one of the laboratory benches that is shown in Fig. 1 contains two electrically heated furnaces used for treating samples. The furnaces are also used for checking thermocouples against established standards. Some of the electrical instruments used for this checking may be seen near the center of the bench.

The workbench shown in Fig. 2 has been especially arranged for the preparation of test specimens for microscopic inspection. Power for grinding and polishing is furnished by the motor located beneath the bench shown at the left. It drives a short lineshaft fitted with multi-speed friction clutches and tight and loose drive pulleys. The bench grinding stand at the right is fitted for the preliminary treatment of specimens that must be polished for etching. Two grinding wheels of equal diameter that have been cemented together are carried on each end of the arbor. Their grades range from a coarse, fast cutting wheel at the left to a very fine grade at the right, thus giving the operator four grinding steps toward getting his finished surface. Grinding is done on the sides of the wheels, not on the face.

The final polishing is done on the vertical spindle polishing wheels *A* and *B*. The first of these carries a coarse and the latter a fine grade of polishing compound. These polishing plates are steel disks similar to the one shown at *A*, Fig. 3, and have a socket on the under surface that fits over the upper end of the spindle. The top surface is covered with a cloth as

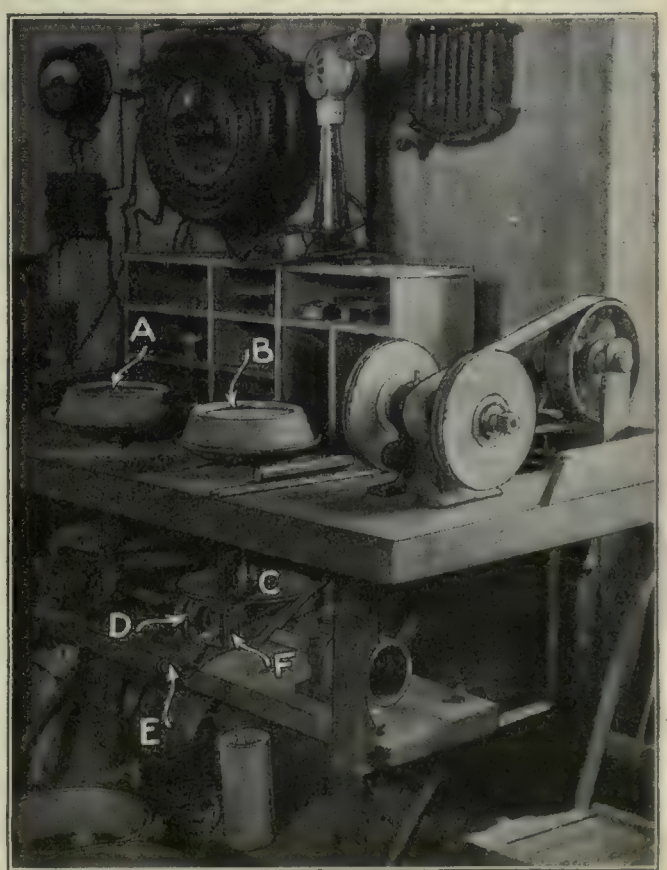


FIG. 2. GRINDING AND POLISHING WHEELS FOR PREPARING SAMPLES

illustrated. For the coarse polishing the grit used is flour emery and for the fine grade, No. 65 C alundum. A third disk can be substituted on either spindle for

finish polishing with rouge. Polishing is done wet, and for this reason the wheels are surrounded by spray guards that catch all the dirt and water and permit

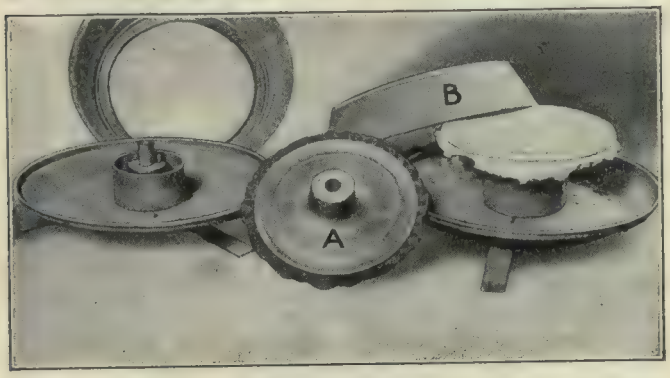


FIG. 3. POLISHING DISKS, SPINDLE HEADS AND GUARDS

it to drip into a receptacle provided for that purpose. One of these guards is shown removed from its place at *B*, Fig. 3.

The friction drive for these wheels can be seen beneath the bench. Each spindle has a steel disk *C*, Fig. 2, which is driven by a steel and fiber wheel *D* mounted on the main shaft. By adjusting the position of the fiber wheel with respect to the center of the vertical spindle a wide range of speeds can be obtained. To stop the grinding disks the lever *E* is raised to a notch on its guard *F* which separates the disk from the wheel *D*.

The electric drier used for drying the specimens after etching may be seen standing on the shelf in the center of the illustration.

Many grades of carbon and alloy steels are used and for each of them the metallurgist designates the heat-treatment to be given. Sometimes the same grade of steel is subjected to different treatments owing to its use for different kinds of service. All treatments have been standardized and are recorded on cards similar to the one shown in Fig. 4.

The treatments are divided into five main divisions and for each of these the same form is printed on a card of different color. The divisions and their designating colors are: Annealing, white card; heat-treating, yellow; carbonizing, blue; hardening, red; and drawing, salmon. There is a wide variety of treatments in each of these divisions and for each of the different treatments a separate card is made out and numbered in sequence. Thus at the present time the number of treatments in each of the groups is: Annealing, 20; heat-treating, 22; carbonizing, 17; hardening, 47; and drawing, 83. For special cases treatment cards are made out in the same manner and given a serial number.

Heat treating.

DATE _____ NO. 2

MATERIAL _____

ANALYSIS		DESCRIPTION OF OPERATION
CARBON		
MANG.		
PHOS.		Heat to 1600-1625 F. and quench in oil.
SUL.		
SIL.		
NICKEL		
CHROME		
VANADIUM		

FORM A-251 1700 12-15-19

FIG. 4. CARD USED FOR RECORDING HEAT TREATMENTS

Several sets of the cards are made up: One for the planning department, another for the metallurgist, a third for the attendant who checks the furnace temperatures. A set is always available to the furnace men and heat-treaters.

The desk and instrument board shown in Fig. 5 are used by the attendant who constantly checks the furnace temperatures. The open card-filing case that appears in the foreground contains the set of treatment operation cards that he also uses.

Each job that comes into the furnace department carries with it a record card that gives the catalog number of the part. From this number the operation performed on that part is determined by the standard records. The furnace man thereupon fills out the card



FIG. 5. INSTRUMENT BOARD AND RECORDS TABLE FOR FURNACE CHECKER

shown in Fig. 6 and turns it in to the furnace checker when the job goes into the furnace.

The reverse side of the card is a ruled, printed form as shown in Fig. 7. There are eleven main vertical division lines across the length of the card and each is numbered to correspond with the hour, so that the card covers the period between 7 a.m. and 6 p.m. A main division is divided by light lines into six divisions, each representing a period of ten minutes. The heavy horizontal lines divide the card into nine main divisions each representing 100 deg. of temperature; and these are divided by lighter lines into divisions indicating 20 deg. each.

In a case like the one shown in Fig. 7, the furnace checker determines the probable range of furnace temperatures as indicated by the requirements of the heat and designates the abscissæ accordingly. In this case the range is from 900 to 1,700 degrees.

The checker now proceeds to record the furnace tem-

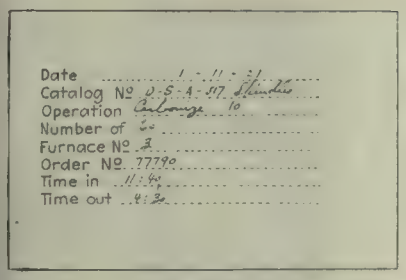


FIG. 6

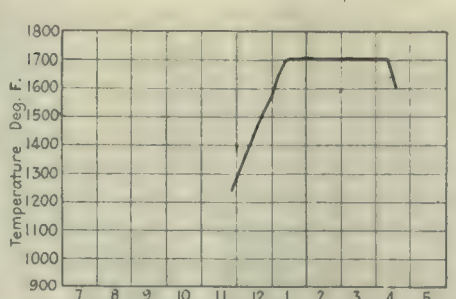


FIG. 7

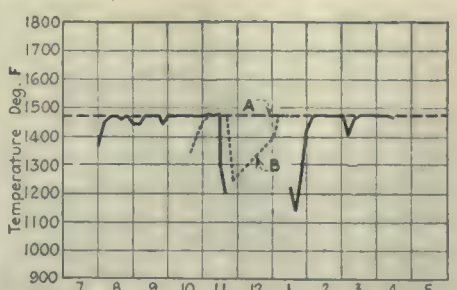


FIG. 8

FIG. 6. JOB CARD FILLED IN BY FURNACE TENDER. FIG. 7. REVERSE SIDE OF CARD, FIG. 6, SHOWING HEAT RECORD. FIG. 8. TEMPERATURE CHART FOR THREE HEATS RUN ON SAME JOB

perature as this lot of work passes through its treatment. The temperature is read at frequent intervals and plotted on the chart by pencil-point dots. A continuous line is drawn later, connecting these dots, and shows the rise of the furnace temperature to the proper point and indicates the time when the charge was drawn.

Jobs are frequently so large that they can neither be finished in one heat nor in a single furnace. An example of the way a job of this character is handled is shown in its chart, Fig. 8. This operation called for hardening from a temperature of 1,465 deg., so for convenience the checker drew a red pencil mark clear across the card at this temperature. (Represented in illustration by long dashes, *A*.) The other side of the card indicated that the operator would use two furnaces—No. 8, marked in black pencil and No. 7 in blue pencil. The checker has made his chart accordingly, showing the curve for No. 7 furnace in a blue line (dotted line *B* in illustration). The pencil-point marks show the respective checking of the three heats.

Electrical arrangements have been provided by which the furnace checker is able to keep close tab on the thirty-five or more furnaces in the shop. He can instantly signal to each furnace operator if the check shows that the furnace temperature has varied from its proper standard.

The indicating pyrometer in the case over the table can be connected in circuit with any one of forty thermocouples by means of the switches on the boxes *A* and *B*, Fig. 5. Either of these switch boxes is in turn thrown into the circuit by throwing the blades of the double-throw knife switch *C* either to the right or left.

The checker constantly passes through his pile of cards representing each furnace in service, reads the temperatures and plots that point on the curve. The minute that the check shows a furnace off temperature he signals the operator to that effect. This is accomplished by pushing the proper annunciator button on either switchbox *D* or *E*. At the same time one of the switches at *F* is closed. The switch at the left lights a blue light that indicates the temperature is too low; the right-hand switch lights a red light and indicates too high a heat. The center switch shows a white light and is only used to indicate the end of a run.

Mounted on posts in the furnace room, where they can easily be seen by the furnace men, are two signaling devices similar to the one shown in Fig. 9. When the checker in the office presses the annunciator button to indicate a furnace off temperature, the bell *A* rings and a hand on the indicator shows the number of the furnace that has been checked. The three colored signal lights are mounted above the indicator and a glance at these shows what trouble is indicated. On the opposite side of the post is mounted a case, Fig. 10, containing a pyrometer and switchbox for 20 thermocouples. This is always available to the furnace operators for checking their heats.

When the furnace checker signals a furnace a little white disk on one of the two signaling devices at *G*, Fig. 4, throws over to the left. When the furnace man perceives the signal, he acknowledges it by pressing a button in the electrical circuit and the disk is returned to the right.

A glimpse of a few of the furnaces and quenching tanks is given in Fig. 11. The furnaces cover a wide assortment of types and sizes, thus affording a variety from which may be selected the one best adapted for any given job. Most of these furnaces are at present gas-fired, using standard city gas as a fuel. However, a gradual change is being made and fuel oil burners are being adapted to some of the furnaces. Eventually oil will probably form the major portion of the fuel used. They have found oil to be a far cheaper fuel and with the improved burners lately installed the ease of control of the furnace temperature seems to be in no way affected.

The waste oils from the factory processes comprise a portion of the fuel used. These wastes include oil and naphtha from the various parts-washing tanks. There is considerable naphtha and it aids the combustion of the fuel.

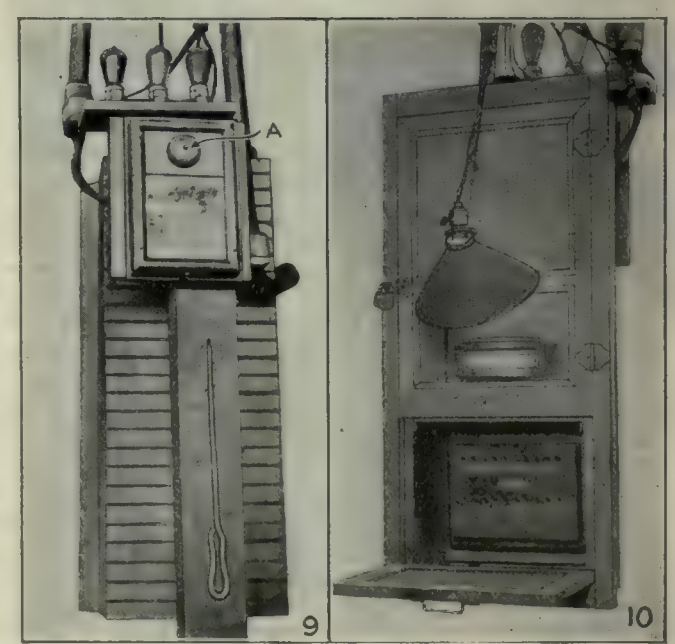


FIG. 9. ANNUNCIATOR AND INDICATING LIGHTS FOR FURNACE CONTROL. FIG. 10. PYROMETER CASE AND MULTIPLE CONTROL SWITCHBOARD

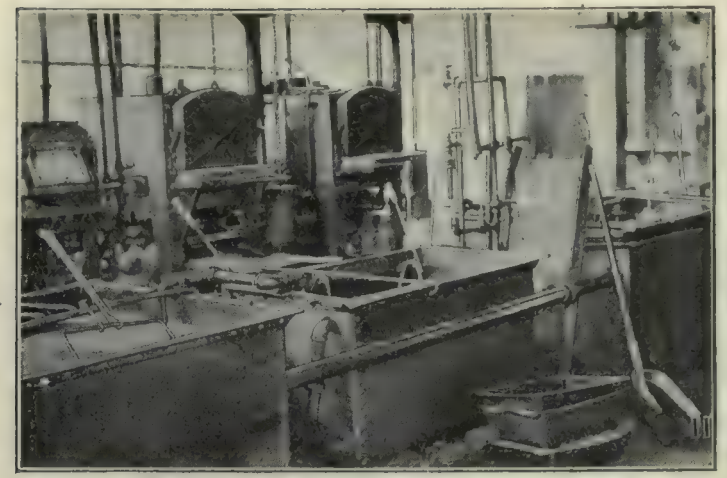




FIG. 11. A FEW HARDENING FURNACES AND QUENCHING TANKS. FIG. 12. BATTERY OF FURNACES FOR HEAT-TREATING AND CARBONIZING

A number of quenching tanks show in the foreground, and comprise a single row of tanks, faced on both sides by rows of furnaces. Tanks are provided with varied quenching mediums to meet all conditions, and these include clear water, brine solutions and quenching oils.

Only soft water is used in the water-quenching tanks. This is collected from the roofs of the shops and is stored in a large cistern, located near the buildings. Water is constantly pumped from the cistern and circulated through the quenching tanks, replacing the heated water which flows back to the cistern. A coil of pipe carries this cold circulating water through the brine tank for cooling that solution. The heated quenching oil is drawn from the tanks and circulated through cooling coils located in the cistern, and thence returns to the tanks.



FIG. 13. DEPARTMENT FOR PACKING CARBONIZING POTS

A row of Tate-Jones furnaces recently installed for heat-treating and carbonizing is shown in Fig. 12. These replaced a row of home-made furnaces that had been in service for a number of years. The first five furnaces in the row are gas-fired and the remainder burn oil. The majority of the furnaces have only a single burner but three are provided with double burners for obtaining high temperatures and equalizing the heat.

One of the trucks used for handling the carbonizing pots is shown in the foreground. The platform of the truck stands level with the floor of the furnaces so that loaded carbonizing pots are easily slid from one to the other.

The carbonizing pots are packed and unloaded in a room separate from the furnace room and shown in Fig. 13. This separation has a number of advantages: It keeps the carbonizing supplies from littering the furnace room; the dust and dirt is shut off by itself, and lastly, trucks loaded with heated pots can be pulled out here to cool without adding to the discomfort of the furnace tenders.

The casehardening pots most commonly used are cylindrical in form and are made in the shop from sections of steel pipe in which disks are acetylene-welded to form bottoms. They are 4, 5 and 6 in. in diameter and are 11 in. high. Rectangular pots are also used for certain classes of work, and these are usually 6-in. or 11-in. cubes. The stock of spare pots is carried on a steel rack that has been constructed along the wall shown at the right of the illustration. Bins on the further side of a doorway serve to store the carbonizing materials.

Several makes of prepared carbonizing compounds are in use, the dominant considerations in selecting them having been the power of penetration and life. The life is determined by the rapidity with which the compound turns to dust, as it is then worthless. To prevent unnecessary burning of the compound after loading, all pots are carefully covered with fireclay.

The tall sheet-metal case shown at the rear of the room, partially covering the window, is an apparatus now under construction for recovery of the carbonizing material. The greatest loss of this material occurs as it gradually is mixed with dust from the fireclay luting

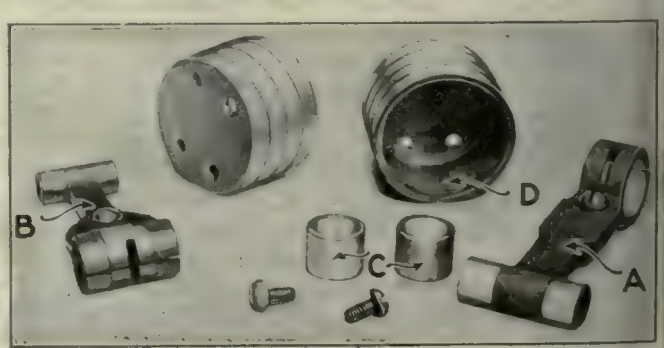


FIG. 14. PARTS COPPER-PLATED FOR SELECTIVE CARBONIZING

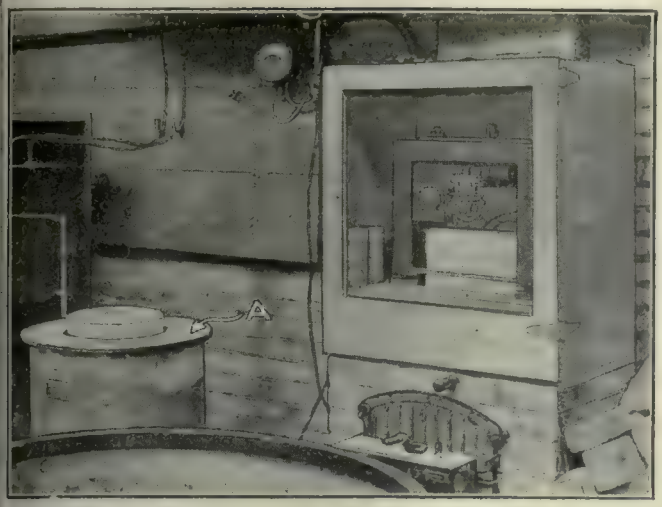


FIG. 15. ELECTRIC FURNACE USED FOR HARDENING DIFFICULT WORK

and from burned-out carbonizing material. To continue the use of such material would result in spotted carbonizing and it must be rejected although its major portion is still suitable for producing a good "case."

Upon the completion of this apparatus all case-hardening material will be dumped from the pots into a bin at the base and carried from there by a light chain-bucket conveyor to a hopper at the top. From the hopper the material will slowly fall over a series of sloping screens inside the casing. The screens will be graduated in size so that all material classed as waste will be separated. At the same time an upward blast of air will be drawn through the casing by a suction fan, and this air blast is expected to carry away with it the major portion of the fine dust and waste. When the material reaches the bottom it will fall into a bin from which it will be elevated to a storage bin.

The success of carbonizing on certain classes of pneumatic tool parts depends upon sectional coating that will give a "case" where wear occurs and leave other sections soft. Examples of work that have been so treated are shown in Fig. 14. Two methods are employed for applying a protective coating to the portions that are not to be carbonized. One of these is an enamel that can be painted over portions of steel parts, but this is not so convenient as is copper-plating. The parts shown have been copper-plated over those surfaces that appear shaded, leaving the bright surfaces clean and ready to take a "case."

The piece *A* is a connecting rod for an air motor, and *B* is another of a different type. The bushings *C* are copper-plated outside and clean inside. The pistons *D* for air motors are drawn steel cups that are hardened only on the outside. These were once plated all

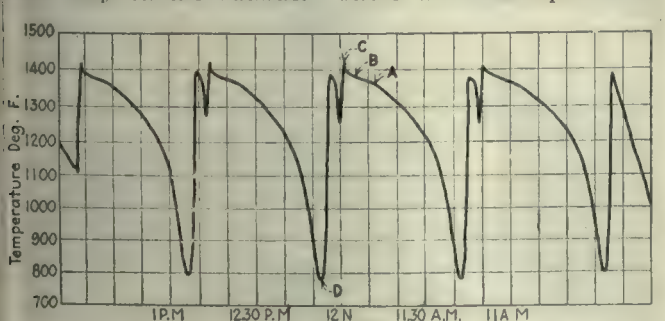


FIG. 16. TEMPERATURE CHART FROM THE ELECTRIC FURNACE

over and then turned off on the outside to remove the plating. It was found that the removal of stock and heating during the treatment relieved internal strains and caused distortion that was blamed on the carbonizing department. Now they are annealed first and then turned, and the outside surface is covered while in the plating bath to prevent coating. Since this reversal of operations no distortion occurs.

A Leeds and Northrup electric hardening furnace controlled by an automatic recorder has been lately installed and is shown in Fig. 15. The furnace *A* is operated by the "hump" method for determining the critical temperature for hardening steel, and is used on particular work, such as spring clips, rivet set clips, exhaust deflectors, connecting-rod clamps and ball races and cones. The "hump" method of hardening depends upon determining the critical point at which the steel should be quenched by watching the rate of absorption of heat by the work. At the critical point the temperature momentarily stops rising. During this period the material stores up an amount of latent heat.

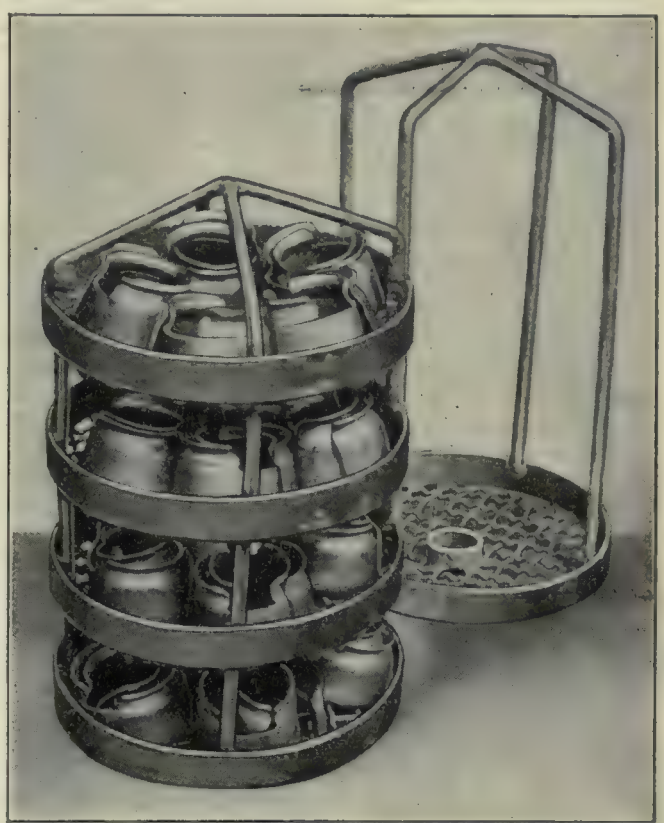


FIG. 17. BASKET WITH FOUR TRAYS FOR HANDLING WORK

The determination of the critical point is strikingly illustrated by the continuous chart recorded by the pyrometer as shown in Fig. 16. This line reads across the sheet from right to left, and the divisions were marked for time and temperature after the removal of the sheet from the instrument.

It will be noted that the temperature curve rises at a fairly even rate until the point *A* is reached. At this point it flattens out and there is a large absorption of heat with little increase in temperature until the point *B* is reached. From the latter point the temperature curve rises very rapidly. This indicates to the furnace attendant that the charge should be drawn and quenched; however, he usually permits the

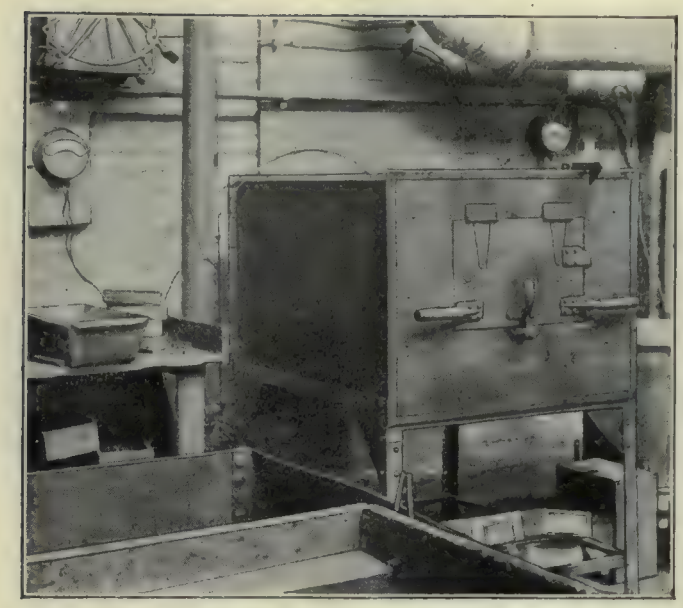


FIG. 18. EATON ELECTRICALLY-HEATED FURNACE USED FOR TEMPERING

temperature to rise an additional ten degrees. The last rise provides for the loss of heat while transferring the work from the furnace to the quenching tank. At the point *C* the furnace is opened and its temperature momentarily falls very rapidly until the cover is replaced. The temperature then rises until a fresh load is charged, whereupon it falls to the point *D* and then starts on a new cycle.

When starting the furnace on a heat the electric current is regulated by a rheostat. The current flowing through the furnace is indicated by an ammeter on the wall at the left of the pyrometer case shown in Fig. 15. It is customary to start the heat with a current of 20 amp., which brings the furnace up nearly to temperature in 25 to 30 min. The current is then cut down to 10 to 15 amp. and this rate is continued during the hardening operations. The ampere rate depends upon the character of work in the furnace and the length of time that has been established for bringing it up to its hardening temperature.

A special basket with four trays used for handling the work in the electric furnace is shown in Fig. 17. This basket was devised in the shop for handling particular classes of shop work. It differs from the standard type of basket, used on this furnace, which has only a single tray as exemplified by the basket shown in the background of the illustration.

It was noted that the machine finish on many piston crankshafts and other small parts had been roug ground before hardening. Other parts were buffed a rag-wheel to a fairly smooth finish. This was e plained to be one of the plant precautions to avo checks and flaws that might occur in hardening a later develop seriously when the part was in servic These checks usually start from minute cuts like too marks and by removing these before hardening a po sible source of future trouble is thought to be elim nated.

The Eaton electric oven shown in Fig. 18 has late been installed and is now used for tempering parts th must be drawn to a high heat. Its temperature ran as used in this plant ranges above that obtainable an oil bath and will run from 400 to 1,000 deg. The temperature of the furnace is controlled by rheostat.

There are certain portions on some of the harden tool parts that are subject to considerable shock wh in service. These portions are tempered by selecti drawing methods that have been developed to a hi degree of success. This work is done on benches, shown in Fig. 19, where gas burners are employed pairs for heating the work. The workman is sho using the gas flames to heat opposite sides of the wo until the temper of certain spots has been drawn the proper color. A pair of the burners *A*, support by the standards *B*, can be swiveled or tilted to a desired position. The standards have a weighted ba and can be moved freely about the bench as far as t length of gas hose permits. A light blast of compress air is used in the combustion of the gas flame, and t blast can be regulated to spread the flame or draw to a needle point.

Practically all work submitted to heat-treatmen undergoes some degree of distortion. Therefore it carefully inspected before it leaves this departme and assurance is given that it is in proper conditi for subsequent machining operations. Crankshafts a similar parts are tested between bench centers as sho in Fig. 20 and an indicating dial reading to thousandt of an inch is used in testing the throws. Consta practice in this operation enables the operators become surprisingly adept and a crankshaft is ve quickly straightened.

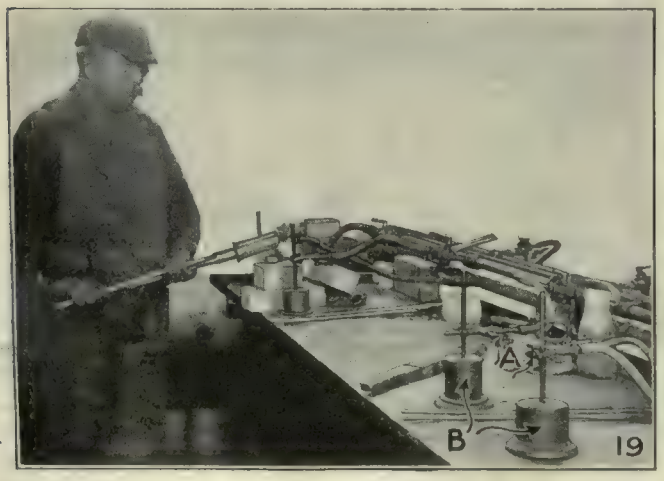
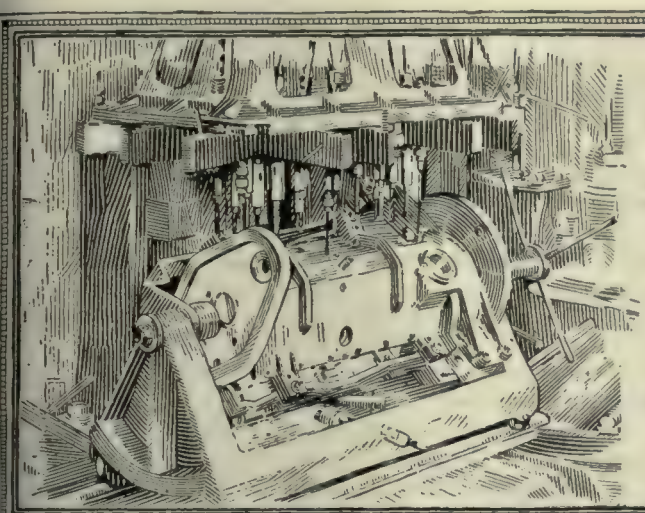




FIG. 19. SELECTIVE DRAWING BY HEATING WITH GAS BURNERS. FIG. 20. STRAIGHTENING CRANKSHAFTS AN OTHER PARTS AFTER HEAT-TREATING



Tool Engineering

By

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Drill Jig Design Continued—Bushing Design and Proportion—Methods of Holding Slip Bushings—Standard Knobs and Thumbscrews—Ejectors

VARIOUS methods of making bushings, of which some are good and some bad are shown in Fig. 62. The bushing shown at *A* is too short and does not ive proper alignment for the drill, so that it is likely o cause inaccuracy as indicated at *B*. It is well to nake a bushing from two to hree times the length of the rill diameter if possible so hat it has an appearance imilar to that shown at *C*. So doing keeps the drill in ood alignment and does not end to produce angular holes. A bushing should have suffi- ient stock in contact with the ole into which it is pressed hat it will not tend to loosen hen in use. The bushing hown at *D* has only about ne diameter in contact with he hole into which it is ressed whereas the bushing has over two diameters. It s sometimes possible to use a onstruction like that shown t *E* where the jig wall is thin, nd it is not possible to obtain reat depth for the bushing. screw such as that shown at can be used to hold the ushing in position.

In regard to the relieving f the inside of the bushing, he form shown at *G* is tapered or a part of its length, a onstruction much better than if counterbored as hown at *H* because in the latter case the drill lip ay strike the edge of the counter-bore and cause rouble. Jig bushings are usually rounded to facilitate he entrance of the drill as indicated at *K*. It is advis- ble to use a large radius in the mouth of the bushing herever possible. Data relative to the distance be- veen the work and the bushing have been given in a revious article.

Slip bushings are used in many cases where it is necessary to drill and ream the same hole in the same jig. The first bushing is made to the drill size and the second bushing to the reamer size. When slip-bushings are used provision must be made to prevent the bushing from pulling out of the jig when the drill is being removed. Several varieties of locks or clamps are shown in Fig. 63. There is shown at *A* a very common type which has a pin *B* with a shoulder which locks the bushing in place, a type used in the majority of shops. A bail-bushing is indicated at *C*. There are advantages to this type of bushing for large work in that it is conveniently removed, as the bail acts as a handle and the bushing is locked in position by snapping the bail down over the pin at *D*. Another form of lock for a

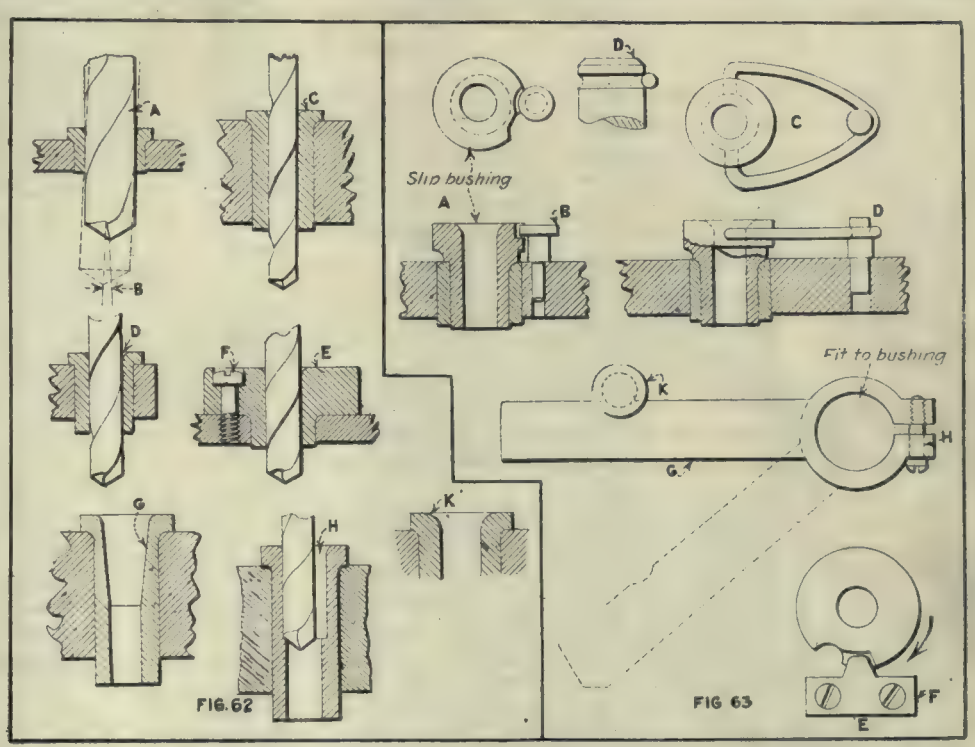


FIG. 62. BUSHING DESIGN AND PROPORTIONS. FIG. 63. METHODS OF HOLDING SLIP-BUSHINGS

For the authors' forthcoming book. All rights reserved.

slip bushing is shown at *E*, embodying the same principle as that used at *B*. Instead of using a pin for locking, a steel block as shown at *F* is screwed to the jig body. Another form of clamp for holding a slip bushing is shown at *G*. The lever is clamped around the bushing by means of the pinch-binder at *H* and the bushing is prevented from pulling out of the jig by means of the retaining pin *K* which is shouldered so that the lever passes under it. The action of the drill tends to throw the lever against the pin *K*. In removing the bushing the lever takes the position shown by the dotted line.

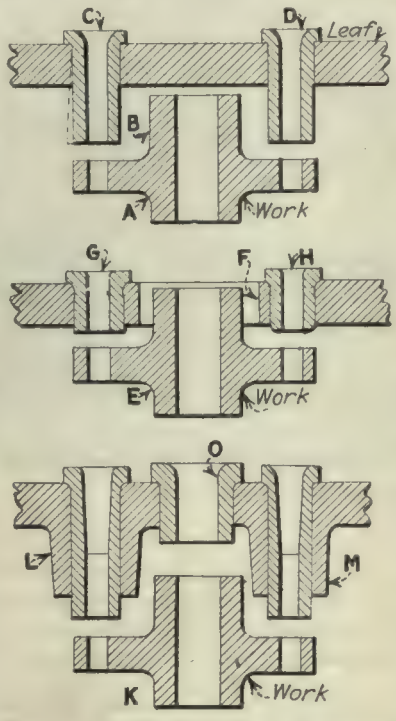


FIG. 64. LOCATING OF BUSHINGS

The shape of the work to be drilled influences to some extent the location of the bushings. There are cases where a piece of work is so designed that it is difficult to place the bushings so that accuracy will be assured in the drilling operation. In the first article of this series the effect of design on the machining process was commented upon to quite an extent, and it was pointed out that the design of the work is an important factor which influences the efficiency of jigs and fixtures. There are some tool designers who are very harsh in their criticism of the pieces for which they are called upon to design tools and are continually suggesting changes in their design. Changes in design are costly, especially if they cause the changing of expensive patterns, and should not be made unless there is something worth while to be gained.

However, it was pointed out that there are numerous instances when a change in design would result very profitably to the manufacturer.

A piece of work is shown at *A*, Fig. 64, having an extended hub *B*. The inexperienced designer would be very apt to locate his bushings as shown at *C* and *D*, without sufficient support in the jig body. Either of two methods can be used to avoid the difficulty. In the method indicated at *E* the jig body is cut out at *F* to allow the hub to pass up into it so that the bushings *G* and *H* can be so made that they will have sufficient contact with the jig body. Another method is indicated at *K*, where the body of the jig is carried down in the form of bosses *L* and *M* to give stock for the bushings. Provision is made for driling the center hole through the bushing *O*.

The ability of the tool designer is frequently shown in small ways such as the application of thumbscrews or knobs to operate various moving parts in the jig. It is well to consider the fact that the workman who handles a jig or fixture has to use his hands all day long. Speaking generally, a knob or thumbscrew should be so arranged that the operator can use it without "skinning his knuckles" on some surrounding part of the jig. The form of the knob should be such that it will not make an operator's fingers sore.

It is advisable to avoid the use of knurled screws as far as possible, because they tend to make an operator's fingers tender if used frequently. The knob shown at *A*, Fig. 65, can be made with as many points as desired and it can be of steel or cast iron. If it is standardized, a number of sizes can be made up and carried in stock to suit various conditions. The hole may be drilled so that it can be readily fitted to standard sizes of screws or studs, as shown at *B*. A pin *C* is generally used to fasten the knob in position.

Another type of knob, shown at D, can be used to advantage in numerous cases. The knob itself may have as many notches as seem desirable, this being a matter for individual decision. In this case the knob is made with a long hub tamped out at *E* so that it can be used to pull up on a stud or down on a clamp; in fact it can be used in a number of ways which will suggest themselves to the tool designer. These knobs also can be made up in several sizes and carried in stock. A very common method of providing a means of adjusting a screw is shown at *F*, where a pin *G* is driven into the end of the screw to act as a handle. In the writers' opinion this construction should be used very seldom, except when very light pressure is to be applied. The objection to this method is that it is hard on an operator's fingers and that he is frequently tempted to use a wrench in order to tighten the screw; as a result the pins very soon become bent and practically useless.

A general form of pin knob is shown at *H* in which the pins are four in number and are set in at an angle. Even in this case however there are objections to the form used for much the same reasons as previously stated.

A very excellent form of knob or thumbscrew is shown at *K*. This form has become a standard in many shops and is excellent both from the viewpoint of economy and convenience of operation. The knob has three points which accommodate themselves to the operator's fingers and do not make them sore. It is a form tha

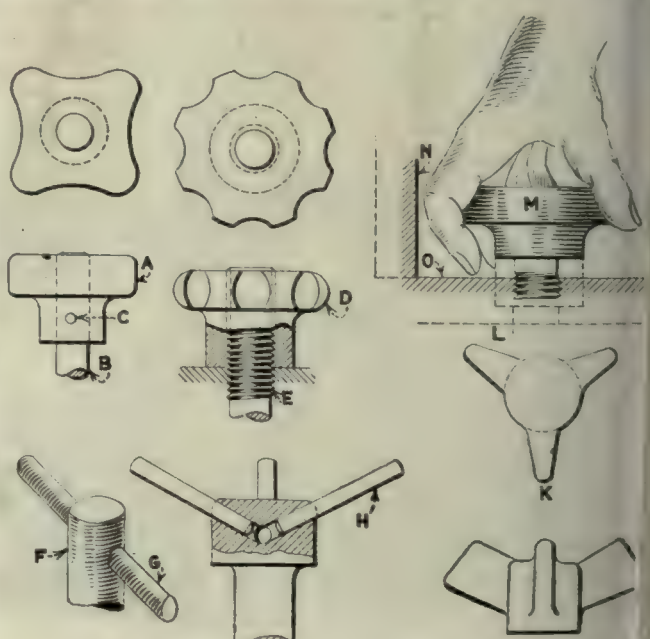


FIG. 65. STANDARD KNOBS AND THUMBSCREWS

can be used as a nut when drilled and tapped, or in a manner similar to that shown at *A*.

A diagram which indicates the importance of clearance for the operator's fingers is shown at *L*. The knob

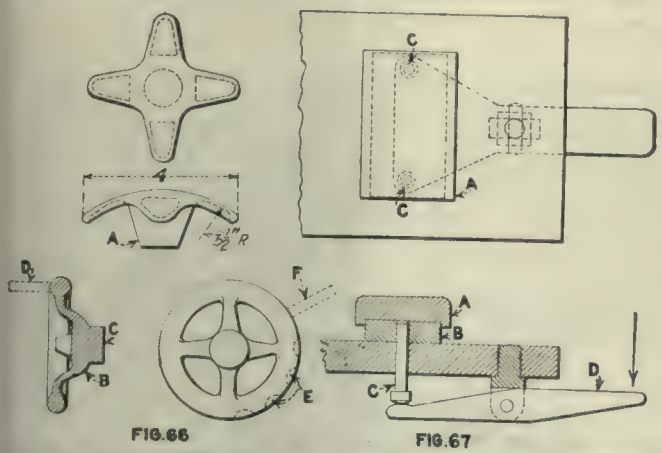


FIG. 66. HANDWHEELS AND LARGE KNOBS

FIG. 67. SIMPLE EJECTOR FOR DRILL JIG

M has been so placed that there is very little clearance for the workman's fingers between the screws and the walls of the jig *N* and *O*. The amount of clearance necessary is shown by the dotted lines. It is a very good idea for a tool designer to imagine that he is operating the jig himself, making sure that his finger clearance is ample. At the same time he must remember that the shop man's hands are somewhat larger than his own and he should therefore make considerable allowance for finger clearance. The writer has frequently seen jigs, considered good by the drafting room, that caused the operator untold trouble, due to improper provision for his fingers.

It should be remembered by the tool designer that the amount of pressure to be exerted influences the size of the knob to be used and it is sometimes found desirable to use a knurled screw in order to prevent the application of pressure enough to distort the work or spring it out of its true position.

On large fixtures it is frequently necessary to use handwheels or large knobs in order to provide pressure sufficient to operate the mechanism. The beginner is very apt to be "stingy" in the details of his design whereas the experienced designer is "generous" and makes a "comfortable" jig which can be used with satisfaction by the operator.

A form of hand knob which has found a great deal of favor with manufacturers in general is shown at *A* in Fig. 66. This form of knob is usually made up in one or two sizes, the example shown being the 4-in. size. A knob of this kind is used only on large fixtures and jigs where considerable pressure is needed. It is generally made of cast iron and the hub is left solid so that it can be drilled or tapped to suit particular conditions. The advantage of this knob is that it fits the palm of the hand and the fingers can go down between the points which enables the operator to get a good grip.

On large fixtures it is often desirable to use handwheels such as that shown at *B*. Handwheels of various sizes can be purchased cheaply and can be drilled or tapped in the hub *C* to suit any particular job. It is also possible to provide the wheel with a handle, as shown by the dotted lines at *D*, if desirable.

There may be cases where it is an advantage to notch a handwheel as shown by the dotted lines at *E* so that an operator can get a little better grip. A handle can be put in as indicated by the dotted lines at *F* to provide more leverage.

There are many cases when it is essential to provide a means for removal of a piece of work from a jig or a fixture. It is not good practice to make up a jig in such form that the operator must use a hammer or screwdriver to get the work out after it has been machined. A simple form of ejector may be used, such as shown in Fig. 67. The work *A* has been placed on the locator *B* which it fits snugly. To remove the work the operator would be obliged to use a screwdriver to pry it off from the locating plug *B* unless provision was made for ejection. It is a very easy matter to insert the pins as shown at *C* and to operate them by means of the lever *D*.

There are many cases where a somewhat simpler form of ejector can be used. The pins *C* could be held by a retainer and the lever *D* left off entirely. The operator could provide a wooden block on his drilling machine table and operate the ejector by striking the pins on it.

There are occasional cases where the removal of a piece of work from the jig requires that considerable

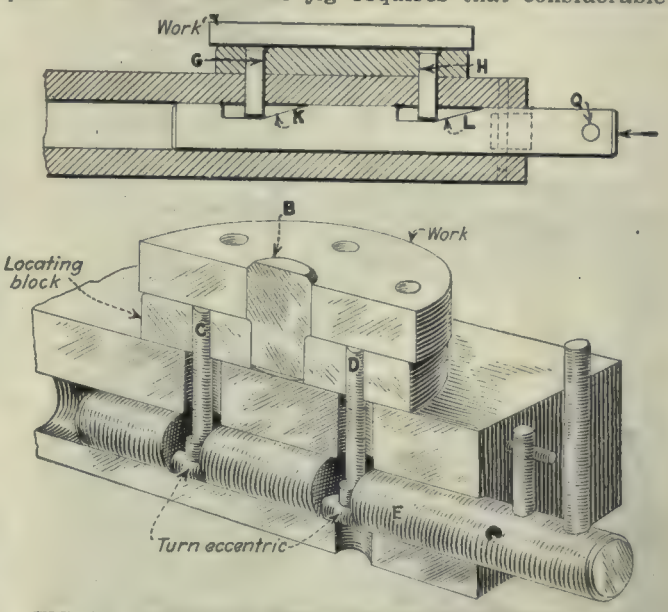


FIG. 68. EJECTORS OPERATED BY ECCENTRIC AND WEDGES

attention be paid to the method of removal. A case of this kind is shown in Fig. 68 in which the work *A* is located on a central stud *B* which it fits closely. Ejectors are formed in this instance by two pins *C* and *D* which extend through the locating block as indicated and rest on eccentric portions of the shaft *E*. When the lever *F* is operated the eccentric cause the pins to rise and push the work from the plug. Another method of operating a similar mechanism is shown in the upper part of the figure. The ejector pins *G* and *H* are operated by means of the angular surfaces *K* and *L* on the rod *P*. A pin or hand knob can be provided at *Q* or as conditions require.

Speaking generally, the use of ejectors would be required on any piece of work that could not be easily removed by hand. It is advisable to consider the conditions and the necessity for ejectors when designing any jigs in which the location is by means of finished surfaces, pins, or plugs. When ejectors are used the pressure must be distributed in such a way that it will not cause a "cramp" or "cock" in the work.

Installation of Motor Drives on Old Tools

Expedients Resorted to in a Railroad Shop to Provide Individual Motor Drive for an Old Planer and a Boring Mill

By J. H. VINCENT

SOMETIME ago the Chicago & Alton R.R. completed its new locomotive shop at Bloomington, Ill., and moved into it machine-tool equipment that had been in the old shop. In connection with the installation, it was desired to install some of the larger machines in the main bay under crane service. The machines are of old types, fitted only for belt drive; it therefore was necessary to build some form of frame or scaffold in which the standard countershafts, together with the new drive motors, could be mounted.

The construction of the steel scaffold used for line-shaft mounting on a large Bement planer is shown



FIG. 1. MOUNTING FOR DRIVE OF LARGE PLANER

in Fig. 1. This planer is usually employed on side and connecting-rod work. The motor is mounted on the top at *A* behind a silent chain-drive housing. Chain drive is used for the first speed reduction on account of the short distance between shaft centers. It is also used for a drive from a stud shaft to the mechanism operating the cross-rail elevating screws. The motor controller box is at *B*, with a safety switch and fuse plugs in the smaller box above.

The scaffold mounting of the countershaft and motor for a smaller planer is shown in Fig. 2. The first speed reduction on this drive is likewise a silent chain that is uncovered as will be seen in the illustration. All belts from the countershaft to the pulleys on the

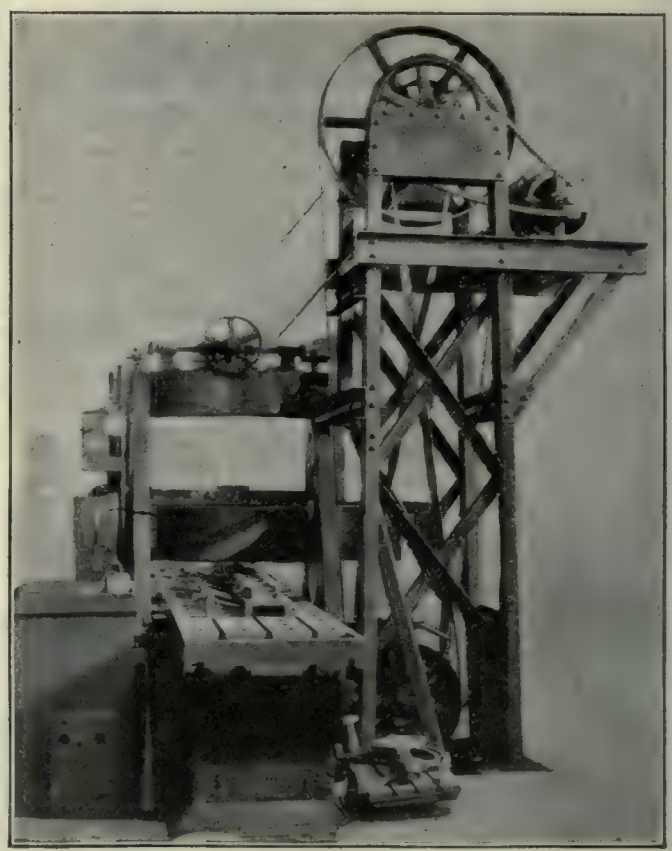


FIG. 2. STEEL FRAME FOR PLANER DRIVE MOTOR AND COUNTERSHAFT

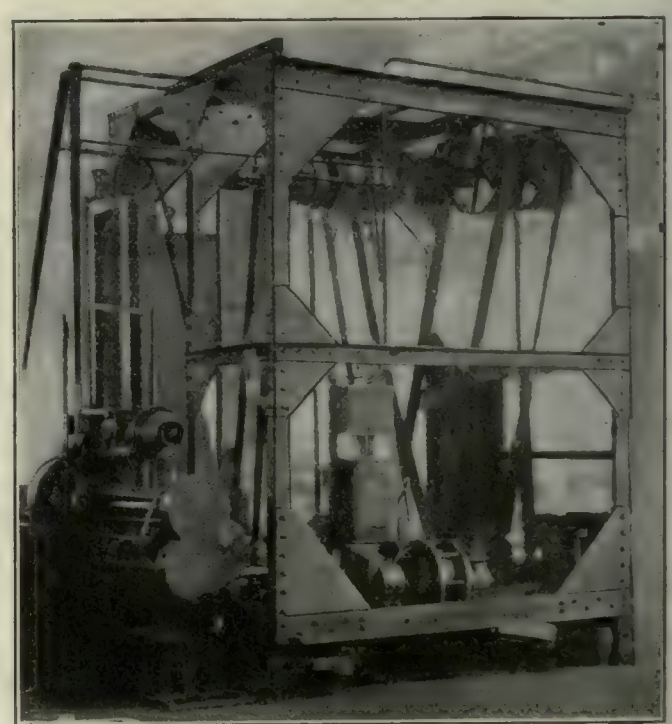


FIG. 3. HEAVY FRAME FOR MOUNTING DRIVE OF HORIZONTAL BORING MILL

planer are inside the scaffold frame, and, thus guarded, insure greater safety for the workmen.

The frame required for mounting the heavy countershaft of a large horizontal boring mill is shown in Fig. 3. Its general type of construction is different from those previously shown. The diagonal bracing has been eliminated and large gusset plates are employed to lend the stiffness required by the frame. The motor is mounted on two I-beams that rest on the floor and its starting box is mounted on cross-bracing located in easy reach of the operator. The unusual mounting for the belt shifting levers and rods shows on the upper left-hand corner of the frame.

Natural Sandstones and Artificial Abrasive Wheels from a Health Hazard Standpoint

By A. Rousseau
Safety Engineer

[Our recent publication of the gist of a report by Dr. W. Herbert Drury of the U. S. Public Health Service, entitled "Wet Grinding a Dangerous Occupation," has been the cause of considerable comment and we believe that more complete information should be given. Needless to say, the natural inference is that the caption applies to the occupation of wet grinding as a whole, whereas the figures used were obtained from three Connecticut villages in which the manufacture of axes is a major industry, where the operation of wet-grinding, as conducted, *is* a "dangerous occupation." The operation in question is that of grinding axes, hatchets and similar products upon sandstone wheels, the sandstone having certain characteristics that make it desirable for use where production is required without drawing the temper of the work.

What the report does prove is that the use of natural sandstones for axe grinding is extremely dangerous to the health of the operator and that this danger is not eliminated by the use of water. It is perfectly obvious that if natural sandstones were used without water, the operation would be infinitely more unhealthful, if not absolutely prohibitive.

It appears that another thing which was not made clear in our extract from the public Health Report is the fact that the dry grinding referred to was done on artificial abrasive wheels. The difference in structure and grinding action of natural sandstones and artificial grinding wheels is really responsible for the great difference in the amount of dust produced in the two series of tests, in spite of the fact that a stream of water was constantly applied to the natural sandstone and only a dust exhausting system to the artificial grinding wheel.

The following article explains the objects, conditions, and results of the tests.—Editor.]

A recent study has been made by the United States Public Health Service in an axe factory to determine the difference between wet and dry grinding in their effect on the health of workers. The report* on this study is very interesting, as it explains some things which have not heretofore been generally understood.

It has been known for some time that in those plants where the natural sandstones have been replaced by the modern artificial grinding wheels a very noticeable improvement in the working conditions has taken place. The report states that where a suitable exhaust system has been installed in connection with artificial wheels, improvement over the old wet sandstone method has been so great as to put the health risk of the operator in an entirely different class. In fact, according to the report, "the air in such dry grinding shops is comparatively free from industrial hazard."

In making the study referred to, the investigators used scientific apparatus by which it was possible to determine the actual number of dust particles of various sizes in the air at any time. Previous investigations in other industries had shown that only those particles of dust which measure 10 microns and under in diameter need be considered as having any effect on the health. (Note—10 microns equals approximately 0.0004 in.) It had also been determined that where the number of these particles is less than 200,000 per cubic foot the condition of the air would not be considered dangerous.

Ten tests were taken in a room of the axe factory where dry grinding is done on artificial grinding wheels provided with exhaust system. These tests showed an average of 154,500 particles per cubic foot, measuring 10 microns and less in diameter. This indicated that the amount of dust in the air was well below the danger point.

Thirty-two tests were then taken in the wet-grinding shops where the grinding is done on natural sandstones and where water is applied to the wheels for the purpose of preventing dust. In spite of the water, however, the tests show that the conditions were much worse than in the dry-grinding departments. The 32 tests showed an average of 15,800,000 particles per cubic foot, measuring 10 microns in diameter and less. This is over 100 times as many as in the dry-grinding room and means that for every particle of this size which an operator in the dry grinding breathes, an operator in the wet-grinding department breathes more than 100.

The report explains that the water is ineffective because the men, in order to turn out more work in a given time, do not use as much water as they should, "and in grinding a heavy object like an axe upon a wheel of soft natural sandstone, the workman presses so heavily upon the wheel that the superficial film of water is pushed back behind the axe and the outer surface of moist stone is ground off, exposing a dry surface which in turn is abraded and discharged as atmospheric dust."

There is one other feature which is not described in the report but which helps explain the great difference in the amount of dust produced by the two methods. This is the greater life of the artificial grinding wheel. Such a grinding wheel of proper grain and grade will outwear at least fifteen natural sandstones of the same size. This means that while grinding a certain number of axes on a natural sandstone, about fifteen times as much material is worn away as if the same work were done on an artificial grinding wheel.

There is also a decided difference in the structure of the two types of wheels. The material worn away from a sandstone is finer than that worn from a grinding wheel, and for that reason each cubic inch of sandstone material contains more particles of the size which are small enough to be dangerous than are contained in a cubic inch of artificial abrasive wheel material.

From these studies it seems reasonable to conclude that the best way to protect the operators in axe-grinding shops and similar industries from respiratory disease is to replace natural sandstones with efficient artificial grinding wheels and to provide these with proper exhaust systems.

*Reprint No. 616 from "Public Health Reports," October 8, 1920, pp. 2393-2401.



The Foreman and His Job

Suggestions for live foremen who wish to go up the ladder, and for firms who want better shop executives

By FRED H. COLVIN
Editor, American Machinist

THE establishment of a training school is always a difficult problem if it is to be efficient and a paying investment. We must first find out just what we want to accomplish and then decide the best methods of going about it.

As stated in a previous installment, we must first decide what we want to teach, and whether we want the workers to be "one operation" men and women, or want them to have a fairly wide knowledge of the operations in our shop. It may be that we want to teach some but one operation and others three or four operations, while only a few will qualify for our full training course.

Next we must decide whether this training shall be done in a school or in the shop. Here again we find a great variety of opinion, some advocating one method and some the other. In some cases it will doubtless be advisable to combine the two methods, starting everyone in the school, perhaps, who has had no previous training, and even completing the training of some of those who are to learn only a few operations. The training school has the advantage of getting entirely new workers somewhat accustomed to the machinery before going into the shop itself.

The organization of some shops makes a training school hardly necessary, as there are subforemen in each department to act as instructors right on the job. Where this is possible it frequently has advantages, But in such cases there should be some central point, either in the shape of a general foreman or of a committee, to insure the instruction being along similar lines, with similar aims, at the same time leaving as much individuality as possible to the different instructors or subforemen.

All the instruction should follow a general plan but each instructor should be allowed as much opportunity as possible to be himself, or herself, in the methods used and the way in which the workers are handled. Personality differs widely and some secure results by one method, others by entirely different means. As long as the desired results follow, the exact method should not be too closely questioned or standardized.

One difficulty in training new people, who know nothing of the business, is to assume that they know more than they really do. And if we overlook elementary points we are building on an insecure foundation.

It seems as though anyone might know that it is necessary to have center holes in work or mandrels clean if the work is to run true. And yet there have been many cases where work has been spoiled because these very obvious points were not thoroughly explained and made clear to the worker. We must remember that to the novice the center hole seems just a hole to keep the work or mandrel from falling off the "points" in the lathe. The effect of a chip in the center hole might not even be considered unless we call particular attention to it. It is little things like this which go far to make an instructor a success or a failure.

Don't be afraid of going into details and always tell *why*. No matter if some do not understand the reason, all who do are going to be better workers for knowing it.

Take any job you give a new worker and analyze it from start to finish. Make a list of every move you make, everything you do. No matter if these moves

TABLE I. THE EIGHT STEPS IN TEACHING ELEMENTARY INSPECTION

	Hours
Inspection Lesson No. 1— Measuring pins and block with scale and marking sizes on blank blueprint	3
Inspection Lesson No. 2— Measuring plate and holes in plate with scale and calipers and marking sizes on blank blueprint	1½
Inspection Lesson No. 3— Using scale for measuring plate and thread pitch gages and scale for measuring threaded holes in plate and marking sizes on blank blueprint	1½
Inspection Lesson No. 4— Using scale and thread pitch gages for measuring threaded plugs and marking sizes on blank blueprint	1½
Inspection Lesson No. 5— Measuring pins with snap gages and marking sizes on blank blueprint	1½
Inspection Lesson No. 6— Measuring pins with snap gages and marking sizes on blank blueprint	3½
Inspection Lesson No. 7— Measuring bevel gears with protractor, scale and calipers and marking sizes on blank blueprint	1½
Inspection Lesson No. 8— Inspecting test shaft with gages used on all previous inspection points; also marking all sizes and notes on blank blueprint	4
Total	18

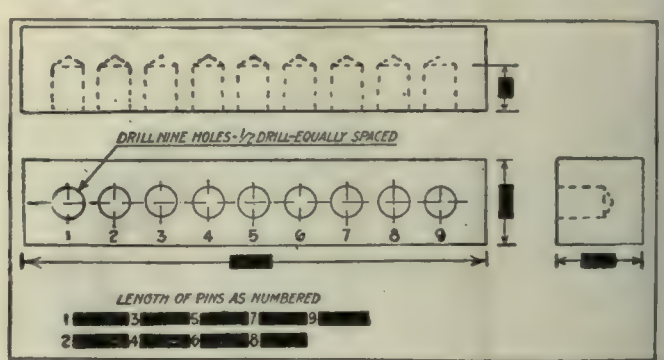


FIG. 1. TEACHING USE OF SCALE

TABLE II. TIME OUTLINED FOR STUDENTS IN GIRLS' PREPARATORY SCHOOL AND DIFFERENT OCCUPATIONS TO WHICH THEY CAN BE TRANSFERRED

Occupation	Time, Days
e Operators—	
ry inspection	2
he	8
	10
hine Operators—	
ry inspection	2
ing machine	6
	8
Machine Operators—	
ry inspection	2
w machine	7
	9
an Gear-Cutting Machine—	
ry inspection	2
cutting machine	7
	9
g Machine—	
ry inspection	2
ling machine	6
	8
ill-Press Operators—	
ry inspection	2
drill press	5
	7
l Press—	
ry inspection	2
rill press	5
	7
d Radial Dri'l—	
ry inspection	2
and radial	6
	8
achine Operator—	
ry inspection	2
machine	5
	7

Occupation	Time, Days
Tool grinding-Machine Operators—	
Elementary inspection	2
Universal grinding machine	6
	8
External Grinding-Machine Operators—	
Elementary inspection	2
External grinding machine	5
	7
Internal Grinding-Machine Operators—	
Elementary inspection	2
Internal grinding machine	5
	7
Splining Machine Operators—	
Elementary inspection	2
Splining machine	5
	7
Lo-Swing Operator—	
Elementary inspection	2
Lo-Swing lathe	7
	9
Fox Lathe Operators—	
Elementary inspection	2
Fox lathe	6
	8
Potter & Johnson Operators—	
Elementary inspection	2
Potter & Johnson	7
	9
J. & L. Operators—	
Elementary inspection	2
J. & L. machine	9
	11
Broaching Machine Operators—	
Elementary inspection	2
Broaching machine	5
	7
Inspection—	
Elementary inspection	2
Practical inspection	8
	10

Occupation	Time Days
Bench Work—	
Elementary inspection	2
Bench work	8
	10
Major Assembling and Dynamometer Test—	
Elementary inspection	2
Major assembling	7
	9
Minor Assembling—	
Elementary inspection	2
Minor assembling	6
	8
Welding—	
Elementary inspection	2
Welding	14
	16
S ock Tracers—	
Elementary inspection	2
Stock tracing	6
	8
Tool-Crib Attendants—	
Elementary inspection	2
Too' crib	6
	8
Foremen Clerk—	
Elementary inspection	2
Clerking	5
	7
Soldering—	
Elementary inspection	2
Soldering	5
	7
Stockroom Clerk—	
Elementary inspection	2
Premium and Production Clerks—	
Clerking	10

vious and in the kindergarten class—remember new and all Greek to many.

u wipe off the lathe center; wipe out the center he mandrel; oil the tail center; set the tool just enter; have the carriage in a certain position; rtain speed and feed; use cutting compound—in matter what you do—make a list of them all, so u will not overlook a single thing when you come uct a new worker. And don't forget to give the why" in every case where there is even a possi- f its not being readily understood.

following from the Packard Training School of training girls should be helpful in outlining nd means along other lines.

The Packard Training School

in charge of the school have found by trial that results were obtained on machine and assembling having one instructor to every three students, and in exceptional cases one to every two. In the elementary instruction one instructor to every six students worked satisfactorily. No matter what department the students were to enter, two days were devoted to elementary instruction in every case, it being found that a knowledge of measurement was a decided advantage in all departments. This preliminary work was accomplished at suitable benches at one end of the shop, everything being done to make the new students feel at ease in their new surroundings. The elementary instruction course is outlined in Table I, while Table II shows the various departments for which workers were trained and the time found necessary in each case.

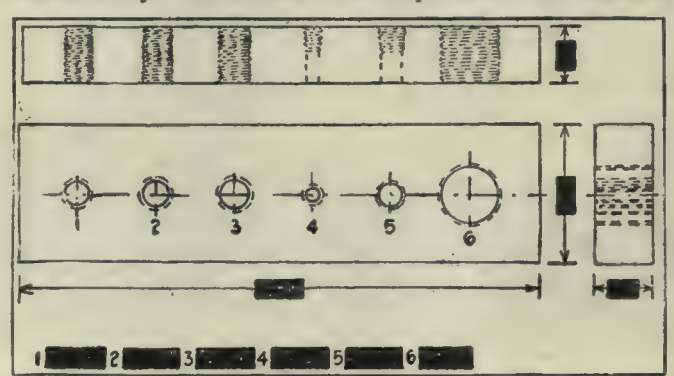


FIG. 3. THREAD GAGE LESSON

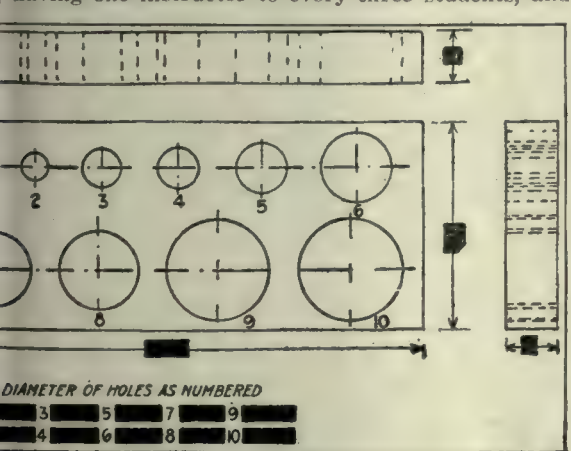


FIG. 2. USING INSIDE CALIPER

The elementary instruction course outlined in Table I consists in learing the use of such measuring tools as scales, micrometers, calipers, depth gages, bevel protractors, thread pitch gages, radius gages, etc., and the reading of blueprints. This was accomplished by means of a combination of blueprints and the articles themselves, some of these being shown in the illustration.

Fig. 1 shows a metal block with nine $\frac{1}{2}$-in. holes equally spaced and drilled to a uniform depth which the student is required to measure. Each block is fitted with pins of varying lengths, the variations being in even eighths, sixteenths, thirty-seconds, and sixty-fourths of an inch. This

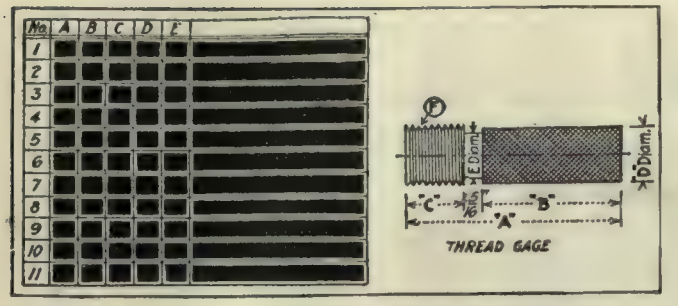


FIG. 4. MEASURING PLUG THREAD GAGE

lesson involves only the use of the scale, as the diameter of the pins is not considered, but only the various dimensions of the block and the length of the different pins. A blueprint is provided with blank spaces for recording each measurement to be made and this answers the double purpose of making it easy to put down the answers and to familiarize the new student with blueprints and drawings.

Lesson 2 involves the use of the scale as before and also the inside caliper, as the dimension of each hole is called for in the blank spaces shown in Fig. 2. The use of thread gages, simply for determining the lead of the screw, is shown in Fig. 3, the plate having four holes tapped straight

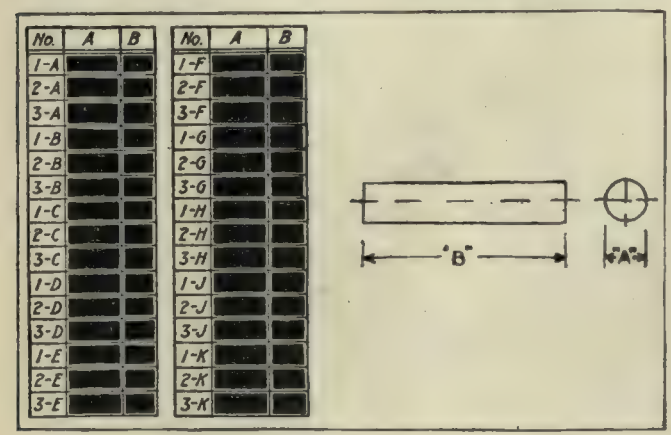


FIG. 5. MEASURING WITH MICROMETER

through and two holes with a taper type thread. More complicated measurement is taken up in Lesson 4, which is a plug thread gage, Fig. 4, and on which six separate measurements are taken. A number of different plug thread-gages are used in this lesson, a blueprint being provided for eleven such gages, should it be desirable to use as many as this.

The blueprint for Lessons 5 and 6 is shown in Fig. 5. In addition to the blueprint there is a block containing ten

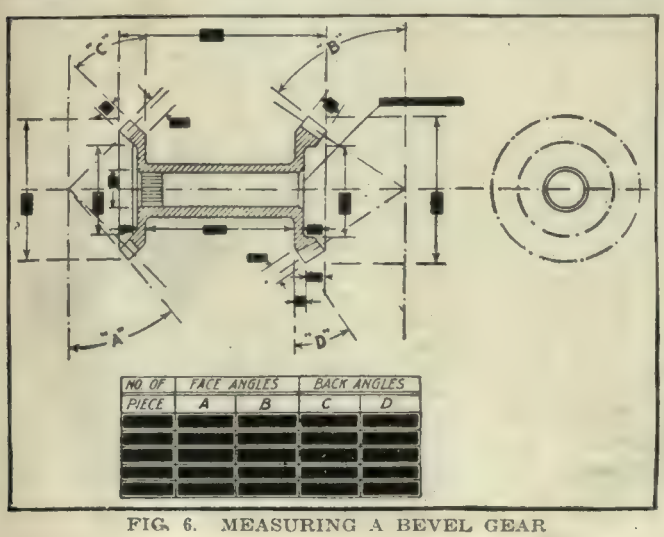


FIG. 6. MEASURING A BEVEL GEAR

sets of three plugs each, every plug being numbered and lettered according to the designation shown. The student here learns the use of a micrometer in a practical way. One of the plugs of each set is the standard size for that set and the other two vary by a thousandth of an inch in each direction. That is, one plug is a thousandth of an inch too small and the other a thousandth too large. In this way the student learns the functions of the micrometer and how to use it, becoming more or less familiar with it in a comparatively short time. The instructor shows how the instrument is handled and how the measurements are read, but does not inform the student of the variations between the different sizes of pins, so that it becomes a real test of

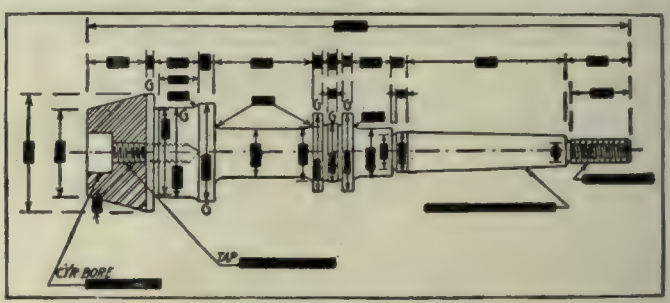


FIG. 7. THE LAST LESSON

measurement with enough repetition to insure fair familiarity with the micrometer.

Fig. 7 shows the use of the bevel protractor in connection with bevel gears, and also includes the use of the scale and caliper, all dimensions being marked down on a blueprint, Fig. 6, as before. The last lesson is a combination of all the others and is a very complicated one for the beginner, as can be seen from Fig. 7. Thirty-nine different measurements are taken and blanks are provided on the blueprint for each dimension. Included in this is the measurement of counterbores, tap holes, bevel gear angles, diameters at the bottom of grooves, and at the outside of shaft and collars. This lesson gives an excellent foundation for mechanical training.

Don't Shirk

Have you given any consideration to the advantages or disadvantages of the proposed tax on sales? The subject will figure prominently before long. Business men, therefore, should give it all possible study, for they are the ones who will be most directly affected. The importance of such a levy may be deduced from the amount a sales tax is estimated to yield; the figures run all the way from one billion dollars to three billion dollars. An association has been formed to spread information, or propaganda, in favor of a law embodying this tax. There certainly is need for more enlightenment. It sounds very simple to say that all that is necessary is to pass a brief measure imposing a tax of 1 per cent on every bill of goods sold. Should the tax apply if one sells his home? Should it apply if one sells securities? Would it mean an impossible burden on certain finished products which pass through quite a number of hands during the process of transforming the raw materials into goods? Would the sales tax bear very lightly on poorer people? Would the wealthy have to bear a reasonable share? These are intricate and troublesome questions. But does it not behoove the business community to investigate and study them so as to be able to voice an intelligent verdict when the proposed legislation comes up for discussion? Remember, the politicians who will vote on the bill probably know less about the merits or demerits of such legislation than hard-headed business men. The country cannot afford to take so important a leap in the dark.—*Forbes Magazine* (N. Y.)

Jig and Fixture Storage

A Well-Planned Method of Storing Jigs and Fixtures—Efficient and Compact Elevator Greatly Reduces the Difficulty of Handling Heavy Units

SPECIAL CORRESPONDENCE

THE storage of jigs and fixtures, particularly when they run into large sizes and heavy weights, is quite a problem in many shops. The solution worked out by the Cincinnati Milling Machine Co., Cincinnati, Ohio, and illustrated herewith, has many advantages. The fixtures are placed on regular trucking platforms and handled from the machine on an electric motor shop-truck, which carries them from the machining department to the elevator of a concrete storage building. Here the truck and fixtures are taken up on the elevator and delivered to the proper point in one of the cross aisles so as to be handled by the special tiering crane shown.

After a fixture with its platform has been deposited on the floor, one of the lifting arms shown at *A* and *A* is lowered to the proper position and moved under the platform by easy manipulation of the small overhead crane and its trolley. The platform is thus easily picked up and carried to the proper bin. It is then pushed into position by means of the overhead trolley, the lifting arm is lowered sufficiently to place the platform on the shelf, lowered still more to release it, then withdrawn to be ready for use at any other point.

These are special tiering cranes, each having a capacity of 1,500 lb. They are provided with electric power hoists, hand control and hand traverse both for the bridge and trolley. The lifting arm is in reality made double and in the form of a bell crank, the other side of the arm *B* being shown turned up against the column at *C*. The bell crank is so pivoted that either arm can be brought down to a horizontal position and in this way it can handle platforms on either side of the vertical column. The arrangement is very compact, requires a minimum of space between the different tiers of racks and is proving very satisfactory in every way.



TOOL STORAGE BINS AND TIERING CRANES

The racks are substantially constructed of standard angles and parts and the whole arrangement lends itself to almost any condition where heavy fixtures are to be handled and stored. A similar plan could easily be provided for storing finished parts. The use of the platform makes possible both horizontal and vertical handling without loss of time.

This is one method of reducing the overhead or nonproductive costs which are too great in many of our shops. Modifications of this plan should be useful in many places.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

An Improvised Boring Mill

SPECIAL CORRESPONDENCE

One way to make a lathe serve as a boring mill, not only with the bar between centers as has often been done in jobbing and repair shops, but to bore transverse holes as well, is shown in the pictures accompanying this letter.

The part for which the device was fitted up is the frame of the Greenerd arbor-press, and there are four holes to be bored at the one setting; the hole for the ram, two holes for the pinions and one for the intermediate shaft. The device has been built upon a standard engine lathe from which the cross-slide has been removed and the casting *A*, Fig. 1, bolted in its place. No other change was made in the lathe except to remove the tailstock, and to substitute a spur gear for the crankhandle by which the carriage was traversed and mount the crankhandle with a pinion on its shaft in a special bearing in the apron. This makes the handle

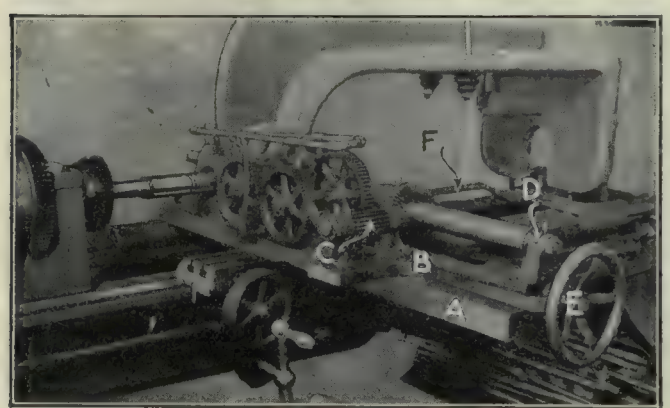


FIG. 1. IN POSITION FOR BORING UPPER PINION HOLE

turn the wrong way, but the operator soon gets used to that.

A plate *B* carries the bearings in which the long pinion *C* turns, and also a bearing that supports the driving quill that transmits the power to the boring-bar spindle when boring the transverse holes. Plate *B* has no movement apart from the lathe carriage when once set for the hole it is to bore, but, being located by a tongue fitting a groove in part *A*, it has three positions in which it may be set, corresponding to the locations of the three holes to be bored. Part *D* is gibbed to part *B* and is moved by the crossfeed screw, turned by the handwheel *E*. Part *D* supports the end of the boring-bar spindle in a suitable thrust bearing and thus provides the means of feeding the boring tool to the cut.

A spur gear is substituted for the usual driving plate on the nose of the lathe spindle and drives the boring-bar spindle through the train of spur gearing, the long pinion *C*, and the bevel gear upon the end of the quill. The outer end of the boring bar turns and slides in a bushing supported in a stationary bracket bolted to the base plate *A*. This can be seen to better advantage in Fig. 2, which shows the same set-up from a different angle. In this latter picture a core-drill is shown in place for the first operation. After taking out the sur-

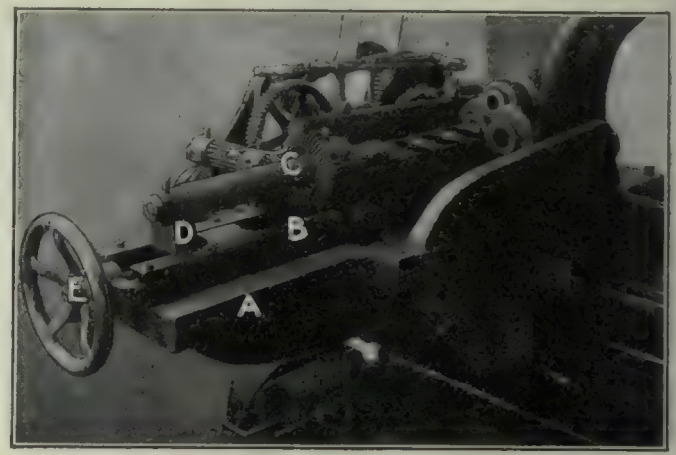


FIG. 2. SAME SET-UP FROM THE OTHER SIDE

plus stock with the drill, the bar is substituted and the hole finish-bored.

After finishing the first hole the part *B* is lifted from the base and set in position for boring the second hole in the same horizontal plane, the tongue that located it now fitting into another groove in part *A*. The same tools are used. To bore the center hole, which is in a different plane, a raising block is used which has tongues fitting both grooves in part *A*, and upon its upper surface a groove to take the tongue of part *B*. The length of the pinion *C* allows it to mesh with its driving gear in

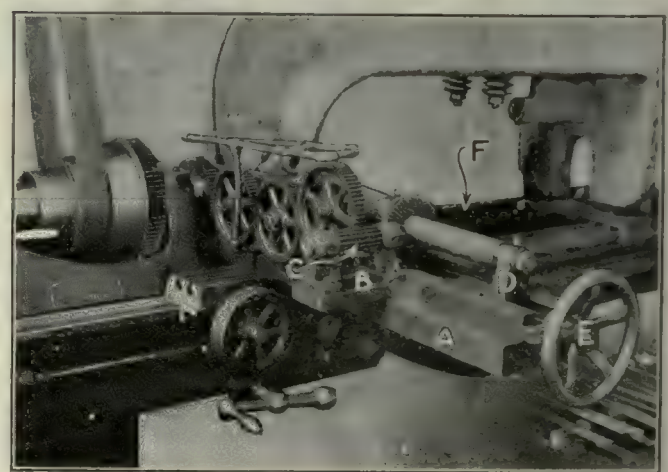


FIG. 3. BORING THE HOLE FOR THE RAM

all three positions and no adjustment of the lathe carriage is necessary.

In Fig. 3 may be seen the method of boring the hole for the ram. The lathe carriage is moved away from

the headstock and the boring bar inserted in the lathe spindle. The outer end of the bar in this position is carried in a bushing as may be seen in Fig. 2. The foot of the press frame is supported by leveling screws upon an auxiliary carriage attached to the main carriage by the reach-rod *F*. This auxiliary carriage has no other function than to support the weight of the work.

Boring bars and core drills are provided for all sizes of holes to be bored and each has a taper shank to fit either spindle. When a frame is once located and clamped on the carriages all holes are finish-bored without disturbing a clamp or adjusting screw, so that the accuracy of the work, both as to relative location and squareness, depends entirely upon the care expended in building the fixture; leaving no chance for error to result from incorrect setting.

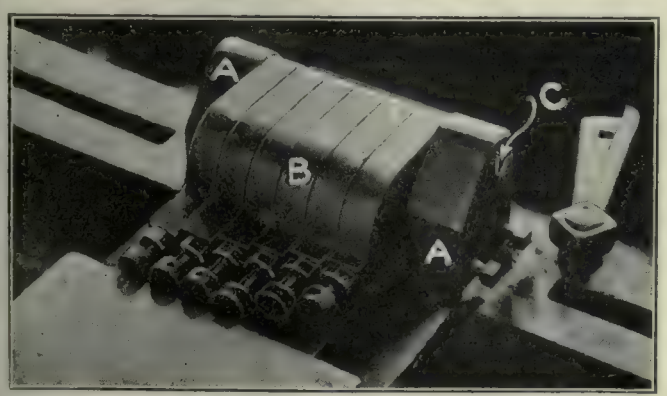
The rig was devised by Mr. Bartlett in whose shops the Greenerd arbor-press is built.

Multiple-Stop for Cross-Slide of Engine Lathe

By Milton Wright

A multiple stop that is adapted to almost any engine lathe is shown in the accompanying illustration. It is a valuable aid to the operator when such a lathe is to be used to produce many duplicate parts having several shoulders on each.

The part *A* is machined to fit over the dovetail of the carriage in the rear of the cross-slide, and is provided with a short gib and two setscrews by which it may be held in any desired position. The leaves *B*—six, in this



MULTIPLE STOP FOR ENGINE LATHE

instance—finished on both sides and fitted nicely between the ears of the part *A*. They may be made of cast iron, of cold-rolled steel, or any piece of scrap material that may be convenient.

A hole is bored through the leaves, as well as the ears of part *A*, to take the pin *C* so that the leaves may be swung back out of the way, and each leaf is provided with its own stop screw and locknut. As the actual stop takes place against pin *C*, care must be exercised in the fitting.

The lathe to which the device shown is attached is used for rough-turning lathe spindles preparatory to grinding. The spindles have six diameters and when the stop screws are once adjusted, the entire lot of work may be run off without further measuring except for the purpose of keeping tabs on the tool wear. When regrinding of the tool is necessary, it is reset by means of the compound slide to cut the same diameter as it was cutting before removal.

On this particular job the work is started with all the leaves but one thrown back out of the way. The work, before coming to this operation, is marked off for the locations of the shoulders. The operator runs the cross-slide up to the shortest stop and turns the smallest diameter as far as the first mark. If as in this case, the amount of material is more than can be removed in one cut, two or more cuts may be taken; the depth of each preliminary cut in accordance with the operator's judgment of what the tool will stand, and the final cut made with the cross-slide in contact with the stop.

On reaching the mark that indicates the first shoulder on the work the cross-slide is withdrawn far enough to allow the next longer stop to drop into place and the movements repeated until all diameters are turned. As the exact location of the shoulders is determined in a later operation, at which time the shoulders are undercut for the grinding wheel, the rough turning is accomplished very quickly.

The device is adaptable to many manufacturing operations in the engine lathe, and being quite simple and inexpensive, a number of them may be made up, thus providing for many operations without the necessity for tedious resetting. To set up for a certain job, the size of the first shoulder on the first piece would be established by means of scale and caliper in the usual manner, when the stop would be slipped into place with the shortest leaf bearing against the cross-slide, and the setscrews tightened.

Special Indexing Fixture on P & W Semi-Automatic Milling Machine

Special Correspondence

A special indexing device that converts a Pratt & Whitney semi-automatic milling machine into a full automatic for the purpose of cutting the pinions that are a part of the Greenerd arbor-press, is here shown and described. It was designed and constructed by Edwin E. Bartlett, maker of the above mentioned press.

The object of the device was primarily to provide a rigid and unyielding support to the pinions so that three pinions could be cut at once, accurately and without chatter, though driving the machine to the limit of its endurance.

The construction of the fixture is perhaps better observed in the rear view, Fig. 1. A single heavy casting provides at one end a support for three long spindle bearings and at the other end for outboard supports for the pinions under operation. The inner end of each spindle has a hole to fit the smaller diameter of the pinion, and a key that fits the spline, or keyway, already milled in the pinion, thus insuring not only positive rotation but accurate relationship between the several pinions; for when these pinions are in place in an arbor press—there are two to each press—they have to divide their work between them and any inaccuracy of relationship between pinion tooth and keyway would throw all the work on one pinion.

The outer end of each pinion instead of being supported by a tail spindle, rests in a closely fitting bushing which in turn is held in a bored seat in the fixture. A T-head stud is made permanently a part of each bushing and enters a T-slot below the seat, which T-slot is not parallel with the centerline but inclines downward toward the front end of the fixture so that a bushing is held firmly to its seat by driving it forward. There is

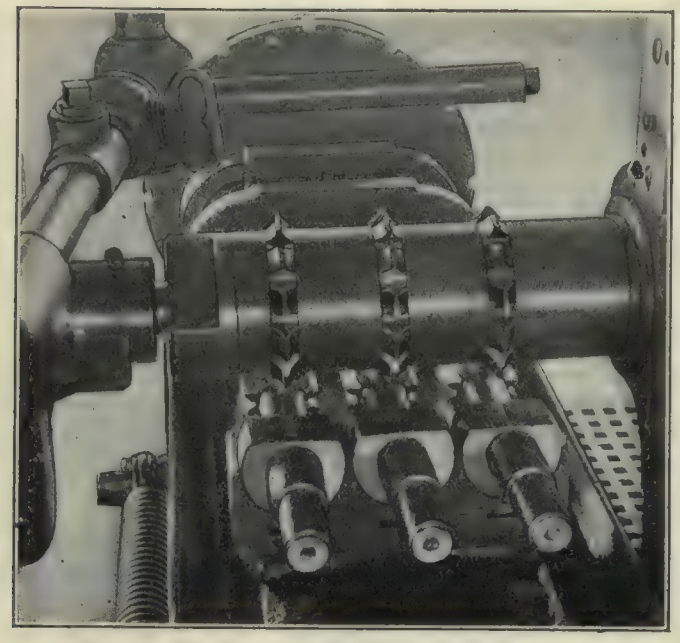


FIG. 1. REAR VIEW OF FIXTURE

no shoulder on the pinion at this end and the bushing can thus be driven to a bearing without being stopped by other limitations.

Fig. 2 shows the spindle end of the fixture and also the special features of the indexing mechanism that have been added to the machine to adapt it to this work. The work spindles are larger in diameter at this end and the shoulders thus formed rest against the frame casting and resist the thrust of the cutters. Each spindle extends through the front of the bearing and has a gear keyed to it that serves to keep the three spindles in proper relation to each other and to impart the rotative movement from the index-plate. The center spindle is longer than the others and the index-plate is keyed to it.

The regular camshaft of the machine is removed and a longer one substituted. Two adjustable cam dogs are attached to the cam disk, one serving to withdraw the locking pin while the other moves the lever A, Fig. 2, to accomplish the indexing movement.

The forward movement of the table is actuated by the regular cam, which is a part of the standard machine, but instead of the speed-up movement of the camshaft for a quick return the return side of the cam is cut away and the table is brought back to the starting point by the helical spring B. The locking pin is attached to the table and is, of course, at all times in engagement with the index plate except when withdrawn by the cam. As the cam does not move forward with the table the locking pin is, during the greater part of the cycle, entirely out of its sphere of action and cannot possibly be withdrawn at a wrong time by faulty adjustment or slippage of the cam dogs.

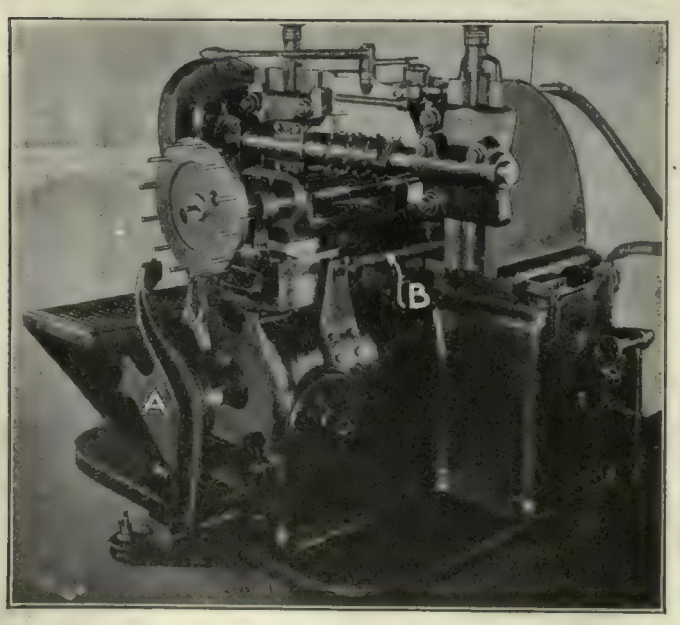


FIG. 2. THE INDEXING MECHANISM

The same is true of the indexing arm. Though it remains at all times under control of the cam, it cannot reach the index plate except at the instant the table is returned preparatory to starting a new cut. Therefore, while a faulty setting or a slippage of the cam dogs might serve to render the machine inoperative, it could not by any possibility cause a movement at the wrong time and thus spoil a piece of work.

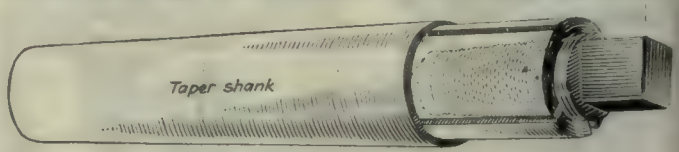
Once set, the action of the machine is continuous until the three pinions are completed, and requires no attention from the operator. Because of the rigidity of machine and fixture there is practically no vibration or noise, and the finished tooth is smooth and free from chatter marks.

Expansion Stud Arbor

By Roy A. Dressler

The illustration shows a tool that the writer has found to be very useful. Such tools may be made up in sets to cover any range of sizes desired.

The shank is first turned and ground to fit the spindle of the lathe, and the remainder of the machining operations, except the slotting, done while the tool is in its working position.



AN EXPANDING STUD ARBOR

Briggs standard pipe reamers and taps may be used to advantage for reaming and threading the hole. The plug is squared at one end for a wrench.

The tapered portion of the plug should be made slightly more tapered than the standard reamers, thus leaving the small end about 0.005 in. under the diameter of the hole and give a clearance at top and bottom of thread. If this is not done the plug may bind and the purpose of the tool will be defeated.

A Tap Holder for Use on the Lathe

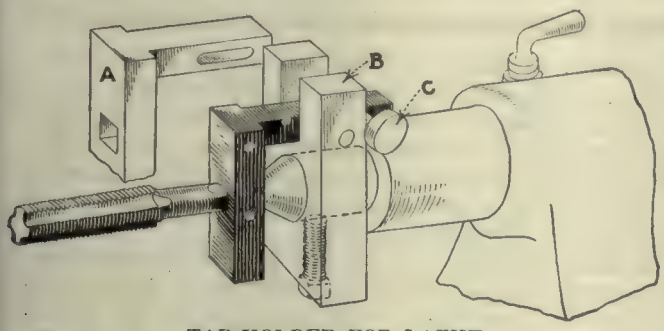
By Harry Moore

When drilling and tapping a large number of pieces in the lathe, the holder shown herewith was made with the idea of providing for the quick removal of the tap to enable the drill to be placed on the center; also to have a certain floating movement for the tap, while at the same time holding it back on the center.

It is made in two parts. Part *A* has a square hole to fit the square shank of the tap, and when both are fitted together they are pinned. Part *B* is drilled to fit the center, tapped for a tightening screw, and slotted to receive part *A*. A pin through *B* and through the slot in *A* completes these two parts.

A knurled head pin *C* through the exposed part of the slot in *A* prevents the tap from falling, while the end of *A*, resting on the spindle of the tailstock keeps it from raising; thus holding it back on the center.

When tapping, the tailstock is loosened from the



TAP HOLDER FOR LATHE

shears. The operator then gives it a shove to start the tap and the whole thing moves up and comes back when the lathe is reversed to get the tap out of the way. The pin *C* is then removed and *A* is pulled slightly forward to clear the spindle and folded back, as it were, till the tap is resting on the body of the tailstock. A flat spot is ground on the center where the tightening screw bears.

Comparison of Cast and Cast-Hammered Babbitt Thrust Washers

By J. M. Henry and F. B. Coyle
Engineer and Metallurgist, Pratt & Whitney Co.

Some time ago the writers were called upon to investigate the relative values of cast and "forged" babbitt thrust washers and the data obtained may be of interest to those who have similar problems.

It had been the practice in our plant to take a piece of babbitt, put it under the drop, and forge it flat, the washer being machined from the blank. This was supposed to give a refined close-grained structure with additional hardness and increased wearing qualities. In another part of the plant, the foreman was casting his washers in a bar—machining the bar to size and cutting the washers to suitable length as they were required. The latter method was much cheaper and the tests were made to find out the advantages (if any) of the "forged" blanks.

Two washers were selected at random from the finished stock. One piece was about ⅜ in. thick and 4 in. in diameter with a 1¼-in. hole in the center. This piece had been machined from a cast bar. The other was about ¼ in. thick and the same as the former piece on other dimensions. This sample had been hammered down to required thickness and then machine finished.

A Brinell hardness test with a 250-kg. pressure gave the following results:

DIAMETER OF IMPRESSION	
Cast	Hammered
4.7 m/m	4.9 m/m

The hammered piece was the softer and this fact will be referred to again.

A piece of each disk was cut out, polished, etched, and examined under the miscroscope. Both specimens were etched with both nitric and hydrochloric acids to ascertain if the presence of lead in one and absence of it in the other were the cause of difference in hardness, but the indication was that lead was entirely absent.

This metal has the following general chemical composition:

Tin	90 per cent
Antimony	8 per cent
Copper	2 per cent

No analysis was taken of these particular samples and the above composition will not apply stringently. However, the microstructure was typical of the above analysis, that is, cubes of the hard compound of antimony and in (SnSb) in a matrix of eutectic.

Both materials showed that the ingots were the result of excellent casting practice. The cubes of SnSb were evenly distributed and covered about one-third of the section. The particles of compound in the cast sample were intact and had clean sharp edges, but the particles in the hammered piece were greatly distorted and shattered. This data is evidence that the cast metal is the only one desirable for the following reasons: When a material of this nature is in service and subject to wear, the softer eutectic wears away and leaves the hard antimony tin particles in relief. These particles present a good wearing surface and also transmit the pressure to the softer matrix which will sustain vibration and at the same time is just plastic enough to mold itself to the shape of the revolving shaft.

When a piece like the hammered sample is put into service the small shattered particles tear out and score the bearing. Also, the load is not properly supported.

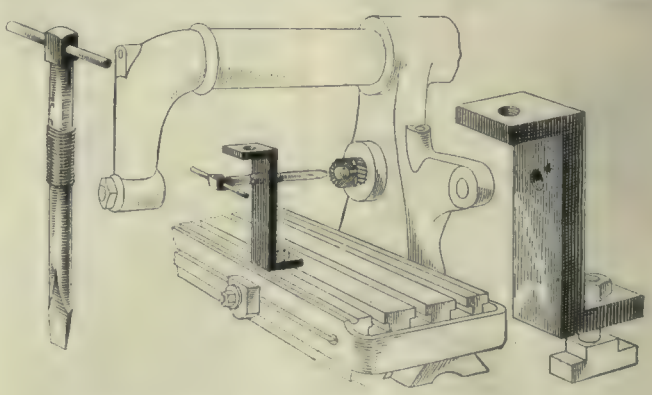
An examination of oil used on these bearings will show that on the cast type the particles will become rounded on the edges before tearing out of the matrix and will barely scratch the surface of the bearing, while in the latter type small angular particles with sharp corners and edges will be found.

Running tests extending over a period of a year have borne out the above analyses and cast washers are now used wherever babbitt thrust washers are called for.

Care of Screw Slots

By Albert W. Leysath

The retaining screws for shell-mill arbors are often abused by being tightened or loosened by means of a punch and hammer. The illustration shows the details



DEVICE FOR PROTECTING SCREW SLOTS

of, and the method of using a device that is simple and efficient.

Care must be taken that the lead on the shank of the screwdriver be made the same as that of the retaining screw. To remove the screwdriver from the screw slot, the table must be backed away from the mill.

IN THIS ISSUE

PRESENT price levels seem to indicate the fulfillment of the predictions made by H. H. Manchester in the article which opens this issue. Written some months ago, before the present downward trend of prices became apparent, it predicted that we may expect to see wages and prices reach a new level by the beginning of 1922, about one-third higher than in 1914. Such a condition would make our price indexes stand at about 133, a figure which the prices of some commodities are rapidly approaching. This article is the first of four that comprise a brief history of post war crises. It gives a résumé of commercial, industrial and financial crises from 1337 to 1860. That the series is going to be of extreme interest is indicated by some of the questions which the author answers, among them: "Where are prices and wages going?" "When are they going to reach there?" "What is going to happen afterward?"

The second article, beginning on page 981, is by George Atwell Richardson of the Midvale Steel and Ordnance Co. It gives the details of an improved method of making steel gear and wheel blanks, a method developed by efforts to manufacture gear blanks, industrial wheels, car wheels, automobile fly wheels and similar pieces of uniform circular sections that would be of superior quality and meet the most severe service requirements. The manufacturing operations, beginning with rolling down the ingot to the final operation of rough machining, are described.

In this week's installment of "Metal Cutting Tools" beginning on page 985, DeLeeuw tells of the cutter sharpening characteristics of cup and disk wheels, the importance of correct angles, the sharpening of cutters, and related subjects. A valuable point brought out is that cutters should be ground before they have been used on the maximum number of pieces that can be machined with one grinding. He states that such a method not only saves the cutter but also makes the workman feel safe in the use of higher speeds or feeds or both. The subject of cutter grinding is important and we think you will decide as we have that the current installment is a very valuable addition to the previous articles of the metal cutting series.

The heat-treating methods used by the Industrial Pneumatic Tool Co. in making parts for Thor pneumatic tools are detailed by Western Editor Hunter in an article that begins on page 991. Proper heat-treatment has come to be extremely important in present day methods and anyone who is up against problems similar to those solved by the company referred to will do well to carefully follow this article.

In our opinion the tool engineering series grows better with each installment. We admire the persistence with which Dowd and Curtis have stuck to the important, but to them probably tiresome, subject of drill jig design. They are not overlooking many bets and when you get together this group of articles on drill jig design you will have something worth while. The current installment takes up bushings, knobs, thumbscrews and ejectors. It tells of the proper design and proportions of bushings; the methods of holding slip bushings; how to properly locate bushings; and shows the various forms of standard knobs, thumbscrews, hand wheels and ejectors. Page 997.

A short article by J. H. Vincent, page 1000, gives a pointer or two in regard to the installation of motor drives on some old railroad shop tools, a planer and boring mill. The installation of motor drives enabled the machines to be set out in the main bay where they could receive overhead crane service. Many shops, by similar installations, can no doubt increase their efficiency a great deal.

"The Foreman and His Job" this week is a little longer than usual. Colvin has taken up the training school as it is related to the foreman and has furnished some exemplary lessons that should be presented to the student. The lessons he gives are a part of the system of the Packard Motor Car Co. Page 1002.

The matter of proper jig and fixture storage has received thorough consideration in many plants but not in as many as might and should be. The article, on page 1005, although brief, describes an up-to-date method of jig and fixture storage and handling that can well be followed by many other shops.

The Shop Equipment News section this week is somewhat larger than the average. The twenty-seven developments described indicate the determination of many manufacturers to be ready for coming business.

Coming Features

Our leading article next week will be on economics. It was written by Doctor Whitney, Professor of Finance, University of Cincinnati, under the title "Obstacles to Business Revival." All of us want to know what the obstacles are, so that we may understand what we are combating. While the statements may appear to some to be somewhat pessimistic, we think that a close analysis will show that while it is a true statement of conditions as they are it shows throughout that progress is being made and that we have in the last year taken a big step toward our destination of a safe and sound business basis.

The same issue will contain the seventeenth of Basset's modern production series and the eighth of the Tool Engineering articles.

There will be another Rolls Royce article, this one taking up connecting rods, and a description of a modern monitor-type shop for building lathes, both by Colvin.

Other complete articles will be "Turbine Work at the Puget Sound Navy Yard" and "Holding Fixtures for Railroad Shop Work."

EDITORIALS

In the Cold Gray Dawn

THE world at the present time is passing through the last stages of "the morning after the night before," with the same demoralization of faculties and the same lack of energy which were characteristic of that pre-Volstead condition. And the apparent delay in recovery is causing considerable concern as to when the old world will be well again, and whether or not it will ever look quite the same.

H. H. Manchester has made a thorough study of industrial and financial conditions both prior and subsequent to each of the more important wars of modern times, and in his article "A History of Post-War Crises" gives a pretty clear idea of what may be expected in the future. Pre- and post-war commercial and industrial conditions have been carefully outlined and comparisons made of both food prices and wages. A study of the facts and figures given will show that "history repeats itself" as evidenced by the fact that conditions at the present time are exactly as outlined in this article.

The Lubrication of Machine Tools

IT SEEMS to be the general complaint that the great majority of machine-tool idleness is due to the lack of proper lubrication. Oil holes so placed as to be difficult of access, and insufficient training or carelessness on the part of the operator both contribute to the neglect and its result.

One remedy is to have machines lubricated by men charged with that specific duty instead of depending on the operator, whose chief incentive is the earnings from his productive efforts. Another is for machine builders to provide more positive methods of lubrication than is usually the case. Geared heads and geared feed boxes have followed automobile practice in many features of design, but few have followed the practice of using forced lubrication on the main bearings.

The problem is not the same, but has many similar points. The main advantage of the automobile is that it distributes its surplus or overflow oil over the road, while, with a machine in a shop the surplus might be annoying. This, however, is not an insurmountable objection.

Machine heads with revolving spindles and shafts are much like motors and transmissions, as both have shafts which extend beyond the case itself. Forced lubrication to the bearings can be accomplished where necessary, and provision made to prevent leakage as is done in automobile motor practice. The keeping of an oil film between the bearing surfaces greatly lengthens the life of a bearing and pressure feed has good features.

The present is a good time to study the question of lubrication with a view toward reducing the damage caused by neglect to find all the oil holes on a machine. Some machine designers have already given this careful consideration, but there is room for improvement in many cases.

Non-Productive Costs

MACHINE-TOOL builders, shop managers and production men are all keenly interested in reducing the cost of production, and rightly so, for much remains to be done in that direction. But the problem of getting business on a normal basis includes much more than shop costs which are often relatively small.

Take, for example, the case of a well known automobile where the production cost is but 10 per cent of the selling price. The car sells for approximately $3,000. The shop builds the motor, transmission, front and rear axles, and many other parts—more in fact than with most cars of similar grade. Yet the actual production cost is less than $300.

Nor does this necessarily mean that an exorbitant profit is being made. The great discrepancy is due to non-productive costs, between the shop and the consumer. These costs may include shop overhead, elaborate cost systems, too much office expense, high selling costs and various other expenses. But as long as these costs exist the shop man can hardly be expected to worry much about reducing shop costs. It also shows the futility of ascribing all our troubles to high wages in the shop. If these men worked for nothing it could not make more than $300 difference in the cost of the car to the consumer.

One has only to recall the days when bicycles were distributed from expensive showrooms and to remember that we paid $150 each for them. Today we buy a better wheel for $40 or less—and the manufacturers, we trust, make a good profit at that. But they have eliminated much of the non-productive costs which formerly existed.

Just how far this condition is true of other lines is known only to those in the various industries. But whether large or small, non-productive costs must receive at least as careful attention as shop costs. They form one of the glaring economic wastes to which Mr. Hoover is so well devoting so much of his attention.

The Need for Simple Airplanes

THE development of the airplane industry depends primarily on the designing and building of planes at a reasonable price. As pointed out by C. F. Kettering, who uses a plane much as most of us use an automobile, the average designer seems to disregard manufacturing costs when designing airplanes and their parts.

Mr. Kettering contends that an airplane motor of 150 horsepower, sufficient for a two or three place machine at least (probably more with efficiently designed wings) should and can be built to sell for $750 and the plane itself for approximately $1,000 more. With planes available at the price of an automobile, the demand will increase, users will demand and cities and towns will provide landing fields, and the industry will begin to get on its feet. This will be more effective than any plan of subsidies, although these may be necessary in some special cases.

Shop Equipment News

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval. Brief descriptions appear later in Condensed Clipping Index in both American and European editions.

H. & G. Threading Machines, Models SS and DS

The Eastern Machine Screw Corporation, New Haven, Conn., has just placed on the market two threading machines designed to hold H. & G. die-heads. The machines are the result of long experiments in the factory of their builder and possess features of individuality.

The center line of the spindles and work carriers is very low, with the result that the torsional strain induced by the cutting tools is kept well within the bed of the machine. The ways upon which the work carriers slide are round bars of tool steel and the corresponding bearings upon the carrier are half bushings of bronze, so that replacement of these parts when worn is very simple and involves little machine work.

The work spindles are hardened and ground, and run in bronze bearings easily adjustable to compensate for wear. Each machine is supplied with an oil pump that delivers the oil or cutting compound to the rear of the spindle, from whence it flows out through the die-head and helps to keep the cutting tools clear of chips.

Change gears provide a means by which the ratio of spindle speed to that of the driving pulley may be changed to suit the requirements of work of different diameters or material. The oil pump is driven directly from the first shaft, so that the flow of oil remains constant in volume irrespective of speed changes.



FIG. 1. H. & G. SINGLE-SPINDLE THREADING MACHINE, MODEL SS

The smaller machine has but one spindle and is intended for use either on the bench or on a pedestal, as shown in Fig. 1. The larger machine, shown in Fig. 2, for floor use only, has the same general char-

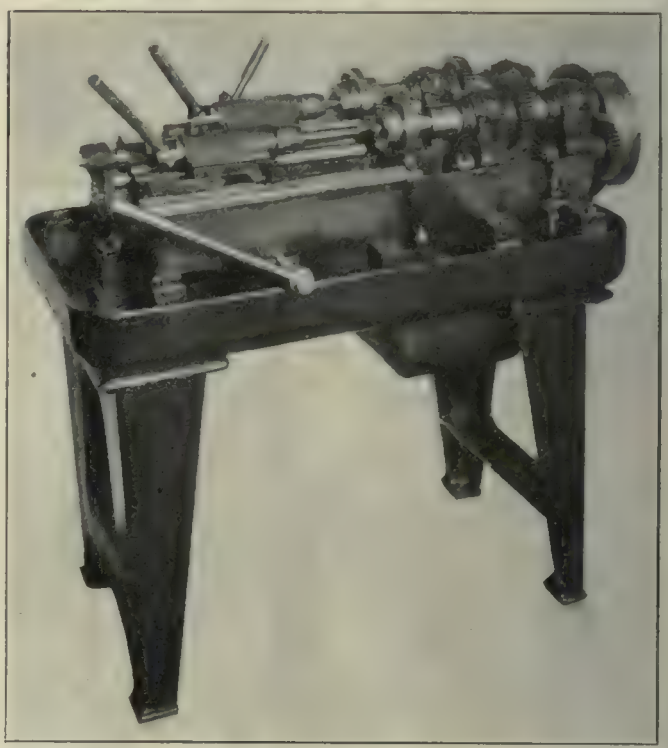


FIG. 2. H. & G. DOUBLE-SPINDLE THREADING MACHINE, MODEL DS

acteristics but with added capacity and power. The work carrier of the single-spindle machine is pushed forward by the same lever that closes the holding jaws upon the work. On the larger machine a rack and pinion movement is added independently to each carrier, and operated through levers at each side of the bed, to assist the operator in advancing heavy pieces of work and entering them in the dies. The opening and closing of the dies in both styles of machine is automatic and demands no attention from the operator. The point at which the dies open and close may be adjusted to suit the work.

Two styles of work carrier are provided. One, with side opening jaws, is shown in place on the single-spindle machine and the other, with spring collets for holding the work, may be seen in the illustration of the double spindle machine, Fig. 2. Either or both styles may be supplied with the machines, as they are interchangeable.

The side-opening feature allows the easy manipulation of long rods that are to be threaded upon the ends. The operator does not have to push the rod

through a hole in the spindle, but may swing it in from the side. In connection with the side-opening jaw slide there is an end stop for positioning the rods so that all may be threaded for the same distance from the end. This stop is actuated by a cam and the operator need pay no attention to it further than to push the end of each rod against it before closing the jaws, as it will get out of the way of the die-head automatically.

For threading short pieces, or studs that are to be threaded on both ends, the collet work holder is more convenient. The holding feature of either style of work carrier is operated by one lever, a single movement of which is all that is required to grasp the work and, in the case of the smaller machine, to advance it to the dies. On the larger machine the side lever and rack and pinion movement may be used, if necessary, to assist the operator in entering large pieces in the dies.

The smaller machine has only a single spindle and a capacity for threads up to 1¼ in. in diameter by 9¾ in. long. The gear ratios are 2:1 and ½:1. The bed and pan are cast in one piece and adapted to use on the bench. The machine occupies a space of 14 x 36 in., and when mounted upon the pedestal for floor use the height from the floor to the center line of spindle is 38½ in. The machine is regularly equipped with countershaft and one die-head. Any die-head from ¼ up to 1¼ in. may be used.

The larger machine has two spindles with five gear ratios ranging from 1:1 to 9:1, and will take the H. & G. die-heads from ⅜ to 1½ in. in size. This machine is made only to stand on the floor, where it occupies a space of 29⅜ x 45½ in., and stands 38 in. from the floor to the center line of the spindles.

Jones No. 3 Horizonal Boring and Drilling Machines

The accompanying illustrations show the Jones No. 3 horizontal drilling machine, also the horizontal drilling and boring machine developed from it, both of which are built by the Jones Machine Tool Works, Philadelphia, Pa.

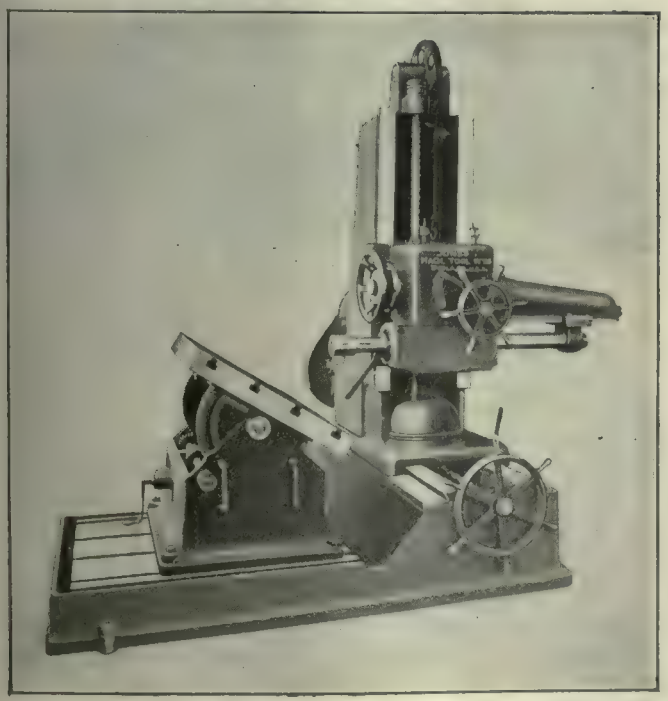


FIG. 1. JONES NO. 3 HORIZONTAL DRILLING MACHINE

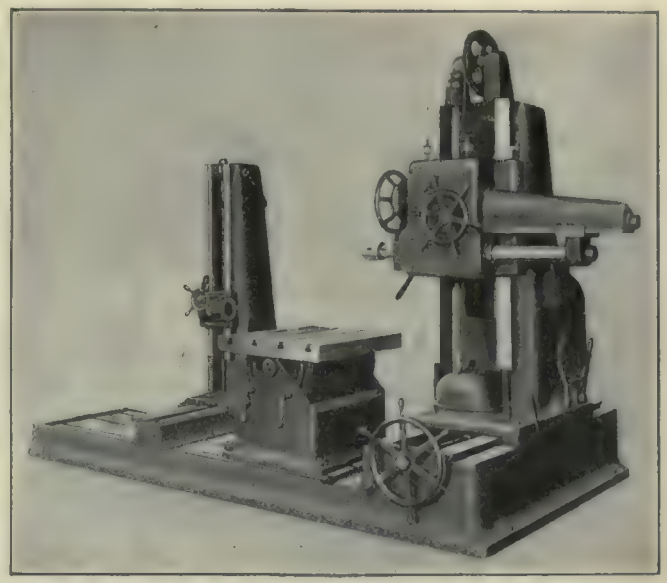


FIG. 2. JONES NO. 3 HORIZONTAL BORING MACHINE

The horizontal drilling machine, Fig. 1, is made standard or portable, in which case the base part for the table is omitted. The machine is driven by a 3½-hp. variable speed motor with six change speeds through gearing located in the base of the column and flood lubricated. The change speed levers, which are located on the side of the column, can be set to give spindle speeds of from 20 to 700 r.m.p. The spindle is 3 in. in diameter and is bored for a No. 5 Morse taper shank. It has a traverse of 20 in. and is operated by the handwheel through a steel screw and bronze nut at the back of the wheel. The friction clutch for the feed spindle is supported by three bronze bearings, two of which are in the saddle and one in the slide. The spindle thrust is received by large thrust ball bearings.

The saddle, which is counterbalanced, has a vertical traverse of 30 in., the horizontal traverse of the column being also 30 in. Both saddle and column are hand operated, although facilities for quick traverse are provided. The table is 30 in. square and can be tilted 45 deg. from horizontal in either direction. The overall dimensions are 92 x 68 in. x 104 in. high. Weight, 9,500 pounds.

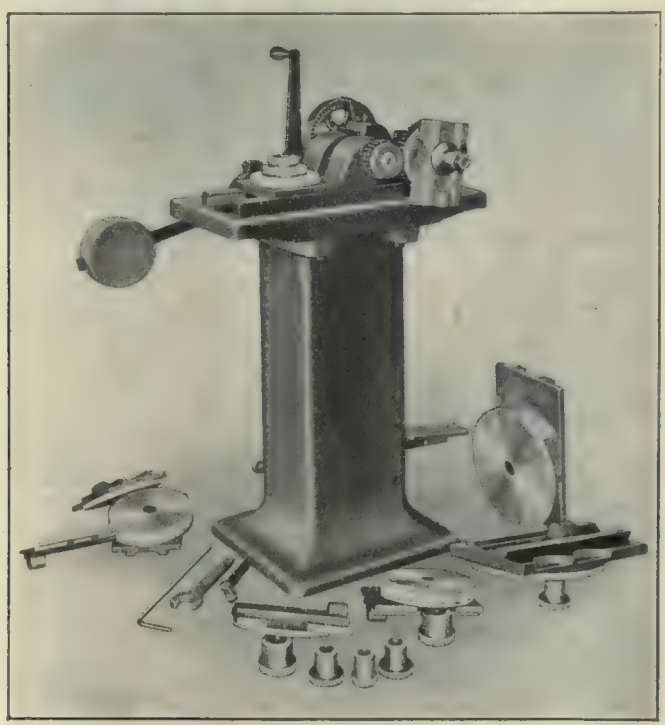
The No. 3 horizontal boring and drilling machine, Fig. 2, is similar to the machine described above except that the base, which is longer, supports the outer support column and runway for supporting the boring bar and facing head when boring cylinders, etc. The table shown is replaced with a universal rotary table which tilts in one direction only from horizontal to vertical. The table top is 36 x 48 in., and can be rotated in either direction when locked in the desired position. Weight, 12,500 pounds.

Noble and Westbrook Graduating and Marking Machine

The Noble and Westbrook Manufacturing Co., Hartford, Conn., has recently placed on the market the graduating and marking machine shown in the illustration. Either hand- or power-driven machines can be furnished as desired. On the power-driven machine, the placing of pieces of work in the machine and removing them when the operation has been performed are the only duties required of the operator. With the hand machine,

one turn of the handle completes a piece of work. Provision is made for holding the work in the proper relation to the graduating die and the depth of the marking is controlled by means of a treadle, cam, and weight which are governed by a positive stop that is adjustable to provide for marking the lines to any desired depth.

The machine is equipped with steel spindles and adjustable bearings. The operation of the marking die is controlled through a clutch on the spindle. The range of work for which the machine is adapted is illustrated by the pieces shown around the machine. Parts of various diameters can be graduated by changing the position



NOBLE AND WESTBROOK GRADUATING AND MARKING MACHINE

of the intermediate gear located on the adjustable section. The graduating and numbering are completed in one operation. Full equipment for the machines, including the engraved marking dies, can be furnished.

Webster & Bennett Duplex Boring and Turning Mill

A boring mill of the duplex type as shown in the accompanying illustrations has been introduced by Webster & Bennett, Coventry, Eng. The turret-heads and tables can be run at different speeds, as they operate independently. This machine is made in two sizes, the 20-in. size, shown in Fig. 1, and the 42-in. size, shown in Fig. 2.

The machine is driven by means of single pulleys fitted with friction clutches so arranged that the speed change gears cannot be changed or shifted until the clutch has been released. Positive horizontal, vertical, and angular feeds are provided and are reversible and interlocking. Rapid power traverse in all directions is instantly available.

A feature of the machine is the feed safety clutch, which is held in position by means of a powerful spring and is set to take the pressure exerted by the heaviest given tool. Any pressure beyond this causes the clutch to slip and so prevents damage to feed mechanism through accident or carelessness. Ball-thrust bearings are provided for all feed screws and worms.

The turret is balanced by compensating springs in-

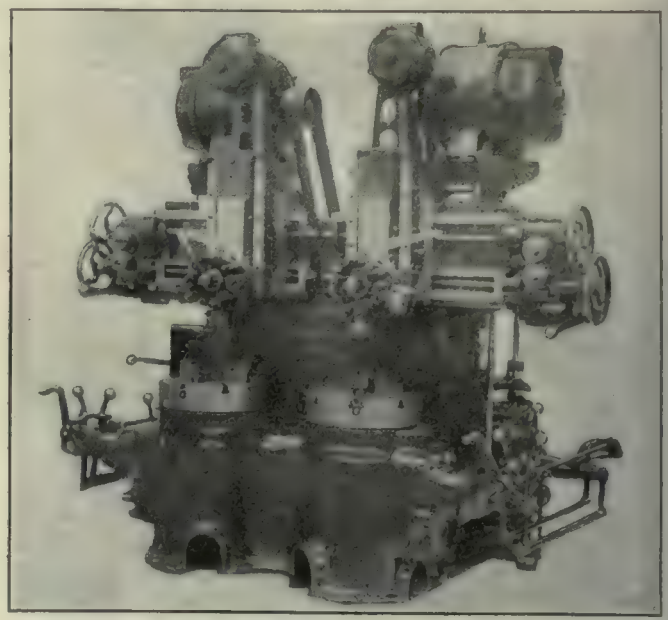


FIG. 1. WEBSTER & BENNETT 20-IN. DUPLEX BORING AND TURNING MILL

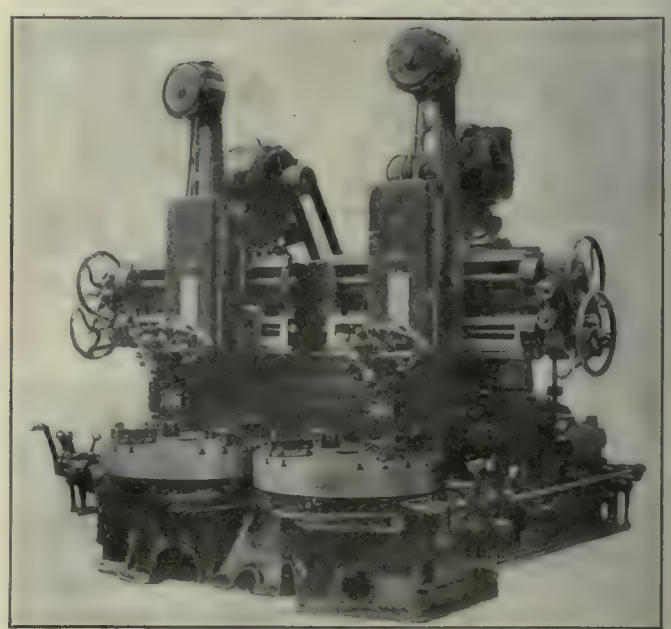


FIG. 2. WEBSTER & BENNETT 42-IN. DUPLEX BORING AND TURNING MILL

stead of weights and chains. Tension is adjusted by means of a revolving wormshaft on top of the balance box. The control is centralized, all levers being accessible from the operator's position at the side of the table. Two levers control automatic feed and rapid traverse in all directions. The machine can be supplied with motor drive if desired.

Tosi Crankpin Lathe

Turning the crank bearings on large multi-throw crankshafts, such as those used in stationary and marine engines, is ordinarily a difficult task, because of the cumbersome shape of the pieces. Several special ma-

chines for the purpose of machining the shafts have been made, Fig. 1 showing a machine recently built for this purpose by the Franco Tosi Societá Anonima, Legnano, Italy.

The construction of this lathe, in which the tools are held by a big hollow mandrel that revolves around the piece to be turned, is said to allow the machine to stand all the stress produced by the use of the best high-speed-steel tools.

The main parts of the machine form two separate rigid sets, the fixed one composed of the bench and the mandrel head, and the other composed of the slide, the two supports to hold the shaft to be turned and the shaft itself. The latter set, shown more clearly in Fig. 2, during the working travels longitudinally across the first set on long guides on the bed. This design makes the slide move so that the work obtained is perfectly cylindrical.

The bed is of strong and heavy construction, and the mandrel head is placed across it. In order to obtain the centering of the piece which is to be turned, the head can be moved transversely by hand and afterward rigidly blocked in the position required.

The hollow mandrel toolholder, having the shape of a ring, turns in the interior of the fixed head, running with great smoothness between half-conical bearings which can be adjusted, see left side of Fig. 3. The arrangement provides for a continuous circulation of cooling oil between the head and the mandrel, keeping the bearing surfaces perfectly lubricated at the same time. Thus expansion caused by the overheating of the head and the mandrel through friction is avoided, a necessary construction in a mechanism of this kind. The view on the right in Fig. 3 shows the construction.

The machine is intended to be driven through gears connecting with an electric motor. The speed-change gears are encased, so as to run in oil, and they give five different speeds to the mandrel. The engagement and the disengagement of the motor are obtained by friction clutches. The slide can be moved either by means of the four power feeds through a quick-shifting mechanism, or by hand with a micrometrical device.



FIG. 1. TOSI CRANKPIN LATHE

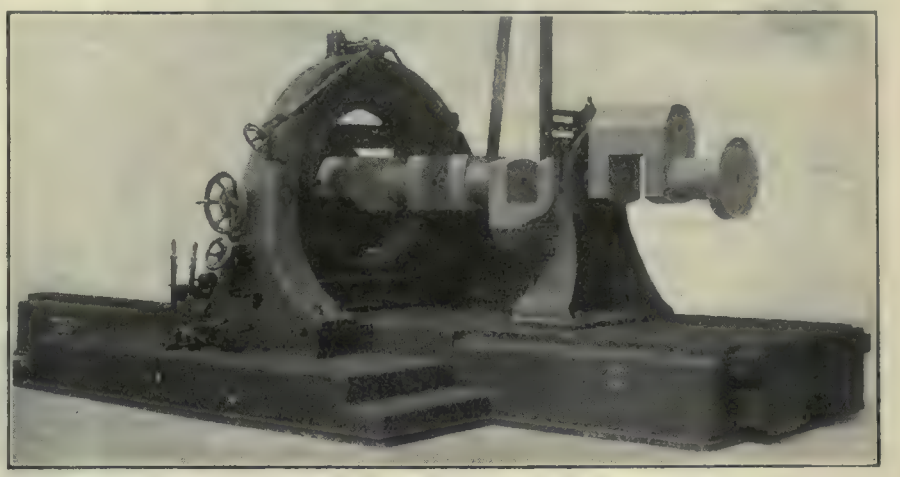


FIG. 2. CRANKSHAFT MOUNTED ON TOSI LATHE

The tools, which are moved in a radial manner, are fixed to special supports, held by two cross-head beams fixed on the hollow mandrel and shown in Fig. 1. Their movement, which can be regulated while the machine is in action, is obtained by a screw and a ratchet gearing, which slides on two helical segments.

All levers and gear handwheels are in a central position, within easy reach of the workman, and a platform at the front of the machine facilitates both operation and survey.

Specifications: Internal diameter of mandrel, 1,400 mm. (55.119 in.). Maximum diameter of pin to be turned, 600 mm. (23.623 in.). Maximum radius of useful cutting, 710 mm. (27.953 in.). Height from the slide face to center of mandrel, 1,120 mm. (44.095 in.). Horsepower of motor, 15. Bench: length, 7,000 mm. (275.59 in.); width, 3,000 mm. (118.112 in.). Approximate weight, 35 tons.

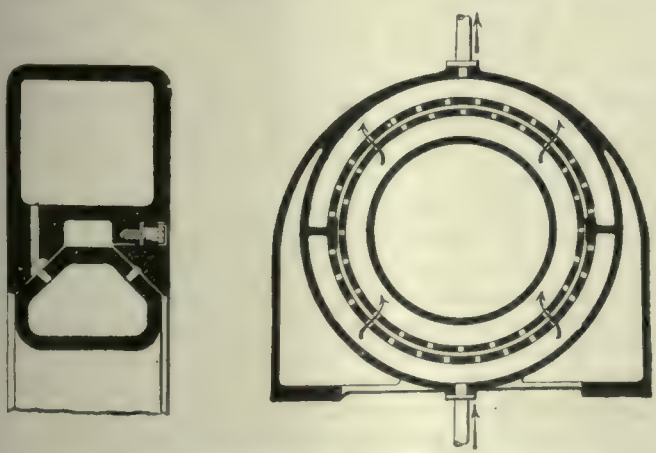


FIG. 3. ARRANGEMENT OF ROTATING MANDREL IN THE HEAD

Phoenix Cylinder Reboring Machine

The cylinder reboring machine, shown in the accompanying illustrations, has been recently placed on the market by the Phoenix Manufacturing Co., Eau Claire, Wis. The machine is designed for the purpose of reboring motor cylinder blocks and is fitted with a cutter head that is said to be especially adapted for this work.

By the use of the attachments which are supplied, the machine can be used either as a hand machine, as shown in Fig. 1, or with power as shown in Fig. 2. The cylinder can also be rebored without removing it from the chassis. The boring bar operates in an adjustable bearing, 13½ in. long, by means of which accuracy of

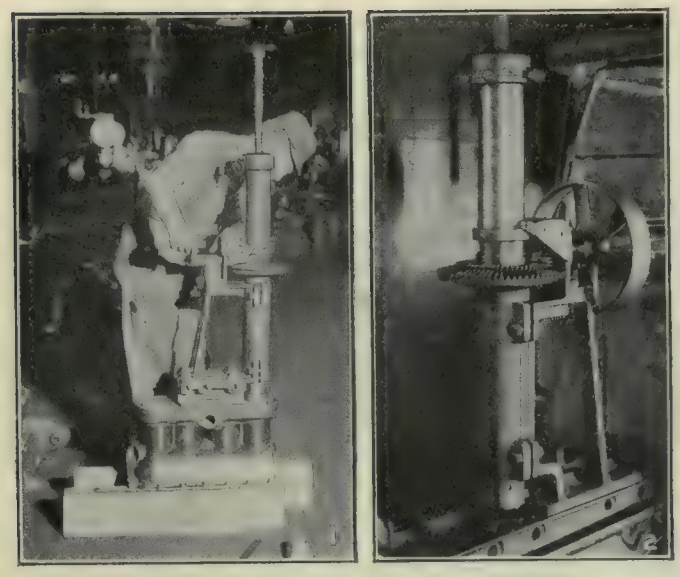


FIG. 1. PHOENIX CYLINDER REBORING MACHINE RUN BY HAND. FIG. 2. POWER OPERATED

alignment is maintained. The cutter head, which is furnished with each machine, is adjustable from 3⅜ in. to 4¼ in., and with an extra set of blades will bore cylinders up to 5 in. in diameter. The machine weighs 160 lb.

Storm Type M Reboring Machine

The illustration shows the Storm Type "M" Reboring Machine, built by the Storm Manufacturing Co., Minneapolis, Minn., for use in reboring motor cylinders. The main body of the machine is a heavy casting which supports the boring bar, feeding and driving mechanism. The boring bar is of hollow carbon steel and is supported by two heavy adjustable bearings. It has a travel of 14 in. The cutter heads are of the Storm patented six-cutter type, which have universal adjustment by means of a central cutter adjuster. The machine is regularly furnished with a connection for a drilling machine, but can also be furnished with a belt pulley or with motor drive. Each machine is also provided with a double-end wrench for operating by hand so that it may be removed from the base and used for reboring motors without taking them from the chassis. The feeds used for boring are 40 and 8 revolutions per inch of travel of the boring bar. The total capacity of the machine is from 2⅝ to 6½ in. and the weight approximately 300 lb.



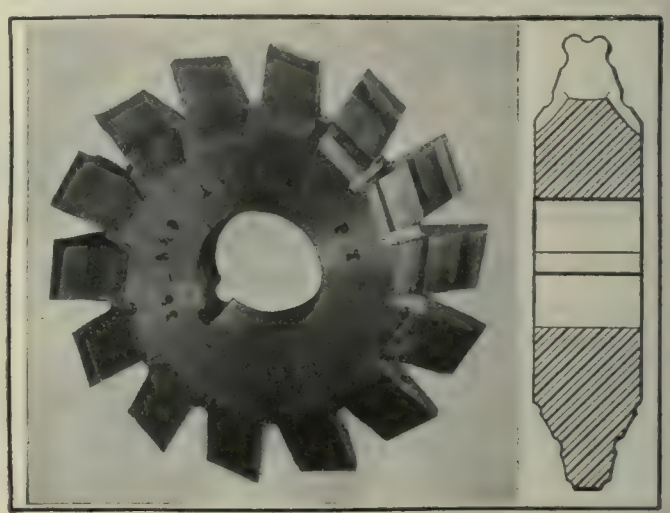
STORM TYPE M REBORING MACHINE

Bonaffous-Bozonnet High-Production Gear Milling Cutter

The illustration shows a formed milling cutter for production work in the cutting of gear teeth. The cutter in various kinds and profiles is made by Bonaffous, Bozonnet & Co., St. Ouen, near Paris, France. It looks at first sight like a roughing cutter; but it is not, as it is stated that a very smooth finish can be obtained, as well as a correct profile.

The cutter is not relieved on a relieving or backing-off lathe, but on a special milling machine. As can be seen by the view on the left, the relieving is straight instead of curved, as is the case in the ordinary gear cutter. The cutter is not ground with the tooth faces radial, but in such a way that the tooth face is kept parallel to a certain diameter line through the tooth, this procedure being necessary in order to keep the profile of the gear teeth correct. The line is scratched on the cutter for one pair of teeth.

The teeth of the cutter are nicked alternately, in the manner shown by the top and bottom portions of the sketch at the right of the illustration. These nicks, or chip breakers, are said to prevent chatter and to



BONAFFOUS-BOZONNET GEAR-MILLING CUTTER

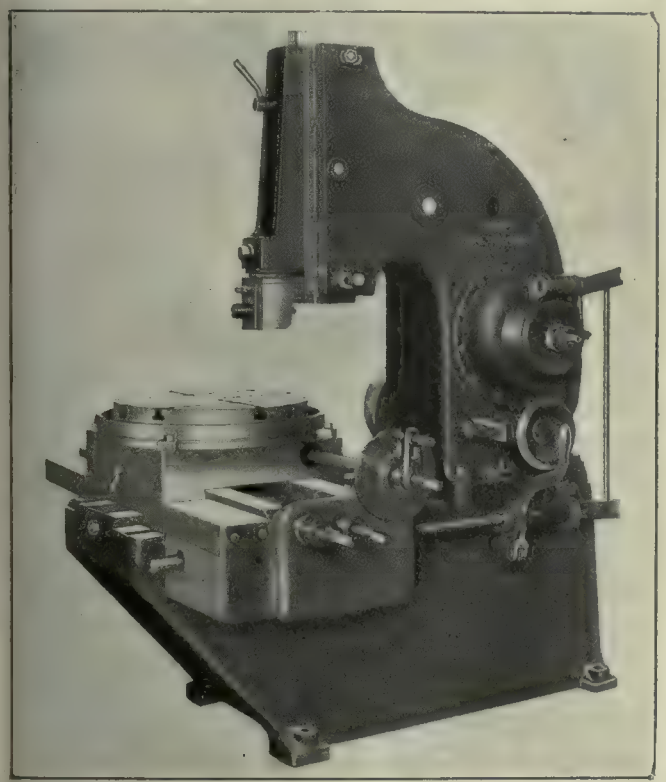
allow each tooth to remove a certain amount of metal. The principal advantage of the cutter is said to lie in the method of relieving. With a cutter relieved on the backing-off lathe, after cutting a number of gear teeth, a flat surface begins to wear at the point and on the sides of the tooth near the cutting edge. The rubbing of this flat surface on the metal of the gear blanks to be cut has a braking action which goes on increasing very rapidly, causing the cutter to heat and destroying the cutting edge. With a cutter having its teeth relieved on a straight line, this action is reduced, with the result that higher cutting speeds and feeds can be adopted.

It is stated that with the cutter shown, cast-iron spur wheels, module 9 (about 1⅛ in. circular pitch) can be cut at a peripheral speed of 55 to 60 ft. per minute and a feed of 8 in. per minute, the work being done in one cut only. Ordinarily, 12 wheels of 57 teeth and 3¼ in. wide can be cut without sharpening the cutters. If this work had to be done with an ordinary cutter relieved on the backing-off lathe, it would require a more powerful machine than the one used in the test mentioned.

Jones Vertical Shaping and Slotting Machine

The machine shown in the accompanying illustration is a vertical shaping and slotting machine which has recently been placed on the market by the Jones Machine Tool Works, Philadelphia, Pa. This machine is made in two sizes, with 6 or 10-in. stroke, and can be furnished equipped for either belt or motor drive. Power is transmitted through a friction clutch and a set of sliding gears, which allow three speed changes for the 6-in. machine and four for the 10-in. machine. The machine is equipped with the McCord quick-return mechanism, which is flood-lubricated, as are also the change gears.

Power feeds for the saddle, cross-slide and rotary tables are of the intermittent ratchet-feed type. The cross-slide and saddle have micrometer dials graduated in thousandths for fine adjustment. The rotary table is graduated to 360 deg. and has an indexing plate with spring stop for accurate spacing. Quick indexing is also a feature of the table, which can be rotated $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$ or $\frac{1}{32}$ of a circle. The 10-in. machine is equipped with quick power traverse to the saddle, cross-slide and table.



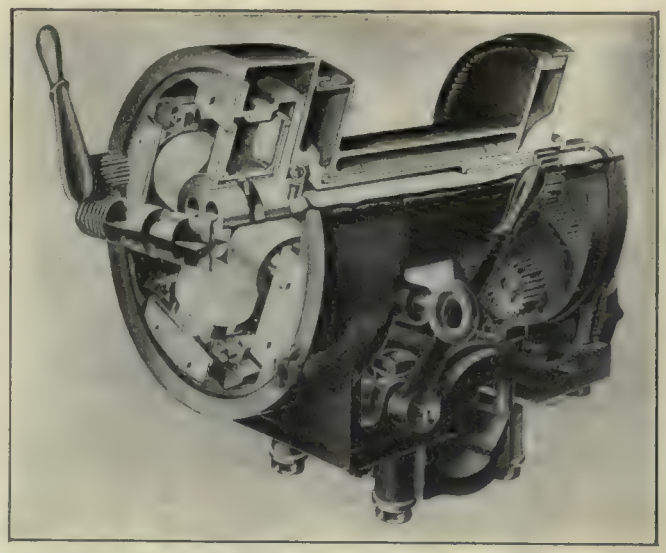
JONES VERTICAL SHAPING AND SLOTTING MACHINE

Denver Air-Operated Hoist

The illustration shows a sectional view of the Model 250 Waughoist, an air-operated hoist recently placed on the market by the Denver Rock Drill Manufacturing Co., 39th Ave. and Williams St., Denver, Col.

The Waughoist is designed on the principle of a rotary engine, and the whole engine revolves within the motor housing, which is an oil and air-tight casing protecting the engine from the atmosphere and also serving as an oil reservoir.

The spider-shaft, upon which the cable drum revolves, is a heat-treated alloy steel shaft. Fixed to the spider-shaft is the spider which revolves within the motor-housing. Around the inner side of the spider are mounted four hardened and ground steel tracks on which the piston rollers run. A clutch pinion is mounted on the small end of the spider shaft so that the cable drum gearing can be disconnected from the engine and the drum permitted to run free when desired. The hoist can be reversed instantly. All gears are heat-treated steel.



DENVER AIR-OPERATED HOIST

Specifications: Brake horsepower, 5.0 at 100 lb. air-pressure. Hoisting capacity, 500 to 1,000 lb. hoisted vertically at the rate of 68 to 143 ft. per minute, depending on weight of load. Drum capacity, 755 cu. in. of rope space which will accommodate 1,000 ft. of $\frac{1}{4}$-in. rope, 465 ft. of $\frac{5}{16}$-in. rope, or 225 ft. of $\frac{3}{8}$-in. rope. Mounting, fits either 4- or $4\frac{1}{2}$-in. column. Size of air connection, $1\frac{1}{2}$-in. hose or $1\frac{1}{4}$-in. pipe. Gearing, 18 to 1 or 27.5 to 1, at option of customer. Length, $24\frac{1}{2}$ in. Height, $19\frac{1}{2}$ in. Width, $17\frac{1}{2}$ in. Weight, 335 lb. Shipping weight, 400 lb.

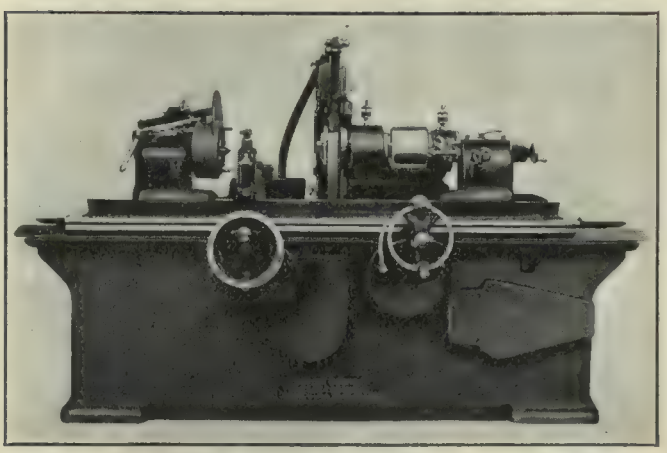
Norton Autopart Regrinding Machine

The Norton Co., Worcester, Mass., has just placed on the market a special type of grinding machine designed for automobile regrinding shops. This machine, which is shown in the accompanying illustration, is so arranged that the various set-ups required can be very easily and quickly made, making it adaptable for the regrinding of crankshafts as well as the grinding of pistons, piston pins, valves, etc. It has a swing of 18 in. and is 55 in. between centers, which will accommodate practically all makes of crankshafts. With the twelve work speeds provided, grinding can be performed on work of small as well as large diameter.

The base is heavy and rigid, and is supported at three points. This method of support makes it unnecessary to provide special foundations for the machine, and insures permanent alignment.

The wheel slide weighs about 900 lb. and is equipped with a 26-in. diameter grinding wheel so that ample clearance will be provided when grinding crankshafts for long stroke motors. The headstock and footstock are of standard Norton type except that they are somewhat heavier and have longer bearing surfaces on the table. A large capacity pump is supplied which is driven directly from the overhead works.

The Norton standard wheel feed mechanism is used consisting of a $3\frac{1}{2}$-in. diameter feed screw engaging with a half nut underneath the wheel slide. The wheel slide rests on one flat and one V-way. The movement of the feed index pin one space advances the slide one-eighth of a thousandth of an inch. The table is operated by a two-speed hand-feed apron.



NORTON AUTOPART REGRINDING MACHINE

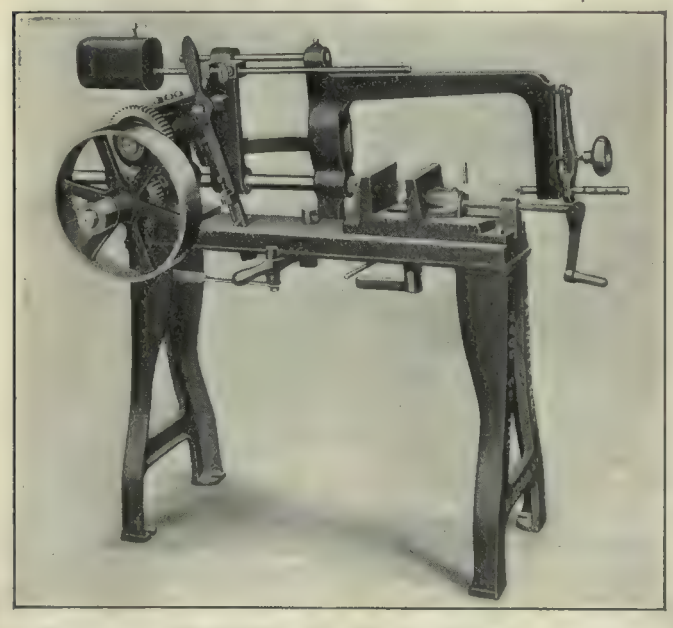
Specifications: Length between centers, 55 in.; swing, 18 in.; weight of headstock, 240 lb.; range of work speed, 20 to 207 r.p.m.; weight of footstock, 160 lb.; weight of wheel slide, 900 lb.; length of bearing ways, 24½ in.; length of spindle, 28½ in.; large bearing, 3⅜ in. diameter, 8 in. long; small bearing, 3 in. diameter, 6 in. long; diameter grinding wheel, 26 in.; net weight of machine, 7,600 pounds.

In order to provide for the many types of crankshafts which the regrinding shop handles, an adjustable end-block is furnished which eliminates the use of blocks and bushings for fastening different diameters of shafts in the fixture.

A combined center and valve-face grinding attachment is also furnished with the machine. By the use of this attachment the machine centers may be ra-ground. The attachment is adjustable, permitting the regrinding of the faces of all types of valves

Frontier Power Hacksaw

The Frontier Machine Tool Co., Inc., 128 Lakeview Ave., Buffalo, N. Y., announces a small power hacksaw, which is shown in the accompanying illustration. The



FRONTIER POWER HACKSAW

Specifications: Length of blade, 8 to 14 in. Stroke, 6 in. Cutting capacity, 5½ x 6 in. Vise: opening, 5½ in.; jaws, 4½ x 3 in. Pulley, 11 x 2⅝ in. Floor space, 36 x 18 in. Weight: net, 215 lb.; crated 235 lb.

saw is belt-driven and provided with an automatic stop and a positive clutch in the driving mechanism. A speed reduction of two to one is made in the gearing, the normal speed being 65 strokes per minute.

Motor Drives for Bradley Hammers

The hammers built by C. C. Bradley & Son, Inc., Syracuse, N. Y., can now be furnished with electric motor drives. The drives are not direct, but through belts, as may be seen in the accompanying illustrations.

In the case of the compact hammer shown in Fig.

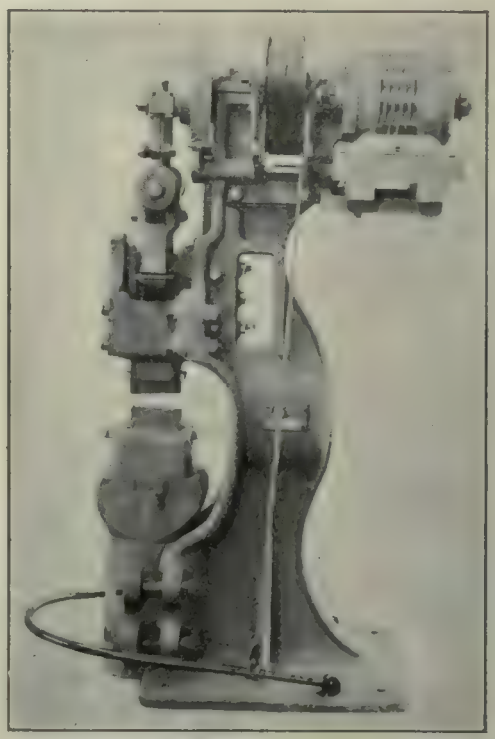


FIG. 1. BRADLEY COMPACT HAMMER, MOTOR DRIVEN

1, the motor is mounted on a bracket attached to the upright. The cushioned helve hammer shown in Fig. 2 has the motor on a separate foundation at the side

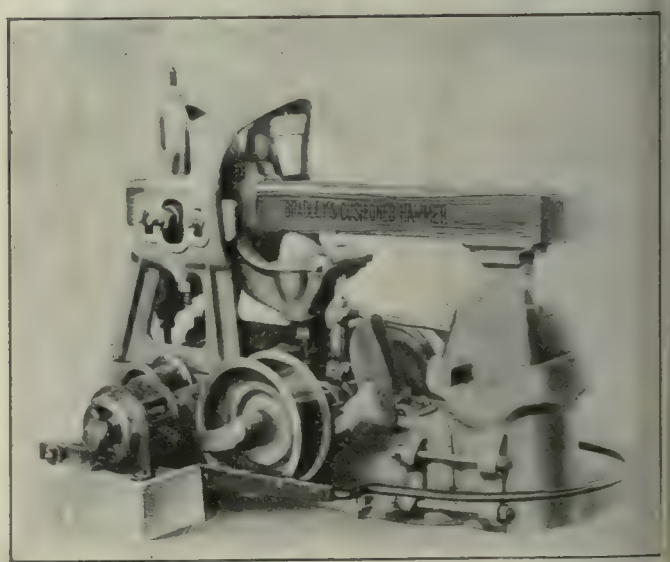


FIG. 2. BRADLEY CUSHIONED HELVE HAMMER, MOTOR DRIVEN

of the machine. The application of motors and belts is clearly shown in the illustrations.

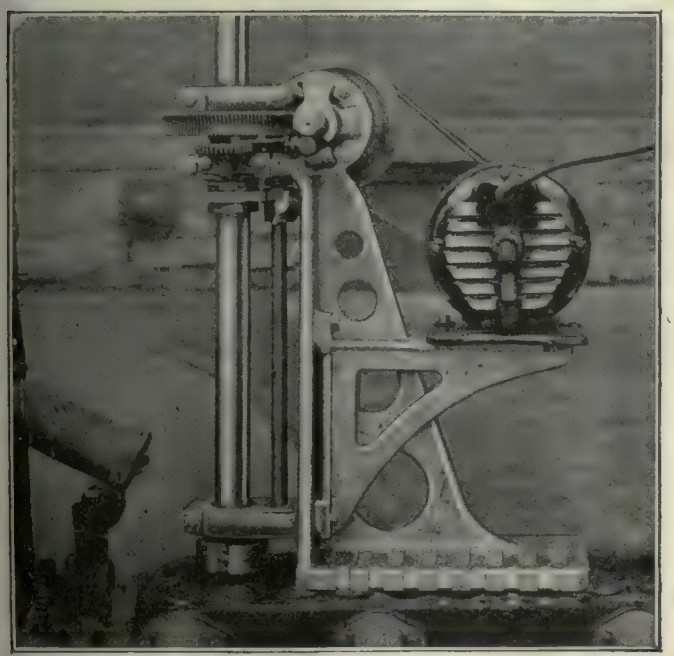
Motors for alternating or direct current and with various voltages, phases and cycles can be furnished

Keeler Cylinder Reboring Machine

The Central City Machine Co., Syracuse, N. Y., has placed on the market the cylinder reboring machine shown in the illustration herewith.

This machine is for use in garages and repair shops for reboring automobile cylinders and is built on an angle plate intended to be secured to the top of the cylinder block. It is motor driven and when in use there is no necessity for removing the engine from the automobile. The boring bar is worm driven and runs in bronze bearings split to take up wear.

Three cutter heads are furnished as part of the regular equipment and will bore from 2¾ to 4½ in. Each head has five high-speed steel cutters centrally adjustable by means of a five-lobed cam, so that any amount of over-size can be obtained for any size of cylinder. The bottom of the cutter head is slightly conical, so that the head can be centered in the cylinder bore before the machine is clamped in place.



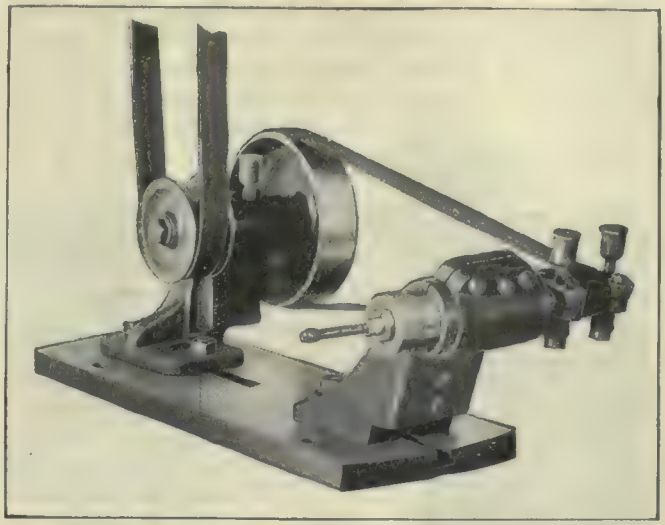
KEELER CYLINDER REBORING MACHINE

Specifications: Diameter of boring bar, 1½ in. Speeds, one. Feeds, two. Motor ⅓ hp. for a.c. or d.c. as required. Floor space, 20 x 11 in. Height, 23 in. Weight, 72 lb.

An adjustable limit stop is provided which will stop the motor when the cutter heads have reached a predetermined depth.

Hjorth Internal Grinding Attachment

The illustration shows the Hjorth internal grinding attachment which has been placed on the market by the Hjorth Lathe and Tool Co., 27 School St., Boston, Mass. It is said that the attachment can be used on practically any of the plain or universal grinding machines now on the market. It has the ceiling countershaft adjustment and a table center adjustment of 2½ in. for accommodating different center heights, also its own countershaft belt adjustment between quill bracket and countershaft. The quill spindles are of two types, one for deep and large holes and one with taper arbors for small holes, accommodating smaller emery wheels and diamond grinding plugs. Each quill spindle has two adjustable bearings, lubricated by oil chambers, and a separate adjustable end thrust bearing. The countershaft spindle is well supplied with oil chambers and with two bearings of its own and is driven by a clutch to a live spindle, thereby relieving the strain from the live spindle.



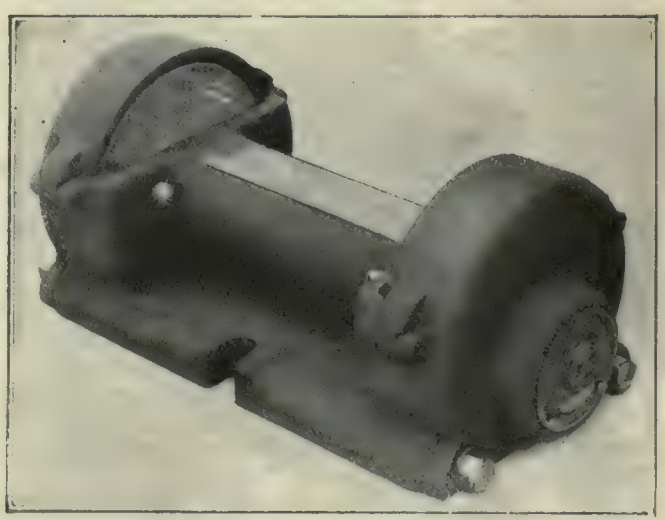
HJORTH INTERNAL GRINDING ATTACHMENT

The attachment is provided with open slots in the base to facilitate easy adjustment and firm holding.

"Precision" No. 23 Truing Machine

The accompanying illustration shows the No. 23 truing machine, which has been placed on the market by the Precision Truing Machine and Tool Co., Cincinnati, Ohio. The machine is similar to the Precision No. 21 machine, but is made for larger grinders such as the Blanchard and Norton surface grinders with wheels up to 6-in. face.

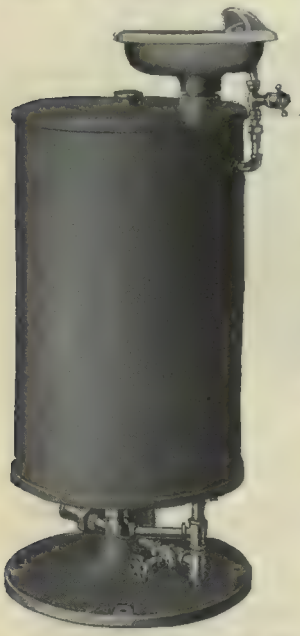
The machine carries wheels 4 in. in diameter with 1 in. face. One of its outstanding features is that a wheel, when not in use, is thoroughly protected by a hinged wheel guard, as the illustration shows. Another is that two different grades of wheels can be carried at the same time, making it possible to use one machine on a number of surface grinding machines when different classes of finish are required; or one wheel can be used for roughing and the other for finishing the same grinding wheel. The machine is equipped with ball bearings.



PRECISION NO. 23 TRUING MACHINE

Economizer Ice-Cooled Drinking Fountain

The illustration shows the "Economizer" combination ice- and water-cooled drinking fountain recently placed in the market by the Manufacturing Equipment and Engineering Co., with office at Boston, Mass., and plant at Framingham, Mass. The principal feature of the device is the fact that two coils and two cooling compartments are used, although ordinarily ice-cooled fountains utilize but one coil for the circulation of water in the ice compartment. One of these cooling compartments with a coil immersed in it is cooled by ice, while the other is cooled by the water which is ordinarily wasted during drinking and which has been thoroughly cooled. The combined length of the coils carrying the drinking water is 105 ft., the coils being made of copper. It is stated that the retaining of the wasted cool water and the utilization of it for cooling the water inside the coils effects a considerable saving in the amount of ice necessary to cool the drinking water. This waste water circulates about the lower or primary coil and is kept cool by the continued replenishing of it by the wasted water from the bowl below the bubbler.



ECONOMIZER ICE-COOLED DRINKING FOUNTAIN

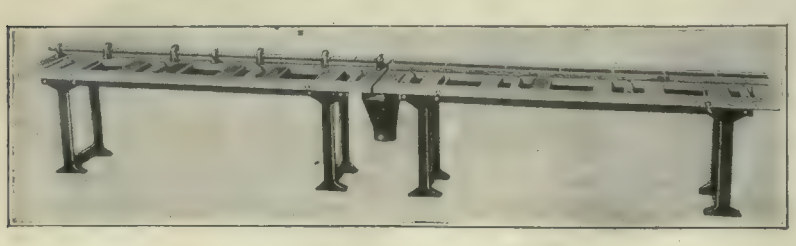
Either inclined or vertical stream types of bubbler can be furnished, the type illustrated having an elliptical bowl with an inclined stream and a cowl to guard it. Other features claimed for the device are the use of a cork-insulated cover, an air chamber surrounding the tank and large connecting pipes.

Oliver Swing Cut-Off Saw Table

The Oliver Machinery Co., Grand Rapids, Mich., has placed on the market the swing cut-off saw table shown in the illustration. The table is designed for use with the overhead swing cut-off saw and is 16 ft. long, 19½ in. wide and 30 in. high. The top is made of kiln-dried rock maple with angle-iron girths and the legs are of cast iron.

The table is composed of two parts or sections. On the rear of the right-hand section is mounted the scale rail, which is graduated in eighths of an inch up to 96 in. On the left-hand section is mounted the Oliver No. 419 patent automatic-swing cut-off saw gage which comprises a square rod graduated in eighths of an inch from 0 in. to 96 in. Four automatic malleable-iron stops, one center and two end door holders are mounted in place. The bed of the table carries a set of rollers as shown. A dust chute is fastened between the two sections of the table, having a 6-in. pipe opening connecting to exhaust system.

This table can be used with any overhead swing cut-off saw.



OLIVER SWING CUT-OFF SAW TABLE

Parker "Shur-Grip" File Holder

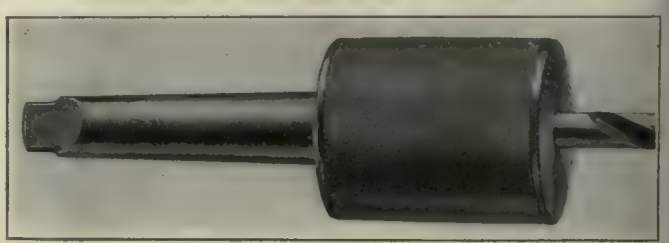
The illustration shows the "Shur-grip" file holder which has been placed on the market by the Parker Supply Co., 785 East 135th St., New York, N. Y. The principal feature of this holder is a case-hardened flexible steel thread in the file opening, into which the tang of the file is screwed. This thread is said to cut into the tang like a die and to hold the file absolutely rigid, not only eliminating the usual troubles of keeping the holder on the file, but making it possible to use the holder on different files. A steel casing around the thread prevents it from turning or expanding. This casing and thread are held in the holder by means of a steel ferrule which covers the end of the holder as shown. The handle is made of hardwood. The holders are made in three sizes, for use with files from 6 to 18 in. long.



PARKER "SHUR-GRIP" FILE HOLDER

Eastern Automatic Drill Chuck

The Eastern Tube and Tool Co., Inc., 594 Johnson Ave., Brooklyn, N. Y., has brought out a drill chuck for use with straight-shank drills. The shank of the drill is held between three cam-shaped rollers, by the simultaneous rotation of which the size of the space for the drill shank can be varied. An internal gear fastened to the sleeve engages with teeth cut on the upper ends of the rollers, so that rotating the sleeve with relation to the shank of the chuck also rotates the rollers. It is thus possible for the operator to change the drill while the spindle of the machine in which the chuck is fastened is rotating, the rotation of the knurled sleeve being retarded with one hand and the drill being removed with the other after it has become loosened. Another drill can then be inserted in the same manner. The cam rollers automatically rotate so as to grip the work, a spiral



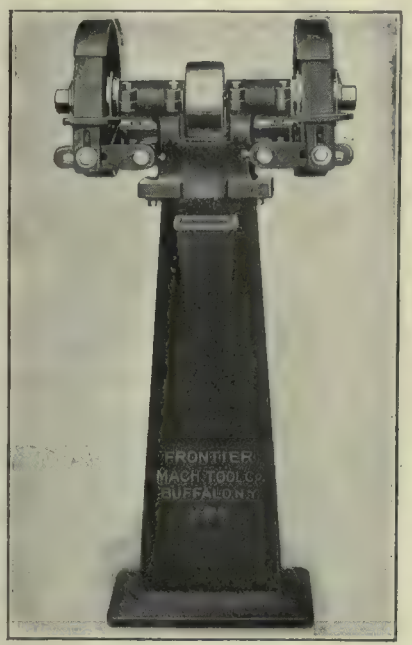
EASTERN AUTOMATIC DRILL CHUCK

spring, which causes the rotation of the sleeve to its normal position as soon as it is released, accomplishing this purpose.

The chuck is said to be self-centering and to be very rapid in its action. There are no screws which can loosen with use, and the presence of oil in the chuck does not prevent the securing of a strong grip. The tapered shank is screwed in place in the chuck, so that it is possible to change it to accommodate the device to different sizes of drilling machines. Morse taper shanks, either Nos. 1, 2, or 3, are ordinarily furnished. The chuck is made in two sizes, the No. 6 size having a range from $\frac{1}{8}$ to $\frac{25}{64}$ in., and No. 8 from $\frac{3}{16}$ to $\frac{31}{64}$ in.

Frontier Tool-Grinder

The illustration shows a tool grinder recently placed on the market by the Frontier Machine Tool Co., Inc., 128 Lakeview Ave., Buffalo, N. Y. The machine is of the ordinary wheel-stand type, is belt-driven and carries two wheels. Guards are furnished for the wheels, and rests for the work. A countershaft can be furnished with the grinder.



FRONTIER TOOL GRINDER

The wheels are 12 x 2 in. in size and 15 in. apart. The diameter of the spindle is 1 in. between the flanges and $1\frac{7}{16}$ in. at the bearings, the bearings being $4\frac{1}{2}$ in. long. The driving pulley is $4\frac{1}{2}$ x $2\frac{5}{8}$ in. in size. The height to the center of the spindle is 39 in., and the floor space required is 18 x 24 in. The machine without the countershaft weighs 195 lb. net, and 215 lb. crated. The countershaft that can be furnished has a length of 24 in., a drop of 7 in., a driving pulley 12 in. in diameter, and weighs 58 lb.

New Britain Pilot Blade Expansion Reamer

A reamer for use in garages and other shops has been placed on the market by the New Britain Tool and Mfg. Co., New Britain, Conn. The reamer shown in the



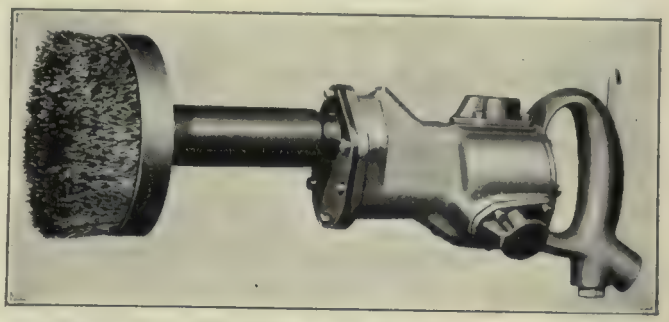
NEW BRITAIN PILOT BLADE EXPANSION REAMER

illustration is of the six-blade expansion type with the entering ends of the blades reduced in diameter to serve as a pilot, to keep the reamer straight, and to prevent "digging" and chattering.

A complete range of sizes from $\frac{15}{32}$ in. to $4\frac{1}{16}$ in. is made. The construction is the same as in the standard expansion reamer manufactured by this company.

Wire Brush for Ingersoll-Rand "Little David" Drill

A wire brush has recently been placed on the market by the Ingersoll-Rand Co., 11 Broadway, New York, N. Y., for use with the standard No. 6 "Little David"



INGERSOLL-RAND WIRE BRUSH ON NO. 6 "LITTLE DAVID" DRILL

drill, on which it is shown in the accompanying illustration. The brush has a face diameter of 5 in. and is made up of wires of a special heat-treated steel, selected on account of its good wearing qualities. It is said to be sturdily constructed, so that it will stand up under severe service. The wire-brush outfit is adapted to the removal of paint, rust, scale and dirt from tanks, steel cars, structural steel and sheet-metal surfaces, as well as to cleaning iron, steel and aluminum castings.

The brush is manufactured particularly as an attachment for the No. 6 "Little David" portable pneumatic drill, previously described in the *American Machinist*, on page 42, Vol. 53. The drill has large bearings to take up the end thrust, a high-speed motor, and it is of light weight and small size. It can be used in sharp corners and other cramped spaces. The whole outfit weighs only $11\frac{1}{2}$ lb.

Randa Floating Reamer and Counterbore Holder

The Randa Manufacturing Co., 1316 East Jackson St., Muncie, Ind., has recently placed on the market the floating reamer and counterbore holder shown in the accompanying illustration. The device is adaptable for use on automatic screw machines, turret lathes and boring mills, and it can be made to suit any purpose, for reamer shanks of different sizes, either straight or tapered. It is stated that the reamer is always held parallel to the axis of the spindle. A large bearing surface on the end of the floating member holding the reamer fits against a corresponding bearing surface on the body or shank end of the tool. The driving is accomplished by means of a square block fitting into correspondingly shaped recesses in both the shank and the floating member. The wearing surfaces are hardened and ground. It is stated that the device is very accurate, and can work continuously to close limits.

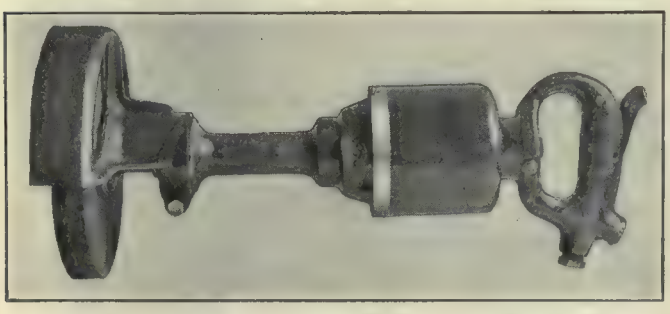


RANDA FLOATING REAMER AND COUNTERBORE HOLDER

The holder is made in three standard sizes, the No. 1 size holding up to ½-in. reamers, the No. 2 size those from ½ to 1⅛ in. in diameter, and the No. 3 size reamers above 1⅛ in. The maximum outside diameter of the device is, for the respective sizes, 1⅞, 2½, and 3¼ in.; and the diameter of the reamer shank is ⅜, ⅝ and 1 in. The two larger sizes are made so as to provide oil feed for the reamer.

Keller Portable Pneumatic Grinder

The Keller Pneumatic Tool Co., Grand Haven, Mich., builds the portable pneumatic grinder shown in the illustration and designated as the No. 22-G machine. Its



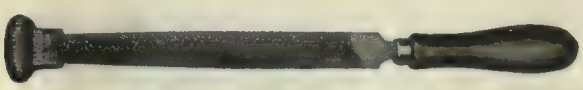
KELLER PORTABLE PNEUMATIC GRINDER NO. 22-G

motor is of the rotary-piston type running at the proper speed for grinding, and it is stated will maintain its speed under load. The construction eliminates crankshaft and connecting-rod thrust, and thus any vibration that might be due to these parts.

The object of the design has been to develop a tool that will be both handy and well-balanced, it is said, thus lightening the strain on the operator. The tools are built in two sizes, the smaller weighing 5¾ lb. and the larger, 18 pounds.

Osgood Safety Filegrip

A grip for use on the outer end of a file has recently been placed on the market by the J. L. Osgood Tool Co., 43 Pearl St., Buffalo, N. Y. The accompany-



GRIP IN PLACE ON A FILE

ing illustrations show both the grip itself and the manner of attaching it to the file. The device is made of rubber, and is pliable and soft, so that it both holds itself in place when slipped on the end of the file, and also prevents cutting and soreness of the hand which occur from constant pressure on the file teeth.

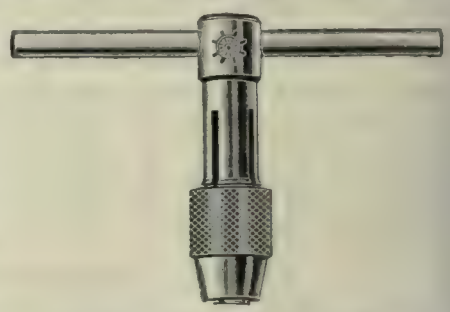


OSGOOD SAFETY FILE-GRIP

It is stated that the use of the grip enables the holding of the file flat on the work, and also enables the production of better work with less effort than required without the grip. The grip can be used as a soft-face mallet for light driving on finished surfaces. In case the file be dropped, the cushioning action of the grip prevents breakage of the file or injury to the work on which it may strike. The grip is made for all sizes and shapes of files.

Consolidated Adjustable Tap Wrench

The Consolidated Tool Works, Inc., 296 Broadway, New York, N. Y., has recently placed on the market the adjustable tap wrench shown in the illustration. The tool is made from solid bar steel, and is ground and polished to a finish. It is said to be a very handy wrench, being quickly and easily adjusted, by means of the threaded collar, for holding different sizes of taps, drills, reamers, wire and other articles. The wrench is made in two sizes, the No. 70 tool holding taps up to ¼ in. in size, and the No. 80 up to ½ in. taps.



CONSOLIDATED ADJUSTABLE TAP WRENCH

How a Fly Spoiled An Expensive Job

By Alonzo G. Collins

While browsing through the back volumes of the *American Machinist*, the article entitled "In Retrospect," by Matthew Harris, on page 1259, Vol. 50, concerning the origin of blueprinting, brought to mind an incident that happened in the early 80's. A tracing, a fly, and a blueprint were the cause of considerable expense to the proprietors of one of the machine shops in the Middle West, who were not using blueprints for their work.

I was connected with the machinery end of a large manufacturing plant being built in Chicago, and part of my duties consisted of visiting the various concerns which had contracts for supplying machinery and seeing that the work was coming on in schedule time and according to blueprints furnished them by the purchaser.

The shop in question had the contract for shafting, pulleys and other power transmission machinery, among which were several pulleys 14 ft. in diameter and 38 in. face and on one of my visits to the plant I found some of them finished and one on the mill being machined. I got out my note book to make a note of the date and on comparing the size as given in my book and the casting as it stood, I noted that the pulley was 3 ft. 8 in. face instead of the 38 in. called for. I asked the operator for an explanation and he said it was according to the blueprint, which he showed me, and sure enough it was as he said; but there was a queer look about the figures that made them seem unusual, and a closer inspection showed that the "foot" mark after the figure three was a round dot instead of the usual dash. The figures also, were not spaced as far apart as usual, nor was there any dash between them.

I called on the management and reported the facts. They were inclined to be a little "uppish" about it, but a glance at the contract showed that they had contracted to furnish 38-in. face pulleys and there was no way out of it but to scrap them and make new ones. An internal flange on each edge of the face precluded turning them down. On my return to Chicago an investigation showed that a fly had, with a fly's usual disregard for consequences, placed a dot right after the 3, which a careless draftsman had placed farther from the 8 than was needed, and the blueprint paper had copied it faithfully.



NEWS SECTION

Longworth Resolution for Quick Action on Tariff

Few pieces of legislation have given rise to as much discussion as has followed the reporting out of Representative Longworth's resolution to give immediate effect to the permanent tariff bill directly after its being completed by the Committee on Ways and Means. The object of the resolution is to prevent large losses of revenue to the government during the time the revenue bill is under discussion. When the proposed higher rates of duty become known importers bring in large quantities of goods in anticipation of the higher rates. The larger loss of revenue always has been regretted but Congress never has been willing heretofore to give immediate effect to legislation previous to its having gone through the usual course. There is evidence that there will be no departure from this precedent, but nevertheless there is certain to be a very determined effort to secure such legislation. It is admitted by all who favor a protective tariff that this would be of incalculable benefit to American manufacturers, but it is very doubtful if the Senate will accept such a proposition.

Great Britain, France, Italy, Canada, Australia and other governments follow such a procedure. It requires from five to nine months for tariff legislation to take its regular course through Congress. Representative Longworth, in reporting his resolution, declared that between the dates of reporting a revenue bill to the House and of its final enactment into law, the loss of revenue resulting from the artificially stimulated imports will run into hundreds of millions of dollars "at a time when the Government is in need of revenue, as never before and when the resulting damage to American industries would be incalculable."

Bids for Pumping Machinery

Bids are being received by the board of public works at East Chicago, Ind., for the installation of centrifugal pumps of a total capacity of 75,000,000 gallons of water daily and all machinery connected with the pumps, which will be used for a sewage pumping station. The work is estimated at $131,000 and bids will be opened June 13.

Some Export Orders

C. C. Bradley & Son, Inc., Syracuse, N. Y., has recently filled foreign orders for some power hammers of the standard type made by the concern. The principal order, which was shipped during the latter part of May, comprised six cushioned helve hammers, and was consigned to Calcutta, India. Recently one machine was sent to Valpariso, South America, and three to Southampton, England, these being upright helve hammers.

Kimball Slated to Head A. S. M. E. During 1922

Dexter S. Kimball, dean of the college of Engineering of Cornell University, was nominated for the presidency of the American Society of Mechanical Engineers in the report of the nominating committee for 1921, submitted to the society's council on Tuesday, May 24, at the Spring Meeting of the Society held in Chicago.

Dean Kimball, who was elected a member of the society in 1900, was chosen manager in 1919. His term as manager does not expire until 1922 and W. S. Finlay, Jr., of New York City, has been nominated to serve the remainder of the term. Dean Kimball has been active in the work of the society, having been chairman of the Committee on Meetings and Programs and member of the Committee on Organization. He is a vice-president of the Federated American Engineering Societies.

Three vice-presidents were also nominated. They are Col. E. A. Deeds, of Dayton, Ohio; Robert Sibley, of San Francisco; and L. E. Strothman, of Milwaukee. Sherwood F. Jeter, of Hartford; Horace P. Liversidge, of Philadelphia; and Hollis P. Porter, of Tulsa, Okla., have been nominated as managers in addition to Mr. Finlay. William H. Wiley, of New York City, has again been nominated as treasurer. He has occupied this office, having been regularly nominated and elected each year, since 1884.

The nominations, all of which were approved by the council, will be voted on by the members of the society through a letter ballot and the election will take place at the annual meeting next December.

Organization of Technical War Service Officers

In connection with the organization, under the direction of General Pershing, of the reserve armies of the United States, it is proposed to informally associate members of the Army Ordnance Association and the Ordnance Officers of the Reserve Corps.

The membership of the Army Ordnance Association, of which Benedict Crowell is president, is comprised of some twenty-four hundred technical and business experts who, during the war, served either as officers of the Ordnance Department or as executives of industries engaged in ordnance manufacture.

For the purpose of offering assistance in the organization of the reserve armies and in the solution of local war plans, it is now proposed to form in the Metropolitan District of greater New York, a local organization of the Army Ordnance Association which shall include as members all Ordnance Officers of the Officers' Reserve Corps.

Organization Meeting

There will be a meeting for this purpose at the Engineering Societies' Building, 29 West 39th St., at 8 p. m., Wednesday, June 15, with Guy E. Tripp presiding. Short addresses will be made by Maj. Gen. C. C. Williams, Chief of Ordnance; Maj. Gen. Robert L. Bullard, Commanding General of Second Corps Area; Brig. Gen. William Weigel, Chief of Staff, Second Corps Area; Col. Samuel G. Shartle, Assistant Chief of Staff, Second Corps Area; Major M. L. Brett, office of Assistant Secretary of War, and others.

All who served as officers in the Ordnance Department during the war, and all who are interested in ordnance as a factor in preparedness, are invited to attend.

Vocational Board Summer Camp

A summer vacation camp for all trainees of the Federal Board for Vocational Education will be held at Fort Sheridan, Ill., from June 15 to Sept. 15 This camp will take care of veterans in the States of Wisconsin, Illinois and Michigan and will be in charge of Charles W. Sylvester, district vocational officer.

Conference of Industrial Cost Association

Various phases of cost accounting were considered at the National Industrial Cost Conference held on May 26, 27 and 28 at the Roycroft Inn, East Aurora, N. Y., under the auspices of the Industrial Cost Association. The conference, which was said to be the first of its kind, was attended by cost accountants representing a wide variety of industries and localities and many nationally known concerns.

The subjects considered were both general and technical. Ideas on present business conditions in relation to accounting were exchanged; the increasing importance of accurate and correct cost accounting in industry was emphasized, and the need for standard practices and a common meeting ground for accountants was brought forth.

Present Cost Problems

The morning session on the 26th was devoted to business and was attended only by the officers and delegates from the local sections. The conference opened in the afternoon with a session treating on "Current Influences on Cost Problems." J. W. Stannard, secretary-treasurer of the American Autoparts Co., Detroit, Mich., speaking on the subject of "Post-War Changes in Economic Conditions," considered cost accounting from an economic viewpoint. He said that cost accounting as now practiced began only about twenty years ago. The development in Europe and in America followed different lines, which, however, met twelve years ago, so that an international viewpoint can now be obtained on cost accounting. We are at present in the first serious business eruption since that time. No fiscal year has been entirely bad, although 1921, which started poorly, will probably remain so throughout the entire year. Mr. Stannard stated that he expected business in general to remain poor for about eighteen months.

Horace S. Peck, comptroller, S.K.F. Industries, Inc., New York, spoke on the subject of "The Influences of Present Economic Conditions on Cost Practices." He said that above all things freedom from wastefulness must exist. Although the cost department has big problems when business is bad, that is the time when cost systems show their worth. The speaker stated that during good times many businesses did not fortify themselves for the bad times to follow. He stressed the point that retail costs must come to the point where they match the cost of production at the factory. In closing, he stated that to get a proper solution to the present problems unselfishness must prevail; and that no thorough readjustment could arise until labor, capital, wholesaler and retailer are each willing to give what they can to obtain normalcy, rather than to take without giving.

In the discussion which followed the meeting the fact developed that in many lines, although the amount of business and the number of employees in the shop decreased, it was not possible to decrease the size of the accounting department, merely the amount of business and not the amount of detail having been decreased.

Distribution of Burden

The evening session of the opening day was devoted to a discussion of the question, "Should Abnormal Burden Be Included in Current Monthly Cost?" A paper by H. B. Pavitt and W. L. Erdman, cost accountants of the Allegheny Steel Co., Brackenridge, Pa., favored the affirmative, stating that, "Deferring burden does not do away with it. In a time of depression the loss should be shown during the period of non-operation, and not deferred for the purpose of penalizing future operations."

Thomas J. Haley, treasurer of the Fawcus Machine Co., Pittsburgh, Pa., also favored the affirmative, stating that the burden should be distributed in the best and quickest manner, and that the figures should be available to all departments.

A paper by Ernest J. Wesson, industrial engineer of the W. T. Rawleigh Co., Freeport, Ill., favored the opposite side of the question, stating that abnormal burden should not be included in the current monthly cost. He said that, since a business is expected to operate through periods of both good and bad business, it is only the average which counts; he advocated the carrying of a burden reserve on the books of the company.

Lively discussion on the subject of the distribution of burden followed. As a climax to the discussion a vote was taken on the question, the conference favoring, by a majority of three to two, the procedure of not charging up the abnormal overhead against the lessened volume of current production.

Uniform Cost Systems

Uniform cost systems occupied the attention of the conference on the second morning of the meeting. Robert E. Belt, secretary of the American Malleable Castings Association, Cleveland, read a paper on "Uniform Cost Systems and Their Weaknesses from the Trade Association Viewpoint." He favored the adoption of uniform methods of accounting throughout each particular industry, and he said that uniform accounting methods would mean uniform competition and not uniform costs.

"Uniform Cost Systems from the Users' Viewpoint" was the subject of a paper by E. M. Brown, chief cost accountant of the American Blower Co., Detroit. Mr. Brown did not favor the adoption of uniform methods of accounting throughout an industry, because the problems of each plant are peculiar to it, and the accounting system must be built up to suit the conditions.

From the discussion, which was led by A. F. Smith, cost accountant of the National Association of Finishers of Cotton Fabrics, New York, it seemed to be the consensus of opinion that no absolutely uniform systems of accounting can be used, although uniformity of method is very desirable and full co-operation between manufacturers is necessary to secure this uniformity.

"The Standardization of Cost Terminology and Fundamental Principles" was the subject of the afternoon session on the second day, papers being read by Addison Boren, manager of the works accounting bureau of the Yale & Towne Manufacturing Co., Stamford, Conn., and by G. K. Wilson, assistant secretary of the Sullivan Machinery Co., Chicago.

Human Element in Costs

The last general meeting of the conference was held on Friday evening, speakers on the subject of the human element in cost being heard after the banquet. Elbert Hubbard II, president of the Roycrofters, told of activities at his shops. Harry Tipper, manager of "Automotive Industries," New York, spoke on "Measuring Human Costs," stating that the human element is the greatest and most variable one entering into costs, being fundamentally the only cost in industry. The only possibility of making large decreases in costs lies in increasing the productivity of the workers themselves. How to do this is a big problem, as we have but little knowledge on the subject.

"The Profits of the Golden Rule" was the subject of an address by I. H. Mills, superintendent of the Sperry Gyroscope Co., Brooklyn, N. Y. Mr. Mills told of happenings in his long experience in the machinery industry which give him an understanding of the problems of the worker and a groundwork for the treatment of them. Fairness is the item of greatest importance, and personal contact with the men probably of second rank, although kindness, firmness and intelligence are necessary. Mr. Mills favored the open shop and the recognizing of individual merit by the pay check.

In the session on the morning of the 28th, M. F. Simmons, assistant manager of the General Electric Co., Schenectady, N. Y., resigned as president, but remained as a director of the association. J. W. Stannard of Detroit, who presided at the conference, was elected to succeed him. A. A. Alles, Jr., will continue as secretary-treasurer, with offices at 1501 Peoples Bank Bldg., Pittsburgh, Pa. The executive committee appointed consists of Mr. Stannard, H. S. Peck, of New York, and G. K. Wilson of Chicago. Mr. Peck was made chairman of the committee to arrange for a conference of the association next fall. Addison Boren of Stamford, Conn., was made chairman of a committee to write a lexicon of cost terminology, one member of this committee to be nominated from each local section.

Business Conditions in England

By Our London Correspondent

In a strike-ridden country the German agreement to the Allied terms, complete though it appears to be, made but little commotion, for the really significant fact is the steady decline in trade and industry. The latest figures of unemployment are eloquent, showing that at the end of April in Great Britain and Ireland 1,853,308 people usually employed, were without work, while 1,095,999 were on short time. This, of course, is quite outside the million and more of miners and others, men and boys, who are refusing to work on the terms put forward. The dispute has been actively in existence for six weeks and recently no definite move has been made on either side to bring it to an end, while by spasmodic refusals to handle or transmit coal brought into the country, or taken from one port to another, the railway and transport workers have widened the trouble, more or less deliberately. Once more the object is to demonstrate the solidarity of labor. The train services are restricted in order to save half or even more of the coal usually consumed, and in electrical works something like 20 per cent has been preserved. On the other hand, water consumption has barely declined, the saving here being about 2 per cent. Only emergency services are being run on the railways. Next week on Whit Monday, a holiday when in the past many crowded cheap excursions by rail have been the rule, the Great Eastern Railway is running five trains the whole day, two in the morning from London, and three in the afternoon to London. As to shipping, 1,160 vessels amounting to a total of 1,707,000 net tons, are out of commission indefinitely, the tonnage laid up having something like doubled since last January. Parliament has elicited the fact that during the current year up to the end of April £18,241,200 had been expended in out-of-work donation and unemployment benefit, £13,340,600 from the unemployment fund and the rest as donation from the Exchequer. Expenditure on the special defence force and reserves during the first four weeks of the dispute amounted to about £1,700,000.

Exports Declining

Naturally overseas trading in Great Britain has fallen away. The strike commenced at the beginning of April (the cynic may find it an appropriate date), and during the month the apparent adverse balance of trade rose to rather more than twenty-one million pounds, the value of imports being nearly 90 million pounds and of exports nearly 60 millions, with re-exports exceeding more than eight and one-half millions. Already the prediction is being made that the current month will show yet a further decline. And it has to be recognized that the figures for last month do not indicate the loss to the full extent, for the monthly figures are usually a somewhat imperfect record of trading, though on balance the matter rights itself. The reason is that a margin of time is permitted to traders for notification. Thus as regards imports, particulars have to be given within fourteen days of the arrival of the ship, with a further extension if necessary; on the other hand, such particulars may be given before the vessel actually arrives. Then information as to exports must thus be supplied within six days of the outward clearing. This statement will explain the need for the proviso that monthly returns are always subject to revision. The total figures of trading of course are correct. All that can happen is that part of one month's operations may be held over till the next month.

Meanwhile, as is usually the case in such circumstances, the downfall of coal has been foretold. Boilers having been adapted, oil is raising steam in a number of power stations, on a few locomotives and so on, and that it will displace coal is being predicted by people who are oblivious of the fact that Great Britain does not produce this fuel in anything like sufficient quantities.

Further fiscal difficulties are being placed on overseas trading by the addition of various duties, although in Great Britain it is an article of faith that foreign debts of consequence can really only be paid by means of goods. The "Ter Meulen" scheme for the insurance of international trade credits is explained in a cheap pamphlet issued by the International Credits Office of the League of Nations and published in London. The scheme is put forward as a means of helping firms in many of the European countries who wish to import on credit. Business is for the most part arranged in the ordinary way. The importer then borrows from his own government bonds which are deposited as security, these bonds on completion of the business being handed back to the importer and thus to his own government. The last-named issues the bonds to the value of its revenue-producing assets. The idea is to provide a reservoir of credit and "to mobilize the full credit of the country behind individual traders."

Effects of Coal Strike

Exactly what the coal strike means to the metal industries can be gathered from local reports on the Sheffield steel firms. Hatfields, Ltd., has shut down, and Cammell, Laird & Co. is almost closed down. A fair number of men are still engaged at John Brown & Co., Edgar Allen & Co. is working three days a week, Jessop & Sons are shutting; while the larger departments have already closed at Jonas & Colver, Ltd., the remainder will cease work in a day or two. A few shops are running at T. Firth & Sons, and at Vickers, Ltd., the machine shops are stated to be fairly well employed, but not one of the heavy manufacturing departments is at all busy. At Brown, Bayley & Co., out of the usual 2,000 or so men, about 100 are working.

While most people are resisting, some at any rate are agreeing to reductions in wages, and on the northeast coast the shipyard trade unions have voted, on the recommendation of their officials, by a relatively small majority, in favor of acceptance of proposals involving a reduction of 6s. a week, to be effected in two steps. The engineering dispute is just reaching a head, and all signs point to a very definite resistance to the employers' proposals for a marked decline in wages. The difference has in fact been estimated to mean 12½ million pounds a year to members of the chief engineering trade unions, doubtless on the assumption of at least full time working.

Meanwhile some balance sheets of ordinary engineering firms do not provide pleasant reading for shareholders. Thus the net profit of Clayton and Shuttleworth, Ltd., Lincoln, for last year, after making various allowances, amounted to £40,036, comparing with £77,715 in 1919. Trade and labor difficulties and the general falling-off in demand are the reasons ascribed for the reduction of profits. It is announced that a working agreement has been reached with Hofherr-Schrantz-Clayton-Shuttleworth, of Vienna and Budapest, with a view to the recovery of trade in eastern Europe and Russia. Beyer, Peacock & Co., Ltd., the Gorton locomotive engineers, after making various adjustments, declared a loss on working for last year of £17,270. A year ago the dividend paid to the shareholders was 10 per cent.

Turning to the motor car firms, Rolls-Royce, Ltd., shows a net profit of £202,552, comparing with £192,296 the year before. Nevertheless in view of the times the dividend has been reduced from 15 to 10 per cent. It may be mentioned that £40,000 has been allocated to the workers' welfare fund. Then, in confirmation of many rumors, it has been stated that pending arrangements for the reorganization of the company's finances Sir Arthur Whinney has been appointed receiver and manager of the Austin Motor Co. A loan has in fact been privately arranged, subject to agreement by the creditors. Price reductions continue to be advertised. The Overland has been dropped from £495 to £395, the Chevrolet from £450 to £330, the Zebra (French) from £395 to £325, the Talbot-Darracq from £850 to

£750 and the Charron from £1,100 to £750.

Electrical engineering is certainly a branch of British industry which was, so to speak, placed on its feet as a result of war operations. The fact is evident in the reports that have recently been issued. The Metropolitan-Vickers Electrical Co., Ltd., for example, showed a net profit of £83,231 greater than the corresponding profit of 1919, the orders received during 1920 being in value about 80 per cent greater, while orders completed were about 50 per cent greater than those of the year previous. Then the English Electric Co., Ltd., showed net profits amounting to £266,936, comparing with £180,835 the year previous. The Brush Electrical Engineering Co., with a financial past of unusual interest, has reported a net profit of £191,100, comparing with £148,700 for the preceding year. The dividend remains at 15 per cent, but as part of the reserve was capitalized and issued as a share bonus the dividend is really 30 per cent on the old capital. Siemens Bros. for the fourth year paid 10 per cent, income tax free, also on an increased capital, and shareholders are to receive as a bonus 300,000 new 10 per cent preference shares, one new share for each five existing shares. The proposal has been criticised for it has been decided to create a million of these shares, which would of course take precedence over the ordinary shares. As to British Thomson-Houston Co., Ltd., capital reorganization has been effected, with the result that the ordinary shares receive a dividend after 18 years. The profit declared on last year's working is £470,470, comparing with £412,400 the year previous.

With nearly all industries paralyzed, the machine-tool trade is hardly likely to be an exception. Indeed in this branch the home demand does not exist and such orders as are being received are for overseas. Very few firms are even moderately employed, though it may be mentioned that the Lang firm of Johnstone is still reasonably well engaged on lathe orders that have yet to be completed. Still, current conditions will not be allowed to prevent preparation, and among inquiries are certain ones in connection with the Brunner Mond chemical works in the northeast of England which will have its own self-contained engineering workshops, at a cost of a quarter of a million pounds. The necessary inquiries have been issued, the shops, as at present proposed, being apparently based on a continental model.

Mechanical Tillage in East Indies

In a recent issue of *Eastern Engineering*, it is reported that investigations have shown that on the Java sugar estates those areas which have been plowed by machinery have yielded more cane, as well as more sugar, than other areas. Sugar experts are now urging the industry to establish a bureau for the study of mechanical tillage on the various estates.

The Swiss Machinery Industry in Critical Condition

The Swiss machinery industry is at present in a critical state. Considering the fact that Switzerland has to import every pound of coal and iron for her industries, it is certainly remarkable that in spite of these drawbacks the country has been able not only to build up a machinery industry of considerable importance, but also to gain a strong foothold in foreign markets. This is especially the case in the electrical industries. At present, however, the consequences of foreign competition are being seriously felt and Swiss manufacturers declare that under present conditions they are no longer able to carry on manufacturing with any prospect of success. This is chiefly due to the high cost of production and high wages for labor. Only a considerable reduction of these two items will enable the Swiss machinery manufacturers to continue their business. In comparison with wages paid in other neighboring countries the Swiss rates are simply prohibitive. This may be seen from the following table.

In February last wages paid per hour in Germany were as follows:

(*a*) For Time Workers	
Toolmakers	155 to 637 pfennigs or 14 to 57 centimes in Swiss money
Blacksmiths	169 to 578 pfennigs or 15 to 52 centimes in Swiss money
Metal molders	219 to 434 pfennigs or 20 to 39 centimes in Swiss money
Turners	188 to 462 pfennigs or 17 to 42 centimes in Swiss money
(*b*) For Piece Workers	
Helpers	113 to 512 pfennigs or 10 to 46 centimes in Swiss money
Machinists	276 to 553 pfennigs or 25 to 50 centimes in Swiss money
Iron molders	225 to 653 pfennigs or 20 to 59 centimes in Swiss money
Stokers	262 to 502 pfennigs or 24 to 45 centimes in Swiss money

In Switzerland, however, the average wages paid in the metal and machinery industries (per hour) are:

	1914	1920
Skilled labor	0.72	1.90 francs
Unskilled labor	0.55	1.60 francs

Though wages have increased in Germany since the outbreak of the war by 500 to 600 per cent, as against only 140 to 180 per cent in Switzerland, the cost of production in Germany, on account of the depreciation of the mark value by more than 90 per cent, is only half of the cost of production in Switzerland.

The great movement now on foot in Switzerland to induce the government to restrict the imports to a certain extent is not at all supported by the majority of the Swiss manufacturers, who believe that such steps will only be followed by similar reprisals on the part of foreign countries. The only way to better the present conditions is the reduction of the cost of production and wages. It is well understood that this is not an easy matter, especially as prices for all necessaries of life and foodstuffs are higher in Switzerland than in any of the other industrial countries. It is further pointed out that numerous Swiss industries are still working with antiquated machines and tools and that the eight-hour day officially introduced by the government has already led to untenable conditions.

In conclusion, some figures may be of interest: In 1913 the exports of Swiss machinery amounted to 561,238 metric quintals (a metric quintal equals 50 kilograms, approximately 100 pounds). valued at 98,734,890 francs; in 1912 to 649,696 metric quintals, valued at 276,434,002 francs. In normal times the Swiss machinery industry exported 50 per cent of its entire production.

Weights and Measures Conference

The discussion of legislation providing for the compulsory adoption of the metric system, which was scheduled to take place at the weights and measures conference in Washington, May 23 to May 26, was omitted from the program and a resolution was passed instructing the executive committee of the organization to make this subject one of the major items on the program at next year's meeting. The resolution specified that the subject should be listed on the program not later than the second day of the conference so as to insure the presence of most of the delegates.

The fact that the conference should put the matter over until the next meeting is regarded as evidence that its members do not anticipate any effort to take the metric bill up for final action within the next year.

Secretary Hoover, in his address, emphasized particularly the need for standardization and simplification of packages. This, he said, would result in a great saving when it is computed on the entire volume of the nation's output of goods in package form. If the United States is to compete for foreign trade, its industries will have to resort to all manner of thrift in order to meet the prices of foreign producers who will have the advantage in several matters of cost.

It was brought out at the meeting that the specifications of liquid-measuring pumps have been revised to the point where they now are regarded as being entirely workable and capable of being enforced.

Among the resolutions adopted was one approving the principle of serialization of types of weighing and measuring devices in common use, and favoring the passage of legislation giving the Bureau of Standards power to put into effect such serialization. In another resolution, the conference approved the recommendations of Secretary Hoover in regard to standardization and simplification of containers. Representative Haugan's slack-filled package bill was endorsed in another resolution.

Southern Metal Trades to Convene at Asheville

The fourth annual convention of the Southern Metal Trades Association will be held this year at Asheville, N. C. The meeting will run over two days, June 13 and 14, and will have its headquarters in the Battery Park Hotel.

Several interesting papers have been prepared for presentation, among which are: "Pressing Industrial Questions," by Magnus W. Alexander, managing director of the National Industrial Conference Board, New York; and "Idleness and its Relation to Industry," by T. W. Dinlocker, of the S. K. F. Industries. An old-fashioned barbecue and a sightseeing auto trip are on the social program.

William T. Harding, president of the association, has sent out an urgent call for all members to be present at this year's convention.

Prize for Hardness Test Machine

Sir Robert Hadfield, to whom the John Fritz Medal for his invention of manganese steel will be presented at the opening meeting of the British Institution of Civil Engineers on June 29 in England, has offered a prize for the best design of an apparatus to determine the hardness of material accurately and suitable for application in metallurgical work for cases in which present methods partially fail, according to an announcement just made here by the American Society of Mechanical Engineers. Drawings or models should be patented and submitted by the close of the current year.

Resumption of Production a Sign of Better Times

During the past week we have received several reports that indicate improvement in business.

It is reported that seventy-five men were called back to work in the Vandalia machine shops at Terre Haute, Ind.

The Universal Machine Co., which occupies a part of the Industrial Building, Baltimore, Md., is reported as working full time with the possibilities of putting on a night shift.

A. F. Rockwell, president of the Standard Steel and Bearings Co., at Plainville, Conn., has issued a statement to the effect that the company will resume operations as soon as a productive force can be assembled.

The Waterbury (Conn.) plant of Robert H. Ingersoll & Bro., which closed some weeks ago, is reported as having re-opened last week with a full force.

Other similar reports, coming from widely separated sections of the country, are taken as omens of better times ahead and the gradual resumption of normal conditions in industrial enterprise.

Business Items

The Baldwin Chain and Manufacturing Co., of Worcester, Mass., has absorbed the Arcade Malleable Iron Co., of Worcester, Mass., and the business will be continued with the former name. The capitalization of the new company consists of $750,000 in common stock and $300,000 in first mortgage bonds. The bonds were authorized to finance the combining of the two companies. The officers of the new company are: George T. Dewey, president; William F. Cole, vice-president; James H. Kendall, vice-president; William H. Rockenfield, general manager; William H. Gates, treasurer, and H. P. Blumnauer, vice-president and general manager of the Arcade Malleable Iron plant. All the above are directors of the concern also.

Articles of incorporation for the Baldwin-Hall Co., Inc., of Syracuse, N. Y., have been filed with the secretary of state. The capital stock is $50,000 and the company will manufacture electrical machinery. William H. Hall, Jr., Harley J. Crane and Fred. S. Baldwin are named as incorporators.

In order to co-operate more closely with their jobbers in the Middle West the Black & Decker Manufacturing Company, Baltimore, Md., has opened a Kansas City branch office at 1711 Grand Ave. This branch will serve Kansas, Nebraska, Oklahoma, Texas, Arkansas, western Louisiana and western Missouri, and will be in charge of J. N. LaBelle, formerly assistant manager of the Chicago branch. Mr. LaBelle will be assisted by Emery Harris, who will make his headquarters at Omaha, Neb., and R. Brice Shipley, who will cover Oklahoma, Texas, Arkansas and western Louisiana.

Joseph Beal & Co., Boston, Mass., is selling out a complete line of machinery which is located in a branch warehouse at Springfield, Mass. This warehouse is to be razed to make way for a new bridge, necessitating the removal of the Beal stock.

The Buyers Machine Co., of Ravenna, Ohio, has opened direct sales offices in New York and St. Louis. F. W. S. Elmes is district manager in charge of the New York Office, which is located at 30 Church St., and Frank E. Miner is district manager in charge of the St. Louis office at 700 Rialto Building.

The Hendey Machine Co., Torrington, Conn., has increased its working schedule to five days a week, ten hours per day. A number of new orders have been received necessitating the resumption of the fifty-hour week schedule.

The Viking Pump Co., Cedar Falls, Iowa, held its annual banquet, in honor of the employees, on May 14. The feature of the evening was the presentation of bonuses to employees who have served more than one year. George Wyth, manager, made the presentations, which totaled over $3,500.

The Blackburn Gear Shift and Steering Wheel Co., St. Louis, Mo., has been incorporated, and has purchased the plant of the Central Insulating and Moulding Co., in that city. It is reported that production will begin at once.

The Federal Machine and Welder Co., Warren, Ohio, announces the following changes in the personnel of the organization: A. E. Hackett is placed in charge of the Detroit, Mich., office and Stanley Mazure, Jr., will assume supervision of the Chicago office.

The Purves Manufacturing Corporation has been organized at Syracuse, N. Y. Articles of incorporation have been filed naming J. A. Purves, W. C. Purves, J. M. Purves and C. S. Carr as directors. The capital stock is reported at $40,000.

The building and improvement work on the plant of the American Rolling Mill Co., at Middletown, Ohio, has just been completed at an estimated cost of $3,000,000. The work was done under the supervision of the Dwight P. Robinson Co.

The Styer Manufacturing Co. has been incorporated at Dayton, Ohio, with a $50,000 capital, to manufacture articles from metal. Directors are John Fitzgerald, Louis Gianopuios and George W. Styer.

The Fulton Pit Car Co. has been incorporated with $325,000 capital by C. K. Myers, H. N. Myers, J. V. Dugan and D. Baughman. This company will maintain its factory at Canal Fulton, Ohio.

For the purpose of manufacturing setscrews and other small goods, together with small machine tools, the Muncie Cap and Set Screw Co. has been organized at Muncie, Ind., with a capital stock of $250,000. The company has incorporated under Indiana laws. The men interested in the company are John Stetter, William Wuthenow and Abe Feinberg, all of Muncie.

Byproduct machines for meat packers and renderers and general packing house equipment will be manufactured by the G. & W. Manufacturing Co., Dayton, Ohio, which was recently incorporated with $50,000 capital stock. The company will soon be in the market for all kinds of boiler shop equipment. Incorporators of the company are A. J. Welty, J. J. Gage, C. F. Canny, R. E. Kneisly and L. E. Smith.

Construction of a factory building 60 x 135 ft. to house the newly organized Woods Engineering Co., Alliance, Ohio, has been announced. The company, which has a capital stock of $350,000, will manufacture automatic jacks. F. C. Woods is president and general manager, and F. A. Hobbs secretary and treasurer.

Announcement is made of the formation at Barberton, Ohio, of the Grant Quick Ice Machine Co., organized for the purpose of making ice machines for commercial use. The new company has a capital stock of $25,000.

Edward M. Moore, David E. Cook and C. J. Williamson, all of Redkey, Ind., have organized the Hoover Tool Co., a retail establishment that will deal exclusively in tools of all descriptions. The company has a capital stock of $10,000.

The Keuthan Foundry Co., Middletown, Ohio, recently was incorporated at Columbus, Ohio, with a capital stock of $100,000, and will engage in general foundry business in Middletown. The company plans to erect a modern steel and brick foundry building which is expected to be ready for operation the latter part of the summer. C. C. Keuthan and L. Keuthan are named the incorporators of the company.

The McCormick Machinery Co. has removed its warehouse from Queen St. to 47 Murray St., Montreal, Canada.

The Shepard Elevator Co. has been organized at Cincinnati, Ohio, and will be incorporated with a capital stock of $100,000. The incorporators include Oscar F. Shepard, Stanely M. Rowe, Robert Hilton, Ralph R. Caldwell and Frank M. Andrews.

The Motch and Merryweather Machinery Co. of Cleveland, Ohio, has taken over the sales of the Gordon cam turning lathe, which is now being manufactured by the Willard Machine Tool Co. of Cincinnati, Ohio.

The Lucius Manufacturing Co., Canton, Ohio, has changed its name to the Canton Tank and Manufacturing Co. The company is located at 9th and Robin Sts. S. E. Officials said the name was changed in order to include the geographical location of the business as well as to indicate the product manufactured. Officers of the company are: H. H. Dine, president; H. B. Ramey, general manager; J. E. Milner, secretary-treasurer. These men with Edward Zintsmaster, L. A. Koons, William Delaney and A. F. Dieringer compose the board of directors.

For the purpose of manufacturing metal parts of all descriptions, including automobile accessories, steel stamps, stencils, dies, etc., and in addition to manufacture mirrors, art glass, plate, etc., the Victor Products Co., Springfield, Ohio, was recently incorporated with a capital stock of $15,000. The company has a large modern factory building and plans to add considerable machine-tool equipment. Officers of the company are: President, John A. Cadle; vice-president, E. E. Stanford; secretary-treasurer and general manager L. B. Lemmon.

The Rogers Faucet Co., 36 River St., Bridgeport, Conn., manufacturer of "Rogers Faucets," has recently filed a certificate with the Secretary of State of Connecticut, increasing the capital stock of the concern from $150,000 to $450,000, to be used in increasing production, etc. The company recently started production in the plant on River St., on the Berkshire Pond, Bridgeport.

Personals

B. B. BACHMAN, chief engineer of the Auto Car Co., Ardmore, Pa., was chosen by the nominating committee to be president of the Society of Automotive Engineers for 1922.

COLONEL WILLIAM C. SKINNER has resigned as president of the Colt's Patent Fire Arms Manufacturing Co. to become chairman of the board of directors. Samuel M. Stone was elected in his place.

ARTHUR J. LITTLEJOHN, secretary of the Meldrum-Gabrielson Corporation, of Syracuse, N. Y., has been elected treasurer of the Knapp Pattern and Castings Corporation, also of Syracuse.

RAY J. SUTHERLAND, formerly welding engineer with the Davis-Bournonville Co., has taken over the management of the Sisterville Welding Co., Sisterville, W. Va.

J. F. SCOTT, of Cleveland, Ohio, has been appointed general manager of the Alloy Foundry Co., Warwick, Ohio.

W. H. JOHNSON has been named receiver of the Dart Truck and Tractor Co., Waterloo, Iowa, and has furnished a bond for $150,000.

H. J. WILSON, until recently connected with the Fairbanks Company of New York, and stationed at the New Orleans branch, has joined the Gulf Machinery and Ship Supply Co., of Galveston, Texas, as sales manager. The Gulf company will specialize in machine tools, crude oil engines, valves, fittings and similar supplies.

C. R. BURT, until recently with the Davenport Machine Tool Co., Rochester, N. Y., is now president and general manager of the New Process Gear Corporation of Syracuse.

G. E. PRICE, JR., has resigned as purchasing agent for the Davis-Bournonville Co., Jersey City, N. J., to accept another position in the Middle-West.

RALPH S. COOPER, vice-president and general sales manager of the Independent Pneumatic Tool Co., Chicago, Ill., has been appointed general manager of the company. He has just returned from Europe, where he went to establish several branch offices and agencies.

GLENN MUFFLY, formerly sales manager of the Lees-Bradner Co., Cleveland, Ohio, has assumed similar duties with the Miller Shock Equalizer Co., also of Cleveland.

ROBERT S. JENSEN, of the sales department of the Gilbert & Barker Manufacturing Co., of West Springfield, Mass., has been transferred from the factory sales offices to the Chicago office, where he will be assistant to Mr. Burrows. Mr. Jensen has been with the company since April, 1916.

E. L. COOLBROTH, SR., and CHARLES E. F. BLAKE, both salesmen for the Gilbert & Barker Manufacturing Co., of West Springfield, Mass., have recently resigned their positions with the company.

CARLOS DELEON, works manager of the Gilbert & Barker Manufacturing Co., of West Springfield, Mass., has recently terminated his services with that company.

H. W. HEINRICH, manager of the Latin-American department of the export division of Yale & Towne Manufacturing Co., of Stamford, Conn., will leave shortly on a trip to South America. Mr. Heinrich expects to be gone from this country six or seven months.

Obituary!

ORAM M. GALE, head of the O. M. Gale Machine Co., Syracuse, N. Y., died on May 13. He was in his fifty-sixth year. Mr. Gale has conducted a machine shop in Syracuse for eighteen years.

F. WILLIAM GARTMAN, formerly vice-president of the York Electric and Machine Co., York, Pa., died on May 3.

C. C. WOLFE, president of the Dart Truck and Tractor Co., Waterloo, Iowa, died May 19 after a short illness. He was actively affiliated with several industries in Waterloo, including the Waterloo, Cedar Falls & Northern Railway.

COLONEL CHARLES M. JARVIS, of Berlin, Conn., died on May 21 at Atlantic City, where he had been convalescing from a recent illness. Colonel Jarvis was a former president of the American Hardware Corporation and was a prominent manufacturer and agriculturist.

KARL G. ROEBLING, president of John A. Roebling Sons Co., builders of the Brooklyn Bridge, died at his summer home at Spring Lake, N. J., May 19.

Forthcoming Meetings

The American Railway Association will hold the Spring meeting of its Purchases and Stores Section at the Blackstone Hotel, Chicago, June 9 to 11, and the Spring meeting of its Mechanical Section at the Drake Hotel, Chicago, June 15 and 16.

The fourth annual convention of the Southern Metal Trades Association will be held in the Battery Park Hotel, Asheville, N. C., on June 13 and 14. W. E. Dunn, Jr., Candler Bldg., Atlanta, Ga., is secretary.

The 1921 annual meeting of the American Society for Testing Materials will be held at Asbury Park, N. J., on June 20 to 24, with headquarters at the New Monterey Hotel. C. L. Warwick, Engineers Club, Philadelphia, Pa., is secretary.

The eighth annual convention of the American Drop Forge Association and the Drop Forge Supply Association will be held at Chicago, Ill., June 22 to 24 with headquarters at the Congress Hotel.

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Conn., New Haven—The J. Reynolds Mfg. Co., 99 Mill River St., manufacturer of set and cap screws, etc.—No. 3 or 4 Farrell foundry or Manville solid die heading machine.

Conn., Norwalk—The R. & W. Shop Inc. —One 9 in. swing x 4 ft. bed style "K" Star bench lathe complete with regular equipment.

One 7 in. x 3 ft. Feather bench lathe with long legs, oil pan, countershaft and regular equipment.

Mass., Meridan—J. H. Miner Saw Mfg. Co.—1,500 to 2,000 lb. single acting press.

N. Y., New York (Borough of Brooklyn) T. F. Flynn, Engr., 7801 Ridge Blvd — No. 2½ Bath Universal grinder complete with equipment "A."

N. Y., New York (Borough of Manhattan)—Halpern & Co., 110 West 40th St.—general machine tool equipment for the manufacture of railroad equipment.

N. Y., New York (Borough of Manhattan) —A. G. Schoonmaker & Sons, 25 Church St. (Machinists)—Size "E" 150 lbs., belt driven power hammer.

N. Y., Sidney—M. A. Doolittle Co.—14 in. swing x 10 ft. bed Porter lathe for machine shop.

Pa., Knox—The Bd. Educ.—manual training equipment and shafting pulleys, etc., for school.

La., New Orleans — The Orleans Steel Products Co. Inc., Box No. 274—

George A. Ohl or equal power press or brake and George A. Ohl squaring shear; machines to bend and cut ⅜ in. soft. sheet steel size ranging from 7 to 10 ft. 6 in. long.

One gas furnace for tempering dies, medium size.

One Jones & Lamson 2 in. x 24 in. flat turret lathe or its equal.

One American or equal engine lathe, 20 in. swing, 14 to 16 ft. bed, latest model. (New or Used).

Tenn., Knoxville—J. G. Duncan Co., 101 East Johnson St., manufacturer of machinery, J. G. Duncan, Purch. Agt.—24 in. or larger cabinet planer, single surfacer, 8 to 12 in. planer and jointer, 36 in. band saw, 36 in. gauge dinkey locomotive for steam shovel work.

Ill., Chicago—The Ferro Mfg. Co., 3011 South Michigan Ave., manufacturer of auto specialties—small crane, lathe and drill press for its factory at Belvidere.

Ill., Chicago — The Machinery Products Corp., 231 Williams St.—1 in. screw machine.

Ill., Chicago — The Nachman Co., 2241 South Halsted St., manufacturer of springs, S. H. Nachman, Purch. Agt.—1 slitting and winding machine.

Ill., Englewood (Chicago P. O.)—E. E. Hilborn, Mgr. of the Alba Optical Co., 60th St. and Eggleston Ave.—

Bench or precision lathes and drill press. (Used) Lathes must be of draw in spindle type with collets or chucks to take work up to ½ in round stock, and to swing 6 in. Distance between centers, 12 in. or a little more.

Ill., Joliet — The Bd. Educ. c/o J. F. Skeel, Clk., Liberty Bldg.—manual training equipment for school.

Mich., Detroit—The Fitxall Wrench Co., 9353 St. Paul Ave.—miscellaneous equipment for the manufacture of special wrenches.

Mich., Marquette—E. W. Jones and C. P. Frei—repair machinery including drill press and small lathe.

O., Bellefontaine — The Bellefontaine Bridge & Steel Co.—

One 36 in. x 48 in. rotary planing machine for facing ends of columns.

Planer mounted on rotary base.

O., Cincinnati—The Highland Body Mfg. Co., Center Hill Ave., Elmwood—

Blanking and forming press 100 to 120 ton capacity, 66 in. long between housings not less than 30 in. width of bed.

Squaring shear 72 in. long with at least 2 in. or 3 in. gap.

Small size spot welder with 18 in. throat.

O., Cleveland—The Davis Tool Co., 1660 East 118th St.—Davis key seater.

O., Cleveland—J. A. Kilroy & Son, 9407 Ramona Blvd., (Builders)—one air compressor, punches, shears and other tools for fabricating shop. (Used).

O., Columbus—Olco Mfg. Co., 36 West Gay St., manufacturer of oil and auto specialties. N. J. McCumber, 275 North 20th St., Purch. Agt.—machinery for soldering cans and making tin and sheet metal.

Wis., Cedarburg—T. Groth & Sons Co.—drill press, lathe, etc., for garage.

Wis., Milwaukee—J. Biedrzycki, 684 3d Ave.—drill press.

Wis., Milwaukee—The Huebsch Mfg. Co., 366 Brady St., manufacturer of laundry specialties—power sheet metal shears.

Wis., Milwaukee — The Voreclone Mfg. Co., c/o H. A. Schlick, 425 East Water St. —machine tools for the manufacture of metal products.

Wis., North Milwaukee—R. Lahse, Hopkins Rd. (Machinist)—medium size planer.

Wis., Oconomowoc — The Jenkins-Barnhast Motor Co.—small lathe for auto repair work.

Minn., Minneapolis—The Bd. Educ., 305 City Hall, G. F. Womrath, Business Supt. —gas engine and vulcanizing equipment and automobile tools of all kinds for new gas engine room at the North high school.

Mo., St. Louis—T. G. Azar, 840 Choteau Ave.—drill press and lathe.

Okla., Beggs—H. T. Purnell—lathe, steam hammer, drill press, bolt machine, etc.

Cal., Berkeley—The Albany Eng. Wks., 2161 Shattuck Ave., H. T. Coburn—machine shop and foundry equipment.

Ont., Wheatley—H. J. Nelson—general garage and repair shop equipment.

Machinery Wanted

N. Y., Buffalo—Hall's Bakery, 2381 Fillmore Ave., F. G. Kumz, Mgr.—baking machinery and equipment.

N. Y., Poughkeepsie—The Pouvailsmith Corp., manufacturers of rubber compositions, J. H. Branham, Purch. Agt.—rubber mixing machine with rolls up to 36 in. in length.

Ala., Demopolis—The Demopolis Lumber Co., manufacturer of hard-wood and pine lumber. J. C. Webb, Jr., Purch. Agt—8 ft. band mill and a 42 in. edger. (Used).

Fla., Miami—The Atlantic Laundry Co., R. B. Leonard, Genl. Mgr.—$25,000 worth of equipment.

N. C., Burlington—The Chamber of Commerce, J. Vear Mann, Secy.—machinery for the manufacture of furniture, including tenon and mortisers, 4 side planer, drum sanders, glue pots, band and cut off saws, glue vises, etc.

N. C., Junaluska—The Junaluska Supply Co., J. Haner, Mgr.—general planing mill equipment steam pipe and headers for kiln.

Va., Norfolk—L. F. Hobbs, Box No. 483 —one 10 ton, 4 wheel standard gauge locomotive crane single line 45 ft. boom.

Mich., Munising — The Munising Paper Co.—1 traveling crane and 1 locomotive crane.

O., Akron—The Miller Rubber Co., South High St.—

No. 63 Bliss Press, stroke of slide 8 in., width between uprights 20 in., size of bolster 16 in. x 18 in. when stroke is down, 10½ in. from bed to slide, or equal.

O., Toledo—N. T. Thurston, 2509 Parkwood Ave.—stamping equipment for small plant.

Wis., Marinette—The Marinette & Menominee Paper Co., 2311 Riverside — new paper machine, 1 digester.

Wis., Neenah—G. Danke, Main St.—dairy machines.

Ont., Thorndale—The West Missouri Milk Producers' Association, J. Dawson, Mgr.—machinery for making butter, handling cream, etc., and refrigerating equipment.

Japan, Osaka — The Japan Commercial Agency, Itchome, Kyomachiboridori, Nishiku—would like catalogs and prices on stone cutting machines and carpenter's tools.

THE WEEKLY PRICE GUIDE

This Week's Market

The metal market has slipped off a little since last week. Copper and tin are weaker, while lead and zinc have not changed.

The market for shop supplies is very weak, and prices in New York are useful only as a guide.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.50
Northern Basic	25.32
Southern Ohio No. 2	27.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	34.26
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	26.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	*25.00
CHICAGO	
No. 2 Foundry local	23.00
No. 2 Foundry, Southern, sil 2.25@2.75	28.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.46
Basic	23.96
Bessemer	25.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.23	$3.33	$3.09	$3.23
Soft steel bars	3.13	3.23	2.99	3.13
Soft steel bar shapes	3.13	3.23	3.48	3.13
Soft steel bands	4.18	4.28	6.25	
Tank plates	3.23	3.33	3.78	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	3.10	4.25	4.00	4.13
No. 12	3.15	4.30	4.05	4.18
No. 14	3.20	4.35	4.10	4.23
No. 16	3.30	4.45	4.20	4.33
Black				
Nos. 17 and 21	3.75	4.80	4.80	5.20
Nos. 22 and 24	3.85	4.85	4.85	5.25
No. 25 and 26	3.90	4.90	4.90	5.30
No. 28	4.00	5.00	5.00	5.40
Galvanized				
No. 10 and 11	4.00	4.75	5.00	5.70
No. 12 to 14	4.10	4.85	5.10	5.80
Nos. 17 and 21	4.40	5.15	5.40	6.10
Nos. 22 and 24	4.55	5.30	5.55	6.25
No. 26	4.70	5.45	5.70	6.30
No. 28	5.00	5.75	6.00	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$4.73	$4.63	$4.25
Flats, squares and hexagons, per 100 lb	5.23	4.63	4.75

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 5/32, 8½c. per lb.; ¼, 8c.; 5/16 to ½, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.50	8.00	8.25
Spring steel (light)	8.00	7.00	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.20
Hoop steel	3.64	3.69	3.83
Cold rolled strip steel	8.00	8.25	7.90
Floor plates	5.30	3.09@3.40	5.78

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of April 13, 1921:

BUTT WELD

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
1 to 3	62½	50	⅜	33½	18½
			1 to 1¼	35½	20½

LAP WELD

2	54½	41	2	30½	16½
2½ to 6	58½	45	2½ to 4	34½	22½
7 to 12	54½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1¼	60½	49	1 to 1¼	35½	21½
2 to 3	61½	50			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	52½	41	2	31½	18½
2½ to 4	56½	45	2½ to 4	34½	22½
4½ to 6	55½	44	4½ to 6	33½	21½
7 to 8	50½	37	7 to 8	24½	12½
9 to 12	45½	32	9 to 12	19½	7½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	14.25
Tin in 5-ton lots	32.00
Lead	5.50
Zinc	5.75
ST. LOUIS	
Lead	5.10
Zinc	5.35

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	21.75	22.50	23.50
Copper wire (carload lots)	15.75	17.50	20.00
Brass sheets	17.00	21.00	20.75
Brass pipe	20.75	24.00	24.50
Solder (half and half) (case lots)	24.00	23.50	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	15.00
Cleveland	18.00
Chicago	18.75

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	41
Electrolytic	43

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots..... 10.00

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.00
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	$9.00
Copper, heavy, and wire	9.00	9.50	8.50
Copper, light, and bottoms	8.00	8.00	7.75
Lead, heavy	3.25	4.00	3.75
Lead, tea	2.00	3.00	2.75
Brass, heavy	6.00	6.00	9.00
Brass, light	4.50	5.00	5.00
No. 1 yellow brass turnings	5.00	5.00	4.75
Zinc	3.00	3.00	3.00

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.4	25.50@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.75
Chicago	20.50
Cleveland	22.50

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	43.50	35.00
Commercial	30.00	15.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$2.00	1.60
Hot pressed hexagon	List	2.00	1.60
Cold punches hexagon	List	2.00	1.60
Cold punched square	List	2.00	1.60

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	50%
Cleveland	75–10%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50–10%	60–10%	50%
1¼ and 1½ in. by 3 in. up to 12 in	50%	50–5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $4.00 Chicago..... $4.00
For cast-iron washers, ¾ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $3.75 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
¾ by 6 in. and smaller	40%	50–10%	40%
Larger and longer up to 1 in. by 30 in	40%	50%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	50%	60%	45%
Tinned	45%	60%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.65 Cleveland...$4.60 Chicago....$4.88 Pittsburgh..$3.70
Boiler, same sizes:
New York...$4.75 Cleveland...$4.70 Chicago....$4.98 Pittsburgh..$3.80

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	25.50
Brass	20.00	23.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ⅛-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$7.00 per 100 lb.; New York price is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	9.00@12.00	12.50	14.25
Colored mixed	6.50@ 9.50	9.50	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$3.50@$4.25
Prompt foundry	4.50@ 5.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.80	$0.75	$0.89
5-gal. cans	.83*	.85	1.14

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

Metal Working

NEW ENGLAND STATES

Conn., Ansonia—The Ansonia Electric Co., 55 Main St., is having plans prepared for the construction of a 2 story, 60 x 200 ft. addition to its manufacturing plant, here. Estimated cost, $250,000. Fletcher Thompson Inc., 542 Fairfield Ave., Bridgeport, Archts. and Engrs.

Conn., East Hartford (Hartford P. O.)—Popp & Wespiser, 24 Willard St., Springfield, Mass., has awarded the contract for the construction of a 1 story, 46 x 80 ft. garage on Main St. and Burnside Ave., here. Estimated cost, $25,000. Noted June 2.

Conn., Hartford — S. F. Hines, 20 Wethersfield Ave., has awarded the contract for the construction of a 1 story, 30 x 120 ft. garage. Estimated cost, $30,000. Noted May 26.

Conn., New Haven—F. T. Herskowitz, 401 George St., will soon award the contract for the construction of a 1 and 2 story garage and work shop on George St. Estimated cost, $15,000. R. W. Fabian, 147 Bradley St., Archt.

Conn., Waterbury—L. N. Albert, 268 South Main St., has awarded the contract for the construction of a 1 story, 50 x 185 ft. garage on North Main St. Estimated cost, $40,000.

Mass., Chelsea—H. Tangard & Son, Willow St., will build a 1 story, 40 x 40 ft. sheet metal shop. Estimated cost, $7,500.

Mass., Clinton—The Payne Garage, Main St., will soon award the contract for the construction of a 1 story, 80 x 90 ft. garage on Main St., here. Estimated cost, $25,000. J. W. Allen, 861 Boylston St., Worcester, Archt.

Mass., Pittsfield—R. M. O'Connell, North St., plans to build a 1 story garage and service station on South St. Estimated cost, $50,000.

Mass., Roxbury—The Danker & Donohoe Co., 462 Brookline Ave., Brookline, has awarded the contract for the construction of a 2 story garage and repair shop on Peabody St. Estimated cost, $100,000.

Mass., Shelburne Falls—M. Ware plans to build a 2 story garage and auto repair shop on Shelburne Rd. Estimated cost, $50,000. Private plans.

Mass., Somerville—The Funk & Wilcox Co., Archts., 294 Washington St., Boston, will soon award the contract for the construction of a 1 story, 40 x 110 ft. milk station and garage on Washington and Myrtle Sts., here, for the Herlihy Bros., Charlestown. Estimated cost, $35,000.

Mass., Springfield—E. Davis, 348 Bridge St., has awarded the contract for the construction of a 2 story, 74 x 182 ft. garage on Chestnut St. and Taylor St. Extension.

Mass., Springfield—P. Quimette, 51 Taylor St., has awarded the contract for the construction of a 1 story, 50 x 60 ft. sheet metal shop on Carew St. Estimated cost, between $7,500 and $8,000.

R. I., Providence—R. E. Arter, c/o C. H. Lockwood, Archt., 171 Westminster St., is having plans prepared for the construction of a 1 story garage and service station to cover 18,000 sq.ft. of floor space on North Main and Frost Sts. Estimated cost, $75,000.

R. I., Providence—P. J. Brennan, Ford and Bucklin Sts., has awarded the contract for the construction of a 1 story garage and repair shop on Ford, Bucklin and Dexter Sts. Estimated cost, $25,000.

MIDDLE ATLANTIC STATES

Md., Cumberland — The Paragon Motor Car Co. Inc., 133 Baltimore St., recently incorporated with $3,000,000 capital stock, plans to build several buildings including a 274 x 300 ft. main automobile building. P. W. Blake, Pres.

MIDDLE WEST STATES

Ill., Belvidere—The Ferro Mfg. Co., 3011 South Michigan Ave., Chicago, will soon award the contract for the construction of a 1 story factory for the manufacture of auto specialties, here. Estimated cost, $60,000. B. Carlson, Archt.

Ill., Chicago—The Guaranty Iron & Steel Co., 2851 West Lake St., will soon award the contract for the construction of a 1 story, 100 x 200 ft. factory on Springfield and Lake Sts. Estimated cost, $65,000. J. A. Taggert, 19 South La Salle St., Archt.

O., Hamilton—The Ford Motor Co., Highland Park, Detroit, Mich., plans to build a 3 story auto assembly plant, here. Estimated cost, $400,000. Private plans.

Wis., Oshkosh—The Oshkosh Tractor Co., c/o A. S. Paive, 22 East New York Ave., is having plans prepared for the construction of a 3 story, 60 x 485 ft. tractor factory. Estimated cost, $250,000. Auler & Jensen, F. R. A. Bldg., Archts. Noted May 19.

Wis., Kiel—The Meili-Blumberg Co., New Holstein, is having plans prepared for the construction of a 1 story, 50 x 120 ft. garage on Main St. Estimated cost, $75,000. W. C. Weeks, 730 Ontario Ave., Sheboygan, Archt.

Wis., Sheboygan—The Dodge Sheboygan Co., c/o W. Y. Dodge Co., plans to build a 4 story, 60 x 180 ft. tractor factory. Estimated cost, $100,000.

STATES WEST OF THE MISSISSIPPI

Minn., St. Paul—The Owens Motor Sales Co., 713 University Ave., will soon award the contract for the construction of a 1 and 2 story addition to present garage. Estimated cost, $80,000. Tolz, King & Day, 1410 Pioneer Bldg., Archts.

Mo., Joplin — The Agrimotor Mfg. Co. will soon receive bids for the construction of a 2 story farm tractor factory and office building on 9th and Illinois Sts. Estimated cost, $100,000. C. W. Lewis, Pres.

Mo., St. Louis—Saum & Saum, Archts., 625 Chestnut St., are receiving bids for the construction of a 1 story, 131 x 150 ft. garage and repair shop on 9th and Choteau Ave., for T. G. Azar, 840 Choteau Ave. Estimated cost, $50,000.

Mo., St. Louis—The Wrought Iron Range Co., 5661 Natl. Bridge Rd., has awarded the contract for the construction of a 2 story, 160 x 272 ft. factory. Estimated cost, $100,000.

CANADA

Ont., Wheatley—H. J. Nelson will build a 45 x 65 ft. garage. Estimated cost, $15,000.

General Manufacturing

NEW ENGLAND STATES

Conn., East Windsor (Warehouse Point P. O.)—The Apothecaries Hall Co., Wholesale Druggist, 63 Bank St., Waterbury, will soon award the contract for the construction of a 1 story, 65 x 140 ft. mixing plant, here. Estimated cost, $30,000. W. B. Reynolds, 95 Bank St., Waterbury, Archt.

Conn., New Haven—The Atlas Bottling Wks., 30 Fair St., will soon award the contract for the construction of a 3 story, 30 x 30 ft. plant on Orchard St. Estimated cost, $10,000. R. W. Fabian, 147 Bradley St., Archt.

Conn., New London—Brainerd & Armstrong Co., 82 Union St., has awarded the contract for the construction of a 1 story, 50 x 50 ft. silk manufacturing plant on Reed St. Estimated cost, $8,000.

Mass., North Andover—M. T. Stevens & Sons Co., manufacturers of Woolens, etc., have awarded the contract for the construction of a 4 story, 53 x 162 ft. factory. Estimated cost, $100,000.

Conn., Norwalk—Foster, Stewart & Co., Inc., 232 Main St., has awarded the contract for the construction of a 1 story, 50 x 165 ft. addition to its awning factory on Main St. Estimated cost, $50,000.

Conn., Waterbury—The Scoville Mfg. Co., 99 Mill St., will build a 1 story, 50 x 96 ft. addition to its brass manufacturing plant on East Main St. Estimated cost, between $18,000 and $20,000.

Mass., Springfield — The Springfield Bronze Co., c/o H. L. Sprague, Archt., 310 Main St., will soon award the contract for the construction of a 1 story, 40 x 65 ft. factory on Cass St. Estimated cost, $10,000.

R. I., Providence—The Sunshine Ice Cream Co., 372 Cranston St., will soon receive bids for the construction of a 2 story, 40 x 80 ft. ice cream manufacturing plant on Cranston and Diamond Sts. Estimated cost $60,000. F. Chiaverni, 117 Bway., Archt. Noted April 14.

MIDDLE ATLANTIC STATES

Pa., Altoona — The Schwarzenbach-Huber Co., 8th Ave. and 25th St., will soon receive bids for the construction of a 2 story, 100 x 160 ft. silk mill on Kettle St., East End. Estimated cost, $75,000. R. Brupbacher, Supt. Noted June 2.

Pa., Waynesboro—M. H. Landis and Associates have organized the Maryland Fibre Products Co., Hagerstown, Md., and plan to build a plant here for the manufacture of fibre products.

SOUTHERN STATES

Fla., Miami—The Atlantic Laundry Co. plans to build a 2 story, 50 x 120 ft. laundry. Estimated cost, $50,000. R. B. Leonard, Genl. Mgr.

Va., Alta Vista—The Standard Red Cedar Chest Co. has awarded the contract for the construction of a 1 story, 60 x 500 ft. manufacturing building. Estimated cost, $125,000.

MIDDLE WEST STATES

Ill., Carthage—The Owings Milling Co., c/o E. Owings, Pres., plans to rebuild a grain milling plant which was destroyed by fire. Estimated cost, $30,000.

O., Marblehead—The Kelly Island Lime & Transport Co., c/o Mr. Price, Purch. Agt., Leader-News Bldg., Cleveland, has had plans prepared for the construction of a 1 story crusher plant, here. Estimated cost, $100,000. Private plans.

Wis., Milwaukee—R. Gumz & Co., 125 Muskego Ave., has awarded the contract for the construction of a 3 story, 32 x 80 ft. addition to its packing plant on Muskego Ave. Estimated cost, $50,000. Noted May 19.

STATES WEST OF THE MISSISSIPPI

Mo., Medill—The Producers Cold Storage Co. has awarded the contract for the construction of a 3 story, 63 x 108 ft. cold storage and packing plant. Estimated cost, $50,000.

Mo., St. Louis — The Standard Underground Cable Co., Westinghouse Bldg., Pittsburgh, Pa., plans to build a manufacturing plant on Kingshighway and Slevin Ave. Estimated cost, $1,000,000. Architect not yet selected.

Okla., Bartlesville—E. G. Hanson plans to build a 2 story, 50 x 145 ft. mill building on Second St. Estimated cost, $25,000. J. W. Scott, Archt.

CANADA

B. C., Chilliwack—The Dairy Products Co., Ltd., has awarded the contract for the construction of a 3 story, 40 x 90 ft. factory for the manufacture of powdered milk. Estimated cost, between $40,000 and $50,000.

Que., Montreal—The Standard Paper Box Co., 8 St. Paul St., East, will soon receive bids for the construction of a 5 story, 64 x 196 ft. factory on Park Ave. Estimated cost, $147,000.

Ont., Thorndale — The West Missouri Milk Products Association is having plans prepared for the construction of a creamery. Estimated cost, $50,000. J. Dawson, R.R. 2, Mgr.

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Obstacles to Business Revival

Necessity for More Effective Production Emphasized—Instability of Prices, and Shortage of Capital Still Hamper Production—Substantial Progress Is Being Made

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THE return to normal business conditions is retarded by a number of influences. The first of these is the fact that the depression under which we are laboring is not merely local or national but is only one phase of a world depression. Unemployment, financial difficulties, and sluggish business are reported from practically every country in Europe, from China, Japan, and India, from the West Indies, particularly Cuba, from Central and South American countries, and from Canada. Some of these countries, such as Germany, Russia, and Austria, seem to be on the verge of bankruptcy; and in some regions the depression is growing noticeably worse rather than better. With the relations of all parts of the world so close that every country depends for its well-being to a greater or lesser extent upon sales to and purchases from other countries, it is obvious that there can be no real improvement in the condition of any one country until there is improvement in the general situation. It is clear that so far as this country is concerned we can look for no great extension of our foreign trade until our leading customers get back on their feet economically. Hence signs of improvement in business conditions in the United States are likely to be deceptive except as they are accompanied by similar evidences of improvement throughout the world.

A second influence which is retarding recovery is the expectation on the part of most persons that there will be further price declines. There have been sharp recessions in the prices of various groups of commodities but these have been "spotty"—greater declines have occurred in some groups than in others. This inequality in the decline of various commodities is indicated by the following table. The index numbers are based on wholesale prices, with the prices for 1913 assumed as 100.

	High	March 1
Farm products	246	129
Foods	287	150
Cloths and clothing	356	198
Fuel and light	284	218
Metals and metal products	195	146
Lumber and building materials	341	222
Chemicals and drugs	222	178
House furnishings	371	277
Miscellaneous	247	180

So long as these wide differences prevail in the prices of different commodities there can be no confidence in the stability of prices. If, in a normal period, say 1913, a certain price relation prevailed between farm products and house furnishings, and if at present that relation has been changed so that house furnishings command relatively a much higher price than farm products, it is clear that the exchange relations between those having farm products and those producing house furnishings will be interfered with. The same may be said of the relations between any other groups of producers. Either the prices of one group must rise or the prices of the other group must fall before the products of the various groups attain stability in value. That this leveling process is going on becomes clear when it is noted that the difference between the highest group and the lowest group on March 1 was 148 points, whereas on January 1 the difference between the highest and lowest was 202 points.

How Low Will Prices Go?

The price situation hangs over the market as a depressing influence in still another respect. Most persons expect the general level of prices to go still lower. Two movements may therefore be expected, a fall in the prices of the highest group to a level approaching that of the lowest group and at the same time a decline of prices for commodities in all groups, in even the lowest, to still lower levels. The disturbing question is, to what extent will the decline go? People in discussing this question usually assume that prices will not get back to the pre-war level and there are only a few daring souls who predict a decline to the 1913 level. It may therefore sound incredible to suggest that prices may gradually work down during the next five or ten years to a lower level even than that of 1913. Yet, unless the nations of the world decide to abandon the gold standard there is more than a possibility that this will be realized.

The price level varies with the quantity of money in circulation. The word "money" here includes not only gold and silver but government paper money, bank notes, Federal Reserve notes, and deposit currency. The great increase in the medium of exchange in the United States during the past few years came through the increase of deposit currency which was created by credits extended through the mediation of the Federal Reserve system. But while there has been very little gold in actual circulation, gold is and has been the solid foundation upon which the credit structure could be reared. Although improvements in the banking machinery in this country and the desperate needs of war in other countries have led to the expansion of credit currency either in the form of deposits or notes on a much smaller foundation of gold, the financiers of every nation have recognized the desirability of keeping the gold reserve against outstanding notes and credits as large as possible.

Must Have Adequate Gold Reserve

Under the stress of war and subsequent attempts at reconstruction, the increase in paper currency throughout the world has greatly outrun the additions to the gold reserve. The paper money of the world has increased from seven and one-half billions of dollars to

more than eighty-one and one-half billions exclusive of more than thirty-four billions of dollars issued by Soviet Russia. The average percentage of gold reserve to notes outstanding in 1914 was about 66.3. In 1920 it was 9.2 and in many of the nations it was negligible: for example, in Germany it was about 0.6 per cent. If approximately 66 per cent was regarded as a proper average gold reserve against outstanding notes before the war, obviously 9 per cent is a very inadequate reserve now. Assuming then that it will be the aim of most nations to get back to a gold basis with adequate reserves of gold, either the large outstanding paper issues in whatever form must be decreased or the gold reserves back of them must be increased tremendously, or, what is more likely to happen, both objects will be sought to some extent.

What is the prospect of increasing the supply of gold? In 1915 the total gold production of the world was about $470,000,000; in 1919 it was only $350,000,000. That the production for 1920 was still lower may be judged by comparing the output for the United States for the three years. In 1915 the United States produced $101,000,000 of gold; in 1919 $59,000,000; and in 1920 $49,500,000. It can thus be seen that it will take many years to bring up the gold reserves of the world to a point where they can maintain, in safety, the tremendous volume of credit currency now outstanding.

The conclusion then must be that the present volume of currency throughout the world will be gradually decreased. If this occurs the price level which is established on the basis of existing quantities of money must likewise decline. But will the decline carry prices below the 1913 level? The answer to this depends on the one hand upon the relation which existed between the volume of production in 1913 and the quantity of money at that time, and on the other hand upon the volume of production likely to be achieved during the next few years and the quantity of money which will be available to move that production. It seems likely, with the gigantic requirements for reconstruction and for new production to meet the needs resulting from the actual waste during the war period and the interference with normal production, that when the world once again gets into its stride it will produce commodities of all kinds in a volume much greater than ever heretofore achieved. This will require a larger available gold reserve than there was in 1913 if prices are to remain on the 1913 level. While the total stock of gold will be larger than it was in 1913, it is extremely unlikely that the stock will show as large a ratio to needs as the 1913 stock represented of the 1913 needs.

Declining Rather Than Low Prices Hamper Business

Hence there is at least a strong possibility that the level of prices may ultimately get below that prevailing in 1913. This outlook would tend to make for slow revival and sluggish business during the next few years. It should be noted however that such a low level of prices, if it should be attained, does not indicate permanently retarded business. It is not low prices that hamper business but declining prices. It is the uncertainty of the price outlook which creates timidity and prevents business development. That there can be a large, even an expanding volume of business on a basis of low prices is evident from experience in the United States during the period from 1873 to 1893. An examination of the price situation thus seems to forecast a period of uncertainty and slow recovery with the possibility of permanent and substantial improvement in business based upon a considerably lower price level.

Another influence delaying recovery is the abnormally small number of business failures. The number of failures and the amount of the liabilities of failed concerns have been increasing however in recent months. For the first three months of 1919 failures to the number of 1,904 were reported; for the similar period in 1920 there were 1,627; and in 1921 there were 4,870. The proportion of failures in January, 1921, to the concerns in business, although larger than the years immediately preceding, was still 10 per cent below normal. So long as the number of failures was less than normal, it could be assumed that there were large numbers of concerns in business which would be shaken out as conditions became unfavorable. Events have supported this assumption; the number of failures for the first three months of 1921 is greater than for any three-month period since the first quarter of 1915, and there have been only four other occasions in the last thirty years when there have been so many failures for a three-month period. The liabilities of failed concerns for the first quarter of this year were $178,589,980—the largest for any quarter of which there is record.

With further price declines in prospect it may be expected that the number of business failures will continue to be large. It is well known that the failures in the past few months would have been very much more numerous were it not for the fact that the banks have virtually taken over the management of a number of unsound concerns and are administering them temporarily so as to liquidate their indebtedness. Of course there is a limit to what the banks can do in this respect. In 1920, 155 banking institutions were compelled to close their doors, the majority of which were forced into that plight by the financial difficulties of their customers. So long as there are large numbers of unsound businesses in existence there can be no real improvement in conditions, for there can be no certainty that some of these weaker concerns will not undermine their competitors and carry down their creditors with them in their dying struggles.

Taxation and Tariff

Business improvement is hampered also by the uncertainty regarding Federal taxation and tariff policies. New legislation concerning these matters always causes uncertainty, and this is particularly the case at the present time when the possibility of harm from unwise legislation is magnified by general world conditions. If the coming session of Congress adopts a high protective tariff, as it now seems likely it will, we may get a temporary fillip to business at the expense of permanent improvement. It requires little argument to convince a sensible and unprejudiced man that, if restoration to a sound economic basis in this country depends upon a similar restoration in other countries, the erection of tariff barriers which are designed to injure other countries will of course not aid permanently in our rehabilitation. With the leading commercial nations of the world heavily indebted to the United States it would seem to be the height of stupidity to put impediments in the way of their payment of these debts in the only manner they can possibly do so—that is, by sending us their products.

Similarly the subject of taxation, if it is to be handled intelligently, cannot be safely intrusted to those whose

guiding principle is political expediency—and usually short-sighted political expediency. Payment for our expenditures in the war and for our huge post-war commitments must be made. The dose is bitter but it will not gain sweetness by spreading it out in smaller measures over a longer period of time. There must be heavy taxation for there is no ledgerdemain by which a government can pay its debts. Senator Smoot has recently estimated that the United States will have to collect taxes of about $3,500,000,000 annually for the next twenty-five years. The funds for this purpose must be obtained from those who possess them. Unless the governments of the world show, by levying heavy taxes, by reducing their expenditures in every possible manner, and by repaying their loans as rapidly as possible, their desire to relieve the financial burdens of the people, we can expect no real improvement. So long as the governments of the world are in the money market in the capacity of borrowers on a tremendous scale, there can be little relief for private business in its needs for capital. If governments fail to take their financial obligations seriously and fail to use every effort to improve their financial position, what can be expected of individual business men?

Governmental Indebtedness

The burden of national debt of the world is appalling. In terms of normal exchange the total debts of the nations of the world were estimated in 1914 at $43,889,000,000; in 1920 they were estimated at $297,604,000,000. Including Russia, the debts of the nations have increased more than eighty-eight billions since the armistice. The burden of these debts can more readily be appreciated when it is known that the interest charge alone, without making any provision for their retirement, is more than twelve billion dollars a year. Furthermore, this burden of indebtedness is growing heavier. At the Brussels financial conference in the latter part of 1920 three out of four of all the nations there represented admitted that their expenditures in 1920 exceeded their income. This, of course, makes it necessary for these governments to come into the market for capital in competition with private individuals.

The Scarcity of Capital

A retarding influence which is closely related to the one just discussed is the scarcity and high price of capital. In the United States the average interest rate during 1920 for prime two-name, sixty to ninety day commercial paper was 7.35 per cent. Since 1857 this average yearly rate has been equalled or exceeded in only '65, '67, '69, '72, and '73. That it is expected that capital will be in great demand for some years is indicated by the fact that long term well-secured bonds are being freely offered to yield from 7 to 8 per cent.

Borrowing has been steadily growing more expensive. In January and February, 1919, the yield of twenty-one selected public utility bond issues ranged from 5.30 to 7.20 per cent, while in January and February, 1921, the yield on bond issues of similar character was from 7.10 to 8.15 per cent. Two years ago the Illinois Central Railroad sold an issue of 15-year bonds on a basis to yield 5.34 per cent; this year similar issues of the Pennsylvania R.R. and the Chicago and Northwestern R.R. were sold to yield 6.58 per cent.

The demand for capital cannot be gaged except as it is indicated by fluctuation in the rate of interest. The demand arises from three main sources: (1) Governmental bodies including national governments, state bodies, and other civil divisions; (2) corporations and similar business concerns whose securities are offered to the public; and, (3) individual business men and small concerns who rely chiefly upon private advances from local banks and from personal acquaintances. The possible demands of the last group for any future period cannot be determined. The requirements of the first two groups can be forecast to some extent by an examination of the amount of securities maturing in a given period and by a comparison with the securities issued in a corresponding period of previous years. To a great extent the securities which mature in any given period are refunded by new issues, and therefore a knowledge of the amount of the maturities will throw some light upon the amount of capital which will be required during the period under consideration. The figures for the new capital raised during a given period in the past are of value only to the extent that there is assumed to be a more or less constant demand for such new amounts of capital. This assumption is not to be accepted without very considerable reservation. However, with this confession of the inadequacy of the data, it may still be profitable to get what information such figures may give us. The following table presents the totals for the United States of the demands for capital including the demands of foreign governments but not including United States Treasury financing as represented by treasury certificates of indebtedness now amounting to about two and one-half billion dollars. Nor do they include the private borrowings of the individual business men. The table presents the totals for the first two months of each year.

	Refunding	New Capital	Totals
1919	$172,704,501	$380,189,819	$552,894,320
1920	112,862,598	653,950,082	766,812,680
1921	120,646,875	593,937,602	714,584,477

Huge as these demands for capital may seem, they would be very much larger if the interest rate—the price for the use of capital—were not almost prohibitive. It is a matter of general knowledge that the railroads of the United States alone could use several billions of capital advantageously if they could obtain it. The same situation prevails in other parts of the world. The transportation systems of most of the countries of Europe have fallen into sad dis-repair because of the lack of capital to use for upkeep and development purposes. Furthermore there are countless industrial establishments shut down entirely or operating under very limited production, which await the energizing influence of an adequate supply of capital.

Most of the depressing influences which have been discussed above will be removed only after the capital supply of the world is augmented. A "readjustment questionnaire" circulated by the United States Chamber of Commerce which was answered by upward of five thousand firms in various parts of the United States elicited the reply from a great majority that one of the most important measures of relief from the present business depression is a lower rate of interest. Some of the largest concerns in the country say they will enter upon no business development until money is cheaper. But there is no royal road by which the supply of capital can be increased and the rate of interest be thereby reduced. The supply of capital can be maintained and increased only by producing and saving.

Thrift is required as much from governmental bodies as from private individuals; as a matter of fact governments should set the example to their citizens by par-

ing expenditures to the bone. Governments, as well as individuals, should consume only what is absolutely necessary so that out of current production may be accumulated the capital with which to repair the ravages of war and to provide for further industrial development.

Interest in Thrift and Industry Helpful Influences

In spite of the impressive list of influences which are retarding business recovery there are others which are helpful. The first of these is a growing conservatism and a reawakened interest in thrift and industry. The widespread speculation in securities and commodities has given place to caution; careless and inefficient management which gave no thought to leaks and waste has been supplanted by more careful attention to possibilities of economy in operation; the reckless buying of all kinds of commodities which was not deterred but was rather stimulated by ridiculously high prices has been succeeded by the so-called "buyers' strike" and the indifference of workmen to the requirements of their jobs is being replaced by a desire to "make good" and to hold the job in the face of possible competition from the ranks of the unemployed. This change of attitude is the result of the changed industrial situation and will be in turn the cause of improvement in this situation.

Increase of Deposits in Mutual Savings Banks

Tangible evidence of increased thrift is to be found in the growth and progress of mutual savings banks in the United States. The year 1920 set a new record in this respect. The total deposits in mutual savings banks on December 31, 1920, were $5,535,389,904. This was a gain of $474,760,885 over 1919. The figures for the average balance per depositor in the mutual savings banks in New York State were, on December 31, 1920, $663.36 as compared with $619.77 the preceding year. In connection with these figures it must be remembered that the early part of 1920 was still witnessing extravagance and expenditure on a great scale; it was only during the latter half of the year and especially during the last few months that the bulk of the people began to practice economy. It is therefore likely that 1921 savings will show considerable gain over 1920. Indeed the reports of the United States postal savings system show a marked gain for the first two months of 1921 over 1920.

The question as to the adequacy or inadequacy of the supply of capital is a relative one. The same volume of capital might be ample under certain conditions and scanty under other conditions. Supply cannot be considered apart from demand. While the supply is now being slowly augmented the demand has been falling off somewhat for two reasons. The lower price level makes unnecessary the use of so large an amount of capital to carry on a given industry; and the slowing up of business activity has either eliminated forcibly or scared off many of the persons who were previously seeking part of the supply.

A second influence, and one upon which most persons base their hope of revival, is the potential new construction. A tremendous amount of construction is in prospect throughout the world. This includes railway and highway building, industrial and housing construction. In the matter of dwelling houses alone in the United States, it is estimated that the shortage at the end of 1920 was 1,250,000. We normally build from 350,000 to 400,000 family dwellings annually. In 1919, however, only 85,000 and in 1920 only 65,000 were constructed.

However, it must be noted that comparatively little of this construction can be carried on until the costs of building decline and until capital is provided in much larger volume. The railroads in the United States have halted much required construction because they are unable to sell their securities in sufficient amount even at the prevailing high rates of interest. In spite of our recognized need for dwellings there is little activity in providing them. The F. W. Dodge Company's review of building and construction activity during February, 1921, estimates the new contracts awarded north of the Ohio and east of the Missouri rivers at $100,789,000, as compared with contracts for $216,663,000 awarded in February 1920. The same influences which are hampering construction on a large scale in this country are operative to a much greater extent in practically all other countries. There is a tremendous amount of work to be done but it waits upon the accumulation of capital. Some observers put the amount of capital needed for construction work in the United States at from $15,000,000,000 to $20,000,000,000. As this capital is provided we may look for revival in construction activity.

A solid foundation for the restoration of prosperity is being laid by the agricultural and extractive industries. Raw materials such as coal, iron ore, copper, rubber, oil, wool, cotton and silk are in large supply, while grains and other foodstuffs are available in larger amounts than at any time in the past few years. The outlook for the coming crop year seems to be very promising in practically all parts of the world.

Two other favorable features deserve note. The Federal Reserve system is functioning in a highly satisfactory manner, and it may be expected that as the pressure of government requirements is relaxed, considerations of a more strictly banking nature will prevail in a manner to increase its usefulness. With the Federal Reserve system in satisfactory operation it may be expected that the banking resources of the United States will be conserved so that they may be mobilized and used in furthering business revival as rapidly as the accumulation of capital justifies.

Finally, it is noteworthy that increased attention is being given to the collection, analysis, and dissemination of business statistics. If all business men were correctly informed as to the trade and industrial outlook and governed their actions accordingly, industrial depressions would occur more rarely and their severity would be greatly modified. Therefore as economic analyses are more generally used to guide industrial development it may be expected that fewer false steps will be taken and that the restoration of normal conditions will thereby be hastened.

Effective Production

The foregoing analysis of economic conditions indicates that there are certain obstacles in the way of a return to normal, the chief of which is the necessity for more effective production throughout the world. There are three important influences hampering production: (1) Instability of prices; (2) inefficiency of labor; (3) shortage of capital. Until these are removed there can be no solid and permanent improvement, though there may be temporary spurts of activity in certain lines of production. Prices have been tending downward, and in some cases are down near the normal level. Those

industries whose products have most nearly reached their normal price level will suffer less from subsequent readjustment than those whose products are still overpriced.

The chief influence needed to furnish an impetus to industrial revival is an increased supply of capital. From the very nature of the present situation no great increase in the stock of capital can be obtained except by the slow, painful process of labor and economy. Hence, real recovery is not likely to be effected this year and the process may even be spread over a number of years.

But already, progress toward partial recovery is being made; productive efficiency is increasing and saving is becoming popular. As these two tendencies become more pronounced improvement in business conditions will be more in evidence. If we do not allow ourselves to be misled by surface appearances we will realize that business conditions are better today than they were a year ago. And from this time onward, although improvement may be slow, and reactions in some industries are certain to occur, general conditions are likely to be better rather than worse. The most significant fact upon which to fix attention in endeavoring to predict recovery is the rate of interest for long time loans. As this rate declines business will improve.

Insuring the Safe Shipment of Machinery

Letters from European Agents and Importers Show Their Appreciation of the Need for Careful Packing

SOME months ago we published an article under the above title in the *American Machinist*, to direct the attention of shippers of machinery to the importance of careful packing. The article was so well received that we sent reprints of it to a number of the bigger European agents and importers to get their reaction to the ideas expressed.

Many of the replies received were rather guarded in their statements, indicating that the writers were unwilling to say anything in criticism of their American clients, but it was quite plain that they were fully in accord with the spirit of the article. A few of the less guarded letters follow, the names of the companies being omitted for obvious reasons:

Referring to your letter of the 24th regarding your article on the boxing of machinery for foreign shipment, we quite agree that the best results can be obtained by following this matter up persistently through your medium, as naturally the American manufacturers will always accept any recommendations which are published in your paper.

We have been receiving some American shapers recently which were packed in such a manner as to assist the breakage of the machine rather than to protect it during transit. The cases were so constructed that the joists were placed cross-ways to the machine rather than parallel so as to assist the taking of the weight where the heaviest stress was encountered, with the result that on all the shapers we received the feet were broken in the same place.

Another point which should be brought out is that while the manufacturers always very carefully mark the cases "top" and "bottom" in English and French, their packers through carelessness sometimes put these marks on in the reverse direction, that is, "top" for "bottom" and "bottom" for "top," and we have received machines under these conditions which have been coming over all the way upside-down.

However, we must say that for some considerable time all our largest manufacturers have given considerable time and trouble to the question of packing, with the result that the machines which we are now receiving all appear to be packed in first-class condition, and it is evident to us they have expended time and thought, as well as money, in devising cases of such a nature that they are absolutely impervious to all shocks received in transit.

Should you feel disposed to publish this letter we are naturally only too pleased to give you our authorization and thank you at the same time for having an opportunity of expressing our views through your medium.

* * * * * *

We duly received your favor with which you were good enough to send us a copy of your article entitled "Insuring Safe Shipment of Machinery."

This article is certainly very opportune and we are sure that it will be of assistance to us if only American manufacturers from whom we purchase will profit by the information and suggestions contained in same.

We have certainly had our share of trouble through breakages caused in transit owing to inefficient packing for shipment and we are inclined to think that it would benefit all parties concerned if firms—whether dealers or manufacturers—that have to ship machinery abroad would adopt a method of packing that has proved from long experience to be perfectly satisfactory.

* * * * * *

We are in receipt of yours of the 24th and note your remarks in regard to the packing of machinery. In writing you further, while we have no objection to your using our name if necessary, we would prefer that you did not publish it. We would, however, say that from our experience the use of holding down screws and bolts should be avoided, and that the machine hould be securely fastened within its frame work by timber put so that any slight variation in the frame will not cause these pieces to become loose and will allow a slight movement without danger of breaking the casting, and at the same time prevent the machine from moving about within these limits under any conditions of reasonable handling which they may have to endure. In some cases attention is wanted to the cover of the bright and working parts, although generally the firms we do business with have dealt with this part fairly well.

The third and most important part is that complete packing lists and foundation plans, etc., together with instruction books for the operator where these are supplied, should be inclosed without fail. This has caused so much trouble that we are inclined to think it would be better if these were sent to the agent or importer direct so that they could be handed to the proper party. All machines should be properly adjusted before they are packed and if any parts are to be removed for convenience of packing, etc., these should as far as possible be removed in units, so that when the units are put back in place all the separate parts in the unit will be properly adjusted. Handles and handwheels, where there is any danger of them coming in contact with the case, should all be removed and packed in a box inside the case. We often have had experience of a case in the handling having had some of the covering boards removed, and while there has been no particular damage to the machine itself, handwheels, etc., have been broken and screws bent. In many cases this would not have occurred had handwheels been removed. The object in view should be that the machine should reach the custimer in exactly as good a condition as it left the manufacturers. No concern likes to have a new machine arrive broken and knocked about and we know from our experience that those concerns which have troubled to study packing have attained this end satisfactorily, and we wish you success in getting the same results from all concerns.



A Monitor-Type Shop for Building Lathes

Construction of Roof Prevents Freezing Difficulties—Good Light in All Places—Convenient Benches for Assembling

By FRED H. COLVIN
Editor, *American Machinist*

IN BUILDING its new shop No. 3, the Lodge & Shipley Machine Tool Co. selected a monitor type of building, but instead of having straight sides on the monitor, or having the roof high in the center, the monitor sides are slanting and all roof drainage is toward the center of the building. Among the advantages are the increased amount and better distribution of light, and also the elimination of drainage difficulties in cold weather. Where the drainage is toward the center, all the drain pipes come inside the shop where they are never cold enough to freeze, so that all the annoyance and disadvantage due to that source is eliminated. This is true of the drainage of the monitor roof as well as of the roof over the side bays, drainage from both roofs coming into the same upright pipes beside the columns as shown at the left in Fig. 1. This view gives an excellent idea of the way in which the light is distributed, the combination of the high side-windows on the monitor and the long windows on the side of the shop resulting in a uniformity of lighting on which it is difficult to improve.

The effect of an abundance of unobstructed daylight in a machine shop can hardly be overestimated. The men do better work and more of it; there are fewer mistakes, fewer accidents and of course less cost in electric light bills and lamp maintenance. Then too there is an undefinable and perhaps unmeasurable something about the place that gives added vigor and enthusiasm and that helps in more ways than we are apt to realize. The exact construction is shown a little more clearly in Fig. 2, which shows the shop to be 90 ft. wide, the width being equally divided among the three bays. The side bays are 14 ft. high in the clear and the clearance below the crane bridge is a trifle over 9 ft. The center bay is 26 ft. high and the top of the crane rail is 19 ft. 3 in. above the floor. As indicated by the outline of the cranes shown, the left-hand bay has one 4-ton crane, the center bay one 15-ton crane and the right-hand bay two 1-ton cranes. The roof construction and the use of concrete both for the flooring and the wall foundations are clearly shown.



FIG. 1. THE INTERIOR OF SHOP NO. 3

The general layout of the shop is shown in Fig. 3, the dimensions being approximately 90 ft. wide by 535 ft. long. It was primarily built to accommodate the erection of machines and to contain the engineering department, the restaurant and kitchen, as well as the tool storage which will be referred to in another

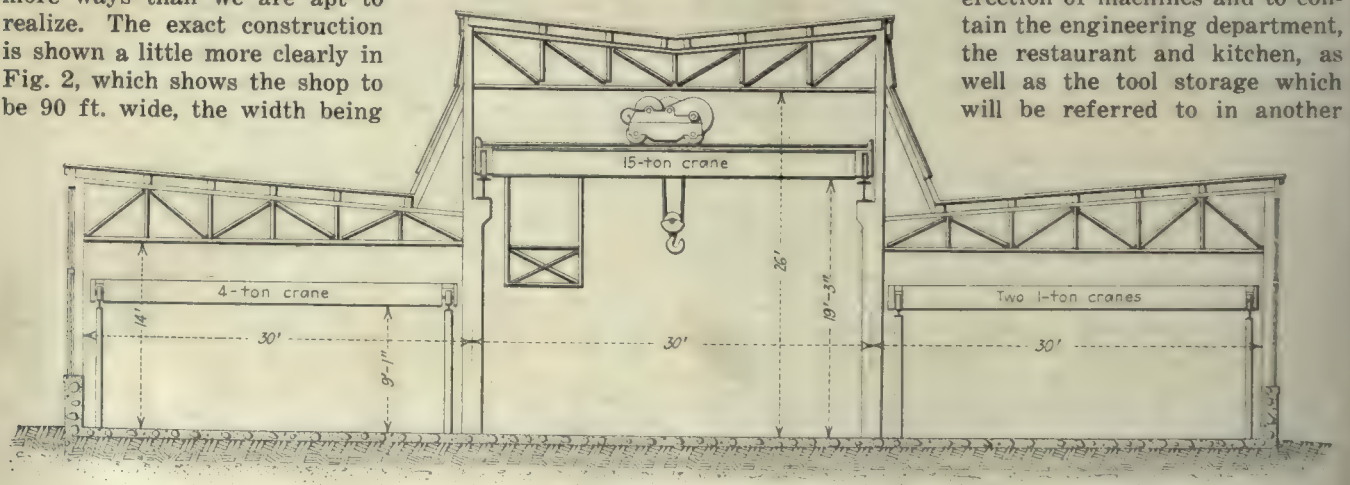


FIG 2. CROSS-SECTION OF SHOP

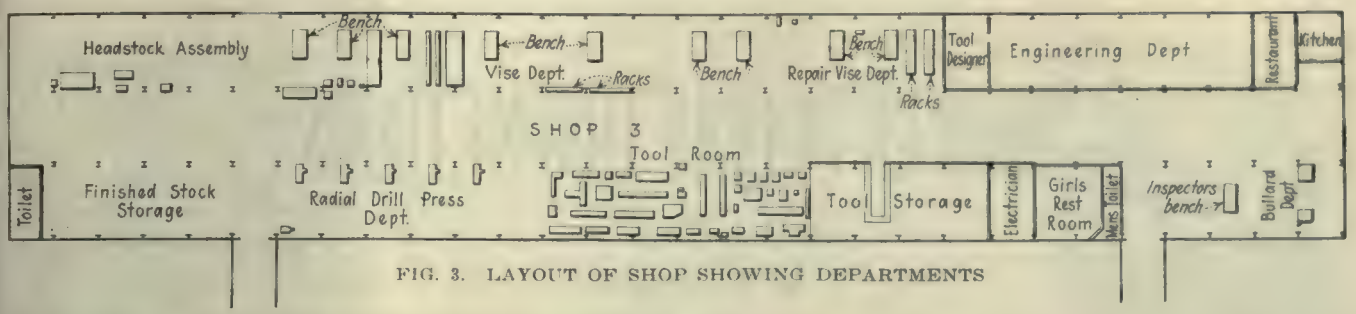


FIG. 3. LAYOUT OF SHOP SHOWING DEPARTMENTS



FIG. 4. THE ASSEMBLING DEPARTMENT, SHOWING LOW BENCHES

article. The toolroom adjoins the tool storage and, as can be seen, has quite an extensive equipment for manufacturing such tools, jigs and fixtures as may be necessary.

It will be noted that the toolroom occupies considerable space and also that it is well equipped with machinery. Its convenience to the tool storage (which will be described in another article) is also an advantage particularly in securing such repairs and adjustments on tools and fixtures as may become necessary from time to time.

The assembling benches in the vise department are particularly convenient, as can be seen in Fig. 4. They are considerably lower than the usual standard height, and are of large size, 6 x 12 ft. This view also shows the small vise benches for erectors and the racks for finished pulley and other units at the right. The lighting is excellent, as can be seen. The wall in the distance separates this department from that for tool designing.

The engineering department is next to the tool designing room and is shown in Fig. 5, where can be seen the excellent daylight lighting and the profuse equipment of incandescent lamps for use at night. At the right is a large drawing board on which new machines are drawn full size so as to get a correct idea of their proportions. This view also shows the type of drawing tables used, the highback chairs and other conveniences for the draftsmen.

The heating of the shop is by hot water but instead of depending on gravity for the circulation, the water is forced through the radiators. This method has been found to be much more economical than the hot air system in use in the older buildings.



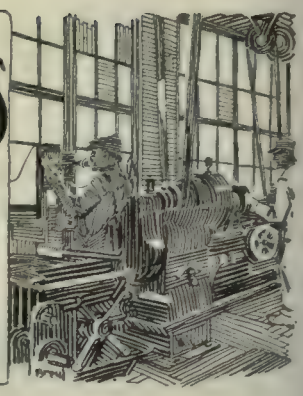
FIG. 5. IN THE ENGINEERING DEPARTMENT





MODERN PRODUCTION METHODS

By
W R. Basset
of
Miller, Franklin, Basset & Co



XVII. Handling Abnormal Expense

Making Monthly Adjustments in the Accounts to Take Care of Fluctuations—Normal and Abnormal Expenses and Costs

SUPPOSE you own a shop able to turn out 200 lathes a month. Suppose that, normally, the overhead expense runs $10,000 a month, or at the rate of $50 per unit of output.

Along comes a business depression and the orders fall off so that it is doubtful if you can sell even 100 lathes a month. The plant runs half time. You will at once cut down on some items of overhead which can be made to follow roughly, the shop's activity.

But there are some items of the overhead, such as the fixed charges and, very likely, the salaries of the superintendent and other executives, which are uncontrollable. You can not very well cut them in proportion to the falling off in output. If you are careful perhaps you can cut the overhead of your plant to around $8,000. Each lathe you make will then have to carry $80 of overhead. That means that your product costs you more when orders are hard to get than when business is good. If you attempt to get back your actual cost, you must raise the selling price.

But the sales department has little difficulty in convincing you that to get orders enough to fill the plant, the selling price must be cut. It looks like another one of those vicious circles. Just when you need to attract new orders you find that because production is low, your costs are abnormally high. Obviously, if you attempt to base your selling prices on your actual costs you will make it still harder to attract sufficient busi-

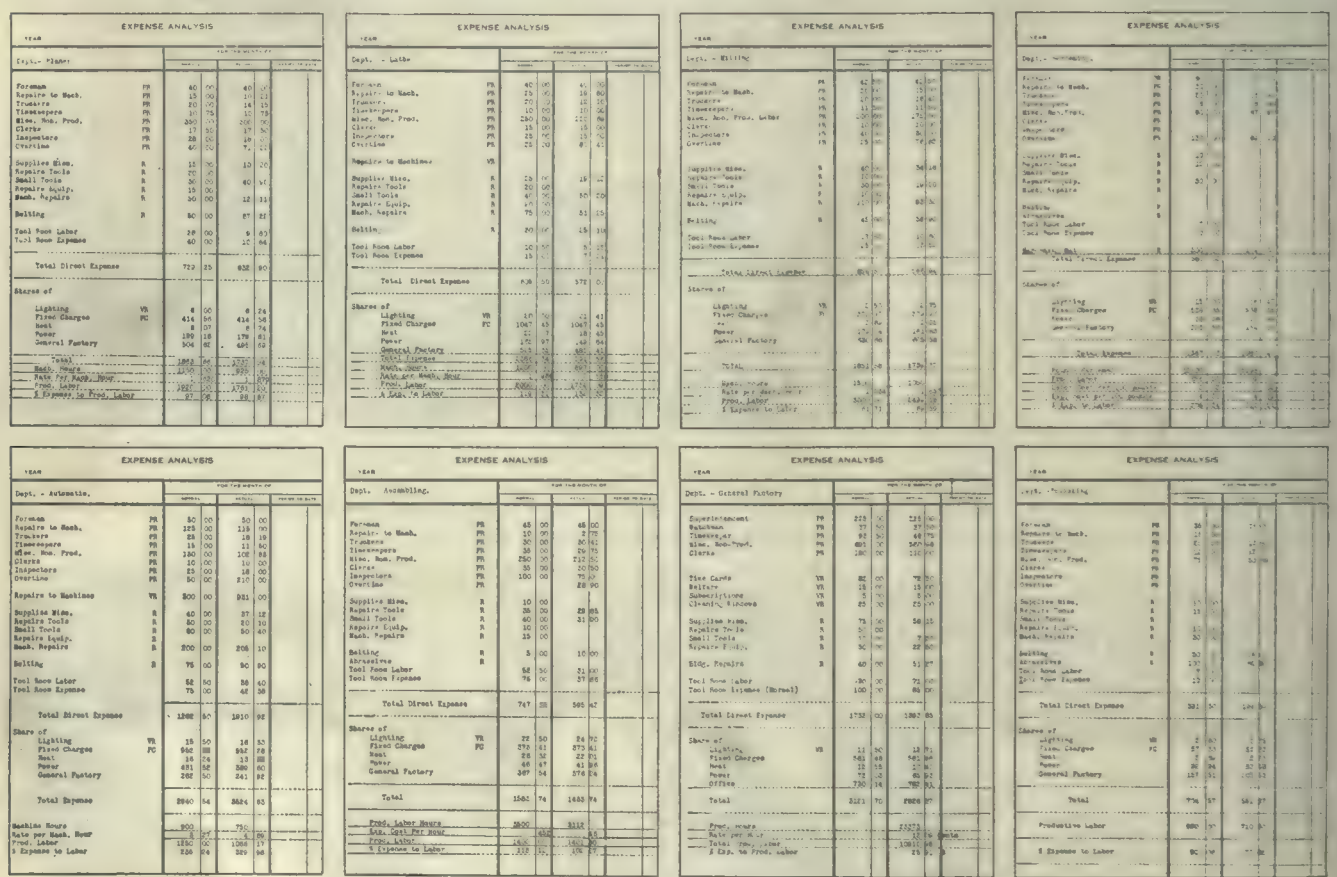


FIG. 82. EXPENSE ANALYSES

ness so that you can get back to normal costs. That is the problem that faces every owner of a machine shop whenever business goes into one of its seemingly periodical slumps.

But in lesser degree the same fundamental problem is present even during times of normal business. The activity of a plant fluctuates somewhat from month to month, reducing the cost of the product a little with extra activity and raising it when the plant is less active. Even with an accurate cost system the executive is puzzled, for he finds that his products turned out in June costs him say $114 each, in July perhaps $121 and in August $117. How is he to price out a product sold, say, in September? He may not be able to tell by then in which month the particular one he is selling was made. And yet the average man, who believes the figures his cost system gives him usually feels that to be consistent he should base his selling price on his actual costs.

This shortcoming of cost systems led me, some twelve or more years ago, to search for a solution. The "normal and abnormal cost" plan which has since been quite generally adopted by competent cost men, is the result.

It does several things for the manufacturer. First it gives him a standard cost which is the cost of the product when the plant is normally active. This does away with the bother of considering the day to day fluctuations in actual cost. Second, it enables him intelligently to go after needed new business at a price which will get the business, and at the same time bring back a certain known part of the actual cost. Third, it does not penalize the factory for high cost of production which is really due to business conditions or poor selling. Fourth, it sets up a budget figure not only for each department of the plant but for each item that makes up the overhead of each department. This gives the executive a quick control when the actual expenditure for an item overruns the budget or normal figure, and it shows him just where expenses may safely be cut when business falls off.

Let us see, in detail, how normal expenses are arrived at and used. The first step is to determine the normal activity of the plant. Presuming that the shop has been put in balance, as described in Part VI, when we were considering the planning of production, it is apparent that for one-shift operation the maximum is 100 per cent of the machine capacity. Actually we find that this is seldom attained, for the sales force does not always make enough sales; production planning may not be perfected; machines will break down and men will sometimes lay off. Research shows that 80 per cent of capacity is a fairly high normal activity for machine shops. Of course, if the plant operates two shifts of equal length we have a possible capacity of 200 per cent when we speak—as is customary—in terms of a single shift.

If a plant is unbalanced, one or more departments may regularly work overtime. One such, for which we developed costs, operated 10 hours a day except one department which regularly worked 6 hours overtime. This department's capacity was thus 160 per cent of a single shift and its normal activity was 80 per cent of 160 or 128 per cent.

In this way we determine for each department its normal activity expressed in productive hours whether of machines or men.

Next, we must develop a dollars and cents' figure for the normal expense of each department. This is based on the history of actual expense for a period of normal activity if it is available. If, however, such a history is not to be had, it is possible to build up accurate normals. Since a description of this method will cover all problems which can be encountered we will consider that we are developing normal figures for a shop during the slump in the fall of 1920.

The expense analyses for this shop have been developing the actual items of expense for, say, two or

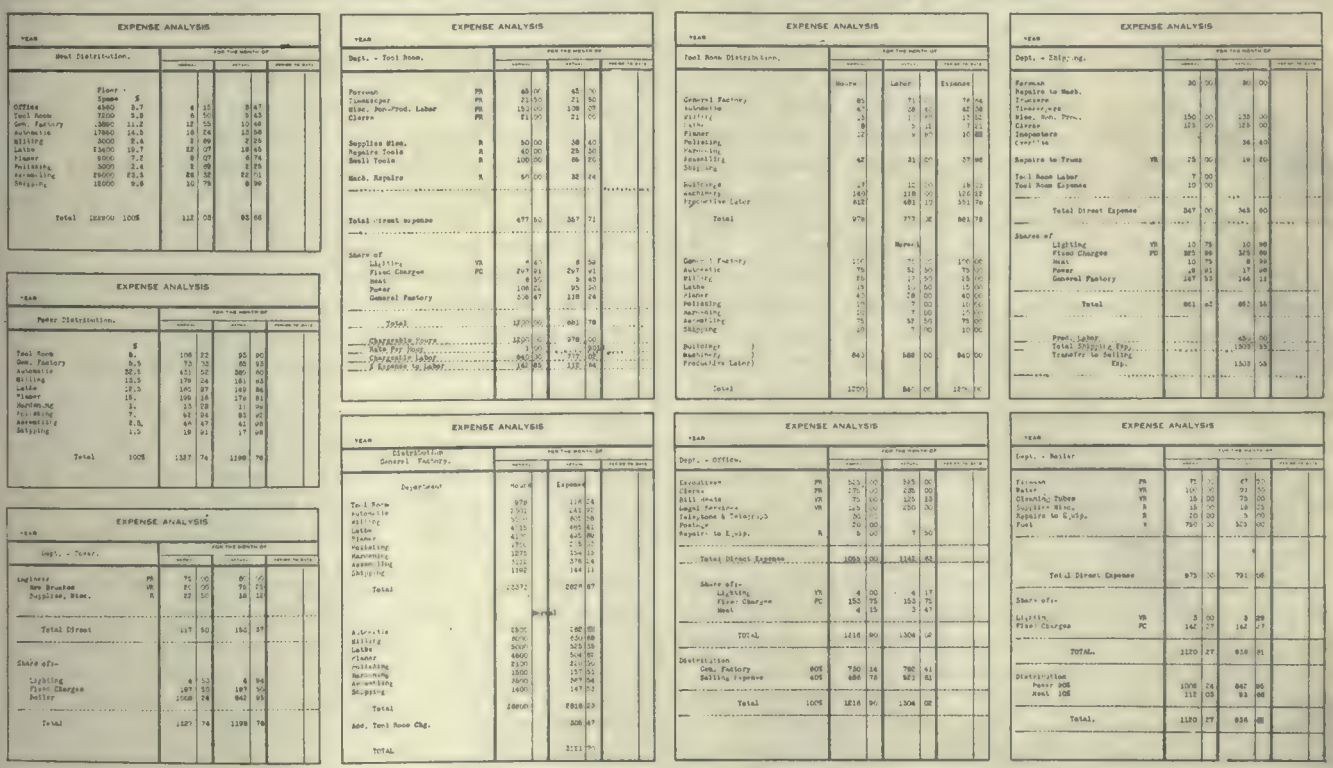


FIG. 82. EXPENSE ANALYSES (CONTINUATION OF)

three months. The figures came from the sources of original entry and we have described how they are carried forward through the contributory departments into the productive departments.

In setting normals we therefore examine each actual item on all of the expense analyses and, in the light of our knowledge of the shop and its problems, we determine what would be a reasonable amount for each item to be at normal—that is 80 per cent capacity—production.

Take the general factory department. The first item shown in Fig. 82 is superintendent's salary, $225. The superintendent is a key man who will not be dropped and his salary will not fluctuate with the shop's activity. As we do not contemplate changing his salary at present, the actual figure becomes the normal. The same conditions apply to the watchman whom we must keep on the payroll whether the plant is on full time or shut down.

REPORT OF ABNORMAL EXPENSE

NAME	MEASURE OF PRODUCTION	ACTUAL			NORMAL		DEVIATION FROM NORMAL	
		PRODUCTION	EXPENSE	RATE	RATE	EXPENSE	GAIN	LOSS
TOOL ROOM	MACH HR	612	551.70	.90	1.00	612.00	60.22	
AUTOMATIC	MACH HR	730	3324.63	4.63	3.270	2455.50		1072.13
MILLING	MACH HR	1030	1733.32	1.657	1.254	1293.70		439.62
LATHE	MACH HR	897	2294.56	2.558	1.588	1783.24		511.32
PLANER	MACH HR	323	1737.34	1.875	1.620	1498.50		238.84
HARDENING	100 POUNDS	251.00	1087.43	4.310	4.210	1060.84		26.59
POLISHING	LABOR	710.30	331.37	77.6¢	80.06	568.67	17.30	
ASSEMBLING	LABOR HR	3112	1433.74	.46	.452	1406.62		27.12
TOTAL			12320.77			10678.07	77.52	1564.22
			10678.07					77.52
NET LOSS			2242.70					2242.70

JOURNAL ENTRY	DR.	CR.
GOODS FINISHED & IN PROCESS	10678.07	
MFG EXPENSE		10678.07
PROFIT & LOSS DUE TO ABNORMAL EXP.	2242.70	
MFG. EXPENSE.		2242.70

FIG. 83. REPORT OF ABNORMAL EXPENSE

But the next item, "timekeepers," is controllable. Under normal conditions two timekeepers are needed, but as production for the period we are reviewing was slack, but one timekeeper was needed. Our budget for normal operation however, must provide for two, so we put our normal figure at double the actual as shown for this month. Miscellaneous non-productive labor fluctuates almost directly with the activity, and we know that when normal conditions come again, this item will go up. We estimate that $695 will be the expense for non-productive labor normally. The normal or budget figure for clerks is arrived at in the same way.

As we have already seen, some of the overhead items do not vary with the activity of the shop. An example is window cleaning. For such items the normal and actual are the same. Other items fluctuate more or less directly with the shop activity. For the month in question there were, for example, no tool repairs requisitioned, but month in and month out we find that this item amounts to about $50 a month, so that figure is decided upon as normal.

The amount of power used will vary with production, but the share of fixed charges will not.

In setting up the normal expense for the toolroom, we are again confronted with the situation of the toolroom bearing a charge from the general factory, and also with the toolroom giving a charge to the general factory. To overcome this difficulty, a fixed figure is used on the toolroom for the general factory amounting to $305.47, and, in making the distribution of the general factory expense, after the total normal expense has been determined, the amount that we have charged to the toolroom is deducted before making our distribution to the other departments. The amount is not used in calculating the percentages which we used for purposes of distribution to the departments of the general factory charge.

After the normal figures for a department are settled upon, they are totalled and distributed to the productive departments in exactly the same way as are the actual figures. This has been described in Part XVI.

The normal or standard rates of expense for the productive departments are developed as they were for the contributory departments. The total normal expense for a productive department is divided to give a normal rate per hour by using the standard expense and the standard hours. If a department's expense is applied as a percentage of expense to labor rather than on the hourly basis, that figure is developed by estimating the total wages that will be normally paid in that department.

This standard or normal expense rate is the figure used in costing the product. This gives an apparent discrepancy between the expense which has actually been incurred and the standard expense. The difference must be taken care of in the accounting. It is easily and accurately done.

There are two ways in which this adjustment can be made. You may recall that during the month we put into the "goods finished and in process" account of the ledger, the productive labor that was actually expended during the month. We also charged to this account the materials drawn from the different inventory accounts, and the total manufacturing expense.

This account is thus charged with the actual cost of the finished goods on hand, and of the unfinished goods in process which are scattered throughout the plant. This actual cost may be high or low, depending upon the activity of the plant for the past few months.

While we have here the total actual cost of a large number of different parts in different stages of completion lumped together, it is apparent how nearly impossible it would be to determine the actual cost of any given part, for they started at different times and went through under varying conditions of shop activity.

And yet these parts, as one by one they are sold, must be credited to the goods finished and in process account at cost. We can in the end take out of this account no less or no greater amount than has been put into it.

Here is where the standard cost is of great advantage, for it saves useless hair-splitting and clerical labor, while giving at the same time complete accuracy. For we credit the goods finished and in process account with the normal cost of those articles which have been sold.

Suppose that during one month the actual overhead expense for the planer department had been at the rate of $1.05 per machine hour, or $2,100. This sum has been charged to the goods finished and in process account as described in previous articles. Suppose that normally the expense of this department is $2,200, or at the rate of $1.10 per machine hour. This is the rate at which goods sold must carry the overhead absorbed

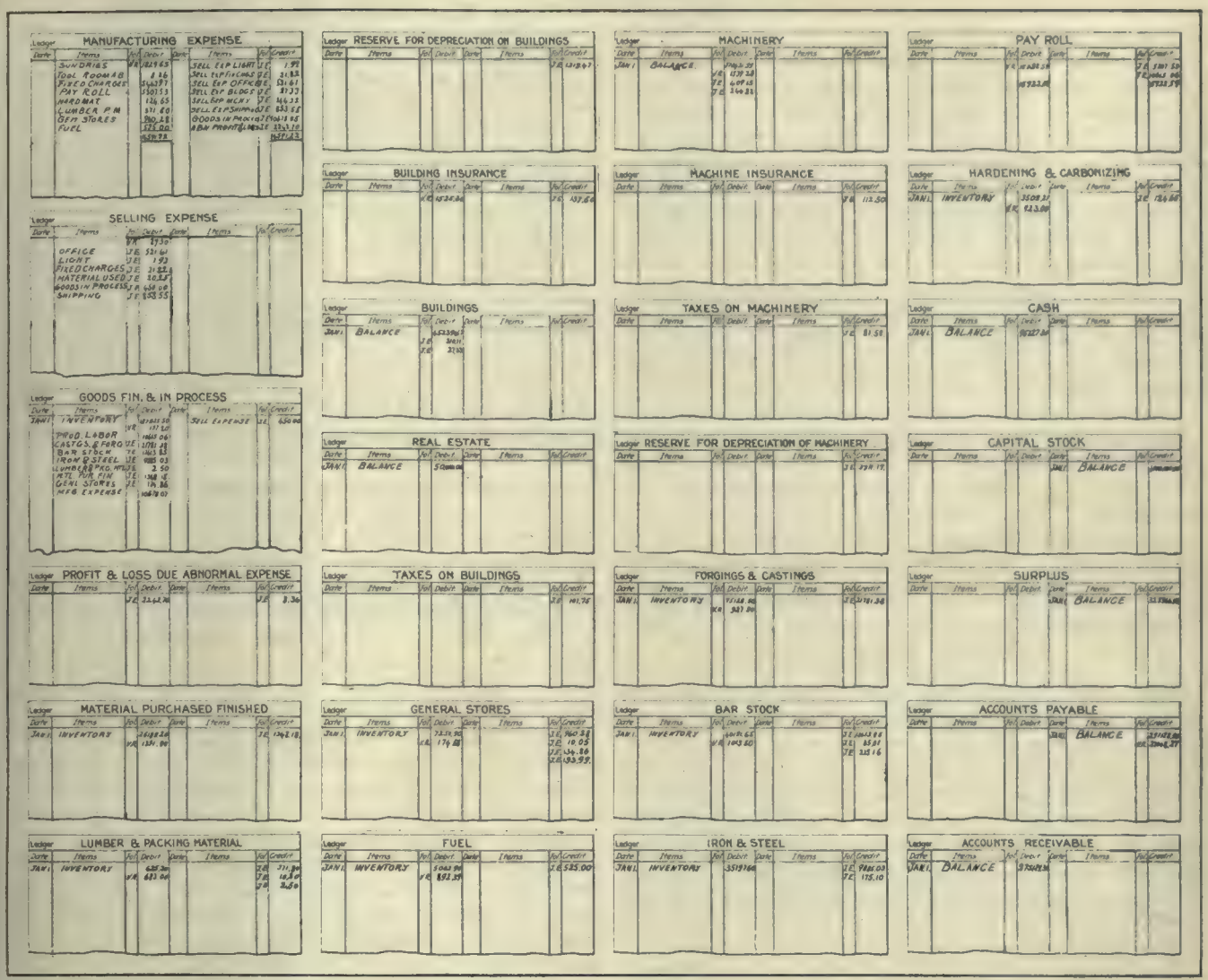


FIG. 84. ADJUSTED LEDGER ACCOUNTS

by them as they go through the planer department. If we credit "goods finished and in process" with the cost of goods sold at the normal rate, it would result in taking $100 more out of the account than was put into it. No conceivable activity of this account can result in a profit to it; yet a profit shows up here. It is due to the increased activity of the planer department.

So we make an adjustment between the "goods finished and in process" account and an account called "profit and loss due to abnormal expense" to take care of the $100 discrepancy. The result is to add $100 to the goods finished and in process account. It is done by the medium of a journal entry, charge "goods in process" $100 and debit "Profit and loss due to abnormal expense." If the shop had operated below normal so that the actual machine hour rate had been $1.15, the journal entry would read, credit "goods in process" and debit "profit and loss due to abnormal expense."

Some cost engineers and managers prefer to make the adjustment directly between the manufacturing expense account and the profit and loss account. There is little to choose between the two methods. If the latter is done we credit the manufacturing expense account with the amount of the normal expense as it is developed for the month, and charge this amount to the goods finished and in process. The difference that now exists, either debit or credit, in the manufacturing expense account is charged or credited as the case may be, to "profit and loss due to abnormal expense." In this way, "goods finished and in process" are kept at a normal base of expense. So when goods finished and in process are relieved by the cost of sales figures at standard rate of expense, there will be no discrepancy in the goods finished and in process account.

If after a period of several months, there is found a persistent discrepancy in the same direction between actual and normal rates, it is advisable to set up new normals. When the normal method is first started it frequently occurs that incorrect normals have been set up, due to insufficient information to go on. Or conditions in the plant may change to a degree. In a period of rapidly rising wages and salaries such as occurred in 1916 to 1919 it may be found that the actual expense persists above the normal. That condition might require that the normals be frequently and carefully revised.

We are showing here in Fig. 83 the building up of the adjusting entry for the difference between the expense actually incurred and the expense as figured at the normal rate on which we base the cost. By referring to this exhibit you will see that it gives the executive at a glance, those departments which have run over or under the predetermined rate of expense and by a

reference to the expense analysis because of this shortcoming, can easily be determined.

The normal method of handling expense solves automatically the much mooted question as to how idle machine time is to be distributed. It has always seemed unfair to have any particular piece absorb a large amount of accumulated expense due to lack of use for the tool on which it is made. Certain charges run on irrespective of whether the tool is busy or not. Neither is it fair to make the shop as a whole take care of this cost, loading the cost for the idle time onto pieces which are in no way connected with the idle machine. The lost time on a machine is a straight business loss. Handling it in this way sets the figures up so that the executive may see at a glance any deviation from the standard rate. By referring to the expense analysis he can see whether it is due to low machine activity or to increased expense. Cost figures throw up their own warning. The expense analysis provides an easy and quick means by which to ascertain the cause of the fluctuation.

In a few unusual shops it may be desirable to set up standards or normal costs for labor and material as well as for expense. The method of handling would be the same in principle.

Inventory Adjustment

Some accountants object to adjusting the inventory and the profit and loss monthly. They say it is incorrect to take a profit or a loss before a sale is made. My thought is that the main object is not to effect the profit and loss, but to normalize and hold the goods in process figure at a common or normal figure, at the same time absorbing the losses on materials as the materials are used. If, by good management, the cost of labor, materials or expense is less than normal, the profit is obviously a profit to the month in which the transaction occurs.

The normal or standard figure that is set for each item of expense on the expense analysis is in effect a budget. The executive who watches the expense analysis to see that the actual expenditures do not exceed this figure has an effective control by which to keep overhead from running away with profits. After an estimate has been made, it is important to make sure that the actual items of expense do not exceed the figures on which the estimate was based. It is more important to know, for instance, that machine repairs in the automatic department are costing $100 a month more than we estimated they should cost, than to know that some minor part is costing two cents more than we figured on our estimate.

In this article are shown the expense analyses, Fig. 82, complete, with normal and actual figures, just as they go to the executive who has a fully functioning cost system. We also show the ledger accounts, Fig. 84, adjusted to take care of the profits and losses due to abnormal expense. It will be noticed that these ledger accounts as previously shown carried no balances from previous inventories. They were purposely ommitted to avoid possible confusion in tracing the later entries. From now on we have to take these balances into account, so we have interpolated them.

When a cost system shows only that a part is costing more than the estimate, it is simply bringing us bad news. With normal and actual figures for expense side by side, we may still get the bad news, but we are shown where to go to stop the loss.

One Man Receives and Issues Stock

By Peter F. O'Shea

In certain sizes and kinds of industries the record making, so valuable in most circumstances, becomes so complicated that dependence upon the human element is simpler and less expensive. As a general thing it might be said that the limit of size where this is true is a two-man department; for if there are more men than this, they need the records for information.

In the raw material stores of the Likly Luggage factory, however, it was found that one man could do all the actual physical work of receiving and picking out raw material. Besides himself a clerk or two had been used in keeping inventory records on the maximum and minimum and exact balance basis. The stores man was of the opinion that he could do the job himself and do it right if the inventory records could be dispensed with. This was tried and succeeded so well that the company saved the considerable expense of clerical work.

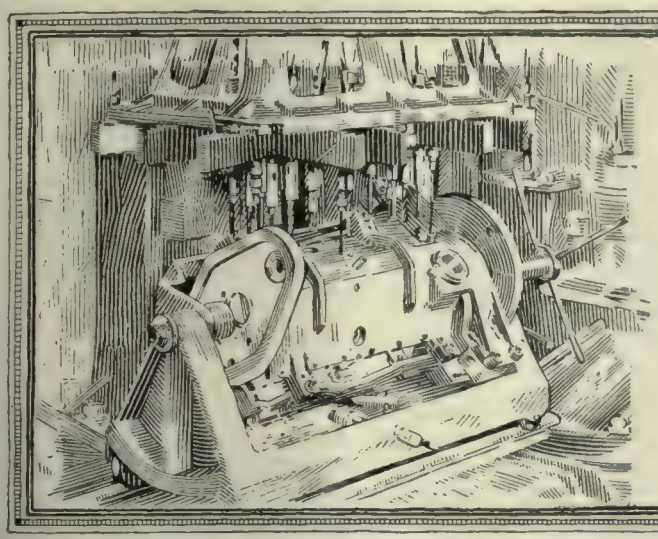
On the arrival of each shipment of material the stores caretaker enters it in a receiving report which is made out in duplicate. One copy on a manilla page remains in the receiving register. The top copy is made on a buff page as large as the register, but subdivided by perforations into four separate tickets, 5 x 8 in. in size. One of these tickets is a complete receiving report. The buff copies are sent to the purchasing department as an announcement that the material has been received, and then they are returned to the stores clerk who files them by the number of the material. When the material is used up he removes his receiving report from his file.

He is so well acquainted with the stock that he ordinarily does not have to consult the file, but can tell offhand how much material he has. The quantities of material issued are of course on job tickets which come first to the stores man. From the job tickets the quantities are analyzed for cost purposes.

If this man were absent from work for a very long period a new man could be broken in only with difficulty by personal attention from the superintendent; but the contingent cost of this is much less than the current cost of keeping up the old records.

Under this simpler system the single stores man not only does the complete job but he also has time to take care of product coming to the repair shop of the company. He receives this material just as though it was raw material, except that he makes out a separate register. This gives source from which the product was received, quantity, size, style, description, condition in which the goods were on arrival, and instructions as to what is to be done with them; with a reference number to the credit memorandum issued to the source. This register is made out in two copies. One is retained by the stores clerk who also handles the goods when they are repaired and ready to be shipped.

The second copy of the report on returned merchandise is on thick manilla cardboard, 6 in. wide by 12 in. long. The top part is the same as the other copy. The bottom part consists of two work ticket coupons which are torn off along the perforations. One of these goes to the workman, the other is retained by the foreman of the repair department. They specify the name of the workman, time taken, piece price and the amount of wages. The top of this card has a little eyelet so that the card can be hung on the "work ahead" hook of the repair department.



Tool Engineering

By
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President and Chief Engineer
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Drill Jig Design Continued—Templet Jigs—Plate Jigs—Open Jigs for a Shaft—Open Jig for a Pump Cover—Closed Jigs

IN THE previous articles we have taken up a number of points in connection with the design of drill jigs. We shall now apply some of the principles which have been described. It is not our intention to apply every principle or each mechanism which has been mentioned, but rather to give a few examples of jigs of various types to illustrate the general procedure in jig construction. From the examples given the tool designer can note various features of importance and by careful study he can doubtless see other ways in which the same piece of work can be jigged. As a matter of fact the studious designer will find it to his advantage to consider each jig shown and endeavor to handle the work in as many different ways as he can, applying the principles which have been carefully explained in the preceding articles.

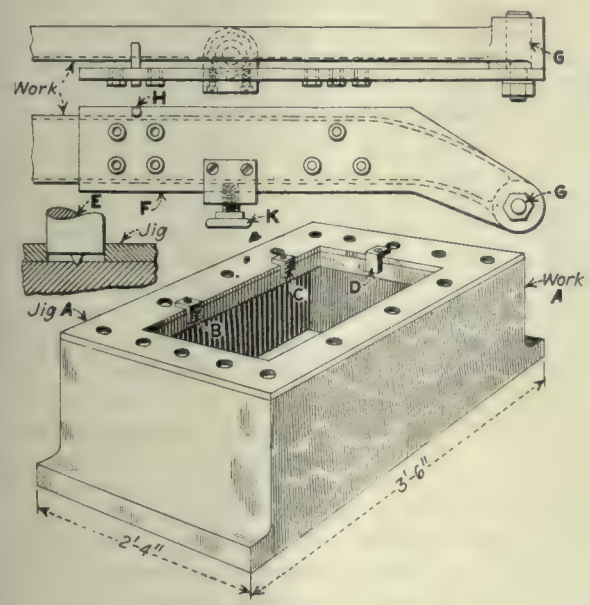


FIG. 69. TEMPLET JIGS

As explained previously, the templet jig is the simplest form that can be made. In elementary form it is sometimes nothing more than a thin plate of steel with holes located to suit the condition. This plate is often set on the work and marked with a prick-punch or scriber. Templet jigs of this kind would be made up only in cases where there were a dozen or so pieces to be drilled and also when the location of the holes did not require very great accuracy.

Going a step further in the design of templet jigs let us consider the ones shown in Fig. 69. The work *A* is a cast-iron frame of large size; there are a number of holes to be drilled on the upper surface, and there are only a few pieces to be machined. In order to drill these cheaply and to have uniformity for the various pieces, the jig *A* is made up of sheet metal and is furnished with three locaters shown at *B*, *C* and *D*. The templet is placed in the position shown and clamped in place by some convenient method, using the locaters to bring it into the correct position. The holes are then prick-punched with a punch similar to that shown at *E*, after which the templet is removed and the work drilled according to the locations marked.

Another templet jig is shown at *F* in which the work is an automobile frame. The hole *G* in the front spring hanger is used as one locater for the jig and the pin *H* acts as the other stop against the side of the frame. This jig is a little more elaborate than the one previously shown as it is furnished with a thumbscrew at *K* to clamp it in position. Jigs of this kind may be furnished with bushings if desired, or they may be used with a prick-punch to locate the holes before drilling, as in the previous instance. It is evident that this type of jig could be made much longer and carried farther along the frame to allow for the drilling of the other holes if necessary. A method of using a templet jig is shown in Fig. 70, the work being shown at *A* and the jig at *B*. Let us assume that the

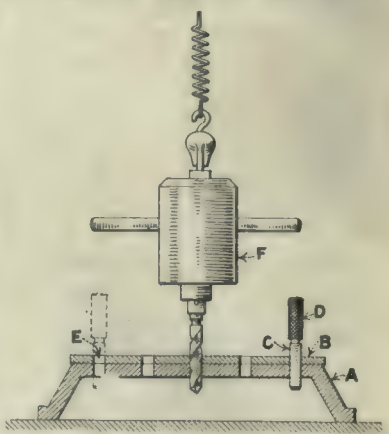


FIG. 70. USE OF A TEMPLET JIG WITH LOCATING PLUG

For the authors' forthcoming book. All rights reserved.

templet has been clamped to the work and that one hole has been drilled at *C*. A convenient method of making sure that the templet does not shift, is to use a plug like that shown at *D* in the first hole drilled. After this another hole can be drilled at some distance away as at *E* and a second plug inserted after which the remaining holes can be drilled without danger of disturbing the location of the templet. An electric drill, indicated at *F*, is convenient for work of this sort.

Plate Jigs

There is a strong family resemblance between plate and templet jigs, yet there is a distinct difference, in that the plate jig is often used for high production while the templet jig is never used except when production is small. There are many cases where a large piece of work requires a few holes to be drilled accurately in relation to other holes which have been previously bored and reamed and it may frequently prove to be more economical to design a plate jig than to attempt to do the work in a very large jig in connection with other holes. An example of this kind is shown in Fig. 71, in which the work *A* is a large casting which has been machined on the base *B* and on the upper surface at *C* and in which the holes *D* and *E* have been bored and reamed. It would not be economical to make a large jig to drill the holes at *F* and *G*, especially as it is necessary to locate them in relation respectively to the reamed holes *D* and *E*. It will be found more economical to make up a plate such as that shown at *H*, which has bushings provided at *F* and *G* and which locates by means of the studs *K* and *L* in the reamed holes. It is evident that a large jig of this sort would need nothing to hold it in place as it would be quite heavy. Therefore a handle is provided at *M* by which to lift it off the work after the drilling has been done. Jigs of this kind are in common use in many factories.

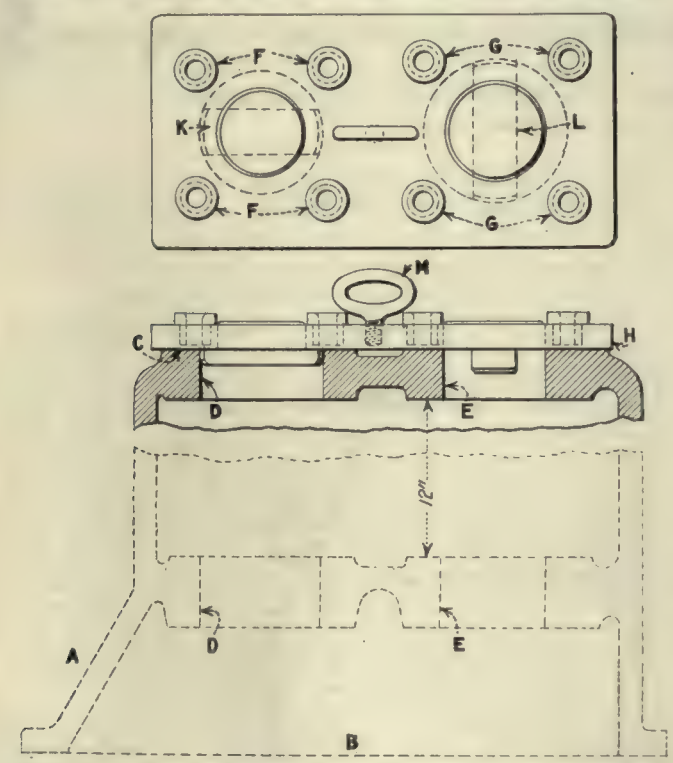


FIG. 71. PLATE JIG FOR A LARGE CASTING

In Fig. 72 is shown another application of a plate jig which, like that in the previous instance, is located by means of a stud *A* in the center hole of the work *B*. This stud is provided with a key at *C* in order that the location of the holes *D* may be in a given relation to the keyway. The location of the holes *D* is such that it would be difficult to support the work properly unless particular provision were made. In order to assist in drilling, a support *E* is made up of cast iron so that the work rests on it. There are occasional cases where a support of this kind may be used in order to avoid designing an expensive jig.

Jig for a Dovetail Slide

A simple plate jig, which will give very accurate results, is indicated in Fig. 73. The work *A* is a dovetail slide which has been finished all over and in which it is necessary to drill the four holes shown at *B*. These holes must be drilled in correct relation to the dovetail and it is therefore necessary to locate the plate jig in the dovetail slide as indicated. The jig is provided with a binder at *C*, operated by a thumbknob *D*. The binding member is so made that it fits a circular recess in the plate and it is evident that this forms an excellent clamp to hold the plate in position. The end location of the jig is obtained by means of the stop-screw shown at *E*.

Open Jigs

In the design of open jigs the general construction of the work to be drilled must be first considered. As a general thing jigs of this kind are made for work which does not have a great depth. Occasionally they are so arranged that the whole jig must be turned over and the drilling done from the side opposite that in which the piece is loaded. This usually necessitates drilling against the clamp and while not always objectionable, it is considered better practice to drill against a solid surface. In the example shown in Fig. 74 the piece of work *A* has been previously reamed at *B* and has been milled on the surfaces marked *f*. It is necessary to locate the work so that the hole *C* is in a fixed relation to the hole *B* which must therefore be used as a locater. The work is set up on a stud at *B* and clamped by means of a swinging C-washer *D* through the nut *E*. It will be noted that the C-washer is pivoted so that it will swing clear of the work. By making the washer in this way loose pieces in the jig are avoided, which is always an advantage. The other end of the work is located under the bushing *C* by means of the sliding V-block *F*, operated by means of bayonet-lock and screw-bushing shown at *G*. This construction allows for variations in the boss on the work at the point *C* and at the same time a quarter turn of the knob *H* releases the V-block and allows it to be pulled back sufficiently so that the work can be removed from the jig. There are many cases where this construction is extremely valuable as it permits rapid action and the mechanism is at the same time simple and easy to manufacture. This is a very good example of an open jig for a piece of high production work and the principles illustrated can be applied in numerous cases.

Open Jigs for a Shaft

Fig. 75 shows an open jig of excellent construction. The shaft *A* has been completely machined before the work is drilled. It is necessary to locate the drilled hole *B* at 90 deg. from the keyway in the taper at *C*. The work is placed in V-blocks and located against

the stop *D* at one end. The sliding member *E* is arranged so that it will locate in the keyway. A cam lever shown at *F* is used to clamp the work. The clamp is so made that it bears at *G* and *H* simultaneously. A slot at *K* allows it to be slid back away from the work when loading or unloading. A suggestion is made in regard to the construction of the pin at *L*. Two methods can be used, the one shown in the drawing being the cheaper. The enlarged view at *M* shows an improved method which is more substantial but also more expensive. The designer must be governed by the size of the stud at *L* and if it is found that the pin is not sufficiently strong to withstand the pressure of the cam lever, the improved construction *M* can be used. A jig of this kind is rapid and its operation makes it very convenient to handle.

The jig shown in Fig. 76 is an open jig which, however, is close to the border line between the open and closed types. The work *A* is a pump cover which has been machined on the surfaces marked *f*. It is to be drilled at *B*, *C*, *D* and *E* in this operation and it is necessary that these holes should bear a correct relation to the outlet *F* as well as to the previously machined surface and also to the outside diameter of the work. The method of locating the piece is rather out of the ordinary. The casting rests on four hardened bushings directly under the holes *B*, *C*, *D* and *E* and the spout *F* is located against the hardened locating pin *G* through the action of the bevel spring plunger *H*. It is also given another location, with respect to its outside diameter, by contact with the locating pins *K* and *L*, which are fixed in the body of the jig. After

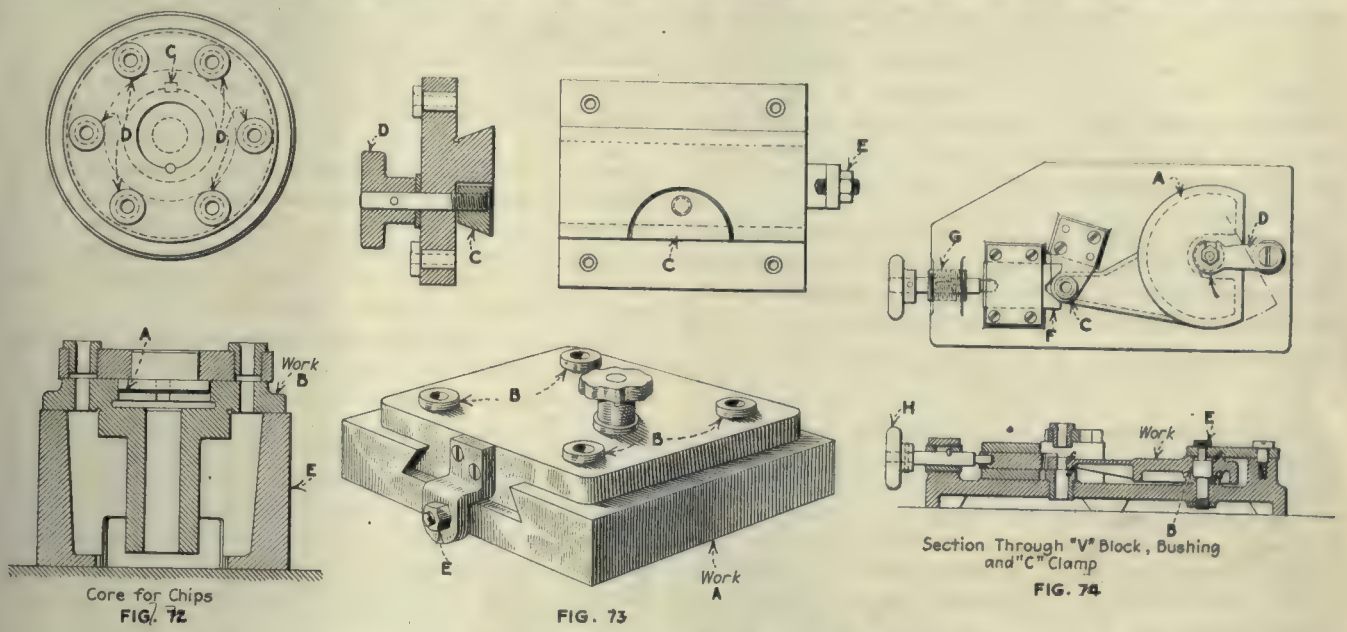


FIG. 72. FIG. 73. FIG. 74.

FIG. 72. PLATE JIG WITH ACCESSORY SUPPORT. FIG. 73. JIG FOR A DOVETAIL SLIDE.
FIG. 74. OPEN JIG FOR A LEVER ARM BRACKET

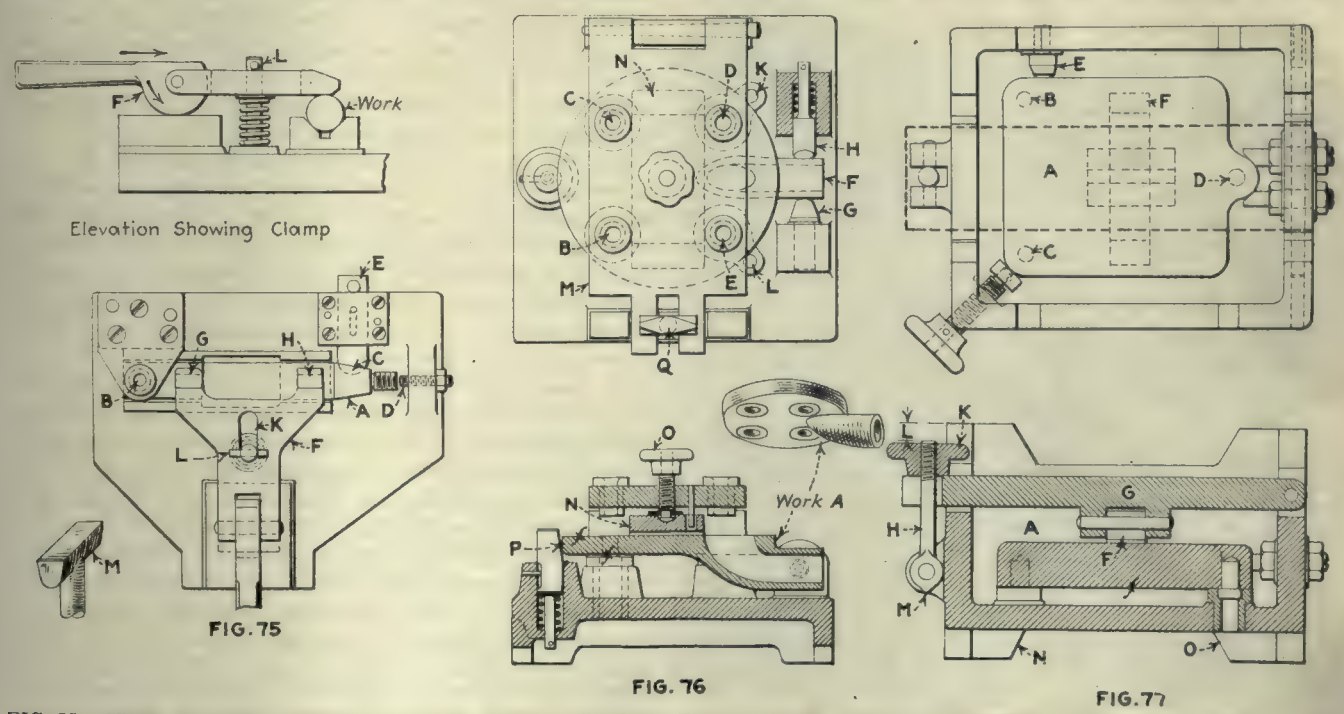


FIG. 75. FIG. 76. FIG. 77.

FIG. 75. OPEN JIG FOR A SHAFT. FIG. 76. OPEN JIG FOR A PUMP COVER. FIG. 77. CLOSED JIG WITH CLAMP IN LEAF

the operator closes the lever *M*, when the work is in position, the clamp *N* is screwed down on the work by means of the thumbscrew *O*. It will be seen that this clamp is not directly above the locating bushings on which the work rests, yet there is no danger of distortion on account of the stiffness of the casting. The portion of the work opposite the points *K* and *L* and mid-way between them, strikes the angular surface of the spring plunger *P* which depresses and at the same time insures a positive location against the two pins *K* and *L*.

The locking of the leaf is by means of a quarter-turn screw shown at *Q*. This jig is rather exceptional in its general construction and may be considered as an excellent example of modern jig design.

Importance of Chip-Clearance in Closed Jigs

In closed jig design particular attention must be paid to the clearance around the work in order to have plenty of room for chips to accumulate, for cleaning, and for setting up and removing the work. Wherever possible in closed jig design it is a good idea to core openings in the side of the jig in order to allow for cleaning. A very good example of a closed jig of simple construction is shown in Fig. 77. The work *A* is a casting which has been finished at *f* in a previous operation. There are three blind holes to be drilled at *B*, *C* and *D* and it is necessary to locate the work from the finished side of the casting, from the boss around the hole *D* and to provide another locater which will come in contact with the rough casting on the side as indicated at *E*. In the design of the jig it is well to note that the stud *E* could be so made that it would be adjustable, but in this case it has not been done because the casting is known to be a good one and not subject to variations at this point. The boss around the hole *D* locates in an adjustable V-block, the construction of which has been mentioned in a previous article. The work is clamped in position by means of the screw at the corner adjacent to the hole *C*. It is advisable to set this thumbscrew at an angle of 10 or 15 deg. so that the action will tend to force the work down on the finished surface *f* as well as to carry it into its correct location. The work rests on the heads of the three hardened bushings at *B*, *C* and *D*. These bushings are slightly different from the regular type in that they are counterbored slightly to allow for chips while drilling. The method of clamping the work is by means of an equalizing clamp *F*, which is mounted in the leaf *G*. Attention is called to the fact that the clamping action is not directly over the points on which the work rests, but it can easily be seen that the thickness of the casting is such that there is little likelihood of its being distorted by the pressure of the clamp. The leaf is clamped by means of the swinging eyebolt *H* and the thumbknob *K*. Care must be taken to allow plenty of clearance at *L* so that there will be no chance that the screw will strike the drilling-machine table before the leg does. The eyebolt is so made that it will not revolve completely on account of the end *M*, which strikes the wall of the jig as the eyebolt is thrown open. When in use this jig is turned over so that the work is drilled from the side opposite the leaf. The jig feet *N* and *O* should not be made too long as they might interfere with the drill chuck. There are several important points of general construction involved in the design of this jig.

Wet Grinding a Dangerous Occupation—Discussion

By Alan A. Wood

On page 825 of the *American Machinist* there appeared an article entitled "Wet Grinding a Dangerous Occupation." I have not had the opportunity of reading in its entirety the report mentioned, but the conclusions drawn seem at variance with modern experience in grinding. It seems that the observations were all drawn from one town, from one industry and from one factory in that industry. Apparently, also, comparison is made between the rough grinders and the polishers, obviously an unfair one because of the greater amount of stock which the grinders have to remove.

There have been brought to the writer's attention instances where dry grinding, even with the aid of properly designed exhaust systems, has proved intolerable to the health and convenience of the operators. I can recall such an instance in the case of a manufacturer of electrical machinery and the trouble was rectified by properly equipping the machine for water. By proper equipment for water there is implied the protection of the operators, not only from the actual drops or splash which might fly off from the wheel but also from spray or mist.

This brings up another point in connection with the article, namely, that the workers were accustomed to remaining in their wet working clothes for several hours after leaving the mills. It is obvious that if the machines were properly guarded the clothing of the workers would not be in this condition. There are some grinding operations in which it has always been the habit of the operator to sit close to large revolving sandstone wheels and almost in the path of the water. Happily this class of machinery is being superseded by more efficient modern machines designed to protect the operator as well as to turn out a satisfactory quantity of good work.

In the case of the grinding of non-ferrous materials such as baked clay, carbon, stone, etc., dry grinding even with exhausters is almost intolerable. The dust which rises is very fine and penetrating and the only protection seems to be a mask. The exhausters seem to catch the heavier particles but the finer particles, more penetrating and apparently more injurious to the system, may remain suspended in the air for hours.

On the other hand, the reverse is true in the case of wet grinding; although some of the heavier particles may escape the stream of water in a properly designed system, the finer particles of dust are dissolved or "killed" by the spray. It is also unnecessary in the case of modern and properly designed grinding machinery for the operator to have his clothing dampened by either direct splash or fine mist.

It seems that this particular set of observations outlined by Dr. Drury is not wide enough to be conclusive, especially since the preponderance of evidence is on the other side. The tendency has been almost invariably to go from dry grinding to wet grinding. Therefore it seems that the attention of the readers of *American Machinist* should be drawn again to Dr. Drury's report and that the conclusions drawn should be more closely defined; that in this particular industry, namely, axe grinding, and with the machines available at this plant, results seem to show that the wet grinding operation, with the conditions noted, was more injurious to the workers than the operation of polishing.

The Rolls-Royce Connecting Rods

Rods Finished All Over—Both Hubs Same Length for Ease in Holding—Continuous Bearing on Crankpin—Floating Piston Pin Bushing

By FRED H. COLVIN
Editor, *American Machinist*

IN COMMON with the other parts of the Rolls-Royce motor, there is considerable material allowed for finish on the connecting rods in order to be sure and remove any minute surface cracks that might exist in the original forging. In the case of the connecting rod, which is finished all over, the weight is greatly reduced and there are fifty operations. Fig. 1 shows some rods in several stages of completion.

The machining begins with rough drilling the small hole, after which the rod is heat-treated so as to test to a Brinell hardness of 293 to 321. When the test shows the correct hardness, the test piece forged on the rod is notched, broken off, and tested to insure the material being suitable in every way. Then the rod is sand-blasted and the first side milled with a slabbing cutter, this operation being followed by a similar milling of the second side. Both of these surfaces are then ground on a Blanchard machine as they are used for the future working faces.



FIG. 1. THE ROD IN VARIOUS STAGES

It is interesting to note in this connection that both ends of the rod are made of the same length so as to be easy to hold in all milling and other fixtures without the necessity of having a step or pad of special height under the large end of the rod. When all the milling has been done the two sides of the large end are faced to their proper length by a simple and efficient method. This makes it possible to produce rod after rod with the boss faces in parallel planes.

Boring and Milling

After the surface grinding, both ends of the rod are bored and reamed on a Bullard boring mill as shown in Fig. 2. The method of holding the rod is unusual. The large end is centered sideways by two jaws, one being shown at *A*. These jaws are actuated by a right and left hand screw at *B*, and bear on the bolt bosses. The screw *C* centers the small end and the straps hold the rod in place. After this operation the edges are milled on an Osterlein milling machine. Then the sides of the flanges are rough- and finish-milled and the radius of the large end form-milled. The outside of the large end is hollow-milled or turned with a 3-deg. angle, after which both sides of the small end are hollow-milled in the same way. Then comes the rough- and finish-profiling of the small end and the flange approach, followed by the rough-milling of the channel on each side.

A special device has been designed and built for finish-milling both sides of the channel in the Garvin duplex milling machine shown in Fig. 3. The fixture carrying the rod is moved lengthwise of the rod and at the same time moved vertically so as to follow the proper contour by means of suitably located cams concealed in the base of the fixture. The object of this compound motion is to secure a continuous movement of the rod with relation to the cutter so as to avoid even the slightest undercutting at any point, due to the cutter revolving while the rod is stationary. For, although such undercuts or depressions are too small to be easily measured, they are known to be excellent starting places for incipient cracks and every contingency of this kind is to be avoided where possible.

Next comes the milling of the profile on the cap and also the rounded outer surface of the small end and also the annulus in the small end. Bolt holes are next drilled, milled, and the cap spot-faced and counterbored for the bolt head. The tops of the bolt bosses are milled and then the faces are surface ground to the finished width on a Blanchard grinding machine. Grinding the larger bore to the finished size is done on a Van Norman

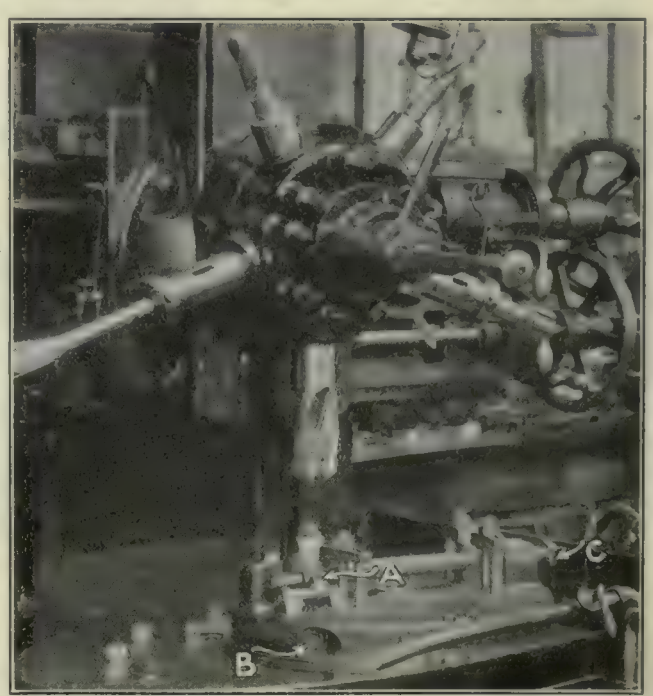


FIG. 2. BORING THE ROD

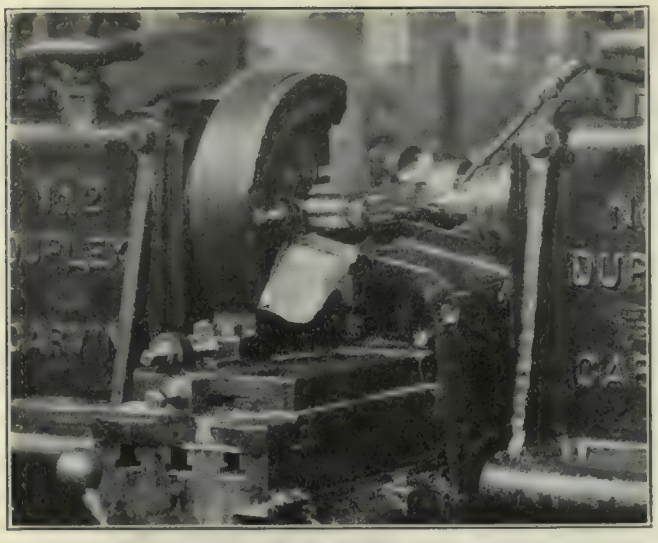


FIG. 3. AUTOMATIC MILLING OF CHANNEL

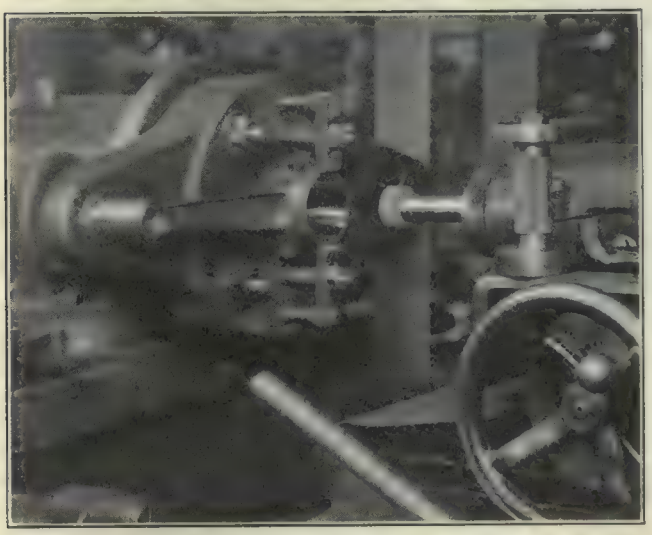


FIG. 4. GRINDING THE LARGE BORE

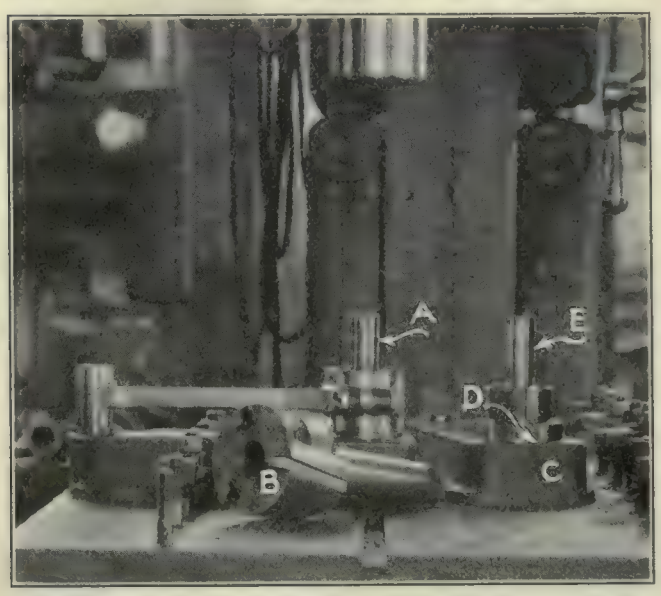


FIG. 5. FIXTURE AND TOOLS FOR FACING LARGE END TO LENGTH

machine, as shown in Fig. 4, the rod being located by the small end and clamped on the special fixture as shown.

The small hole is next ground to the finished size on the same machine but in another fixture, and the sides of the large end are then faced to their proper length on a Foote-Burt machine, using the tools and fixtures shown in Fig. 5. The rod, whose position on the fixture is shown, is suitably centered and held at the large end by a pilot having a projecting plug *A* of a definite length. The facing cutter *B* is not only guided by this projecting plug, but also stopped in its downward movement by this same plug touching the bottom of the hole.

After one side has been suitably faced, the rod is turned over on the fixture shown at *C* in which the collar *D* supports the side of the rod which has been faced off. The same cutter then faces the second side in the same manner, being both guided and stopped by the plug *E*. This method is very simple and has proved to be very accurate and satisfactory.

Next comes sawing the cap from the rod with a cutter 0.187 in. thick. This cutter, however, does not cut clear through but leaves a wall of metal 0.010 in. next to the bore. The rod and cap are given similar indentification marks and are then separated. Holes for the oil pipe are then drilled in both ends as well as the small rivet holes in the channel of the rod for holding the oil pipe in position. These rivet holes are then properly countersunk and the holes in the ends reamed for the oil pipe.

The radii of the flange are next blended into the flange side and the caps are tied to the rod so as to prevent separation while in the storeroom.

All burrs are then removed and the oil pipes and clip fitted. The white-metalled bushes are next fitted to the rod and cap and all the joint faces surfaced. Suitable liners are chosen and the whole assembled. The liners or shims are merely to take the place of the metal removed by the saw cuts, and differ from the usual shims in that they have a bearing-metal face which forms part of the rod bearing, and are reamed with it, so as to form a continuous surface and prevent the escape of oil under the pressure feed system.

The final reaming of the white metal bushings is done in the fixture shown in Fig. 6, where the rod is positioned by the piston-pin hole and the large end swung down into the fixture where it is position-guided (not clamped) by the two arms shown at *A*. The reaming is most carefully done. The bar having some of its cylindrical surface milled away to allow for inequalities of the bore is for properly centering the connecting rod before reaming. No scraping is done to secure a surface. Some rods are reamed to slightly different diameters so as to allow the proper oil film space at each crankpin, provided the difference comes within the manufacturing tolerance allowed.

The fixture for testing the connecting rod is shown in Fig. 7 and is very similar to the usual design with one or two exceptions. The square cornered gaging surfaces on the end blocks gage the alignment of the holes in both directions while the inner block gages both the length of the piston-pin boss and also the squareness of the rod to the large bearing.

It will also be noted that there is a bushing in the small end of the rod. This is of bronze and floats between the rod and the piston pin, which is locked in the piston at each end. It has oil holes drilled through it and is a working fit both in the rod and on the pin. The cap bolts are hollow for lightness.

One of the notable features in connection with this



FIG. 6. THE FINAL REAMING FIXTURE

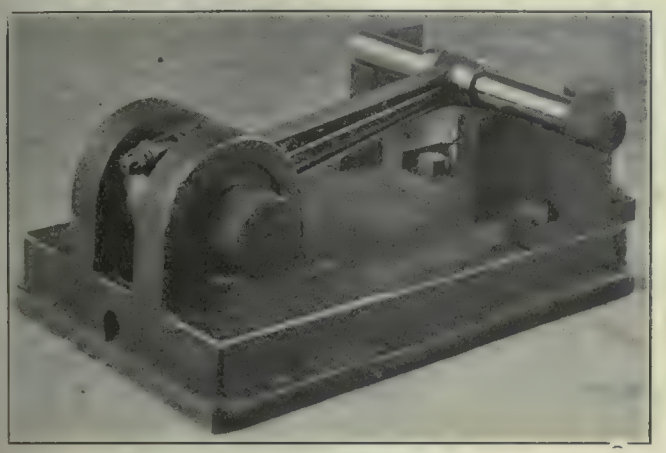


FIG. 7. TESTING SQUARENESS OF ROD

connecting rod is that no provision is made for straightening the rod to bring the two holes in alignment. They are machined with extreme care so that no straightening seems to be necessary. Whether or not the straightening does any harm, if properly done, the management evidently believes in being on the safe side by avoiding it altogether.

The War Work of the Bureau of Standards

It has seemed advisable to gather together in one report, descriptions of some of the more important military investigations conducted by the Bureau of Standards during the war. This is important for two reasons. In the first place it is essential that as complete a record as possible be kept of the activities of the bureau during the period of hostilities; and in the second place, many of the results gained through military investigations are equally applicable and important in peace-time work.

The report consists of short descriptions of the various investigations which were carried out, each description being complete in itself and having no reference to the organization of the bureau or the scientific divisions which carried out the work. It is, therefore, possible to read any one of the sections of the report without referring to any of the others. No attempt has been made to give complete descriptions, and but little data will be found as it was believed better to limit the text of this report to general information and conclusions.

Detailed results of the various military investigations which the bureau conducted will be found not only in the regular publications of the Bureau of Standards, but in the reports and specifications of the War and Navy Departments, and in the material published by such organizations as the National Advisory Committee for Aeronautics. In almost all cases the bureau's war work was carried out in close co-operation with these other organizations and quite frequently the bureau itself issued no reports on the subject.

Subjects Treated

A very large number of subjects will be found to be treated, a few of which are as follows: Aeronautic instruments; aeronautic power plants; aircraft materials and construction, such as the relative merits of wood and metals for building airplanes, the best substances for airplane dopes, etc.; balloon gases, including the work which the bureau performed in connection with the recovery of helium from natural gas; the calibration of testing machines, by which the tests made at various arsenals and munitions plants were referred back to the standards of the bureau; various chemical investigations including analysis of ferrous and nonferrous metals, the development of platinum substitutes, the routine testing of soap, oils, and paints, experiments in connection with the prevention of corrosion, etc. Chromatic camouflage and its detection illustrates the application of scientific work in optics to modern warfare, while the description of the investigation of various processes for cooking inferior grades of coal illustrates the successful co-operation of the bureau with other Government establishments, in this case the Bureau of Mines.

In connection with the building of concrete ships, a new aggregate giving a particularly light and strong concrete was developed. Other parts of the report deal with various electrical subjects, such as batteries for automobiles and trucks, electric generators for setting off high explosives, magnetic methods for detection of flaws in steel, testing of special lamps for signalling purposes, and extremely important work in connection with radio telegraphy and telephony, including the development of the radio direction finder, radio instruments for submarines and the electron tube.

The production and testing of precision gages in various munitions plants was one of the important pieces of work conducted by the bureau and will be found to be briefly described.

Various materials of construction, ranging from metals to leather and rubber, were tested in large quantities and investigations conducted to determine their availability for all sorts of new uses. This work, as well as the more usual testing of structural materials, will be found described in the report.

In connection with the development of various new processes of manufacture in the United States, mention should be made of the work on the production of optical glass, the making of a successful cotton fabric for airplane wing construction to replace linen formerly employed and aid in the development of a satisfactory laminated wood construction for airplane beams. Many other subjects are included in the report, but the above list is typical.

Illustrations are given showing the apparatus employed in some of the investigations and also various representative specimens, from simple devices to complicated machinery, which were tested by the bureau.

Abstract of miscellaneous publication of the Bureau of Standards, No. 46. The complete paper may be secured from the Superintendent of Documents, Washington, D. C.

Turbine Work at the Puget Sound Navy Yard

Boring, Blading and Assembling Ship Turbines—Standard Designing of Special Machines—Cutting Blades and Packing Pieces from Strips

SPECIAL CORRESPONDENCE

AMONG the different varieties of work undertaken at the Puget Sound Navy Yard during the war, was that of building turbines for various ships. The accompanying illustrations show some of the work done on a turbine for ammunition ship No. 1, which was one of the wartime activities of this yard. Fig. 1 shows the boring of the high-pressure turbine casing, this being of comparatively small diameter although requiring a good size floor boring machine for the work. The blading of a casing is shown in Fig. 2. The location of the blades as well as their length can be clearly seen at *A*, smaller and shorter blades being in position at *B*. This view also shows that the section at *B* is cast separately and bolted into position as the casing to be seen at the rear is still minus this important part.

A low-pressure casing and rotor are shown in Fig. 3 with the rotor being lowered into position. The method of handling the rotor by the overhead sling with cables at *A* and *B*, and the guides at *C* and *D*, are of special interest. These guides insure the rotor being lowered straight into position, which is very necessary as it only takes a slight deviation to bring the turbine blades in the rotor into contact with those in the casing and cause excessive damage.

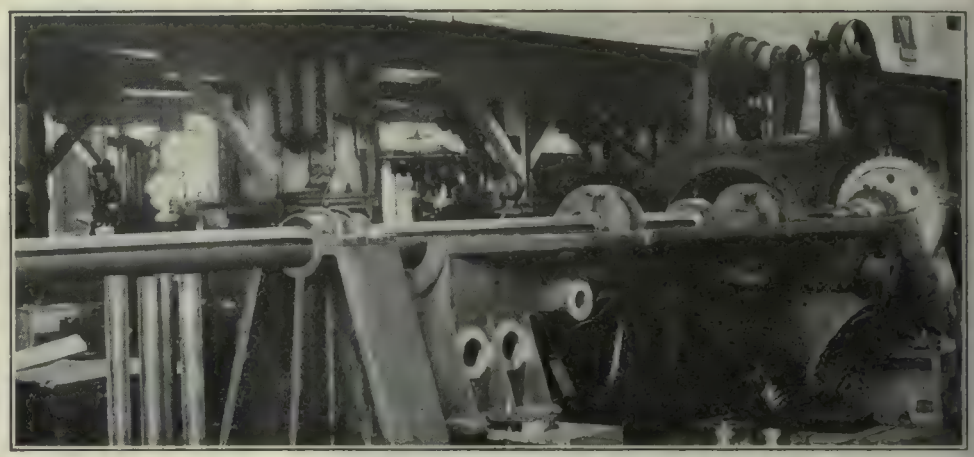


FIG. 1. BORING A HIGH-PRESSURE TURBINE CASING

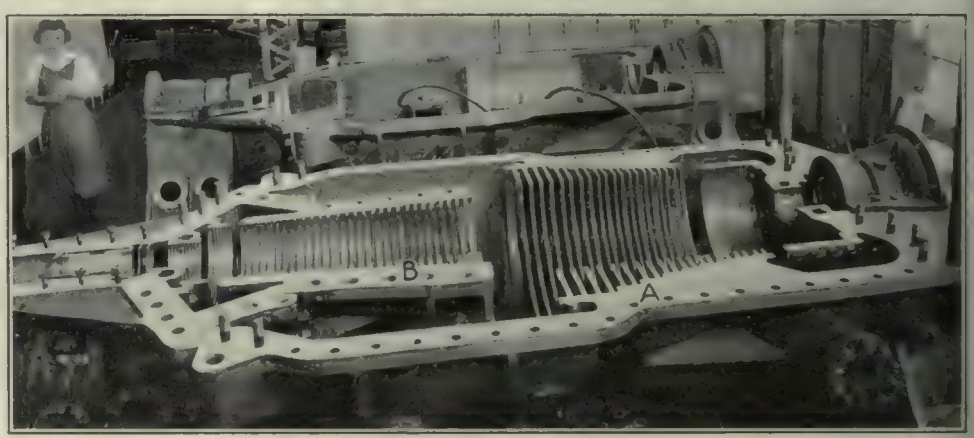


FIG. 2. INSERTING THE BLADES IN A LOW-PRESSURE CASING

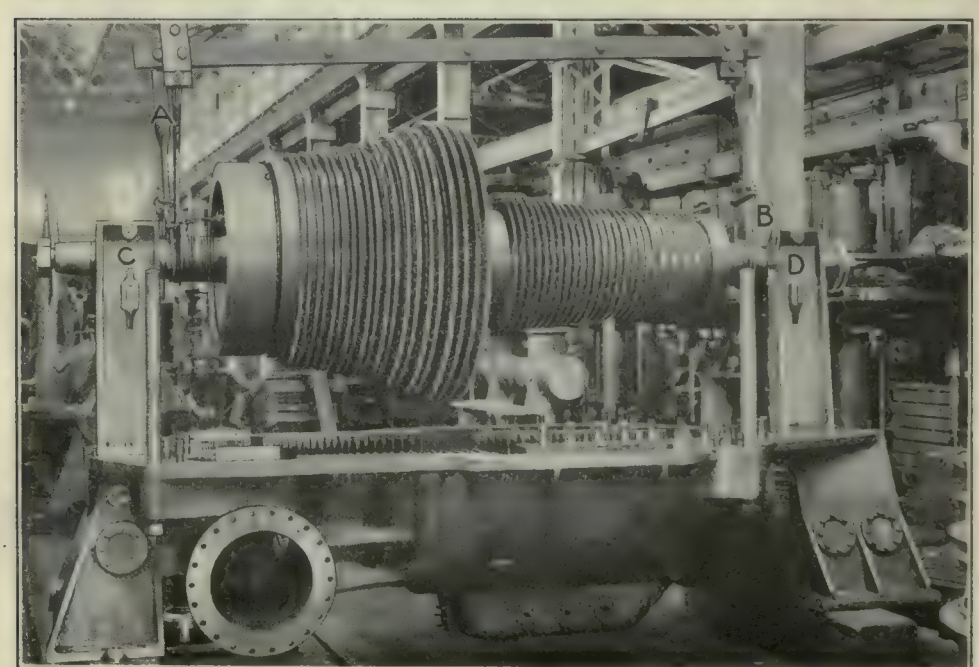


FIG. 3. LOWERING THE ROTOR INTO THE LOW-PRESSURE CASING

Some of the small special machines devised for assisting in the production of turbine blades, are shown in the following illustrations. Fig. 4 shows the small machine built for cutting the turbine packing pieces which go between each of the blades or buckets and space them their proper distance apart.

These packing pieces are cut from a specially shaped bar as can be seen from the shape

of the pieces at *A*. The bar is clamped in the special vise *B*, and fed against a stop to insure the pieces being of the correct length. A forward movement of the lever *C* cuts off a packing piece and the operation can be repeated at a rapid rate. The round key *D* locates the toolblock *B* and holds it in position with relation to the slot in the table, the holding down bolts clamping it firmly in place. Such a key obviates the necessity of special fitting to secure good alignment. In Fig. 5, the turbine blades are being cut off and serrated or notched to fit in their grooves in either turbine casing or rotor. Special drawn stock is used for this purpose in order to avoid as much machining as possible, and the Niagara press shown is fitted with suitable guides both for cutting off and for notching.

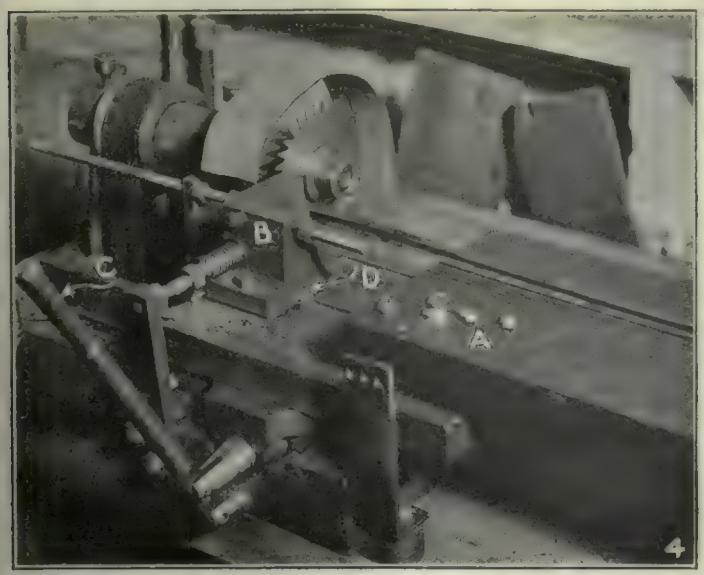




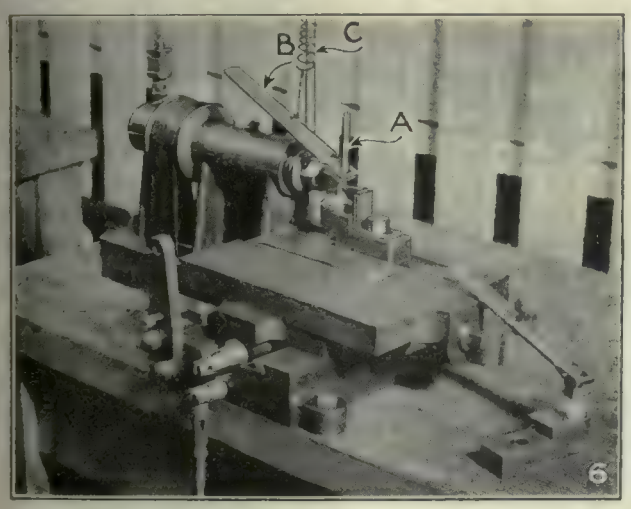
FIG. 4. CUTTING TURBINE PACKING PIECES. FIG. 5. CUTTING OFF TURBINE BLADES

A special machine for tipping the turbine blades is shown in Fig. 6. The blades are held in a vertical position as at *A*, the lever *B* being pulled upward by the spring *C* and clamping the blade with the lower end.

A machine for slotting the ends of the turbine blades is shown in Fig. 7.

It will be noted that the machines illustrated in Figs. 6 and 7 are of the same general design, the bases and tables having been cast from the same patterns without alterations.

Designing special machines so that one or more patterns can be used for several different machines indicates a highly commendable spirit on the part of the responsible one.



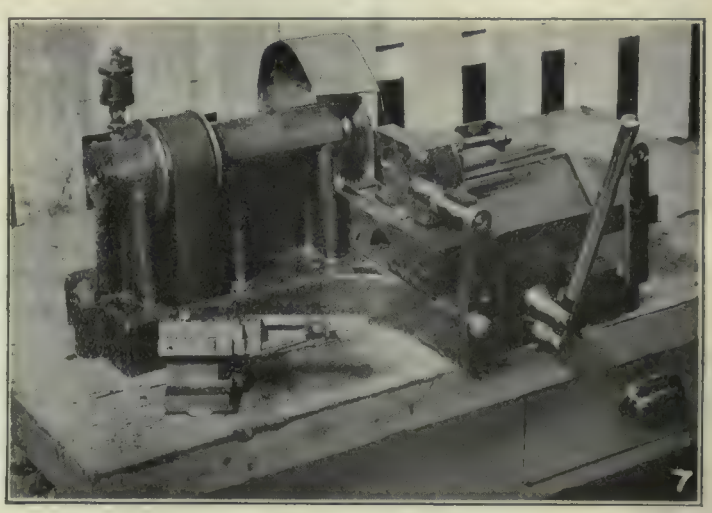


FIG. 6. TIPPING TURBINE BLADES. FIG. 7. SLOTTING TURBINE BLADES



Defiance Multiple-Spindle Drilling and Tapping Machines

Single-Purpose Machines—Either Horizontal or Vertical — One or Two Heads — Inclosed Working Parts—Unit Mechanisms—Tunnel Work Fixtures

By J. V. HUNTER
Western Editor, *American Machinist*

THE design of modern drilling machines has been profoundly influenced by the demands for the intensive production of automotive parts. Development has produced the multiple-spindle drilling machine with fixed-center spindles, some of which machines

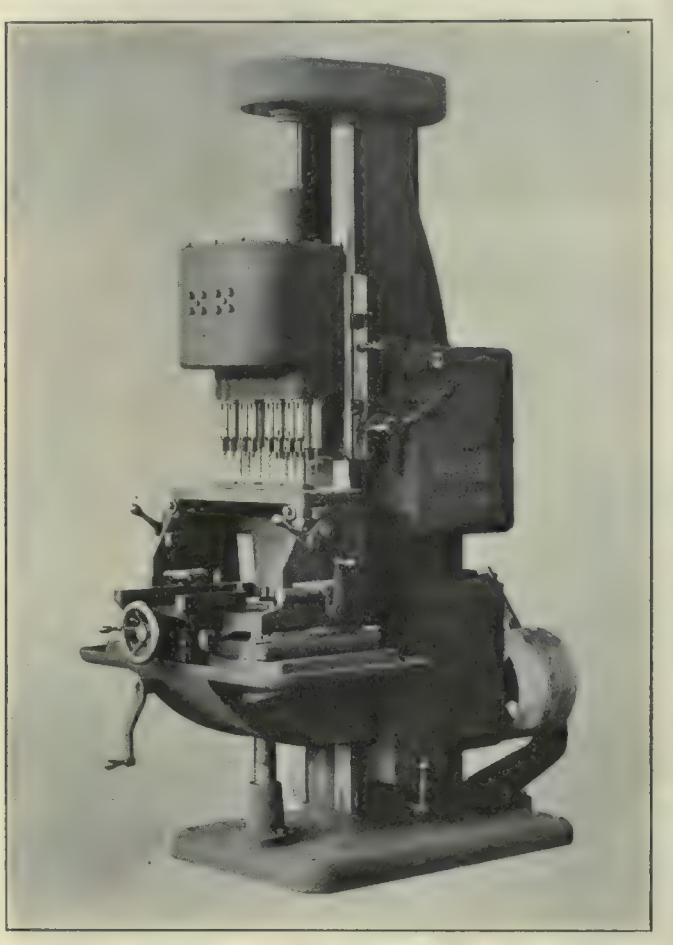


FIG. 1. DEFIANCE 16-SPINDLE MULTIPLE DRILLING MACHINE

are capable of drilling nearly a hundred holes in a single operation.

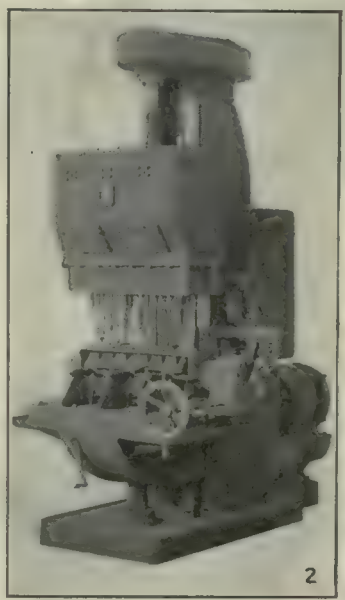
The Defiance Machine Works, Defiance, Ohio, builds a line of multiple-spindle drilling machines, some of the late models being here illustrated. A large share of the machines are of the single-purpose type; but the fact must be borne in mind that by changing the spindle housing and work fixture it is frequently possible to convert a machine to other work of similar character. A vertical drilling machine with sixteen working spindles is shown in Fig. 1.

The machine serves both for drilling and countersinking operations and performs them progressively by making use of a sliding work fixture. In operation, the work is pushed in place along the slides, lowered onto locating spots by turning the lever at the right of the fixture housing, and then clamped in place. The handwheel at the front is used to move the fixture against its back stop, and eight holes are drilled by the rear line of spindles. The fixture is then brought against the front stop and the holes are counter-bored by the front row of spindles.

The base and column are a single casting proportioned to withstand heavy strains. The speed and feed drive-gear mechanisms are housed in separate units bolted to the sides of the column and frame. Square, flat-faced ways are finished on the front of the column for guiding the spindle housing and the work-table. The work-table may be raised and lowered by means of a heavy screw running in a large sleeve mounted on the base, which screw can be operated by a helical gear drive from a handle on the front of the table. So far as has been practical, all mechanism has been inclosed.

The oiling system was designed with a view to reducing to a minimum the attention to this vital feature required from the operator. Therefore, it is planned to lubricate most of the parts by splash and spray, or by feeding the oil to them by gravity, or by forced flow. In the housings a mist of oil spray is said to exist at all times when the machine is in operation, and the operator may ascertain its existence by a glance through the glass-covered peepholes. These peepholes have been placed on the housings of all of the late models and clearly show on the spindle housings in Figs. 2 and 3.

Mention has been made of the fact that the gear mechanisms are enclosed in separate unit housings, and bolted into the frame. While many of the frames must



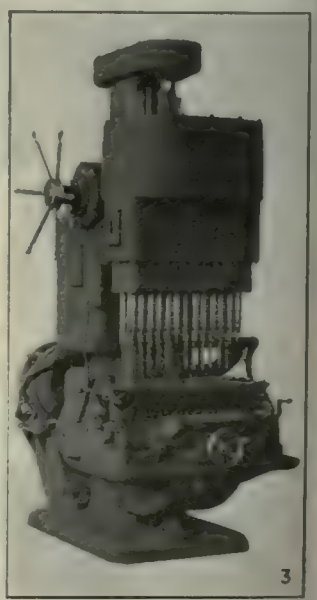
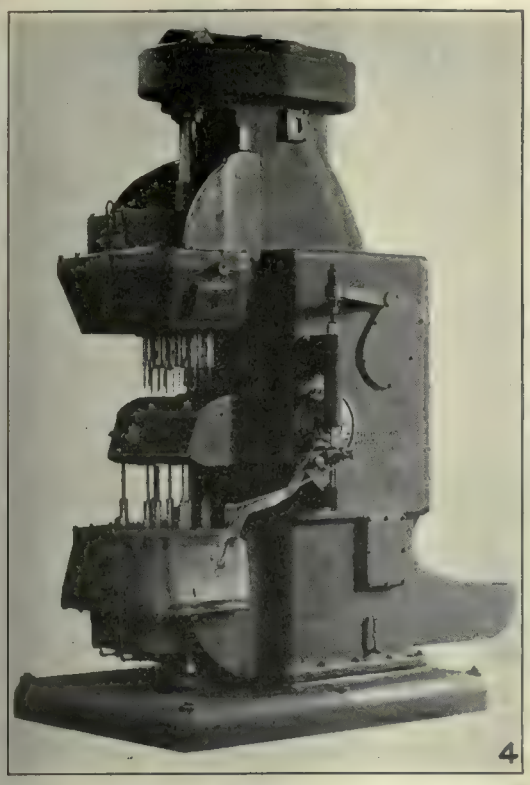


FIG. 2. MACHINE WITH CIRCULAR CAM FEED CONTROL
FIG. 3. LEFT SIDE OF MULTIPLE-SPINDLE DRILLING MACHINE



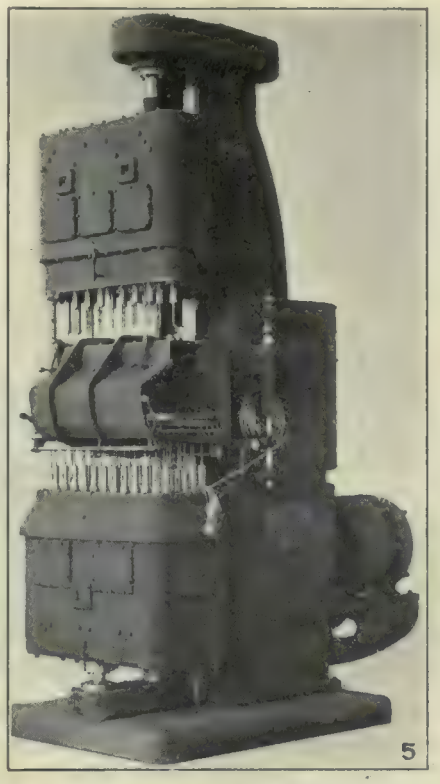


FIG. 4. VERTICAL TWO-WAY DRILLING MACHINE WITH STANDARD WORK FIXTURE.
FIG. 5. TWO-WAY MACHINE WITH TUNNEL-TYPE JIG

be of special design to suit the job for which they are built, it is the designer's intention to use standard units for the different drive mechanisms, such as the feed-gear box, spindle-head-drive gear box, spindle-feed-screw box and the driving box. The units are standard on all the machines of the type, the only variations being those necessarily involved in the creation of different spindle drives for each particular job that has to be handled. The shafting used on all of the drives is made of 0.45-point carbon steel, and either Hyatt or ball-bearings are used on all general drives. Where end-thrust is involved, it is taken care of by means of ball-bearings. The drive gears are steel, carbonized and heat-treated, and all bevel gears in the mechanism are hardened.

The feed mechanism drive unit is housed in the upper compartment on the side of the column, and besides the gearing consists of two friction clutches and a jaw clutch. The friction clutches run in a bath of oil and are provided with ball-thrust bearings to take the end thrust. A system of feed control has been designed to expedite the work, consisting of a cycle of operation that is carried through automatically after the feed control lever is thrown into the starting position, and that stops at the completion of the cycle.

The starting lever engages one of the friction clutches, operating a rapid feed that advances the spindles until the drills are about to engage the work; then the feed lever is shifted and the square-jaw clutch engages the drive during the regular drilling feed. At the conclusion of the cut the other friction clutch is engaged and the spindle housing is returned to its starting position by a quick-return drive. An inter-locking mechanism is employed for the clutch levers, preventing the engagement of more than one clutch at a time.

Two forms of lever-shifting control are employed for the feed mechanisms. One is a straight slide, planed on the side of the spindle-head flange, as shown in Fig. 1, with dogs that engage the control levers and shift them at the proper intervals. Another form employs a circular cam located on the side of the column, Fig. 2. The cam is driven from the feed mechanism and rotates while the spindle-head moves, thus engaging a series of dogs, set on its face, with a plunger that is directly connected with a lever controlling the feed mechanism. This mechanism is started by the small hand lever which trips the feed plunger and permits the cam to start rotating. If necessary, the feed may be stopped at any point by means of the same control lever. It is possible to alter

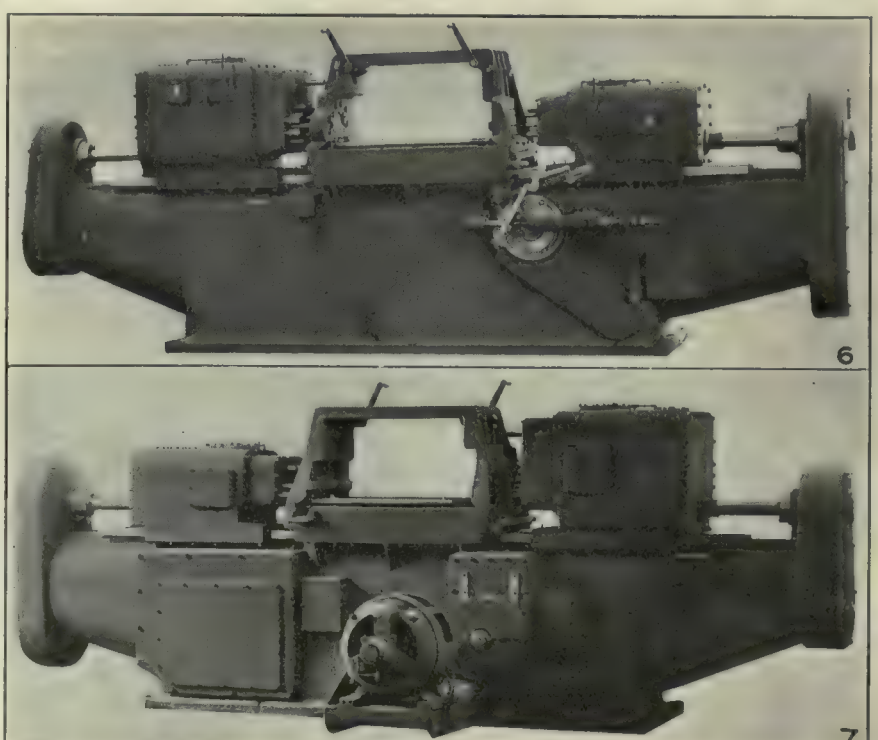
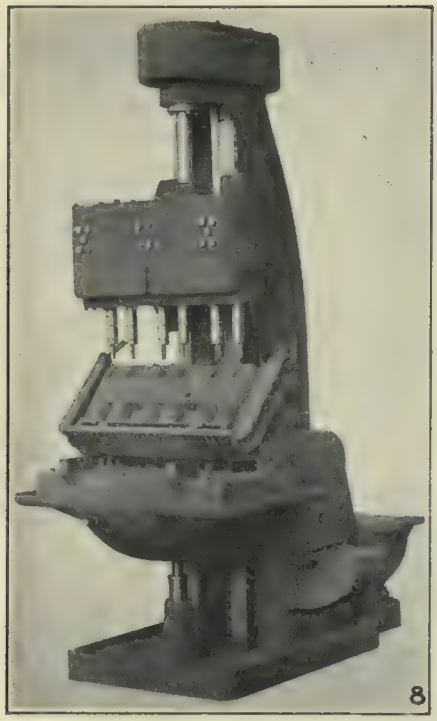


FIG. 6. FRONT OF HORIZONTAL TWO-WAY DRILLING MACHINE. FIG. 7. REAR OF HORIZONTAL MACHINE SHOWING DRIVE MOTOR



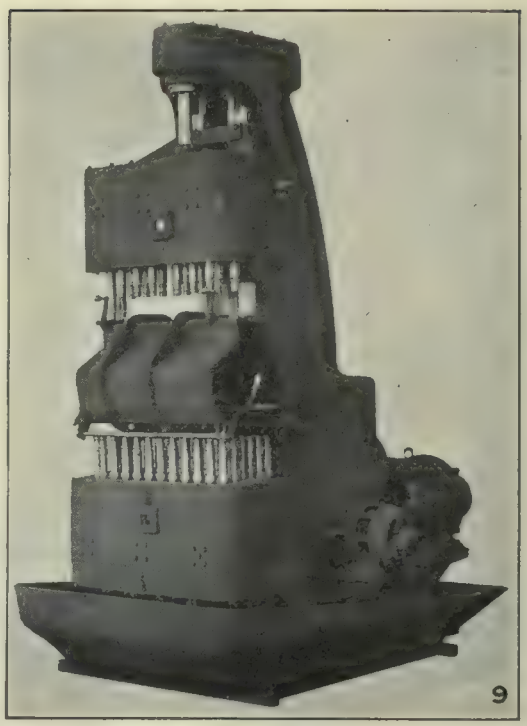


FIG. 8. VERTICAL MULTIPLE-SPINDLE TAPPING MACHINE. FIG. 9. TWO-WAY TAPPING MACHINE WITH TUNNEL FIXTURE AND DOUBLE MOTOR DRIVE

the rate of feed by opening the feed gear-box and changing two gears.

The feed drive is carried by a vertical shaft from the feed-gear box to the feed-screw gear train located in the top of the column housing. The thread of the screw engages a bronze nut located low in the spindle head to prevent the threads from being exposed when the head is fed to its lowest position on the column. It is planned to have the feed screw nearly central with the thrust of the spindles, so that their vertical thrusts will be approximately balanced on all sides and to avoid side-twisting strains on the column ways, and also to eliminate the tendency toward side-thrust in the spindle bearings. The end-thrust of the screw in both directions is borne by ball-bearings.

The spindle head is a heavy housing that completely encloses the drives of the individual drill spindles. It is secured to the ways on the face of the column by square locking gibs, and an apron is usually extended from the body of the housing to secure additional length of bearings. The spindle housing receives its drive from a vertical shaft located in a recess in the column between the ways. An extension on the rear of the spindle housing completely encloses a sleeve gear that slides on the vertical drive-shaft as the housing moves up or down. The sleeve gear is driven by two splines cut directly on the shaft. A spoke-wheel on the left side of the machine, as shown in Fig. 3, is used for moving the spindle housing up or down by hand when setting up work, or for hand-feed.

The late models of the machine employ a removable spindle head on the lower end of the housing. This arrangement, to be seen in Figs. 2 and 3, is planned to permit the attachment of other spindle-heads with spindles at fixed center distances, so that the machine may be used for jobs other than that for which it was originally intended.

The spindle speeds are regulated through a speed mechanism located in the base of the column and placed where it is said to cause the least vibration. The speed gears are driven from the main-drive shaft and are engaged through a Johnson friction clutch with its control handle located on the left side of the machine, Fig. 3. The drive extends from the speed gears to the vertical drive shaft through a set of hardened-steel bevel gears.

Either belt or direct motor drive can be furnished for the machines. The former is arranged to drive with a tight and loose pulley; the latter usually employs a variable-speed motor of capacity corresponding to the power required to pull the drills while cutting.

The two-way drilling machine, shown in Fig. 4, represents in most respects a duplication of the design of spindle head, speed and feed drive arrangements used in the vertical multiple-spindle drilling machines, with the added head placed in an inverted position, so that it will drill the lower face of the work simultaneously with the drilling of the upper face. The special features of the design of the lower head for preventing chips and dirt from entering the spindle bearings are similar to those of inverted-spindle drilling machine heads described on page 633 of the *American Machinist*. This two-way machine is fitted with a work-holding fixture in which the piece is entered from the front. The starting and control mechanism for two heads is operated exactly the same as for a single head.

In Fig. 5 is shown one of the late types of machine fitted with what has been termed a "tunnel-jig", that is used when the machine is a unit in a production transportation line. In these transportation systems the work is carried from one machine to the next on roller

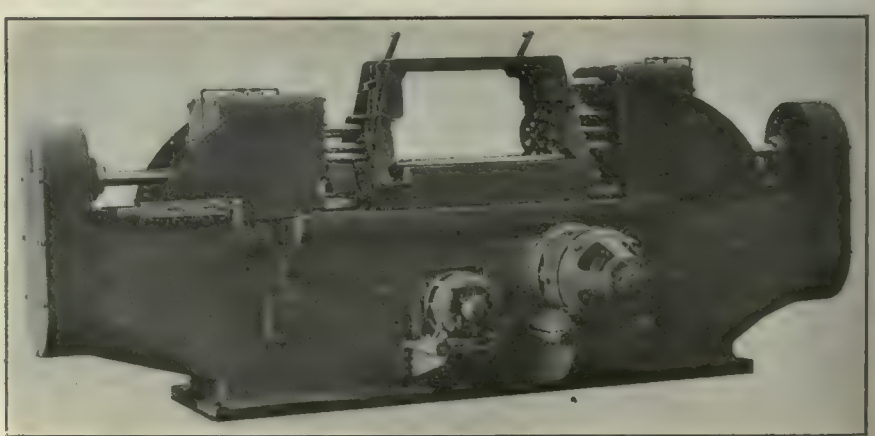


FIG. 10. REAR OF HORIZONTAL DOUBLE-TAPPING MACHINE

tracks, extending to the entrance of the tunnel-jig. In the jig are rollers to facilitate sliding the work into position; and when the work is in place, a mechanism controlled by the lever on the front of the machine permits the rollers to be lowered so that the work will come down to rest on the locating points. The piece is then locked in place and the drilling operation carried through. After releasing the work, it is again raised on the rollers and pushed out of the jig by little effort on the part of the operator.

In order to avoid the manual effort entailed in turning and repositioning work that is carried on production line conveyors, the horizontal two-way drilling machine, shown in Fig. 6, has been developed for drilling the sides and ends of work as it passes along the system. The general details of design are similar to those described in connection with the vertical drilling machines. The examples shown are likewise fitted with tunnel jigs so that the work is virtually carried through the machine. The drive motor is mounted on a pedestal near the floor on the rear of the machine, as is shown in Fig. 7.

The multiple-spindle tapping machines are built along the same general lines used in the design of the drilling machines, and in fact resemble them very closely, as will be noted from the illustration of a six-spindle machine shown in Fig. 8. In all of this line of tapping machines, screw feed has been used to replace the hand-feed method of entering and carrying the taps into the work, as this arrangement is said to reduce the tap breakage. The feed-screw is placed over the center of the head, in order to balance the thrust and keep the wear on the slides even. The feed of the screw must necessarily be arranged to carry the head forward in accordance with the pitch of the taps; likewise, since the taps may not be all of the same pitch, their spindles are so speeded that taps of different pitches will all be fed at an equal rate into the work.

The reversing mechanism of the spindles is governed by a special electrical control. When the taps have entered to the required depth, a dog on the head comes down and hits a stop on the switch, thus shutting off the power and causing the rotor to reverse before it has rotated five revolutions. The quick reversal was designed to be of particular value in tapping dead-end holes. When the motor is reversed, it raises the head to clear the taps from the work, until the control switch is actuated in the opposite direction and the machine then stops. A push-button control with three buttons is provided for governing all operations of the machine. One button is used for starting the motor in a forward direction when the operation on the work is commenced. The second will stop the motor at any time in case of necessity. The third will reverse the motor and bring the machine back to the starting point when it is already in the middle of a cycle, if it should at any time be required to do so.

The two-way tapping machine with fifty-one spindles, shown in Fig. 9, is fitted with a tunnel type of jig similar to the ones used on the drilling machines. It has screw feeds for both the upper and lower heads and its feed control, mounted on the left-hand side of the machine, is governed in the same manner as the machines with a single head. Two motors are provided to drive the different units of its mechanism. A 20-hp. motor serves for the main drive, and the smaller motor mounted on a bracket on the right side of the machine drives the coolant and lubricating oil pumps, so that they are not affected by the reversal of the main drive motor at the completion of the tapping operation.

A rear view of a horizontal tapping machine is shown in Fig. 10. This machine likewise is fitted with two motors, one for the main drive and the other for operating the coolant and lubricating oil pumps. Horizontal tapping machines can be fitted with tunnel-jigs or any other of the types of work-holding fixtures that best adapt them for fitting into production lines.

Loose Bushing for Loose Pulley

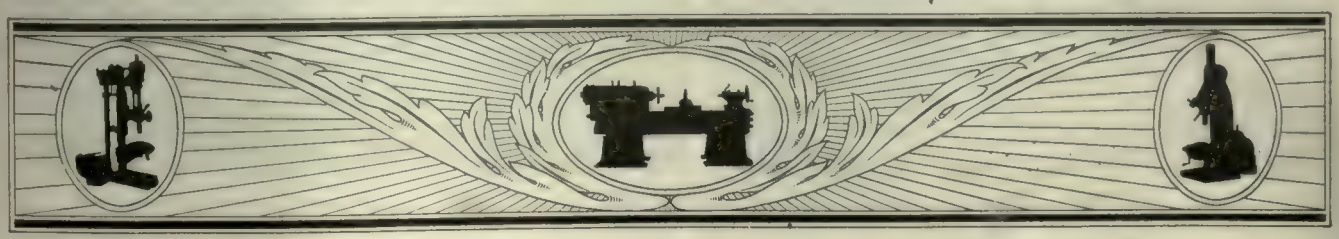
By W. T. Elzinga

Many of us have had and are having trouble with the loose pulley. We neglect to oil it because it needs so much attention. It usually means that we must find a ladder and do some climbing and risk our fingers. This is all wasted effort it seems.

The other day, while visiting a garage, I saw a dry grinder with a tight and loose pulley on the spindle, driven direct from the lineshaft. It was rattling merrily at the rate of some 1,500 r.p.m. and without attention, except perhaps once a week or even less. The pulley was worn at least $\frac{1}{32}$ in. large and would soon need a bushing. The dealer selling this grinder said that the price being low no provision for a good oiling system could be made.

Having received permission to make an improvement we took the spindle to our school shop, bored the pulley about $\frac{1}{16}$ in. larger and turned a cast-iron bushing to a sliding fit for both pulley and spindle. We next drilled about a dozen $\frac{1}{4}$-in. holes in it, so spaced that they were not in line with the oil hole in the hub, filed several helical oil grooves *between* the holes, filled the holes with plugs of felt (we keep an assortment of old hats for such purposes), tapped the oil hole in the hub for an oilcup, assembled the spindle and put it to work again. It has been running now for several weeks and the owner is happy because its noise does not distract him any more and he can forget about oiling it.

We have in our school shop a dozen or so pulleys with bushings from $1\frac{1}{4}$ to 3 in. in diameter so treated and they are certainly a great improvement over the old style. We have eliminated several counters on account of this kink. It seems that this bushing slips around in the hub and turns about half the speed of the pulley, distributing the wear over pulley, bushing and spindle. The larger area and the oil being held by the felt, this method has proved to be much better than bushing the pulley in the old way.



Holding Fixtures for Railroad-Shop Work

Clamping Fixtures for Boring Mills—Ganging Work on the Planer—Boring Driving Boxes—An Expanding Mandrel for Lathe Work

WESTERN CORRESPONDENCE

DESPITE biased opinions to the contrary, the majority of railroad shops are constantly introducing more efficient methods to secure greater production. A recent visit to the locomotive shops of the Chicago & Alton R.R. at Bloomington, Ill., showed many endeavors on the part of the executives to cut idle machine time to a minimum.

Inadequate and slowly-operated work-holding fixtures are the cause of one of the most common losses of machining time. Under-loading of machines, and particularly planer tables, constitutes another source of loss, but this is frequently caused by poorly designed fixtures, as has just been mentioned. The management of the shops under consideration is endeavoring to remedy both of these faults and a few examples of what has been accomplished are illustrated.

Driving wheel tires are clamped to the table of the boring mill by four special clamps similar to the one shown in Fig. 1. The body of the clamp *A* has a tongue that fits in the table slot and is held down by a heavy T-bolt. The tire is centered and held by the screw *B*, while the screw *E* on the top of the jaw holds the tire down. The forged jaw *C* swings on a bolt *D* passing through the body and is shown in the position used for clamping down the tire while taking a heavy boring cut. For taking a facing cut across the tire the top screw is loosened and the jaw swung out of the way into a horizontal position.

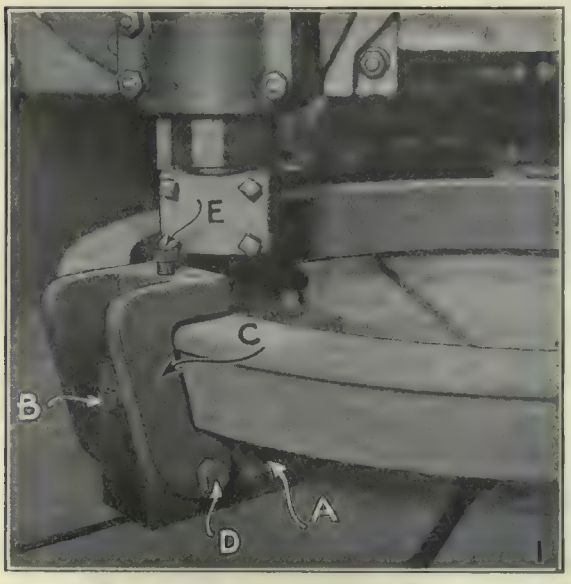


FIG. 1. CLAMP FOR HOLDING TIRES ON THE BORING MILL.

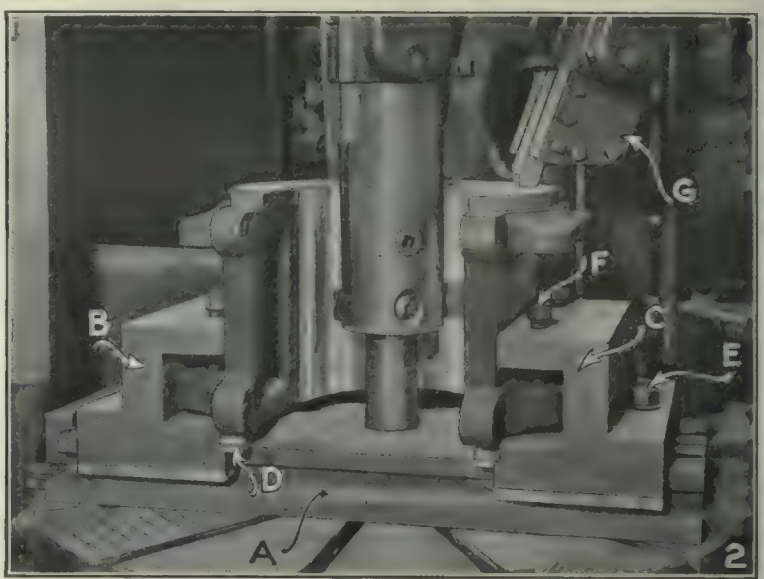


FIG. 2. SPECIAL CLAMPING FIXTURE FOR DRIVER BOXES

Boring Driving Wheel Boxes

The boring mill shown in Fig. 2 has been rigged up with a special work-holding fixture so that two cuts can be made simultaneously on driving wheel boxes. These cuts bore the box and face off the hub flange.

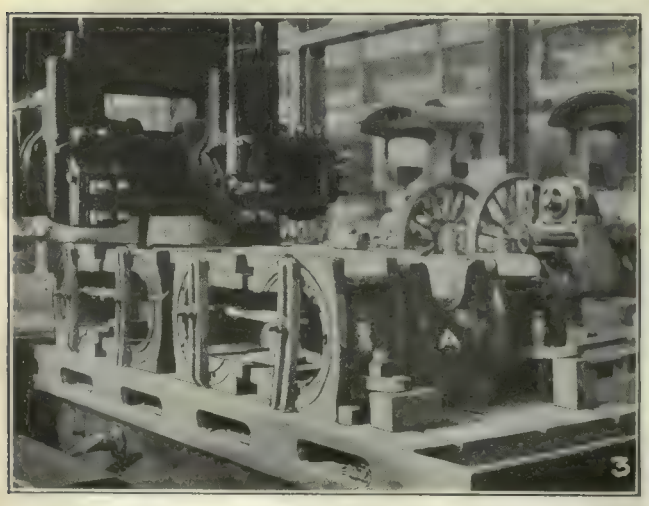




FIG. 3. FULL SET OF DRIVER BOXES MOUNTED ON A PLANER TABLE. FIG. 4. PLANER SET-UP FOR FINISHING OF SHOES AND WEDGES

The work-holding chuck has a base *A* bolted to the table of the machine. Its top face and sides are planed to provide ways for the two jaws *B* and *C*. The jaw *B* is set up with a stop at its back and can be positioned to suit any size of driving boxes so that each box will be centered when put in place. The planed side of the box comes up against the squared edge of the jaw, and the back against a dog located on the strip *D*, thus insuring that each one of a set of boxes will be in the same position.

The work is removed by loosening the nut *E* and pulling out the jaw *C*. After putting in a new piece of work the jaw *C* is slid back in place so that the edges of both jaws come against the planed sides of the box, and the nut *E* is tightened. Four screws *F*, two in each jaw, are then tightened down on the flanges of the box to hold it firmly in place. The boring bar has been fitted with a pilot that passes through a bushing in the base of the fixture. A special toolholder *G* for working at an angle has been provided for the hub-flange facing tool.

A full set of driving wheel boxes is set up at one time as shown in Fig. 3, for the planing operations. A heavy cast-iron center frame *A* is bolted down in the center of the table as shown. This frame has been carefully planed on both sides, and T-slots have been machined, one on each side, to serve for rapidly and easily bolting on the work in the manner shown. For additional firmness the boxes are also clamped to the planer table.

A job of planing shoes and wedges is shown in Fig. 4. Again in this case a set of parallel spacing blocks

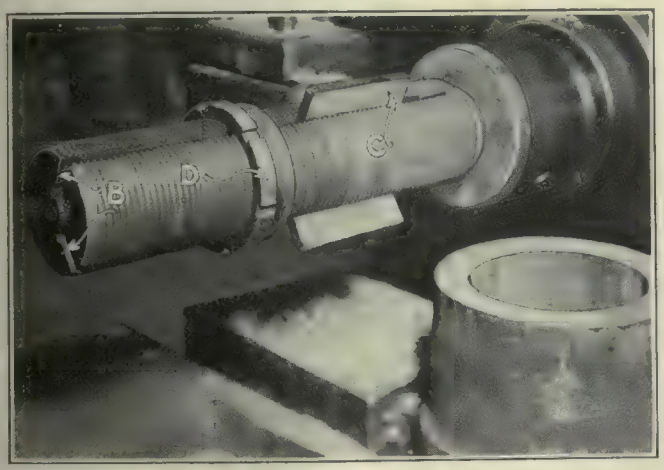


FIG. 5. AN EXPANDING MANDREL FOR TURNING BUSHING

serves to facilitate the set-up of the work. Moreover, the spacing blocks are of sufficient width so that both toolheads can be used to finish the two lines of work. In this case the bolts for clamping the work pass clear across the table so that each bolt serves to hold two pieces.

The expanding mandrel shown in Fig. 5 for turning bushings similar to the one shown at *A* was made in the shop's toolroom. Several sizes of these mandrels have been made; the one shown having an outside diameter, over the threads, of 3 in. and a length of about 14 in. There are three T-slots *B* cut on a taper of $\frac{5}{8}$ in. to the foot in which slide three blades *C* that fit in the T-slots. The inside edges of the blades are tapered to match the taper of slots and their outside edges are parallel with the center line of the mandrel. They are about 4 in. in length.

In mounting work the blades are slit down the taper of the arbor until they are contracted sufficiently to enable the bushing to be slipped over them and are then forced up the arbor by turning the nut *D* until they have been expanded sufficiently to grip the bushing firmly. Wider or narrower blades may be used on the same mandrel, allowing it to handle a greater range of bushings than would otherwise be possible by the total expansion permitted by the taper in the slots. Thus each successive set of blades should be increased in size an amount equal to the increase of the taper for the length of slot traveled in expanding from minimum to maximum. In this case the total travel is 6 in., the gain is $\frac{1}{16}$ in. and so each set of blades should be $\frac{1}{16}$ in. larger than the preceding. The mandrel is carried and driven by a coupling attached to the lathe spindle, and the outboard end is supported by the tail center. It is stiff enough so the heaviest practical cuts may be taken.

Ten Safety Rules for the Factory

By George Swetnam

1. Open high voltage switches and transformers should be enclosed, or at least fenced off from the rest of the factory. Prominent signs should also be posted.

2. Concealed wiring is less liable to receive damage which will cause fire or accident than is open wiring. Use it. It is also well to protect all bus bars from possible falling wires, etc.

3. Forbid workmen to crawl through narrow, moving belts. This seems foolish but if you will watch you will be surprised at the prevalence of this little short of lunatic performance.

4. Never run a boiler at a pressure higher than its rating without the advice of the maker. The same is true of superheaters and engines.

5. Most boilers are kept too full, as this does much to prevent explosions. It causes priming, or water in the steam, which is likely to cause broken piston-rods, cylinders, and cylinder heads, and scored pistons and cylinders, to say nothing of making packing renewals very frequent. Avoid this trouble by having the chief engineer look the boilers over frequently.

6. It happens once in a while that a lazy fireman keeps his boiler only about one-half full, being under the false impression that so doing makes firing easier. As this is only courting explosions it is best to dismiss such a man at once.

7. Never allow machines to be cleaned while running. Any number of one-armed men could testify to the foolishness of such an act. It is still sometimes done.

8. Don't let bearings stay loose. They endanger life and property by causing broken shafting, and are responsible for loss of power.

It seems useless to say this as it should be an axiom, but I know of one man who ran his plant with an important bearing loose for more than a month, cutting down his production perhaps as much as 25 per cent.

9. Bar all irresponsible persons and children from your plant while it is running, unless they are accompanied by a careful escort.

10. Don't wait until an accident occurs to put these rules into operation. You are responsible for the safety of all concerned. Act!

Proposed Standard Roller-Chain Sprocket

Excerpt from Report of Chain Division of Standards Committee, of Society of Automotive Engineers at West Baden, Ind., May 24, 1921

THE first tooth forms for roller-chain sprockets were designed upon the theory that the tooth action was similar to that of gear teeth, the chain being regarded as analogous to a rack. It was, however, soon found that when chains had been in use a short

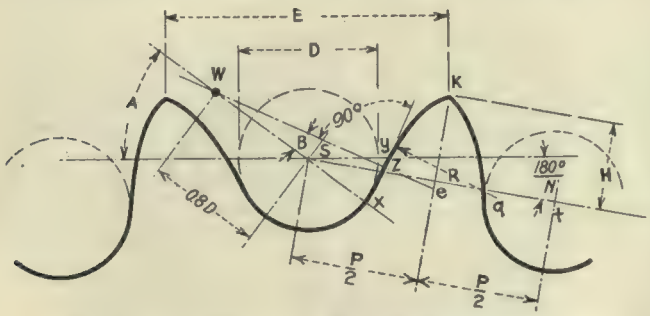


FIG. 1. ROLLER-CHAIN SPROCKET TOOTH FORM

time the wear at the joints caused an elongation of the pitch of the chain, thus destroying the perfect registration with the sprocket teeth which resulted in rough action and rapid wear. The sprocket teeth were then redesigned to provide for the chain elongation by making the tooth gap somewhat greater than the diameter of the chain roller, but with little or no modification in the contour of the tooth, which was so shaped that the chain roller bore almost squarely against the sprocket tooth, throwing practically the whole load on a single tooth.

Meanwhile, the use of roller chains became more extensive and the demands made on them more exacting. This condition naturally led, both in this country and abroad, to a more careful study of the action between chains and sprocket teeth than had heretofore been given to the subject, and it soon became apparent that by giving some obliquity to the face of the sprocket tooth, quite different and decidedly better results could be obtained. The action of the forces called into play can be readily analyzed by the graphic method of laying out a parallelogram of forces which will show in true proportion the initial tension on the chain, the resultant thrust on the sprocket tooth (determined by the degree of obliquity selected) and a balancing force passed on to the ensuing links of the chain where this action is repeated in a lessening amount.

By this method the load on a chain may be distributed over several teeth of the sprocket and at the same time, by extending the oblique portion of the sprocket tooth a suitable distance, make it possible for a chain of elongated pitch to slide outward on this oblique face until it finds a pitch circle on the sprocket coinciding with the lengthened pitch of the chain. These general findings were freely exchanged among the chain manufacturers and one of the English companies published a brochure on the subject. During the war more pressing matters prevented an interchange of opinion on this subject, but nevertheless most of the sprocket manufacturers evolved tooth forms along these lines.

It is now proposed to effect an agreement upon one standard form that shall supersede the various individual designs and the formula now presented by the Chain Division for adoption as an extension of the present S. A. E. Standard for Roller Chains, page E3, S. A. E. Handbook, Vol. I, is a composite of the best features of the various tooth shapes that have been tried and pronounced satisfactory.

P — Pitch of chain
D — Nominal roller diameter
N — Number of teeth in sprocket
D^1 — Diameter of seating curve $= 1.005\ D + 0.003$ in.

$$A = 31^\circ + \frac{90^\circ}{N}$$

$$ws = 0.8\ D$$

$$B = 13^\circ - \frac{18^\circ}{N}$$

xz — A circular arc whose center is at w
zy — A straight line perpendicular to wz

$$xy = 1.3\ D \times \sin\left(25^\circ - \frac{90^\circ}{N}\right)$$

ek — A line perpendicular to st
H — Height of tooth crest above the chord $st = 0.35\ P$
qy — A line parallel to wz with q so located that the circular arc through y will pass through k, thus forming a pointed tooth.

Outside Diameter of Sprocket = Pitch Diameter + $P\left(0.7 - \tan\frac{90^\circ}{N}\right) = $ (approx.) $P.D. + P\left(0.7 - \frac{1\ 592}{N}\right)$

$$E = O.D. \times \sin\frac{180^\circ}{N}$$

Cutters shall be designed for 6, 7-8, 9-11, 12-17, 18-34, 35 teeth and over.

The number of teeth on which each cutter shall be based is, $M = \frac{2\ N\ n}{N + n}$, where "$N$" and "$n$" are the maximum and minimum number of teeth to be cut by any given cutter. A sprocket having N teeth will thus have

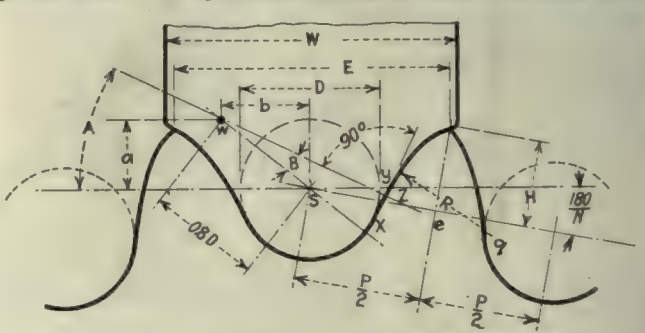


FIG. 2. ROLLER-CHAIN SPROCKET CUTTERS

a pressure angle which departs the same amount from the desired pressure angle as one having n teeth.

The values of M for the various cutters are respectively, 6, 7.47, 9.9, 14.1, 23.54 and 65.42 teeth.

Cutter numbers shall be respectively, 6, 7½, 10, 14, 24 and 65.

$D^1 = 1.005\ D + 0.003$ in.

$$A = 31^\circ + \frac{90^\circ}{N}$$

$ws = 0.8\ D$

$B = 13° - \frac{18°}{N}$

xz = A circular arc with w as the center

zy = A straight line perpendicular to wz

$xy = 1.3\ D \sin\left(25° - \frac{90°}{N}\right)$

$se = \frac{1}{2}\ P$

$ek = H = 0.35\ P$

yq = A line parallel to wz

q = is so located that the arc yk, struck from q as a center will pass through k

The radius R may be determined graphically.

Where the same roller diameter is used on chains of two different pitches, (as $\frac{5}{8}$-in. roller, 1-in. pitch; and $\frac{5}{8}$-in. roller, 1¼-in. pitch), cutters No. 6 and 7½ shall be designed for the longer pitch, and may be used for cutting sprockets of the shorter pitch. Cutters No. 10, 14, 24 and 65 shall be designed for the shorter pitch and may be used to cut sprockets of the longer pitch.

W = with of cutter $= 1.02 \times O.D. \times \sin \frac{180°}{N}$, to the next higher 32nd inch; where $O.D.$ equals the outside diameter of the sprocket with the larger pitch and the lowest number of teeth to be cut with the cutter.

The specifications to the cutter maker may be simplified if w and z are located as follows:

$$a = 0.8 \times D \times \sin\left(31° + \frac{90°}{M}\right)$$

$$b = 0.8 \times D \times \cos\left(31° + \frac{90°}{M}\right)$$

$$xz = 2.6 \times D \times \sin\left(6\tfrac{1}{2}° - \frac{90°}{M}\right)$$

Johnson Organizes a Shop Progress Committee

By John R. Godfrey

I've been wondering how Johnson was standing the gaff these days, so I dropped in to see if his pet schemes had worked out. I landed just in the midst of a confab with his foreman, but he asked me to "sit in and favor them with my experience." Johnson is some kidder, at times. I didn't have to do much talking—'twas almost a monologue with Johnson as the star performer.

"Boys, we're up against it—and we've got to find a way out. Times are bad—they had to be after the past six years. You can't rip the world up the back without paying the penalty. We spent money like drunken sailors. We said, 't'ell with the cost,' whether it was silk shirts or automobiles. And now the piper has to be paid. It would be bad enough if all had profiteered alike. But we've got to face the music and get down to business.

"We've got to remember that business just has to come back. The country will go on. Motors will be used and the best will have a good business when things simmer down. Everyone is suspicious. They've been robbed and they know it. Now they're fighting shy of everything. But it can't last forever. In the meantime we've got to live—and we're going to live—don't forget that.

"But we've got to go on rations just as a shipwrecked crew does. We don't want to chuck anyone overboard to the sharks, but if anyone falls off, we can't endanger the rest attempting a rescue. In other words, if anyone drops out, we won't replace him. But if we find a chap who won't take his full turn at the oars, or refuses to bail when his turn comes, overboard he goes.

"We've been paying too much for cast iron and that's the basis of all modern business. But the iron producers seem to be slowly coming down to earth and that will help a lot. But until orders come faster we'll make up parts of motors that use least material and take the most labor. In other words, we'll 'store labor' to keep our organization life-boat together as long as we possibly can.

"We'll make up sub-assemblies and tuck them away on the shelf as long as we can stand the pressure. And the new machinery we've put in will reduce the cost on these, so we won't tie up so much capital in stock. We're not going to shut down if there's any way to prevent it, but we may have to go on short time when the cash balance runs too low.

The Time for Co-operation

"The main thing I want to get over to the men is that everyone who does his level best, is one of the family—he belongs to the elect and no one is going to be dumped without cause. We want every man to realize that he is part of the organization and not a mere attachment to any machine. We want the closest kind of co-operation and we want any ideas or suggestions they may have floating around loose, and they probably have more than you dream of.

"This is the time when most of the other shops in town are forgetting all their fine talk about 'personnel' work and the value of harmony. Seem to think because good jobs are scarce they can go back to the old 'master and man game' and get away with it. But they're guessing wrong again. They'll lose out when things get back to normal.

"Now is the time to plant the best seeds of co-operation you can find, and to cultivate them with care. And the best way to cultivate them is to prevent misunderstanding. I've thought this over a lot, boys, and I believe we better have a clearing house for ideas, troubles and other things. Suppose we call it the Shop Progress Committee—or any similar name. Anything but a grievance committee, and that's one thing we want to keep away from—don't want to even suggest grievances.

"I'd suggest that each department elect a representative to this committee and that all suggestions, questions, requests, etc., come through that representative to the foreman of the department. If it needs to go further, it can come up to the whole committee, which can have regular or special meetings as required.

"We want a place where everything can be done in the open, where every request or suggestion can be threshed out. If changes in piece rates are necessary, we can show our side and get the other as well. If bonuses or wages come up for discussion, it's just the same. I have a hunch that one of the great disturbers of shop peace and harmony is arbitrary actions on either side. No man likes to feel that he can be fired unjustly by a foreman with a grouch due to cold pancakes or other snags in the domestic relations. Neither does he fancy a cut in rates without a discussion as to the whys and wherefores. So I'm going to try and play the game that way and I want you to help me.

"You might talk it over with your men. If they help do the organizing, the committee will work better than if we hand them a cut and dried plan. They want to 'belong'—to be a part of the institution—and they are bound to take more interest if they do. After this Shop Progress Committee gets going in good shape we'll ask Godfrey here to come down and give it the double O."

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Three Pattern Making Kinks

SPECIAL CORRESPONDENCE

Three pattern-making kinks, all connected with gearing, are illustrated herewith. They are from the pattern shop of the Vulcan Iron Works, Denver, Col., and

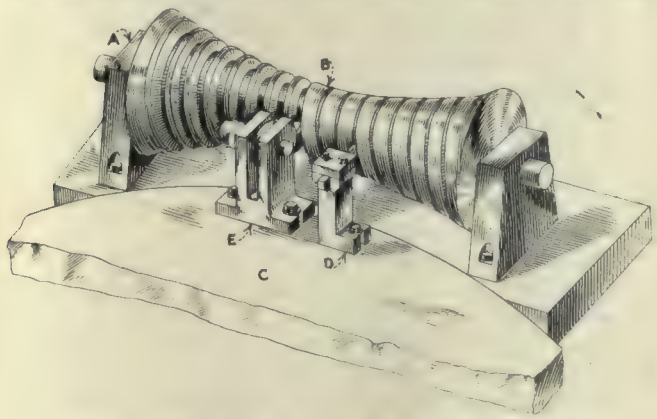


FIG. 1. MAKING A HINDLEY WORM PATTERN

stand to the credit of R. Bristow, a veteran pattern maker who rarely passes up any problem which may be presented, regardless of its difficulties.

Some months ago the shop job called for a fair-sized Hindley worm, and it was finally decided that the only way in which this could be procured in this particular case was to have a pattern made from which a casting could be secured. The making of the pattern was put up to Mr. Bristow, and after some deliberation it was made in the following interesting manner. The spool

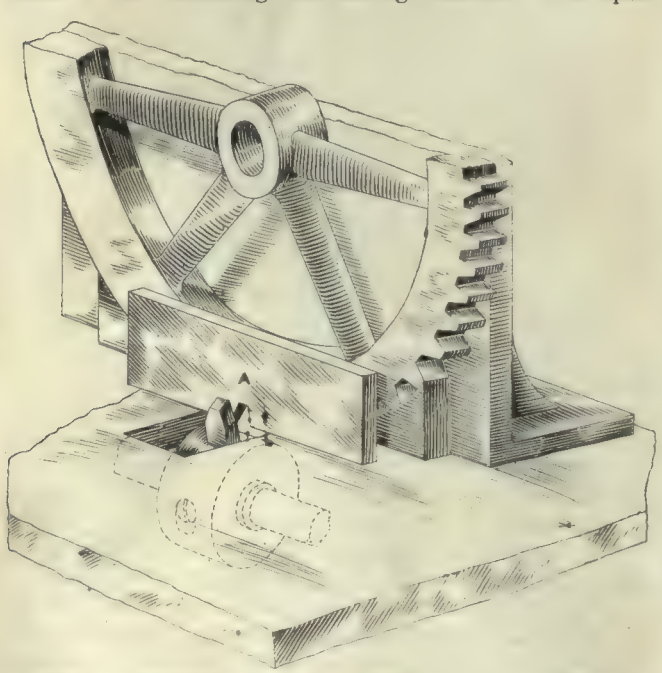


FIG. 2. CUTTING TEETH IN SPUR GEAR PATTERN

or body of the worm was first mounted on a steel bar and turned up to the correct size and shape. The path of the worm thread was then carefully laid out with a pencil, and a shallow groove cut along the pencil line with a file, to act as a guide in future operations.

The blank for the worm pattern was then mounted on a base *B*, Fig. 1, with end blocks, one of which is shown

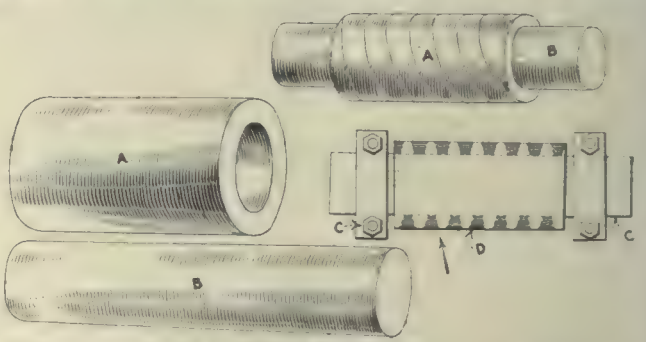


FIG. 3. MAKING A WORM PATTERN ON A BANDSAW

at *A*. The back edge of the base was cut to the same radius as the pitch line of the worm. This curved edge fitted against the guide *C*, which enabled the block carrying the worm to be moved on the correct radius.

The block *D* carried a wooden guide, which fitted into the shallow grooves that marked the path of the worm thread, while *E* is a cutter head fitted with a fly cutter to give the correct shaped tooth to the worm thread. This, of course, was located radially with the arc of the guide *C*.

Placing the base carrying the worm to be cut so that one end of the thread was central with the fly cutter, and having the guide *D* properly located in the thread groove so as to control the lead, Mr. Bristow turned the worm by hand against the revolving fly cutter. As the roll was turned the carriage, or block in which it was mounted, was advanced along the curved guide *C* as guided by the block *D* bearing in the thread groove. By careful feeding Mr. Bristow was able to cut the worm thread along the line and groove first laid out, until over half the worm was cut. Then by reversing the worm in the block and using the thread already cut, he was able to complete the cutting without difficulty. This made a comparatively simple solution for a somewhat difficult job.

In another gear pattern job Mr. Bristow used a fly cutter to advantage in cutting the teeth of a large spur gear, as shown in Fig. 2. The gear pattern was joined and turned up; then it was placed in the frame *A*, square with the fly cutter and clamped against the angle plate as shown. Most of the stock was first moved by circular saws, after which the teeth were completely finished by the fly cutter. A simple method of indexing was devised and the use of the fly cutter greatly reduced the time necessary to make the piece in the usual way.

In another case it became necessary to make a fair

size worm pattern and Mr. Bristow adopted an interesting and novel method of cutting out the thread. He first turned a cylinder as at *A*, Fig. 3, the inside diameter representing the root or bottom of the thread, the depth of thread being the thickness of the cylinder and the length corresponding to the desired worm. He then turned up a center core, which was a snug fit inside the cylinder as at *B*.

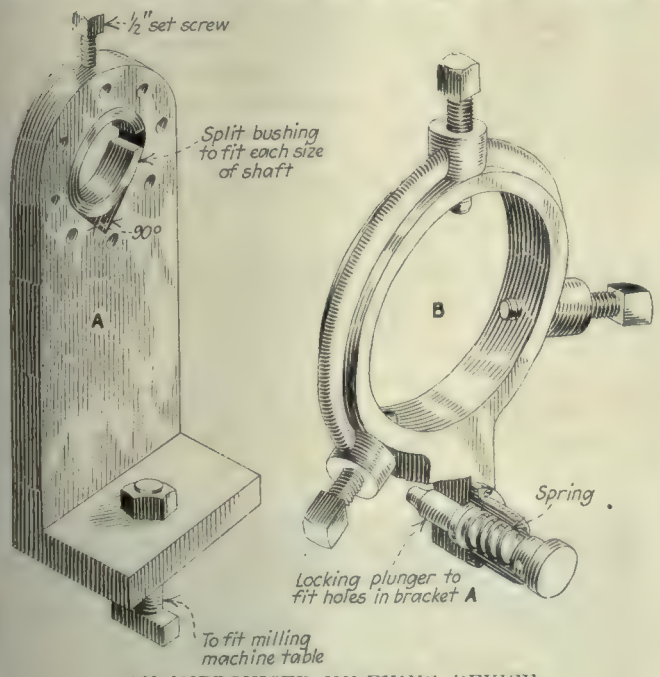
The next step was to lay out the thread on the outside of the cylinder and to mount the cylinder and its supporting core on suitable blocks as at *C*. These blocks must hold the worm at the proper angle, both for the sides of the thread and also for the lead. When so rigged up, it was an easy matter to cut the thread on a band-saw. By sawing through the cylinder, carefully turning it and at the same time moving it along the band-saw table to take care of the lead, the complete thread was formed by a single cut on each side, the shaded portion *D*, between the thread being removed.

A Simple and Inexpensive Indexing Rig

By Richard H. Kiddle

For the man who has no centers for his milling machine the device illustrated and described here may be of interest.

Two brackets as shown at *A* are made of cast iron to bolt on the machine table, and a dog as at *B* carries a



AN IMPROVISED INDEXING DEVICE

spring locking pin that engages in the circle of holes surrounding the opening in one of the brackets.

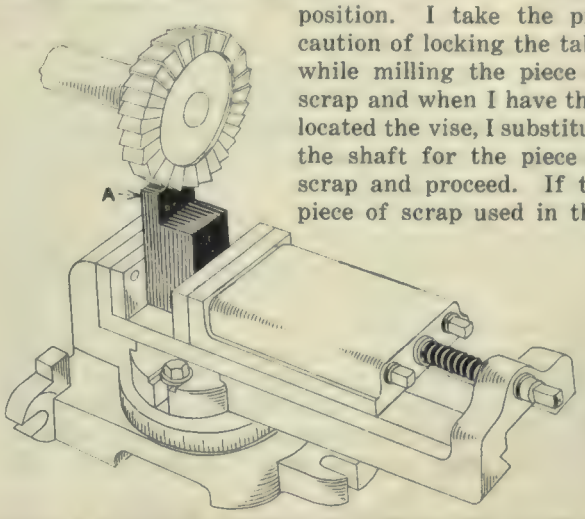
To use the device for splining shafts of a diameter other than that for which it is originally made, split bushings can be fitted to the openings in the brackets.

Center Finding Tool

By Atol Maker

On Page 288 of the *American Machinist*, Mr. Moore has described a special attachment which he uses when setting a piece of round stock in relation to a milling cutter, which calls to my mind a method that I pursue when I find it essential to machine a slot or keyway precisely in a certain position.

I place a piece of scrap steel in the milling machine vise and mill away the stock as shown in the sketch with the slotting cutter. By measuring at *A* I can readily determine when the cutter is in the desired position. I take the precaution of locking the table while milling the piece of scrap and when I have thus located the vise, I substitute the shaft for the piece of scrap and proceed. If the piece of scrap used in this



SETTING A SLOTTING CUTTER TO A DEFINITE POSITION

case is not of the same diameter as the shaft it is very essential that point *A* of the piece rest against the stationary jaw of the vise.

It may be well to mention that I only pursue this method when precision is desired, and before I attempt to locate the cutter or vise I determine just how wide a slot the cutter produces.

A Spring-Winding Device

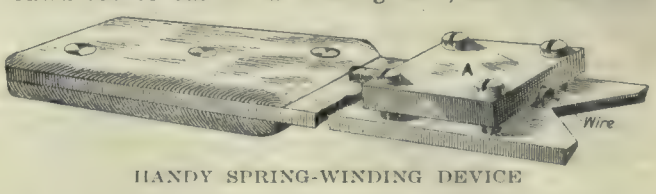
By John T. Slocomb

I have always noticed that the average machinist dislikes to wind springs. By our usual methods this work seems to involve considerable fuss to accomplish little.

A few days ago I saw in use the little device here illustrated and tried it; and I must say that for a spring winder it is quite a discovery. I understand that it is old but feel sure that few have seen it.

Made as illustrated it consists of a bar of soft steel 18 x 1½ x ¼ in, with one end notched and beveled inside as shown, and with the wooden handle riveted on the other end. The clamp *A* is made of brass and, with its four ¼-in. screws, is used for a combination wire guide and friction binder or tension on the wire while the latter is being wound. The V groove in the under side of the binder should be well rounded on the back end to prevent tearing or shaving the wire.

In winding springs I generally use a piece of cold-drawn rod or bar for a winding core, and either hold



HANDY SPRING-WINDING DEVICE

it in a chuck or between lathe centers. To hold the end in starting I sometimes drill a hole through the bar and insert the end of the wire, or else clamp it to the rod with a lathe dog; and then again sometimes it comes handy to stick the end between the jaws of a lathe chuck. When a hole through the rod is used to hold the end of wire it becomes necessary to cut

the wire with a hack saw or chisel in order to get it off. This device is made long, with a strong handle, so it can be controlled when held at different angles.

In winding a close spring, the winder is held with the flat and clamp side toward the work but in winding an open spring it is held with the clamp side away from the work, and the particular angle at which it is held sets the pitch. The V in the end makes a supporting rest, so that very long springs can be wound on a slender rod. I wound some springs of $\frac{5}{32}$-in. steel wire on a $\frac{3}{8}$-in. arbor with one of these winders, and did it very easily.

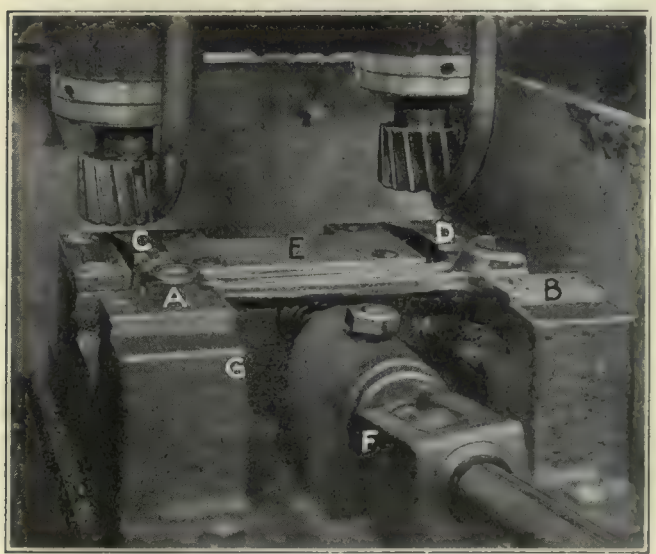
Because of the strong tension, these springs will open up very little after winding. In winding an open spring the device is turned over to close the end in, making a square end.

When it is desired to wind a number of springs at once the device is turned over where the end of each spring comes and the end closed in, which also starts the next spring with a square end. Then after a lot are wound they are cut apart in the proper places.

A Connecting Rod Fixture

By I. B. Rich

The illustration shows a fixture for holding connecting rods while being milled on both surfaces. The rod is located by the fixed jaws *A* and *B* which have suitable



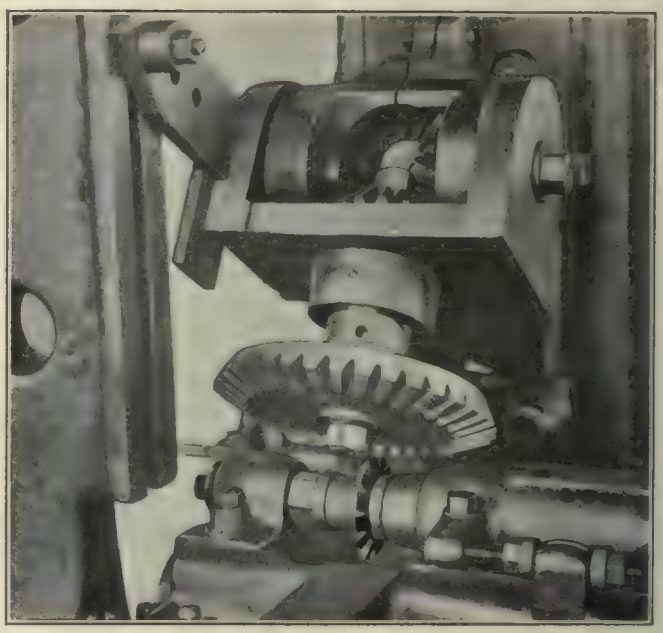
A QUICK-ACTING CONNECTING-ROD FIXTURE

V's for locating them by means of the bolt bosses. The rods are clamped against the fixed jaws by the sliding jaws *C* and *D* which are connected by the central plate *E*. The jaws are brought against the work by means of a cam at *F*, this being connected to the plate *E* by a central bolt attached to the lower part of the plate. The spring *G* opens the jaws as soon as the cam is released. This fixture is quick acting, of simple design and holds the work firmly at both ends.

Attachment for Rough-Cutting Bevel Gears on a G & E Automatic Spur Gear Cutting Machine

By August De Angelis

In the manufacture of our machines there are many bevel gears required and we had but two Gleason bevel-gear generating machines, one of which was



ATTACHMENT FOR ROUGHING BEVEL GEARS ON AUTOMATIC SPUR-GEAR CUTTER

used for rough cutting and the other for finishing. The production from these machines did not meet our needs, so we conceived the idea of using an old Gould & Eberhardt spur gear-cutting machine to help out.

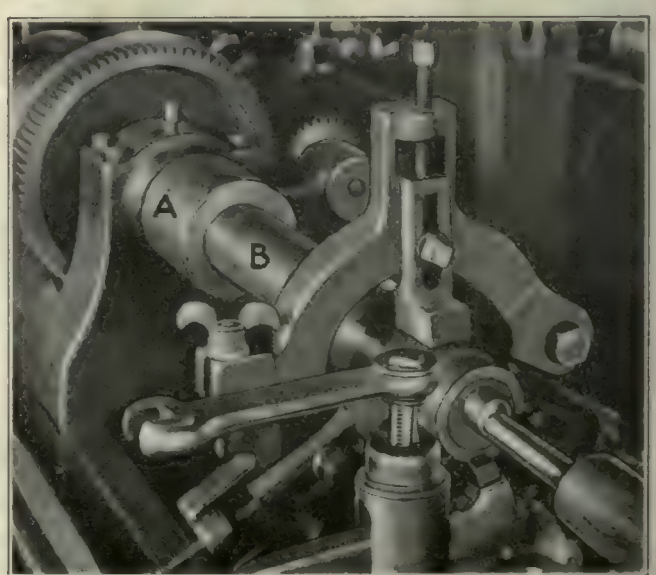
We designed the attachment shown in the accompanying photograph to do the rough cutting so that we could keep the two generating machines busy on the finishing, and found it to work out very satisfactorily.

One side of the attachment is graduated so that it can be set at any angle.

A Device for Turning Eccentric Journals on Back Gear Shafts

By Milton Wright

The back gear shaft of a lathe as usually constructed requires that eccentric journals be turned on the ends, the amount of eccentricity being greater or less according to the size of the lathe.



DEVICE FOR TURNING OFFSET JOURNALS ON BACK GEAR SHAFTS

To do this work in the way that it is ordinarily done means to lay out and drill a pair of centers in each shaft sufficiently removed from the original centers to give the required amount of offset and in exactly the same plane. This method demands the services of a skilful and experienced man, and even then the chances for error are large, especially if the shafts are being run through in quantities.

The device here illustrated and described eliminates the possibility of error once the setting has been established and does away with the necessity for the extra centers, though making it perfectly easy to drill them if they are desired.

A chuck *A* is made to screw on the nose of the lathe spindle, the hole in the face of the chuck being ground to take the shouldered ends of the long sleeve *B*. There is a keyway in each end of the sleeve and a nicely fitting key in the chuck so that the sleeve when entered at either end can occupy but one position circumferentially.

An eccentric bushing is fitted to each end of the sleeve, the amount of eccentricity being equal to that required on the shaft.

A heavy setscrew is inserted radially at each end of the sleeve to bind the shaft. The setscrew passes through the eccentric bushing and bears upon a hardened steel key that is fitted to a slot in the bushing and ground in place so that the surface presented to the work is a part of a true circle of the same diameter as the work and does not mar it.

The outer surface of the sleeve, of course, runs true; one end being held in the chuck and the other in the jaws of the center-rest. It is but the work of a moment to throw back the upper part of the rest, withdraw the sleeve from the chuck and reverse it; the shaft in the meantime not being disturbed.

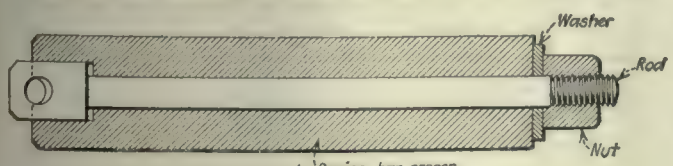
With this device a lot of such shafts may be roughed out and the offset centers drilled without the possibility of error for there is no laying out to be done.

A Boring Bar of Merit

By B. Gilbert
Barrow-in-Furness, England

What, precisely, is the merit of the tool illustrated by Mr. Houssman under the title "A Boring Bar of Merit," on page 278, Vol. 53, of *American Machinist*?

E. Lytton Brooks, on page 113 of the current volume, objects to having the turner use a machine spanner to knock the wedge in and out, but it is exactly this



A SUPERIOR BORING BAR

knocking of the wedge that puts the bar out of merit, in my judgment.

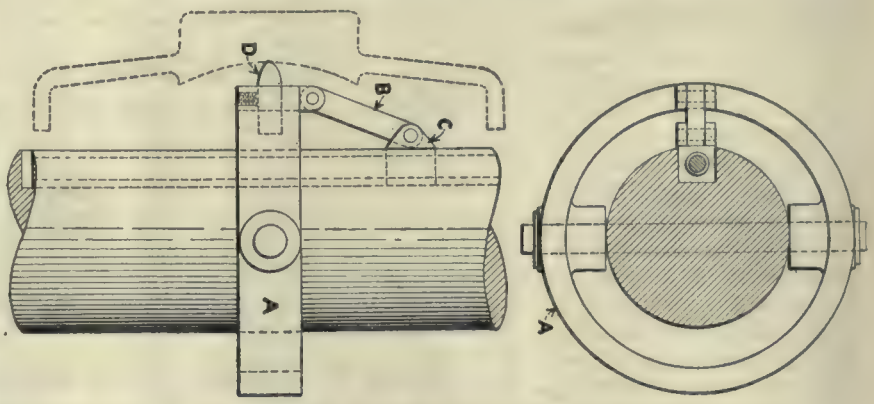
Human eyes are too precious. Soft wedges are useless. Fellows are careless enough without adding further to their risks. I submit herewith the sketch of a bar that has been in use for several years, that is in many ways superior to the one shown by Mr. Houssman.

Boring Bar for Spherical Holes

John S. Watts

The accompanying illustration shows a boring bar that the writer designed for boring out the pedestal for a ball and socket type of bearing. As this is a job that is likely to crop up occasionally in the repair shop, and as tools for doing this work are not usually available in such a shop, a description of the bar may be useful to others.

The main part of the tool is the regular boring bar with a screw feed such as is commonly used for re-boring cylinders, etc., and is a regular part of the equipment of a machine shop handling repair work. On this bar is pinned the ring *A*, which may be forged or cast steel. The pin should be a good fit



BORING BAR FOR SPHERICAL HOLES

in both the bar and the ring, being just free enough to allow the ring to swivel without excessive friction.

A hole is drilled in the ring to take the cutting tool *D*, which is clamped by a setscrew. On one side of the ring will be seen a double eye, which can be cast on if the ring is cast, or screwed on if the ring is a forging. The double eye is fitted with a link *B*, which connects it to the nut on the feed screw, and causes it to swivel as the feed screw nut is traversed back and forth. The feed screw nut may need to be specially made, or it may be possible to simply screw a double eye into the existing nut.

In any case the new parts to be made are simple and inexpensive and will enable any shop to handle this job at a much cheaper cost than is possible by any other available means where the cost of the tooling has to be absorbed in the machining of only one pedestal.

In action the pedestal is clamped to the lathe bed at the right height, and with its vertical center line in the same plane as the center line of the pin on which the ring swivels. The cutting tool is then clamped in the ring, projecting as required to cut the desired diameter. Actuating the boring bar feed screw in the usual way, while the bar is revolving, will cause the point of cutting tool to travel in a truly spherical path. From experience a tool constructed and operated as above described I am satisfied that it will produce spherical holes at least equal in both quantity and quality to that produced by any other known device.

IN THIS ISSUE

IT IS highly probable that from now on business will make increasing use of a science heretofore regarded with so much reverence that it has been left almost wholly for the use of professors and politicians. We refer to the more or less known science of economics. Our first article in this issue, "Obstacles to Business Revival," by Nathaniel R. Whitney is an economic article that furnishes a very fair and accurate analysis of present day conditions. By it we are told what are the causes for the present depression and that they will gradually be removed by the growth of certain reforms now under way. Chief of the causes, or in other words the obstacles to business revival, are declining prices (including a lack of uniformity in the relative rates of decline of various commodities), scarcity of capital, and the immense burden that we are carrying in the way of bills payable. Set against these obstacles are the following reforms that indicate improvement: A growing conservatism and a reawakened interest in thrift and industry, potential new construction, successful operation of the Federal Reserve system, and increasing collection and use of business statistics. Retrospectively, we shall no doubt be able to appreciate that conditions such as pertain at present have had their value in showing the way to a desirable amount of conservatism and thrift and in bringing about a recognition of the necessity for comprehensive statistics as guides to the organization and successful conduct of a business.

The second article this week is a description of the monitor-type shop, the newest building of the Lodge & Shipley plant. Of particular interest are the methods of obtaining light, draining the roof and heating the building. There are to be articles on other new shops from time to time, so that opportunity will be given for comparison of designs, methods of lighting and layout. Page 1030.

The seventeenth of W. R. Basset's modern production articles, page 1032, takes up the matter of handling abnormal expenses, explains the making of monthly adjustments in accounts to take care of fluctuations, and normal and abnormal expenses and costs.

You will not be surprised that Dowd and Curtis are still on the subject of drill jig design because you know that much ground remains to be covered. The eighth installment, page 1037, considers templet, plate and closed jigs in general and gives examples of open jigs for a shaft and a pump cover, which have been chosen as typical. The next subject taken up will be milling fixtures and we promise that the high standard established in the articles already published will be maintained. Just as it is true that many of the general principles brought out in treating the subject of drill jig design will be used throughout the series, so will many additional principles be brought out in the articles on milling fixtures that will be applicable to fixtures for other operations such as profiling, splining, etc.

Coming Features

About one-third of the editorial section of our next issue will be devoted to series articles, among them "Tool Engineering" and "The Foreman and His Job." There will also be the second of Manchester's "A History of Post War Crises." The first of this series was published in our issue of June 9.

Among the complete articles will be one by Roland W. Sellew and H. R. Reynolds of the Fafnir Bearing Co. furnishing a comparison of various types of ball bearings. Stanley will be represented by a railroad article dealing with locomotive driving wheel axles and crankpin work.

With the matter of machining connecting rods freshened up by the Rolls-Royce article this week, we are going to run next week an article taking up another method of machining connecting rods. The method described will be that used in manufacturing the rods for the White motor.

Some little time has gone by since we published a Rolls-Royce article. This week we are presenting one dealing with the connecting rod, page 1041. Editor Colvin has, with his usual care, described the entire manufacture of the rod. You will be interested in checking the methods used with those which we have previously described that are part of the system of wholly American concerns.

We recently published a story on work done at the Puget Sound Navy Yard. There are several more in process and we have one in this issue, page 1044. The current article deals with boring, blading and assembling ship turbines; cutting blades and packing pieces from strips; and standardizing the design of special machines.

Beginning on page 1046 there is an article by Western Editor Hunter that describes various multiple spindle drilling and tapping machines made by the Defiance Machine Works. They are single-purpose machines designed for intensive production and serve to show the effect on machine tool design of methods required in the manufacture of automobile parts.

The railroad article this week is short, but is none the less instructive, dealing as it does with clamping fixtures for boring mills, gang work on the planer, boring driving blocks and similar subjects.

The reader should not overlook the short articles such as the discussion of a previous article on wet grinding, the statement on the war work of the Bureau of Standards, and the report of the S. A. E. committee on standards for roller chain sprockets.

EDITORIALS

Facing Facts

THE only optimist whose opinions are worth listening to is the one who has made a study of the facts and weighed the good against the bad before forming his opinion. Baseless optimism is only a shade less objectionable than confirmed pessimism. It is often more dangerous to the community.

In times of business depression economic factors, business trends, trade indicators and all sorts of more or less reliable commercial barometers are watched and consulted with almost prayerful eagerness. "When will business pick up?" is the universal question. The question might perhaps not be so vital if we gave equal consideration to such matters when business is booming, but with human nature constituted as it is, it seems likely that we will learn little from our present troubles.

Unfortunately, all the facts in the business problem are not known by every one and many men have not the ability to make a logical analysis of those they do know. Their training has been along other lines and they are too close to their own troubles. With this condition in mind we have secured from Professor Whitney, of the University of Cincinnati, the article which opens this issue. The author does not mince matters and he gives due prominence to the adverse factors that are delaying our recovery, but his conclusions based on mature deliberation are distinctly favorable. We urge that the article be read carefully all the way through. Hasty inferences drawn from the unfavorable factors only are unjustified and can do no good. We Americans are too prone to make snap judgments—hence this word of warning.

"Full Speed Ahead"

PRESIDENT HARDING'S slogan for business, "Full Speed Ahead," is typical of the attitude of the new administration toward business and business men and is in marked contrast to that of the late unlamented administration. In his speech at the one hundred and twenty-fifth anniversary banquet of the *New York Commercial*, the President not only paid a fitting tribute to the achievements of the business press in support of American business, but took advantage of the opportunity to bring a message of encouragement to the business men of the country.

The message came at an opportune time. A frank statement of the desire of the administration to do all in its power to stimulate business, it did much to dispel the cloud of uncertainty which has been covering us. There was a vital need for clearing up the doubts that existed in the minds of business men, for they hesitated to act until they were sure of the attitude of official Washington, just as the buyer in a falling market holds back until he thinks the bottom has been reached.

If we could be as sure of the good sense and interest of Congress as we are of the intentions of the Administration we should feel decidedly complacent. Unfortunately we are unable to do so while our political system places so many demagogs, cheap politicians and briefless lawyers in legislative positions. The able men are far too few and they are greatly hampered by the obstructionists and class representatives with whom they have to struggle.

Another factor that militates against the successful functioning of the average congressman is that he feels that no sooner is election over than he must shape his course for the next one two years distant. As a result he spends valuable time in open or covert electioneering that should be devoted to his legislative duties.

We can but hope for the best and each one let his representative at Washington know that the policy of the Administration toward business is right and should be supported.

The Need of Airplanes

THE wreck of the Army plane carrying seven people is regrettable in every way—the more so because had we been more wide awake to the needs of air travel it could probably have been avoided. Yet we must not forget that the same kind of disaster occurs at sea, even though we have had centuries of experience in building and navigating vessels of various kinds.

So far at least, man has never been able successfully to defy the elements, even on land, when wind and rain and electrical energy are let loose by the god of storms. So it is not surprising that aircraft should fall a victim to the fury of such a storm as caused the wreck on Decoration Day.

Two things are necessary to prevent the repetition of such disaster: Landing fields at much more frequent intervals and a system of wireless communication so that planes can be instantly apprised of storms and warned to land or directed how to avoid them, just as is now done in the case of shipping. And just as we have laws which require radio apparatus on certain grades of ships, so we can prevent passenger carrying in planes which are not so equipped.

The main thing, however, is to realize our opportunity to develop air transportation and the aircraft industry. Handley Page, the well-known English airplane builder, tells us that we have the greatest opportunity in the world to develop air transportation because of the size of our country and the absence of annoying custom houses as is the case in the small European countries. But we must first realize that the industry cannot thrive on indifference and that it must be treated as a method of transportation and not as a means of entertaining crowds at county fairs.

It is time for the Chamber of Commerce of every city to secure adequate landing fields and co-operate in securing wireless service for warning and control. It is also time for serious consideration on the part of the builders as to the production of aircraft at a moderate price. A Henry Ford in the airplane industry would do much to further the use of aircraft, to secure landing fields, instruments and all the other things which we so badly needed.

Shop Equipment News

Robertson "Economy" High-Speed Power Saws

The W. Robertson Machine and Foundry Co., 56 Rano St., Buffalo, N. Y., has recently placed on the market the "Economy" No. 400 portable hacksaw, shown in Fig. 1, and intended for either hand or power drive. It can be used as a general utility saw in the shop when fitted

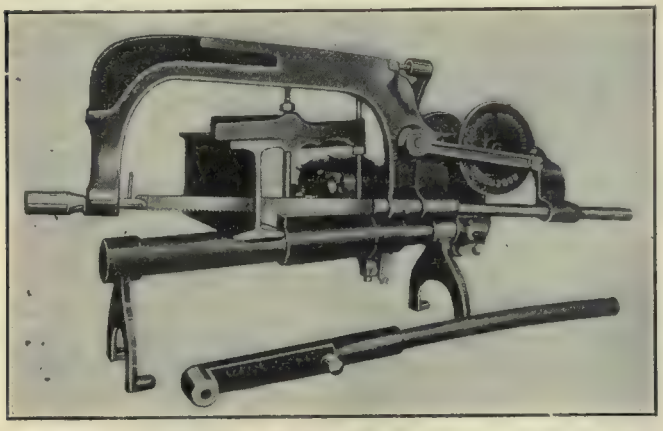


FIG. 1. ROBERTSON "ECONOMY" NO. 400 PORTABLE SAW

with the two legs as shown. By removing the front leg, it is suitable as a rail raw for use on street railways, where the current is taken from overhead. The electric current is ordinarily taken from a lamp socket, but where it is not available, the machine may be driven by hand by means of the lever shown lying in front of the saw, after connecting the lever to pins on the crank disk and on the frame.

The machine has a maximum capacity of 8 in. and uses 17-in. blades. The motor is mounted on a bracket supported on the bed and drives the crank disk through

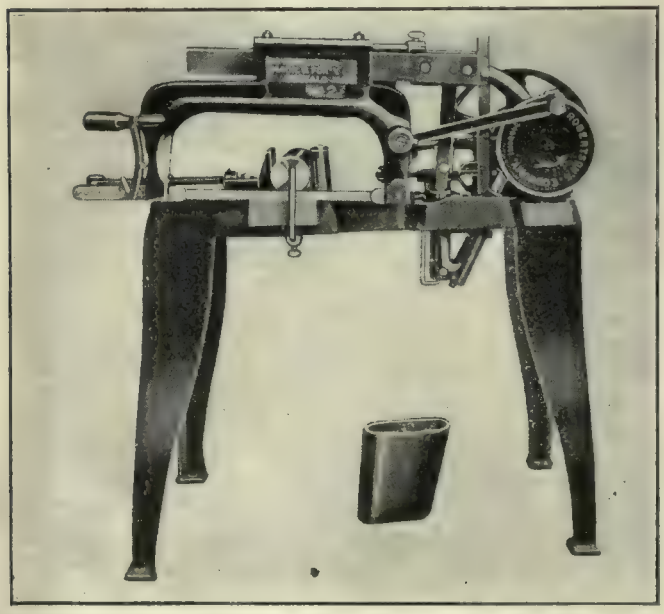


FIG. 2. ROBERTSON "ECONOMY" 1921-MODEL NO. 2 POWER SAW

worm gears running in oil. Gravity feed is used, and a lever engaging a stud is provided for holding up the saw while clamping the work.

The 1921 model of the No. 2 "Economy" power saw is shown in Fig. 2. This machine, which is a draw-cut saw having a capacity of 6 x 6 in., has been equipped with an oil lift of the type employed on larger machines made by the concern and intended for relieving the teeth of the blade from the work on the idle stroke.

The oil-lift device consists of a two-cylinder pump submerged in oil contained in the tank shown removed and placed beneath the machine. One plunger is timed with the crankshaft, the other being connected to the saw frame. At the end of the cutting stroke the plunger connected to the crankshaft is on the down stroke, which forces the oil under the plunger connected with the frame, thus raising the saw from the work. At the beginning of the cutting stroke, the pump timed with the crankshaft has just passed a port allowing the oil to escape, thus allowing the frame to lower while on the cutting stroke. It is said that the lift greatly decreases saw breakage.

The machine is equipped with a swivel vise for cutting angles up to 45 deg. It is driven through a friction clutch and stops automatically when the cut is completed.

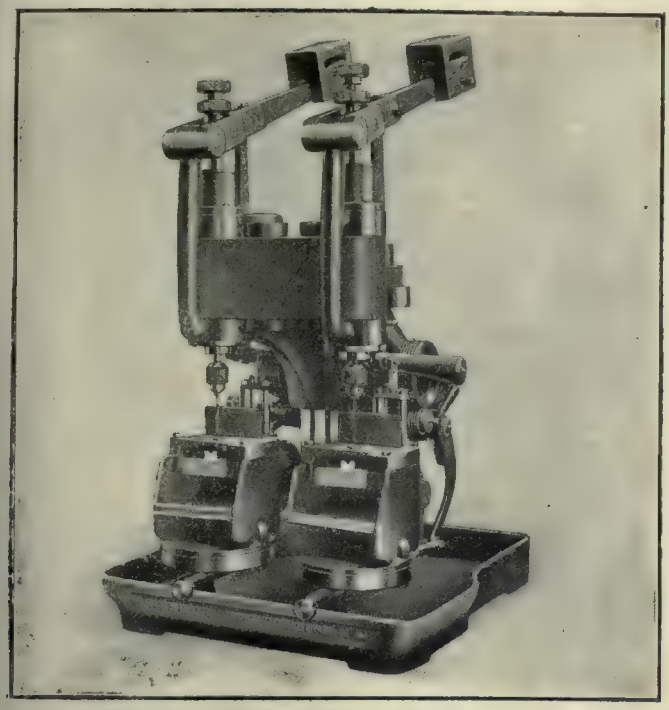
Kingsbury Automatic Pin-Drilling Jig

The Kingsbury Manufacturing Co., Keene, N. H., has recently placed on the market a pin-drilling jig for use with the two-spindle automatic sensitive drilling machine made by the concern and described in the *American Machinist* on page 1066, Vol. 53. The jig operates in conjunction with the drilling machine so that the operation is completely automatic, the accompanying illustration showing the jig adapted to drilling the crossholes in small pins, rivets or screws.

When the operator pushes the pin to be drilled in place into the small V-block at the top of the jig, the spindle is released from its position at the top of its stroke and starts to travel downward, the pin being automatically locked in place at the same time by the turning of a cammed roller. While the drill is cutting a stream of coolant is delivered to its point. At the completion of the hole the spindle rises and the work is unclamped and ejected automatically. The spindle stops at the top of its stroke until it is released by the replacing of another pin in the jig.

Probably the most important feature of the machine, and the one which permits of continuous operation without drill breakage, is a mechanism, used when drilling comparatively deep holes, which raises the drill when it is part way through the work, so as to relieve the point of the chips. This mechanism consists of a cam with a grooved periphery to replace the grooved eccentric ordinarily used on the machine.

The rate of production of the pins, of course, varies with their size. It is stated that cold-rolled steel pins $\frac{3}{32}$ in. in diameter were drilled with a No. 53 high-speed drill at a production rate of 15 pins per minute

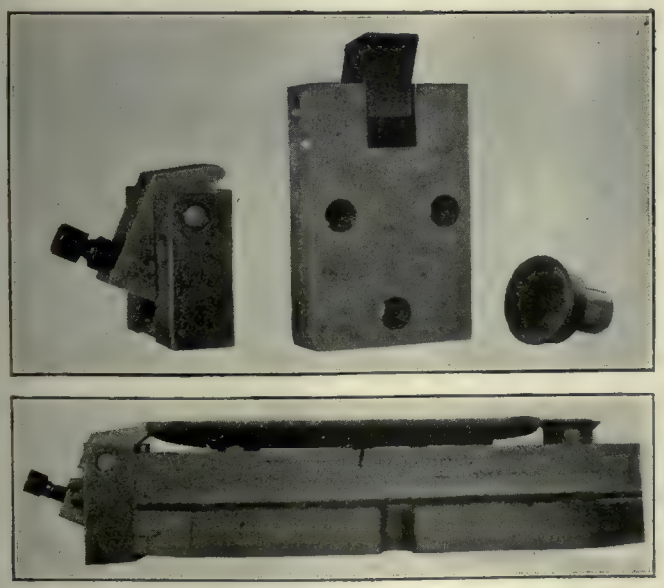


AUTOMATIC PIN-DRILLING JIG IN PLACE ON KINGSBURY DRILLING MACHINE

per spindle, 1,200 pins being drilled between grindings of the drill. It is said that a production of 1,500 pins per hour can be easily maintained by the use of two spindles.

Cincinnati Engineering Tool Co. Holding Dogs

The special dogs shown in the accompanying illustration have been placed on the market by the Cincinnati Engineering Tool Co., 4659 Spring Grove Ave., Cincinnati, Ohio, for use on first-operation fixtures. At the top of the illustration are shown two sizes of the



CINCINNATI ENGINEERING TOOL CO. HOLDING DOGS AND THEIR USE ON A FIXTURE

adjustable dogs, while one size of the stationary dog is shown on the right. The lower part of the illustration shows the smaller adjustable dog and the stationary dog in position on a fixture, illustrating their use in holding work. The adjustable dogs with their holders are made of case-hardened machine steel and the stationary dogs are made of hardened alloy steel.

The advantages of the method of holding the work by means of the dogs are said to be as follows: The fixture can usually be designed and built very cheaply, due to the simple pattern and small amount of machining. The fixture is easily cleaned, as there are no projecting walls which hold chips in it. The work can be clamped close to the finished surface, which is especially advantageous when work has a large rounding and is difficult to hold in any other way. The adjustable dog positively clamps work down on the locating points, and does not cause the trouble incident to the use of a setscrew on which the point is slightly eccentric; that is, lifting the work from the locating points instead of clamping it down.

Fritz Werner A. G. Hardness-Testing Device

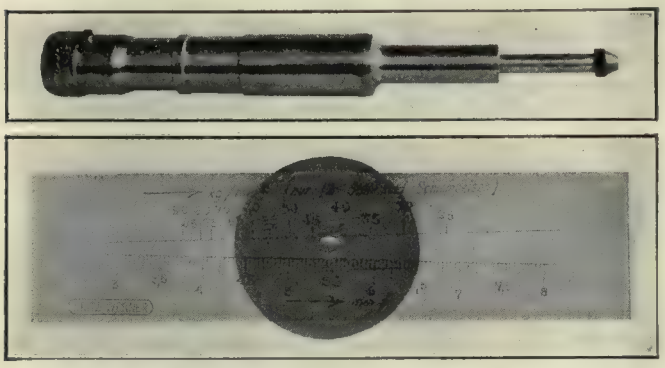
A portable hardness-testing instrument, operating on the Brinell principle, and not confined in its use to testing rooms, but which is intended for workshops and stockrooms, has been put on the Continental market by Fritz Werner A.-G., Berlin, Germany. Hardness tests in Germany are more or less confined to large firms, but this portable instrument is intended to supply a testing-tool at low cost and suitable even for the small manufacturer.

The maker does not claim high accuracy for the device, but that it fulfills all practical requirements. The tool is of simple design, making its handling easy and fool-proof. It can be used for testing stock in place, or set in the machine, not needing special test pieces. The instrument, shown at the top of the accompanying illustration, consists essentially of a tubular casing with its top screwed on, and a plunger carrying the test ball at its end. In the interior of the casing is placed, with ample play, a piston, and between the latter and the top, a spiral spring. The plunger and the piston are connected by a sliding joint, and both parts are held in place by a device which is released automatically at a certain position of the piston in the casing.

When the tool is used, it is held with one hand on the closed end of the casing and one on the other end, and the ball end is pressed against the piece to be tested. Under this pressure the casing is moved forward toward the ball end, against the pressure of the spring between the piston and top. At a given position, the releasing device comes into action, whereupon the piston is moved forward by the spring and strikes against a shoulder of the plunger, producing an impact of the ball end against the piece under test. When the tool is removed, another spring carries the piston back into its starting position. In order to avoid too sharp a reverse movement, the plunger has an air-tight fit in the bushing, producing cushioning of the reverse stroke. The intensity of the blow can be adjusted by screwing or unscrewing the top, thereby contracting or loosening the spring. Once set, the spring can produce several hundred strokes of sufficiently equal intensity, without readjusting.

For ascertaining the hardness of a material, a transparent rule made of celluloid is supplied, showing two lines at a very acute angle, one graduated to read twentieth parts of a millimeter, the other for reading directly the strength of the material, in kilograms per square millimeter. This applies, however, to steel and

malleable iron only; and for other materials tables are supplied. The view at the bottom of the accompanying illustration shows how the rule is applied to a ball im-



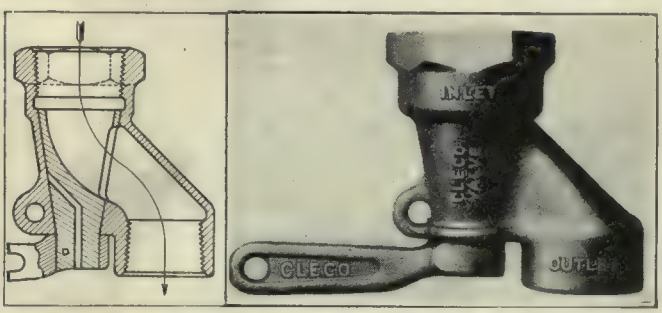
WERNER HARDNESS-TESTING DEVICE AND SCALE FOR MEASURING BALL IMPRESSION

pression. A diameter of impression of approximately 5.45 mm., and a hardness of the material of 42 kilograms per square millimeter are indicated.

"Cleco" Pressure-Seated Air Valve

The Cleveland Pneumatic Tool Co., Cleveland, Ohio, has recently placed on the market the "Cleco" pressure-seated air valve, a view of which is shown on the right side of the accompanying illustration. The maker calls attention to the fact that the conical plug is forced in place on its seat by the air pressure itself.

As can be seen by the sectional view on the left side of the accompanying illustration, packing, gaskets, stems and springs are eliminated, there being only three parts to the valve, the body, the plug and the handle. The air does not come in contact with the seat of the valve, which prevents damage to the seat and the necessity of replacing it. As shown by the arrow marking the direction of travel of the air, the air enters at the top of the valve, passing into the top



"CLECO" PRESSURE-SEATED AIR VALVE

of the hollow plug, and then out of the side of the plug and into the supply line. The turn in the path of the air is slight, so as not to impede the passage.

The valve is provided with a waste arrangement, to allow the accumulated pressure in the air hose to escape to the atmosphere when the valve is shut off. In this way the hose from the valve can be relieved of strain when it is not desired to use the air, thus enabling the operator to disconnect the hose from the valve more easily. It is stated by the maker that the valve has been subjected to severe service tests under both low pressures and pressures as high as 500 lb. per square inch; and that it has operated very satisfactorily and without leakage.

Why I Write for the Technical Papers and Why I Think You Should

By E. F. Creager

Primarily, my reason for writing for trade journals is because I have something of interest to tell to enough of the readers to warrant its publication.

Also, because I feel that I owe something in return to the many writers who have given me the benefit of their ideas and thoughts—their "pet schemes" that worked, or the ones that didn't work.

I also get an education from writing, since I try to present my subject correctly and intelligently; hence, I must look up such information as may be required and check the same for errors.

I encourage others to write about their various ideas or systems, and I have four boys with articles either submitted to or in preparation for trade journals. They have seen "write-ups" by the "old man" of items that they have been using every day and had previously given no thought to the utility or novelty of them, beyond their being useful labor-saving devices of every-day service.

I frequently received requests from the editors to "write up something" and at first I was very much worried for fear some one would make fun of my efforts, or that my sketches would not be in the proper "plane of projection." Then, too, I had an idea that the editors who would "pass" upon the article were a bunch of "high brows" whose only pleasure was to "turn down" an article because the rhetoric or punctuation was not all that it should be. However, one day one of the Associate Editors of the *American Machinist* called on me and it was the beginning of a splendid friendship that has now lasted for over fifteen years. He showed me how. He looked over my private "morgue"; borrowed a lot of it from time to time and had it photographed, and in a short time I had the pleasure of reading a series of illustrated articles on my stuff under the name of E. A. Dixie. Now, the only way I found to keep ahead of him was to write for myself. I wish to say, however, that all he ever got from me, he has repaid in full.

Then, one day I called on the editors in their den; and say! They were only men like you and me; Miller, Viall, Colvin, Halsey, Suverkrop and the rest of them were not the ogres that I had pictured.

Don't be afraid to present your ideas to them. If you are in doubt, write them and ask if they would be interested in the subject you have in mind.

I gave a talk before forty foremen the other evening at the Y. M. C. A. and a couple of them went to sleep, but I am sure that I had at least 75 per cent of them interested and had told 50 per cent of them some things that they did not know before, and for almost thirty minutes after the talk was over they crowded around me in informal discussion of the points taken up.

I have just been informed that my title would be changed from works manager to a higher one and that I would have the mechanical supervision of two large factories producing widely different articles, with a consequent increase in salary, and I attribute much of my ability to fill the higher position and to hold a member's certificate in three of the largest engineering societies, to information gained from trade papers and engineering journals or proceedings.

So look around, boys, and see if you can't find some wrinkle of interest and send it in.

The Demand for Machinery in India

The Aryan Is Enterprising With Regard to Machinery — Industrial Concerns Are More Numerous Than Generally Known Here—There Are Possibilities of Big Developments

By GEORGE CECIL

WITHOUT going so far as to say that the possibilities of the machinery export trade to India are unlimited, one is justified in stating that it has before it a promising future. Every year developments are taking place. The rich native of twenty-five years ago is giving place to a more enterprising Aryan, who puts his money into manufacturing undertakings.

Many of the shares in the Bombay Cotton Mills and in the Calcutta Jute Mills are held by Mahometan and Hindu capitalists, and the same applies to the various sugar and paper mills of Hindustan. And, not only do England's Eastern subjects take an interest in existing industrial concerns, but they launch out on their own account, by erecting jute and flour mills, stone crushing mills, cotton presses, bone mills, printing presses and engineering works, while occasionally a stray Eurasian is equally venturesome.

Payment Necessary Before Shipping

It may be added that, whether the colored man of means be wholly or partly black, machinery and engine makers would do well to secure payment before shipping the goods, for the Oriental is notoriously "slim," be he the possessor of millions or only of thousands of rupees. "Cash against documents" does not necessarily result in the shipper receiving his just dues, since the purchaser is quite capable of declining to take delivery of the consignment on finding that he is expected to pay for it.

Tea-Garden Machinery

Another outlet for machinery exists in the planting districts. For, though in the indigo centers a horizontal engine of obsolete mechanism and a few wooden screw presses answer the purpose, among the tea-garden community there is quite a demand for the more modern productions of engineering firms. Indeed, from here is sent many an order to the eight or ten structural engineers of repute, who, in addition to a dozen or so of lesser importance, exist in India.

Mention also may be made of the various general merchants who stock machinery, or who are not too proud to act as agents for its sale. Among them are Gillanders, Arbuthnot & Co.; Anderson, Wallace & Co.; Ahmutty & Co.; Balmer, Laurie & Co.; Barry & Co.; Bird & Co.; and Turner, Morrison & Co., all of Calcutta. India's capital also possesses a number of shipbuilding and repairing yards, while in Bombay a few foundries and importers of engines and machinery carry on business. In fact, all over the country ironmongers, jute and cotton merchants, wine merchants and the like are only too glad to turn a timely rupee by undertaking an agency for the sale of 500-hp. mill engines, cotton-spinning machinery, and even mowing machines and sewing machines.

One of the curious things about Anglo-Indian commerce is that the cobbler cannot be induced to stick to his last. The tea-broker thinks it necessary to dispose of tea-drying machines, and the insurance agent is not happy till he has succeeded in obtaining an agency for the sale of driving belts, lubricating oil, and gas engines. In addition to the outlets mentioned, there are the "shops" in connection with India's railway companies, of which there are about thirty. A considerable amount of machinery is imported by them. It may be added that they each possess a London office.

India Has Many Industrial Enterprises

The following information with regard to the precise number of machinery-using concerns in India will perhaps be of interest. Of tea companies there are about 230, of indigo concerns some 280, and of bone-crushing mills three or four. Four wool mills exist; twenty-four tanneries, of a somewhat assorted nature; fifteen sugar factories, several of which are by way of being in a more or less moribund state; and a dozen saw-mills. Of roperies there are twelve, of paper mills nine; whilst India possess over sixty linseed- and castor-oil mills and twenty or thirty jute presses.

There are some thirty jute mills, nineteen foundries, twenty-four ice works, and ten gold-mining companies—which are now resting on their laurels. Of breweries there are nineteen, and of rum distilleries eleven; whilst of coal companies, cotton mills, and cotton presses there are, respectively, fifty-five, one hundred and forty-seven and forty-seven. Added to this there are hundreds of small printing presses, several horse and steam tramways, mica works, and numerous other small enterprises using machinery. It can be seen that the diversity of industries is even greater than one would expect to find.

India is also rich in contractors and municipalities, the last-named requiring steam-rollers and water-works machinery. There are several local lines of steamers running between Calcutta and Bombay, and Calcutta and the further East. Calcutta is, moreover, rich in steam-launches; whilst electric installations have made their appearance in that city and in Bombay.

Scarcity of Practical Engineers

The majority of mills and machinery-employing concerns in India are under the superintendence of an expert machinist or engineer. But the small jute presses, steam tramways, cotton presses, oil mills, printing presses, and so forth, are in charge of stupid Eurasians, or equally unsatisfactory natives. The result is that the machinery often comes to grief, owing to the manager of the works paying but scanty attention to it. Hot bearings are of frequent occurrence, and the engineer, in his ignorance, often blames the maker.

It may be observed that in India the sale of machinery is seldom arranged without an aggravated form of secret commission passing between the salesman and the buyer, should the last-named be an employee and not a principal. This is just one of the peculiarities of the Indian method of trading, which the American manufacturer shipping there must learn and study before he is able to export to India with success.

Declarations of Principle of Manufacturers Association of Connecticut, Inc.

The Manufacturers Association of Connecticut, Inc., Hartford, Conn., has subscribed to a set of declarations of principles concerning industrial relations and industrial management. A booklet containing them has been published by authority of the board of directors and the executive committee. The declarations are:

(1) We believe in fair dealing.

(2) We believe in good faith in the matter of agreements and contracts.

(3) We believe that men and women should receive equal pay for service of equal value rendered under equivalent circumstances.

(4) We believe in proper constructive legislative regulation and control.

(5) We believe in the enforcement of the law.

(6) We believe in the proper regulation of night work for women.

(7) We believe in the proper regulation of child labor.

(8) We believe in the proper regulation of any occupations injurious to the health and morals of workers.

(9) We believe in healthful and safe working conditions.

(10 We believe in the guidance of entry into, and training for, industry.

(11) We believe in compatibility of occupation.

(12) We believe in the use and development of methods of determining the character of work to which individuals are best suited with a view to their greater service, growth, prosperity and contentment.

(13) We believe in opportunities for technical training and education, individual development and progress.

(14) We believe that industry should provide methods of self-expression suited to the individual or class concerned.

(15) We believe in freedom of opportunity of any individual to learn or engage in any trade or profession or occupation to which such individual may be adapted.

(16) We believe in an opportunity for mental growth commensurate with the capacity therefor.

(17) We believe in an opportunity for advancement proportionate to growth.

(18) We believe in adequate wages proportionate to productivity, work done, or service rendered.

(19) We believe in systems of pay that recognize and provide an incentive for increased production or service.

(20) We believe in proper methods of study, investigation and research to determine the relation between productivity and reward.

(21) We believe that every worker should have an opportunity to earn a wage proportionate to his ability, skill and productive capacity.

(22) We believe that capital is entitled to a return proportionate to the services rendered and the risks run.

(23) We believe that capital is the friend and not the enemy of labor and that the interests of both are common.

(24) We believe that employers and employees must avoid selfishness and recognize mutual considerations, obligations, opportunities, responsibilities and benefits.

(25) We believe that the human factor in industry deserves first and primary consideration.

(26) We believe that the working hours should be adjusted to the character of work and working conditions, with due regard to health, morals and social private life.

(27) We believe in the progressive improvement in working and living conditions, and further believe that our modern industrial and social order is conducive to such improvement.

(28) We believe in a proper American standard of living.

(29) We believe that health, happiness, prosperity and contentment result from earnest and sincere productive effort and hard work by all, with an appropriate measure of leisure, recreation and rest, accompanied by proper living conditions conforming to moral, hygienic and sanitary laws.

(30) We believe in the open shop.

(31) We believe in the right of both employers and employees to organize where such organization is committed to proper purposes and pursues proper methods.

(32) We do not believe that membership in any organization is essential to social fellowship.

(33) We believe that the employee has a right to leave employment when he sees fit and that the employer has a right to discharge any employee when he sees fit, each with due regard to agreements or contracts.

(34) We believe that employers should be free to engage employees at wages and hours mutually satisfactory without interference or dictation on the part of individuals or organizations not directly a party to the arrangement.

(35) We believe that employers must have freedom in the management of their business, subject to the provisions of law, justice and equity.

(36) We believe that the employer must have full discretion to determine the methods of work and the competency of industrial workers.

(37) We believe that employers and employees should seek to bring about regularity and stability of employment.

(38) We believe in a peaceful settlement of disputes between employer and employee.

(39) We believe in the utilization of the knowledge, ability and special skill of all classes of industrial workers and of society.

(40) We believe in progress and improvement in processes, methods, efficiency and organization.

(41) We believe in the encouragement and utilization of inventions and improvements.

(42) We believe that the management of any industry should be so constituted as to make possible and encourage the consideration of the rights of all individuals and classes engaged in such industry, and where the problems, benefits, responsibilities and opportunities are mutual, there should be the opportunity for mutual consideration thereof without reference to the mechanism by which this is accomplished, it being understood that such mechanism may and should be adapted to the particular and peculiar conditions existing in such manner as to bring about the most cordial relationship, compatible with mutual efficiency and confidence and the discharge of obligations and responsibilities.

(43) We believe that efficiency is essential to the growth and progress of modern industry and industrial opportunity for all, and that such industries cannot continue and grow in the mutual interest of all concerned without reasonable and relative efficiency corresponding to the standards of the age, and we are opposed to any system or mechanism that destroys, obstructs or makes impossible such efficiency. Where it is necessary for the maintenance of such efficiency, the interests of all must be merged and placed under the control of those most competent in the exercise thereof. We do not believe that any class can permanently retain such control in modern industry without consideration and recognition of the interest of others.

(44) We believe that increased production at greater efficiency means a correspondingly greater return for the industrial worker, an increase in his purchasing power and an increase in the wealth of the nation, which only those who help to produce should share.

(45) We believe in the constructive development of our American democratic system of public education.

(46) We believe in the encouragement of agriculture as a means of reducing the cost of living and promoting the welfare and prosperity of the country.

Some of the things the association is opposed to are enumerated as follows:

(1) We are opposed to the closed shop.

(2) We are opposed to coercion or intimidation.

(3) We are opposed to violence, destructive agitation, class wars, revolutionary socialism, lawlessness, disorder.

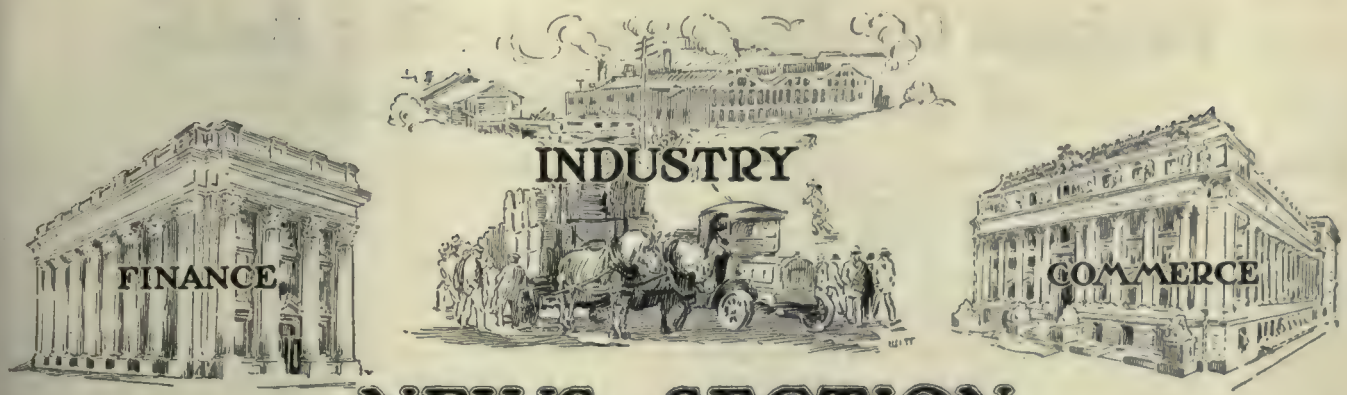
(4) We are opposed to boycotts, blacklists, lockouts and illegal acts of interference with the personal liberty of employer and employee.

(5) We are opposed to limitation of output or production.

(6) We are opposed to excessive leisure because it prevents a reasonable measure of productivity and is liable to lead to social evils.

(7) We are opposed to over specialization.

(8) We are opposed to despotic or autocratic treatment of the matter of human relations.



NEWS SECTION

Patent Amendment to Protect American Industries

In the interest of the national defense and to prevent unwarranted advantages to foreign inventors, Senator Stanley, of Kentucky, has proposed an amendment to the revised statute providing that any patents issued to foreigners must be put in operation, and that production in reasonable quantities begun within the continental limits of the United States within two years. Failure to comply with that provision entitles the United States to issue a license which will permit use of the patent.

The legislation, Senator Stanley states, is intended to prevent such a situation as arose at the outbreak of the war when the United States was cut off from supplies of dyes which were made only in Germany. German interests had American patents covering more than 1,000 coal tar products. Had these interests been required to manufacture their products in the United States, American industries depending on them would not have been paralyzed. Senator Stanley points out that practically every other nation has a law requiring compulsory production, within the country, of patented articles taken out by foreigners.

Monster Plans for Pageant of Progress at Chicago

The latest news coming from the headquarters of the Pageant of Progress Exposition, to be held in Chicago on July 30 to Aug. 14, indicates a world-wide interest in this novel undertaking. Plans for the event are being worked out and most of the exhibition space has been taken up. There will be three and one-half miles of exhibitions, taking up the entire floor space of the famous Municipal Pier, which extends 3,000 ft. into Lake Michigan.

The exhibitions will show the progress made in all lines of industry, agriculture, and the arts and sciences. Special features will include boat, airplane, automobile and carrier pigeon races, naval and military sham battles, receptions by the foreign consuls and representatives and numerous other events.

Machinery Exhibit at Rouen, France

An exposition which should be of interest to American manufacturers of loading and unloading machinery, will be held at Rouen, France, during the entire month of July. The new port works at Rouen have just been completed and will eventually be in the market for machinery of this kind. The exposition is in charge of M. l'Ingenieur de la Chambre de Commerce, Rouen, France.

Some Data on Corrosion of Sheet Duralumin

Under the direction of the Bureau of Standards, Washington, D. C., an inspection has been made of corroded duralumin in the form of thin sheets used in the construction of all metal airplanes. The material became brittle in service owing to the development of intercrystalline "cracks" evidently as a result of corrosion. The attempt was made to produce the brittle condition in portions of the sheet which apparently were still ductile. By corrosion alone as well as by the simultaneous action of corrosion and stress, it was possible to develop intercrystalline brittleness in the specimens. Annealing of the material, annealing followed by slight cold rolling and severe cold rolling of the commercial stock did not appear to affect materially the corrosion. In this case it appears certain that the deterioration was the result of the corrosion of the sheet. Brittleness developed because of corrosion from both acid and neutral solutions but an alkaline attack did not appear to cause the development of brittleness.

Detroit-Cleveland Steel Merger

At a meeting of the stockholders of both companies, to be held on June 24, a proposal will be submitted for a merger of the Detroit Pressed Steel Co., of Detroit, Mich., and the Hydraulic Steel Co., of Cleveland, Ohio. New stock will be issued in the new company. The Detroit company manufactures frames for automobiles and Disteel rims and brake drums.

World Finance at London Conference

A trial balance sheet of the world's financial condition, taking into account the amount Germany agreed to pay in reparations to the Allies, will be one of the American contributions to the first conferences of the International Chamber of Commerce to be held in London during the week of June 27. Other contributions will be a survey of world communications, a review of economic conditions in the United States, reports on ocean transportation, fabricated production, distribution, raw material production, port facilities and a comprehensive summary of American railroad practices in making international shipments to Canada and Mexico. All these reports are now being prepared by committees made up of leading American business men.

Some two hundred delegates from all parts of the United States will attend the conference. Representatives from the eleven constituent countries will be in attendance at the meeting. Walker D. Hines, formerly director general of the United States Railroad Administration, will be chairman of the group for transportation and communication.

Industrial Y. M. C. A. at Bayonne

In an effort to bring about a more general application of the golden rule in industry, a large and completely equipped Y. M. C. A. has been established in Bayonne, N. J. The project was started some time ago and the recent dedication of the building was the culmination of a campaign undertaken by the industries of Bayonne to provide a means of healthful and educational recreation for its thousands of workers.

Among the industries which backed up this enterprise were the Standard Oil Co. (N. J.), Tide Water Oil Co., Babcock & Wilcox Co., International Nickel Co., Vacuum Oil Co. and the Pacific Coast Co.

More than 75 per cent of the operating expense will be cared for by membership fees and other income from those who use the building. For every dollar contributed by the employers for operating expenses, the employees will invest three dollars.

Business Conditions as the Big Banks of the Country See Them

National City Bank of Chicago Declares Business Structure Is Stronger—Increased Gold Reserves Improve Banking Situation

The country is doing a conservative business with its buying power much restricted. In the West there has been a moderate gain, but the volume is not impressive, judged by the records for this season in other years. However, the cost of doing business is declining, and the price structure is materially sounder than it was a year ago, or even six months ago. This is an important achievement and shows that orderly deflation is eliminating many of the evils from which the country suffered so seriously during the inflation period. The chief problem still has to do with bringing about such a reduction of retail prices as shall secure for the consuming public the benefits growing out of the drastic cuts in wholesale commodity prices. This readjustment is progressing, and will receive greater impetus in the future, as the public is determined to force down the average merchandise level by refraining from doing business at the quotations of war days. Concessions in steel prices have not attracted much buying yet, as consumers believe that lower quotations are inevitable for an industry which is now operating at scarcely 40 per cent of capacity. It has been estimated that general business throughout the country is just about half what it might be with the industrial machinery fully employed. This is by no means true of all industries, however, for increased activity is being shown in leather and a few other lines.

Good Progress

The reduced buying power of the country districts contrasts sharply with the larger sales reported by retail stores of the cities, as a result of the strong efforts being made to reduce high priced merchandise stocks and to pay off, or to reduce long standing indebtedness. There are signs of improvement in the foreign demand for pork, flour, wheat, cotton seed oil, and other products and with the abandonment of war-time food regulations abroad, it is probable that this buying will enlarge with ultimately heavily increased sales to German markets. This will be a great help, since Germany before the war made large provision purchases in the United States and a resumption of large-scale buying of this character would be of material benefit to the Southwest.

The outstanding fact is that the recuperative powers of American industry are enormous and with the banking position as strong as it is and commodity prices 48 per cent below the high level of last year, the folly of taking a bearish position on the United States is even more apparent today than it was during the life-time of the elder Morgan.

Strong Reserves

The tremendous over-subscription to the United States Treasury's recent $200,000,000 offering of short-term certificates of indebtedness shows that there is an abundance of funds awaiting temporary investment at 5½ per cent if offered by a borrower of the highest credit. The gain in the country's banking position has been progressive, so that the increase in the reserve ratio of the combined system on May 18 last exceeds 14 per cent compared with a year ago. The ratio of gold reserve to Federal Reserve notes in circulation, after setting aside 35 per cent against deposit liabilities was 70.4 per cent as compared with 47.2 per cent last year. These increases are very striking and emphasize the steady improvement in the banking situation which is fortunate, in view of our constantly increasing investment in Europe's restoration and salvage undertakings. The gold inflow, great as it is, would be much larger were it not for the export embargoes still in force in various European countries. One of the most interesting problems of the moment has to do with a proper utilization of our enormous gold reserve. Constant efforts are being made to get the Federal Reserve Board to let down the bars and through extending the time for certain obligations to lengthen the life of paper rediscounted by the reserve banks. These entreaties are natural under the circumstances, but the situation calls for strong handling, for all nations are looking to this country to rally to the support of the gold standard and to preserve it for the rest of the world.

Some Light on the Money Situation by the National City Bank of New York

Nine-tenths of the erroneous thinking about money is due to confusing money as a medium of exchange with capital. Money is a convenience in effecting the exchanges but it does not take the place of capital. The money question always has been a subject of controversy, and it is not easily elucidated in all its details, but there are certain broad propositions which most people are able to grasp, and which when agreed to will dispose of many of the most plausible fallacies. It is a safe rule in the business world not to try to get something for nothing, and in the world of applied science not to try to get more out of any combination than the sum of all that is put into it. By the same reasoning it is safe to conclude that a people cannot make themselves rich by printing money or by any other scheme for making credit take the place of capital. There is a hole in every such proposition somewhere.

False Prosperity

It does not stand to reason that the unproductive expenditures which the United States made on the war could be the basis of a higher permanent level of prosperity than it had ever known before. Real prosperity comes by an increase of the supply of wealth which one way or another contributes to the well-being of the population, and the expenditures upon the war do not come under this description. And yet a great many people who considered that they were very prosperous during the war and in the two years following, are convinced that that state of prosperity might have continued indefinitely if the bankers had not arbitrarily restricted the manufacture of credit. They do not see that a settlement day need ever have come, or that a reaction was inevitable.

Temporary Affluence

It does not seem that the broad proposition needs to be argued. It must be agreed that war-time prosperity in the main is fictitious, and that those who actually improve their position do so at the expense of others. Normal relations were violently disturbed, with the result that some were gainers while others were losers, and many were temporarily deceived into thinking themselves gainers when in fact they were not. A good many people were consuming principal when they thought they were living on income, and many were happy and wasteful under conditions which could not possibly be lasting. The people who gained unearned profits by the sudden rise of prices should have known that such a disturbance of normal conditions involved the probability of a reverse movement, and all those whose incomes increased faster than their accustomed expenditures should have known that this was a temporary gratuity at the expense of the letter-carriers, school teachers and millions more whose expenditures increased while their incomes were unchanged or increased in smaller degree.

Washington Notes

By Paul Wooton
(Washington Correspondent)

With the passage of the second deficiency bill by the Senate, the Department of Commerce is certain to receive the $500,000 asked by Secretary Hoover for the specific purpose of aiding industry. Of the amount, $250,000 will be expended in an effort to encourage foreign trade. The remainder will be utilized in various types of investigation and research looking to simplification, standardization and improvement in industrial practices and devices. The detailed plans for expending this money in the most effective way possible now are being worked out. As this is written, the bill still is in conference, but no great amount of difficulty is anticipated in harmonizing the differences between the bill as passed by the House and as it finally emerged from the Senate. That the President will sign the bill is a foregone conclusion as he has expressed himself on several occasions as favoring such legislation.

Track Laying Vehicles

The Ordnance Department is concentrating some of its best brain power on the problems involved in motorization of the army. It is recognized that animal traction is a thing of the past and that a mechanical substitute for the horse must be developed, not only for artillery use but for the transport of men, munitions and equipment. The problem would be relatively simple if operations were to be confined to good roads. To develop vehicles of various types that will negotiate a rugged terrain and at the same time be capable of high speed, both on and off roads, as well as having some types possessing sustained navigating ability has placed monumental problems before the ordnance transport division.

Experimental work in the elimination of the wheeled truck gives great promise. There is every reason to believe that great improvement can be made in track laying machines and in the track mechanism. Work is being done looking to the ready conversion of standard four-wheeled trucks into track layers.

Must Be a Change

The work has gone far enough to demonstrate that there must be revolutionary changes in the present type of tracks. The difficulties of lubrication and the very high power losses, when high speeds are obtained, must be overcome. Some experiments have shown power losses as high as 36 per cent at a speed of 16 miles per hour. Experiments are being made with hollow track shoes filled with oil but it is doubtful if a satisfactory lubrication system will be devised for the present type of tracks. Preliminary tests have been made of tracks made largely of fabric belting. These are quite successful on small vehicles. Somewhat similar tracks made of steel cables, to which are attached suitable shoes, are now in process of construction.

Dayton-Wright Gets Airplane Award

The Secretary of the Navy has approved the final awards under the navy competition for ship-board airplanes. The first award goes to the Dayton-Wright Co., whose designs will be purchased for $16,000; the second award went to G. Elias & Bro., Inc., who will receive $10,000 for their design; the third award was to the Curtiss Airplane and Motor Corporation, whose design will be purchased for $5,000, and the fourth award was made to Alexander Klemin, whose design will be purchased for $3,000.

The board states that in its opinion, while useful information has been obtained from all five designs and the competitors have shown a praiseworthy zeal in attempting a difficult problem, that the designs of the Dayton-Wright Co. and G. Elias and Bro., Inc., are sufficiently promising to warrant experimental construction at this time, and the board recommends that negotiations with these firms be made at once with a view of arranging a contract for the construction of sample airplanes for experimental flying tests on ship-board.

It is expected that these planes will solve the difficult problem of providing the navy with ship-board planes for taking-off and landing on ships and also on the surface of the water.

Wage Changes Since 1914

Authoritative information on the course of wage changes in the major manufacturing industries of the United States during the past six years, compared with changes in the cost of living, together with data regarding the number of workers employed and the average hours worked per week are made public in a report issued by the National Industrial Conference Board, 10 East 39th St., New York. This report, covering fifteen representative industries, employing in June, 1920, 539,113 wage-earners, traces the movement of average actual earnings in the principal industrial occupations from September, 1914, to the end of 1920, compared with changes in the cost of living as ascertained by separate extensive investigations made by the board.

In December, 1920, the report says, average hourly earnings of male employees in the industries reporting ranged from 127 to 198 per cent, and those of women employees from 111 to 192 per cent above the September, 1914, level. In certain industries the hourly earnings of men increased relatively more than those of women—this was true in the boot and shoe, cotton, wool and silk industries. In the hosiery and knit goods, rubber and metal industries the percentage of increase for women since the beginning of the war was greater than the percentage increase for men. It was found generally true that the industries in which the least increase took place are the ones in which the wage rates were relatively high in 1914, while the industries showing the greatest increases are those which before the war paid relatively low wages.

Some of the industries showing the largest percentage increases in average hourly earnings of men workers are the wool, leather, cotton, hosiery and knit goods industries, while women in wool, hosiery and knit goods, cotton and paper manufacturing showed the greatest increases over 1914.

Average weekly earnings for men and women, the report shows, in general increased less than hourly earnings. The range of increase in weekly earnings from September, 1914, to December, 1920, was from 77 per cent in the rubber industry to 159 per cent in the chemical industry; for women the highest increase was 157 per cent in hosiery and knit goods, and the lowest was 71 per cent in the boot and shoe industry.

The period covered by the board's investigation includes the industrial depression which began to develop in the spring of 1920 and with increasing force continued for the remainder of the year. This depression showed itself in irregularity and sharp fluctuations of wages in several industries, due partly to the uncertainty as to future business conditions and partly to the elimination from time to time of wage-earners with low wage-earning capacity.

In June, 1920, the number of men employed in eleven of the industries covered was 404,094 and in December, 304,678, a decrease of 24.6 per cent; the number of women decreased about 26 per cent in this period.

Average weekly earnings, the report states, were affected more than hourly earnings by the industrial depression in the latter part of the year 1920. The principal cause of the decline in the average was the widespread adoption of part-time operation made necessary by the reduced market demand. Reduction of wage rates, though of less importance, was a contributing factor to the decline.

The course of average hourly earnings during the last seven months of 1920 was affected by a number of influences, some of which operated to raise, while others tended to lower the average, the report says. There was a tendency of hourly earnings to remain steady, or in some cases to rise, even after weekly earnings had begun to decline through part-time employment. As the business situation became more acute general wage reductions were made in a number of industries.

The investigation indicates that in the eleven major industries for which data from 1914 is available wages—as measured by hourly earnings and to a smaller extent as measured by weekly earnings—rose somewhat more rapidly than the cost of living, up to the spring of 1920. Since then hourly earnings have declined generally parallel with the fall in the cost of living. Weekly earnings have, however, fallen more rapidly than living cost since September, 1920, for the industries covered.

First Report of American Engineering Council's Committee on Elimination of Waste in Industry

The first report of the committee on Elimination of Waste in Industry was made to the American Engineering Council at the St. Louis meeting, June 3. It is understood that comprehensive statistics were not included in the report. The following paragraphs indicate some of the general conclusions reached by the committee.

Waste results from an interruption of production, low production, restriction of production and lost production. The wastes of interrupted production result from idle men, materials, plant and equipment.

Large inventories of raw materials and finished product and unbalanced production are causes of waste resulting from idle materials; large sums of money are invested in idle equipment and over-equipment; and factory buildings in many instances are larger than necessary.

Ill health and industrial accidents figure as the causes of lost production, the findings as to which are summarized as follows: The economic loss in this country annually from preventable disease and death is over $3,000,000,000; 42,000,000 persons gainfully employed lose 350,000,000 days from illness and disease and non-industrial accidents annually; 42 per cent of the waste of ill health is preventable; in 1919 there occurred in industry 3,000,000 accidents resulting in an economic loss to the country of about $853,000,000; industrial accidents are caused by the carelessness of the workmen and a lack of ordinary safeguards; authorities agree that it is possible by using methods already perfected, to reduce deaths and serious accidents in American industry by at least 75 per cent.

Trade associations should be formed in those industries lacking comprehensive organization; greater co-operation and publicity should be established within certain industries by improving and increasing the effectiveness of existing grade organizations; there should be recognization of the importance of the collection and distribution of trade information; trade associations should realize their opportunity to promote programs for the standardization of cost accounting methods, the introduction of standardized material specifications, the establishment of production standards, the standardization of equipment and the standardization of finished products; these associations should establish greater co-ordination of activities and relationship between interdependent and intradependent agencies and organizations; the associations should encourage industrial research; industrial trade councils such as have been established here and abroad are worthy of careful study; a nation wide system of employment exchanges should be established and maintained.

The building industry was said to be about 60 per cent efficient; the shoe industry 65 per cent; the average plant in the metal trades group was considered to be from 25 to 30 per cent behind the best plant in output per employee.

The committee consisted of the following men, headed by J. Parke Channing, of New York, as chairman and L. W. Wallace, executive secretary of American Engineering Council; Herbert Hoover, of Washington; L. P. Alford, New York; George D. Babcock, Syracuse; F. C. Colburn, Philadelphia; Morris L. Cooke, Philadelphia; Harrington Emerson, New York; Ira N. Hollis, Worcester, Mass.; E. E. Hunt, Washington; C. E. Knoeppel, New York; Robert Linton, New York; Fred J. Miller, New York; H. R. V. Scheel, Passaic, N. J.; J. H. Williams, New York; Robert B. Wolf, New York.

It is anticipated that there will be made available before long a fuller report which will include the statistics gathered by the committee and information as to how the general conclusions that are reported in this article were reached.

Charles Piez Addresses Engineering Advertisers

"Advertising and Selling from an Executive's Viewpoint," was the subject of an address delivered before the meeting of the Engineering Advertisers Association, of Chicago, held in the Great Northern Hotel, Chicago, on June 7. Mr. Piez, who is president of the Link-Belt Co., and wartime director-general of the U. S. Shipping Board, brought out some interesting and instructive information which, backed up by years of personal contact with big business, was thoroughly enjoyed and appreciated by the "ad" men.

Steel Treaters Convention and Exhibition

Colonel A. E. White, national president of the American Society for Steel Treating, has made some announcements in regard to the annual convention and exhibition of the society, which will be held this year at Indianapolis, Ind., on Sept. 19 to 24.

One of the features will be the awarding of gold and silver medals to the best and second-best papers presented at the meeting.

The Meetings and Papers Committee has been appointed: It comprises Prof. H. L. Campbell, George O. Desautels and Victor Hillman.

1921-1922 Officers of American Supply and Machinery Manufacturers Association



NELSON A. GLADDING, President — IRVING W. LEMAUX, 1st Vice-President — JOHN C. RUF, 2nd Vice-President — S. D. BALDWIN, 3d Vice-President

At the triple convention of machinery dealers and manufacturers, held at Atlantic City, N. J., on May 16, 17 and 18, the American Supply and Machinery Manufacturers Association elected the officers shown in the panel above. Mr. Gladding is vice-president and sales manager of the E. C. Atkins Co., Indianapolis, Ind.; Mr. Lemaux is secretary and treasurer of the Indianapolis Brush and Broom Manufacturing Co.; Mr. Ruf is an executive with I. B. Williams & Sons, Dover, N. H.; Mr. Baldwin is president of the Cincinnati Rubber Manufacturing Co., Cincinnati, Ohio.

Effect of Coal Strike on British Iron and Steel Trade

Wilbur J. Page
Trade Commissioner, London, England

While the effect of the coal strike on all industries in Great Britain has been serious, its influence on the iron and steel trade has been most marked.

The first two months of this year showed little change in the British iron and steel trade, owing to the fact that there was a sufficient quantity of old contracts, placed previous to November, 1920, to keep the industry running fairly well. Early in March a distinct slump all along the line became noticeable. So great was this slump that, while on Dec. 31, 1920, there were 274 blast furnaces in blast, on March 31, 1921, there were only 119 furnaces in blast.

With production already dwindling and prospect of cheaper prices of coke, the blast furnaces were buying fuel from hand to mouth during the month of March. The coal-strike threat developed rapidly, and the threat was carried into effect on April 1. Blast furnaces immediately were damped down by the score, owing to the uncertainty of the outlook and the shortage of fuel, with the result that on Saturday, April 16, from the best figures available, it could only be determined that five blast furnaces in all Great Britain were in operation. As a natural consequence of this the pig-iron trade is to all intents and purposes suspended for the time being. What little business is being done consists of deliveries of small lots from old stock.

Unfortunately, just at the time the coal strike started, the British pig-iron industry was beginning to show some signs of activity. The last cut in the price of Cleveland foundry iron of 30s. per ton, bringing the price of the standard No. 3 G.M.B. down to £6 per ton, should have stimulated domestic inquiry, had it not been for the industrial upheaval. In fact, buyers did show increased interest, especially in those cases where they found their stocks somewhat short and they wished to insure against being caught empty handed in the event of a sympathetic strike of the railway men and transport workers. But this recovery in interest lasted only a few days, and the past week witnessed a complete stagnation in the domestic as well as in the foreign demand for British pig iron.

Foreign Competition

Manufacturers of pig iron are naturally reluctant under present abnormal conditions to quote for business, and buyers are influenced by the same reason to place their orders with Continental works. French and Belgian interests are taking full advantage of the situation to secure orders that might under ordinary circumstances go to British manufacturers. To meet the 30s. reduction in Cleveland foundry iron the Continental manufacturers immediately reduced their prices.

Belgian foundry iron is now being offered c.i.f. in the Tees, or in Scottish ports, at about £5 10s. per ton. This competition is particularly serious as regards Scotland, which is the best market for Cleveland foundry iron, due to the fact that it costs 18s. per ton on an average to ship Cleveland iron to Scottish destination by rail, while there is an additional charge of 2s. 6d. per ton for loading. This simply means that No. 3 Cleveland foundry iron costs, delivered in Scotland, £7 0s. 6d. per ton. It is true that the Continental iron is not equal in quality to the Cleveland iron, but it satisfies the requirements of the average buyer quite well.

The international situation as regards reparations from Germany practically confines the competition from the Continent to France and Belgium. Furthermore, it seems not unlikely that the British colonies will pass legislation affecting the importation of German material similar to that already passed by Great Britain. With this possibility in view, there has been a general suspension of buying from Germany for export to the colonies, although German prices of pig iron are on a competitive basis as regards other Continental works.

Future of British Pig-Iron Production

A great many of the producers have accumulated large stocks of pig iron manufactured at very high cost. Under present conditions these stocks are moving slowly. It is estimated that in the Cleveland district alone there is a minimum of 150,000 tons of high-cost pig iron. There is, however, a shortage of No. 3 Cleveland foundry iron, and this will be just the particular grade of pig iron that will be most required when there is a normal resumption of business. Under these conditions, even if the coal strike should be settled immediately, it will be some weeks before the majority of the blast furnaces will be put into operation again. Producers of pig iron will certainly hesitate to start production until their existing high-priced stocks have been liquidated to a greater extent and until they feel assured that pig iron can be produced once more on an economic basis. There is no doubt that the slump in the prices of pig iron has resulted in their reaching a point which is far below present-day production costs. This slump has been more spectacular in its rapid decline than any period of advance in prices.

Manufactured Iron and Steel Stagnant

Everything is at a standstill in the manufactured iron and steel industry. The question of further reduction in prices is held in abeyance awaiting the outcome of the coal strike. It is felt that under present circumstances further reductions would not stimulate demand, and that it is advisable to wait until the strike is over and there is definite information as regards future fuel costs on which to base further action as regards prices.

While everything depends on future costs of fuel, the trade generally recognizes that further reductions in prices must come if they are to even maintain a portion of their domestic market against foreign competition. Belgian prices for finished iron at the present time are far below any British prices, which are based on actual production costs. The sale of British common iron bars against Continental prices is impossible, while British manufacturers of gas strip steel are also feeling the inroads of Continental competition very keenly.

Most of the finished iron and steel plants throughout the country and the rolling mills are closed down. Occasionally there will be found a single department in a large steel plant in which a few men are still employed, but with the increasing shortage of coal there is bound to be a general shutdown in the trade by the end of this month.

Decimal Bill Again Before Congress

A coalition of western and southern Senators, without respect to party, has determined upon a legislative program which, it will insist, must be embodied in the legislative plan of the congressional leaders. Most of the measures deal strictly with agricultural matters, although the list includes Senator King's proposition for decimal divisions of English measurements, the pure paint bill and the truth in fabric bill.

Senator King's weights and measures bill was before Congress at the last session, but was not given consideration by the Committee on Standards, Weights and Measures. It provides that the English foot is to be divided into ten parts, each to be known as a decimal inch. The one-hundredth part of a foot is to be called "the line" and the one-thousandth part of the foot is to be known as "the point." In like manner other decimal sub-divisions are provided.

It was admitted by the Senators in charge of the conference that a change in the existing system of weights and measures is not regarded as an important part of the program and that the matter was included simply that there might be some committee consideration given to the question. Senator Ladd, of North Dakota, chairman of the subcommittee which made the recommendations, states that he is inclined to favor the metric system of weights and measures but that his idea in selecting the King bill simply was done in the hope that the general subject would receive some consideration.

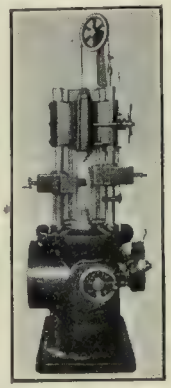
Welcome the "Dart"

We are in receipt of a copy of the first issue of the *Dart*, the house organ of the Medart Patent Pulley Co., of St. Louis, Mo. The magazine is edited by F. E. Chandler and its pages are full of live and interesting reading matter.

Condensed-Clipping Index of Equipment

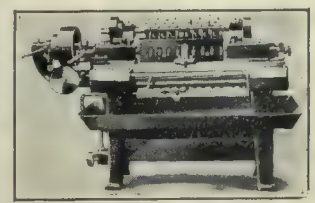
Patented Aug. 20, 1918

Lathe, Vertical.
Cadillac Tool Co., Detroit, Mich.
"American Machinist," March 24, 1921



This machine is intended for quantity production work on such parts as automotive pistons, one of its chief advantages being the saving of floor space. It is essentially a single-purpose machine, and is semi-automatic in its operation. It has a swing over the carriage of 9 in., and a maximum distance between the centers of 16 in. The bed and column are a single box casting, the reservoir for the coolant being incorporated in the base. The driving mechanisms for both the spindle speeds and the tool feeds are enclosed in compartments cast on the bed. The tailstock can be removed on the column by means of a rack and pinion. Two tool carriages, one for turning and one for facing, are ordinarily used, being mounted on the side bars and bearing on scraped ways.

Lathe, Cam-Turning, Melling
Walcott Lathe Co., Jackson, Mich.
"American Machinist," March 24, 1921



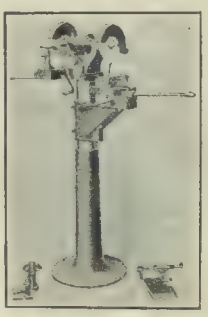
The machine is intended for the turning of the cams on automotive-engine camshafts, so as to eliminate the process of rough grinding from the forging. It consists of a flat bed on which is placed all of the mechanism for turning the shafts. A "master cam" shaft is placed at the back of the machine at the same height as the shaft to be turned and is exactly reproduced, all of the cams on the rough shaft being turned at the same time. Spring press the cutting tools against the work. While the cams are being turned the work table moves the camshaft, so as to feed the tools across the faces of the cams. The machine is semi-automatic in operation.

Shear, Angle, Steel, "Chicago"
Dreis & Krump Mfg. Co., 2909 S. Halstead St., Chicago, Ill.
"American Machinist," March 24, 1921



The device is similar in principle to the slitting shear made by the same concern and described on page 392 of the *American Machinist*. The frame and base are made of one piece of pressed steel. A geared lever actuates the upper shear blade, which is reversible and has two cutting edges. The upper blade can be raised high enough to allow the angle to be inserted from the front of the machine. The maximum capacity of the machine is for angles $1\frac{1}{2}$x$1\frac{1}{2}$x$\frac{5}{16}$ in. in size. The length of the base is 9 in., and the height of the frame is 8 in. The handle is 25 in. long, and the weight of the shear is 22 lb.

Grinding Machine, Cutter
Bilgram Machine Works, 1217 Spring Garden St., Philadelphia, Pa.
"American Machinist," March 24, 1921



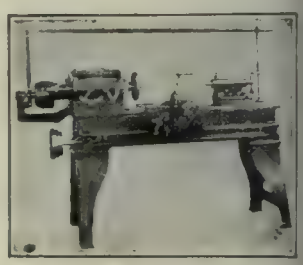
The grinding of the prismatic cutting tools used on Bilgram bevel-gear generators, ordinarily performed on a surface grinder, is done on the ends only of the cutting tools. The rectilinear movements of a standard surface grinder are approximated in this machine by movements of levers in circular arcs. The grinding fixture for holding the tool is clamped in an upright position upon a table below the wheel. Two levers control the movement of the table. Fixtures for use in grinding milling cutters and rotary gear cutters can be furnished with the machine.

Table, Spacing, Semi-Automatic
Cleveland Punch and Shear Works Co., Cleveland, Ohio
"American Machinist," March 24, 1921



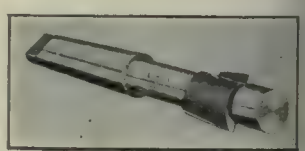
The table can be applied to either vertical open-gap punches or multiple punches. It can be used for plates, angles, beams or other structural shapes, and it has a capacity up to and including 24-in. beams. The machine has a runway 100 ft. long and a table that will handle pieces up to 50 ft. long, although both these parts can be furnished in lengths to suit the requirements. The table is propelled along the runway by a push-button-controlled motor that drives through double friction clutches. The correct pitch or spacing of holes is obtained automatically. The table travel is stopped by dynamically braking with the motor.

Lathe, Geared-Head, Production
Sebastian Lathe Co., Cincinnati, Ohio
"American Machinist," March 24, 1921



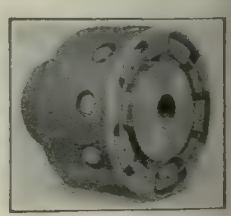
The lathe is made in 13 and 15 in. swings, and is similar to the engine lathe made by the same firm and described on page 1065, Vol. 52, of the *American Machinist*. The lead-screw assembly and other parts are not furnished, however. The lathe is fitted with a plain toolrest for doing plain turning. It is furnished with a friction pulley. No countershaft is needed, as the machine can be connected up direct with the line shaft. It can be furnished with either a $4\frac{1}{2}$, 5 or 6 ft. bed.

Counterbore, "Cutwell"
Bickford-Switzer Co., 50 Norwood St., Greenfield, Mass.
"American Machinist," March 24, 1921



The device has only two lips, placed helically on the body of the tool. It is stated that the tool makes chips of the same sort as cut by a drill, thus permitting of very rapid work. The space between the lips allows of easy sharpening. The body of the cutter is solid, being circular between the lips. Different mountings, tapers and pilots can be furnished to suit the special conditions of the work. The tool is made in standard sizes, and is said to be adapted to the performing of counterboring on a production basis.

Coupling, Flexible, A. E. G.
Algemeine Electrizitäts Gesellschaft, Berlin, Germany.
"American Machinist," March 24, 1921



The coupling consists of two main parts. The bell-shaped outside part is made of one piece in the smaller sizes; but for larger sizes it is made of two parts screwed together. The inside part has five or more oblong projections, and the outside part an equal number of shoulders on its inner surface. To each of these projections and shoulders a flat piece is bolted, thus holding strips of leather belting connecting the projections. When the drive is in one direction one half of the leather strips is in action, transmitting the force by tension; and when the motion is reversed the other half comes into action. The coupling can be used for any drive, but it is best suited for electric drive, as it is insulating.

Clip, paste on 3 x 5-in. cards and file as desired

National Research Council Funds for Scientific Research

The Research Information Service of the National Research Council has recently compiled information about funds for scientific research. From this compilation it appears that there are hundreds of special funds, trusts, or foundations for the encouragement or support of research, in the mathematical, physical and biological sciences, and their applications in engineering, medicine, agriculture and other useful arts. The income from these funds, which amounts annually to at least fifty million dollars, is used principally for prizes, medals, research scholarships and fellowships, grants and sustaining appropriations or endowments.

So numerous have been the requests to the Research Council for information about sources of research funds, availability of support for specific projects and mode of administration of particular trusts or foundations, that the Research Information Service has created a special file which it is proposed to keep up to date in order to answer the questions of those interested in such funds. Furthermore, in order to give wider publicity to the immediately available information about research funds, the council has issued a bulletin under the title "Funds Available in 1920 in the United States of America For The Encouragement of Scientific Research."

Inquiries concerning the bulletin or for information about research funds should be addressed, National Research Council, Information Service, 1701 Massachusetts Ave., Washington, D. C.

Open Shop After Eight-Month Strike

After a strike lasting for nearly eight months, union machinists, helpers and blacksmiths employed by the McDonough Manufacturing Co. of Eau Claire, Wis., it is reported, have voluntarily called off the strike and offered to return to work on an open shop basis. The strike was called after the union had made demands for a 12½ per cent increase in wages.

The McDonough company has rehired the best workmen among its striking employees, but did not replace any of the men who helped to re-open the plant last October, after it had been shut down for nearly two months by the strike.

Westinghouse Business by Wireless

An interplant wireless communication service was formally opened on May 31 by the Westinghouse Electric and Manufacturing Co., with the establishing of communication between the East Pittsburgh plant and the Cleveland foundry. Besides the Cleveland and East Pittsburgh factories, the Springfield, Mass., works, and the Newark, N. J., works are being equipped with stations for the transacting of company business.

Business Items

The Phoenix Manufacturing Co., Eau Claire, Wis., is now promoting the manufacture of some special garage machine tools. The project is being conducted under the supervision of J. G. Worker, vice-president and general manager, and I. B. Roland, sales manager.

The Union Gear and Machine Co., Boston, Mass., has been purchased by C. W. Sayce and C. L. Pratt, who have been connected with the Boston Gear Works for many years. Mr. Horne, formerly owner of the Union Works, will still retain an active position under the new management.

The Spray Engineering Co., Boston, Mass., has moved its offices to 60 High St., in that city. The factory and shipping department will remain at the old address, 70 N. Washington St.

The Motch & Merryweather Machinery Co., of Cleveland, Ohio, has taken over the sales of the Gordon cam turning lathe, which is now being manufactured by the Willard Machine Tool Co., of Cincinnati, Ohio.

The Harrisburgh Corporation has been organized in Harrisburg, Pa., to manufacture the "Farmotor," a late model of tractor. The plant of the Harrisburg Foundry and Machinery Works has been secured and a board of directors has been chosen. Production will be started at once.

Stockholders of the Morgan Engineering Co., Alliance, Ohio, at a special meeting authorized the board of directors to increase the capital stock of the company from $3,000,000 to $5,000,000.

Stockholders of the Defiance Machine Works, Defiance, Ohio, have authorized an increase in the dividend rate, on preferred stock, from 7 to 8 per cent and $300,000 of preferred and $3,000,000 of common stock, will be offered to the public. The Defiance Machine Works, capitalized at $5,000,000, was organized several years ago by Peter Kettering. His sons C. H. and R. P. Kettering are president and vice-president respectively. The plant manufactures special wood working and metal working machinery.

Through the efforts of the Chamber of Commerce the "Little Giant" motor truck will be manufactured in Geneva, Ohio. The H. B. Young Motor Truck Co., of Euclid, Ohio, has bought the plant of the Geneva Canning Co. where the truck will be made.

The Central City Machine Co., Syracuse, N. Y., has moved its plant from 103 Decker St. to 121 Pearl St. An automobile cylinder reboring machine will be made as a stock product. No change has been made in the organization.

The Andover Machine Co., of Boston, Mass., has recently been organized and incorporated to engage in the manufacture of machinery. The capital stock of the concern is $120,000. Ivar L. Sjostrom, of North Andover, Mass., is president and treasurer, and Mr. Sjostrom, together with Clarence L. Newton and A. M. Nolan, are directors of the company.

The Reserve Co., of Boston, Mass., has recently been organized and incorporated under the laws of the Commonwealth of Massachusetts, to sell machinery, tools, etc. The officers are James H. Marshall, Brookline, Mass., president and treasurer; Winthrop O. Coffin, Brookline, Mass., and Morris Hudnut, Boston. These three also constitute the board of directors.

Automobile tools and parts will be manufactured by the Triangle Steel Products Co., of Michigan City, Ind., a newly organized concern. H. C. Jostes, C. A. Kurrash and L. J. Finske, all of Michigan City, organized the company with a capital stock of $150,000. The company plans to begin production this summer.

The Augur-Perry Co., of New Haven, Conn., has been incorporated with a capital stock of $50,000 to engage in the hardware and tool business at New Haven. The incorporators of the company are E. M. Augur, W. E. Perry, G. H. Bishop and J. H. Dockendorff, all of New Haven.

The Maxf Grinding Wheel Corporation, of Chester, Mass., and the Cortland Grinding Wheel Co., of Cortland, N. Y., have combined interests and the wheels of the two companies will be made at the Chester, Mass., plant in the future. The Cortland plant was destroyed by fire last November. The officials of both concerns will remain in their present capacities.

The Master Tool Co. has been organized under the laws of the State of Ohio, to manufacture a new line of pneumatic tools, and will specialize in the reclaiming of all types and makes of same. The officers of the company are: J. Nightingale, president; Charles F. Overly, vice-president and general manager; William Eckert, secretary-treasurer.

The headquarters and general engineering service and sales division of the Champion Engineering Co., manufacturer of electric traveling cranes, has been moved from Kenton to Columbus, Ohio. R. W. Valls is in charge of this office.

The Claypool Machine Co., Claypool, Ind., has been organized with a capital stock of $70,000. Directors named are D. W. Cripe, J. D. Cripe and W. E. Black.

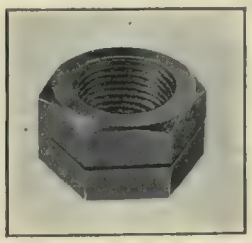
A Bentley and Sons, Toledo, Ohio, have been awarded the contract for installing the machinery in the Government coal station at Mobile, Ala.

The Empire Steel Partition Co. has been organized by a group of manufacturers at College Point, Long Island, N. Y. The company will build hollow steel extensible-type office partitions. Officers of the company are: W. C. Lange, president; H. W. Charmley, secretary-treasurer.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Locknut, "Non-con-cen-tric"
Sevigne Foundry and Machine Co., Nashua, N. H.
"American Machinist," March 24, 1921



This nut is made by cutting a slot partly through it in a plane parallel to the helix angle of the thread. The depth of the cut is so regulated as to pass completely across the hole, stopping at the thread on the further side and leaving the remainder of the nut uncut. The upper part of the nut is then slightly offset with relation to the lower part, the amount of the offset varying with the service to which the nut is to be put. The direction in which the offset is made is of importance, as the nut can be turned in the direction in which the offset is made with comparative ease, although offering resistance varying in accordance with the amount of the offset to a moment in the reverse direction.

Separator, Moisture, Stratton.
Griscom-Russell Co., 90 West St., New York, N. Y.
"American Machinist," March 24, 1921



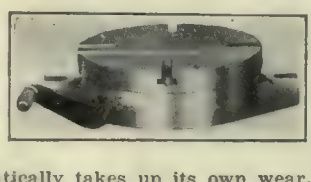
The separator is intended for use with either steam or compressed air. It is said that water is effectively removed from high-pressure steam entering an engine or turbine, regardless of the velocity and of the quantity of water present. The device is adapted also to the removal of water from compressed air. The collected water can be drained out when necessary from the sump in the bottom of the cylinder. The separator is built in four types, being made of either iron or steel, depending upon the pressure employed. The device is made to fit pipe lines from ¼ to 8 in. in diameter, the sizes below 2 in. having screwed connections and those above 2 in. having flanged connections.

Tapping Machine, Friction-Driven
Anderson Die Machine Co., Iranistan Ave., Bridgeport. Conn.
"American Machinist," March 24, 1921



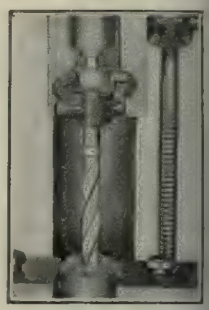
This machine is intended for use in tapping small parts such as those incident to the manufacture of electrical appliances. It is driven by a ½-hp. motor through the medium of an adjustable friction disk continuously in contact with two friction cones. The surface of the driving disk is shaped as a portion of a sphere, so that any deviation of the motor shaft from a horizontal position changes the relative speeds of the cones. In operation the spindle is lifted slightly by the pressure, bringing the upper friction surfaces together and revolving the tap. When the upward pressure is released by the operator, allowing the spindle to drop into contact with the lower friction disk, the tap is withdrawn at a higher rate of speed. The work can be presented to the tap by laying it on the table and raising the latter.

Table, Indexing
Industrial Engineering Co., 25 E. Fort St., Detroit, Mich.
"American Machinist," March 24, 1921



The device is made in two sizes, with table diameters of 10 and 16 in. A single movement of the handle indexes the table 180 deg. and clamps it to the base, no other movement by the operator being necessary for clamping the table. All working parts are of steel, hardened and ground. The indexing is controlled by a lock which automatically takes up its own wear, and which is claimed to be positive and fool-proof. A keyway is cut across the face of the table for use in aligning jigs or other fixtures, and T-slots are provided for bolting them in place.

Holder, Drill and Reamer, Self-Centering, W. B.
Woodall-Basch Tool Co., 450 Welting Block, Syracuse, N. Y.
"American Machinist," March 24, 1921



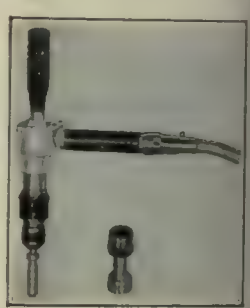
The device is intended for use upon drilling machines, lathes and screw machines, its purpose being to grip the drill or reamer so as to prevent it from turning in the spindle, as well as to center it. It consists of a sleeve having a head, through which a T-slot is milled at right-angles to the center line. This sleeve has a taper hole reamed in the head end, so as to receive a center point, upon which the rear end of the drill or reamer fits. Floating freely in the T-slot is a dog having an elongated hole, in which the shank of the drill is gripped by means of a setscrew. The holder can be furnished in two sizes, the No. 1 having a capacity up to 1-in. shanks and the No. 2 up to 2-in. shanks.

Clamp, Toolmaker's
M. B. Hill, 10 Eden St., Worcester, Mass.
"American Machinist," March 24, 1921



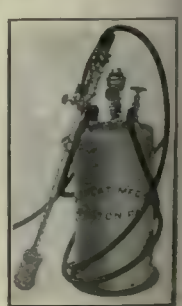
The jaws are pack-hardened and left in the natural color. The fulcrum screw is fixed in the outer jaw and slides loosely through the inner one, a knurled thumb-nut on this screw regulating the position of the inner jaw. The clamping screw is threaded through the inner jaw and bears in a socket in the outer jaw. A steadying pin is also fastened in the outer jaw, and sliding through a hole in the inner jaw, it prevents the latter from turning out of place. Two sizes are made, with 4- and 6-in. jaws respectively.

Screwdriver and Nut-setter, Power Driven, Flexible Shaft
N. A. Strand & Co., 549 W. Washington Blvd., Chicago, Ill.
"American Machinist," March 24, 1921



The appliance is used in connection with the standard type of motor drive and flexible power shaft made by the company. It is made in four sizes, Nos. 4, 5, 6 and 7, requiring motors of ¼ hp. for the two smaller units, a ½ to 1-hp. motor for the No. 6, and a 1 to 2-hp. for the No. 7. The device has two handles so that it can be easily controlled and can be used at any angle. An adjustable tapered friction device may be set by the knurled nut on the sleeve to drive the work with any desired maximum torque. The motor can be furnished mounted on either an iron stand or on a plain cast-iron base.

Burner, Oil
McKneat Manufacturing Co., Easton, Pa.
"American Machinist," March 24, 1921



The illustration shows the oil-burning device for general use in machine and repair shops, foundries and plants where compressed air is available. A vaporizing type also is made, for use where compressed air is not available. The compressed-air type will burn crude oil, fuel oil or kerosene, the fuels producing 1,800, 2,500 and 2,900 deg F. of heat, in the order named. The vaporizing type burns kerosene only. U. S. Standard 12- and 10-gage steel plates are used for the tanks, and all joints are electrically welded and subjected to a hydrostatic pressure of 225 lb. Electric steel castings are used for the back and front heads of the burner tip, which is removable and can be easily replaced.

Clip, paste on 3 x 5-in. cards and file as desired

The National Machinery Co., Tiffin, Ohio, has elected the following officers: M. Frost, president; Mrs. J. K. Rohn, vice-president; Earl Frost, secretary, and W. L. Hertzer, treasurer.

Newly chosen officers of the Boos Machine Co., St. Marys, Ohio, are: President, Louis Stout; vice-president, Albert Herzing, and secretary-treasurer, C. W. Schmehl.

The Carbon Hill Coal Co., of Terre Haute, Ind., has secured leases on a large acreage of Minshall coal, near Rosedale, and commenced sinking a mine last week. A complete coal mining plant will be installed, including tipple, machine shop, forge shop and other mechanical buildings, with power plant for general operations. This will make this mine one of the best equipped in this part of the state.

The Plainville Castings Co., Inc., of Plainville, Conn., is erecting a new iron foundry. General jobbing and contract work will be done. The incorporators are H. S. Washburne, C. F. Conlin and William Stewart.

The Hauck Manufacturing Co., of Brooklyn, N. Y., has elected Henry T. Gerdes as president. Other officers elected were M. C. Hauck, first vice-president; A. B. Hauck, second vice-president; H. H. Kress, third vice-president; A. H. Stein, treasurer, and J. Lutz, secretary. Mr. Gerdes was formerly manager of the Treadwell Engineering Co., of Easton, Pa.

The Meldrum-Gabrielson Corporation, Syracuse, N. Y., will erect a $300,000 factory in that city as soon as plans have been approved. The company manufactures special machinery and tools and in the new plant will take up the production of a heavy-duty milling machine, recently patented by Mr. Gabrielson.

The Steel Fabricating Corporation announces the removal of its factory and offices from Harvey, Ill., to the new plant at Michigan City, Ind.

The Parker Supply Co., Inc., New York City, has been reorganized and placed under the management of the J. G. White Management Corporation. At a recent meeting of the directors the following officers were elected: Walter Rautenstrauch, president; W. S. Bowen, vice-president and treasurer; D. L. Boyd, secretary and general manager. The company will continue its production of Parker sheet metal screws, punches and other specialties.

The growth of business in the Philadelphia district has necessitated the removal of the office and salesrooms of the Combustion Engineering Corporation, of New York, to more spacious quarters in the Finance Building, Philadelphia, Pa. W. C. Stripe is in charge of this office.

E. D. Morton & Co., Louisville, Ky., dealer in general factory and machine shop supplies, has added a machinery department and will carry a full line of machine tools.

The Davis-Bournonville Co., Jersey City, N. J., announces that hereafter all purchases will be made through the office of the works manager, under the direct supervision of H. H. Meixsell. Sales representatives will be interviewed only between the hours of 10:30 and 11:45 in the morning, and 1:20 and 2:30 in the afternoon, with no interviews on Saturdays.

The Repelarc Furnace Co. has been organized at Indianapolis, Ind., for the purpose of manufacturing furnaces and special machinery. The stockholders include E. E. Gates, R. L. Walker, S. W. Huls, N. C. Heuser and J. C. Ralston.

The Martell Packings Co., of Elyria, Ohio, recently completed arrangements whereby it will produce the line of turbine air tools being marketed by the Turbine Air Tool Co., of Cleveland. This line includes drills for wood and metal, grinders, wood planers and groovers, marble polishers, and sanding machines. D. S. Cole, formerly production manager of the Leece-Neville Co., is the general manager.

Personals

FRANKLIN G. HUBBARD, formerly master mechanic of the Western Electric Co., of Chicago, Ill., and more recently associated with the H. E. Harris Engineering Co. and Hubbard & Harris, consulting engineers of Bridgeport, Conn., is now president and mechanical engineer of the Lacey Manufacturing Co., Bridgeport, Conn., which makes a specialty of die and tool work.

J. G. KOEPPEL, formerly engineer for the Saulte Ste. Marie Bridge Co., Saulte Ste. Marie, Mich., has been granted a patent for a new automobile clutch which it is said will make the operation of a car safer and will greatly simplify control.

P. H. WITHINGTON, of Toledo, Ohio, president of the Sparks-Withington Co., has been made president of the Sterling-Knight Motor Co., which will produce a new model Knight six-cylinder car.

Obituary

ALEXIS I. DU PONT, secretary and director of E. I. Du Pont de Nemours & Co., died at his home in Wilmington, Del., on May 31. He was 52 years old.

FRANK H. WHEELER, president of the Wheeler-Schebler Carburetor Co., Indianapolis, Ind., committed suicide in his home on May 31. Despondency over long illness is given as the cause of the action.

WILLIAM A. KYTE, sales manager and member of the board of directors of the Foster Machine Co., Elkhart, Ind., died on May 24. He had been associated with the Foster company since 1905.

New Publications

Employment Methods. By Nathan W. Shefferman, 573 pp. 6 x 9 in. Illustrated by diagrams, drawings and sample forms. Published by the Ronald Press Co., New York City.

One of the thoroughly worth while developments of the stress and tribulation of war has been the growth of interest in and the understanding of employment management and the methods used therein. The author of this book has had a wide experience in his chosen field and is well qualified to talk of employment methods.

The book is divided into five parts, the first of which takes up the function and development of an employment department. Under this general head the author tells the reasons for the establishment of an employment department and its function. He also takes up the duties and qualifications of the employment manager. Part II is devoted to the problem of getting employees. Various types of forms are described as well as methods of interviewing and testing the applicant.

Under Part III, which is concerned with holding employees after they have been hired, the labor turnover problem is attacked from various angles. The different kinds of training for employees are analyzed, wages, transfers and promotions are considered, and absences and discharges are dealt with.

Part IV is headed, "Employing for Office, Store and Bank," and is devoted solely to the office end of employment management. Part V takes up the human element, which is to many people the principal reason for the existence of employment managers. It discusses service work, the medical department, industrial housing and employees' representation systems.

The whole subject is well handled and will give the progressive owner and manager not only a good deal to think about but many practical suggestions as well.

Training Industrial Workers. By Roy Wilmarth Kelly, 437 pp. 6 x 9 in. Illustrated by forms, tables and diagrams. Published by The Ronald Press Co., New York City.

The second of the three Ronald manuals of labor management, as its title implies, takes up the matter of educating and training industrial workers. An excellent introduction has been written by Professor John M. Brewer, of Harvard University, and we can hardly do better than quote a portion of his opinion of this book.

"'Why not try education?' is the question which must occur over and over again to one who studies the adjustments and readjustments of industry. The worker in shop or factory must be brought to see that only through increasing enlightenment represented by education will he be able to solve his life problems, increase his productive power and make progress toward full stature as a citizen.

"Putting industrial problems into the schools and putting education into the factory involve a high degree of co-operation among all the persons concerned. They must make contacts, get acquainted and learn from each other.

"Dr. Kelly's book is written to tell industrial managers and educational directors about the lessons which both school people and manufacturers have learned in shop and factory education, and to show how these lessons can be applied to particular establishments. He brings in review the successful accomplishments in vocational education, with the reasons for their success. He points out the need on the one hand for quick training in skill and on the other for the more fundamental education which shall give knowledge of the correct principles back of successful business and for the development of responsibility.

Whether the reader wants to find out the theory back of successful plans or the actual way to begin he will find his answer."

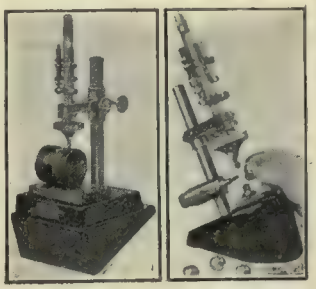
Labor Maintenance. By Daniel Bloomfield, 530 pp. 6 x 9 in. Illustrated by a few charts. Published by the Ronald Press Co., New York City.

This book is the third of the Ronald manuals of labor management. It takes up the principles of the various forms of service for employees, such as safety work, suggestion systems, recreation, housing, plant magazines, Americanization, financial aids, etc., and follows up each with numerous examples of actual experiences with the many different plans that have been tried.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Gage, Micrometer, Fluid, Prestometer, No 5.
The Coats Machine Tool Co., 110 West 40th St., New York, N. Y.
"American Machinist," March 24, 1921



The gage is shown in Fig. 1 equipped for the measuring of pistons. The instrument has a capacity up to 6½ in. and is suitable for marine, truck and tractor engine pistons exceeding 4½ in. in diameter. The total height with the arm in the uppermost position is 22 in., and the width of the cast-iron base 8¼ in. The instrument is equipped with both flat and slanting bases. The size of the surface plate is 6x4 in. The plunger pin is equipped with a detachable ⅛-in. ball. In Fig. 2 is shown the machine equipped with a micrometer, V-type backstop for use in the inspection of steel balls. Removable, loose steel-ball contact points touch the ball from above and below.

Adapter, Chuck, Draw-in
Phoenix Tool Co., 2 Remer St., Bridgeport, Conn.
"American Machinist," March 24, 1921



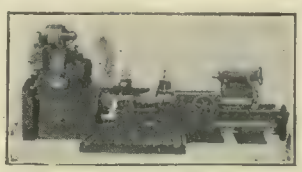
This self-contained adapter enables the using of spring or draw-in collets in the spindle of an engine lathe or milling machine without the necessity for a draw-bar or for a through hole in the spindle. The illustration shows the adapter disassembled, the parts in the foreground being milling cutters to be held by the device. The thread for drawing the collet is in the body of the adapter and the knurled ring has a pin fitting the spline in the collet, so that the latter may be closed or released by turning the ring. The adapter can be furnished to take any standard spring collet, and the shank can be fitted to any standard taper.

Dressing and Truing Machine, Grinding Wheel, Style 21
Precision Truing Machine and Tool Co., Cincinnati, Ohio
"American Machinist," March 24, 1921



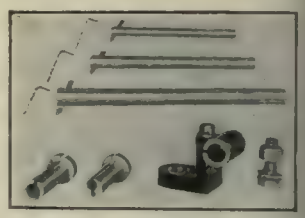
The device can be applied to any surface- or tool-grinding machine. It consists essentially of a spindle mounted on ball bearings and carrying a flywheel on one end, the whole being encased in an aluminum housing. On the other end of the spindle is mounted a small hard grinding wheel. To operate, the device is placed on the table of the grinding machine with the sides of the two wheels parallel. By bringing the faces of the wheels together while the grinding machine is running, the wheel of the device is made to revolve, and the action of the two wheels running together trues and dresses the grinding wheel.

Lathe, Gap, Geared-Head, 74-in.
Canada Machinery Corporation, Ltd., Galt, Ontario, Canada.
"American Machinist," March 24, 1921



The lathe is built with a 27-speed head, 18 of the speeds being obtained through the spindle and 9 through an internal gear on the faceplate. The speed changes are obtained by levers located on the head of the machine, the motor being mounted on top and driving to the head by means of steel and rawhide gears. A friction clutch is mounted in the gearing. The bed may be moved on its base by means of a rack and pinion, operated by a wrench at the rear of the machine. It is supported by a box leg. A thread-chasing dial for indicating the correct point for engaging the nut is mounted on the carriage. A compound pillar rest is provided, with an English toolpost mounted on the extended base. Weight, about 30,000 lb.

Tool Set, Boring, Lathe
Cascade Tool Co., 71 Washington Ave., Cohoes, N. Y.
"American Machinist," March 24, 1921



The illustration shows the standard set for 18-in. lathes, consisting of a holder, clamp bolt, two eccentric spring sleeves and three boring bars, ¾ in., 1 in. and 1¼ in. in diameter respectively. Each bar is fitted with a high-speed-steel bit. An advantage of the tool is said to be the offset in the holder, which can be swung around so as to enable the operator to turn the outside of work that cannot be reached with the ordinary tool. Sets can be furnished in any combination to suit the purchaser, and are made to fit any size of lathe.

Oil-Grooving Machine, "Sacrey"
Philadelphia Engineering and Machine Co., Philadelphia, Pa.
"American Machinist," March 24, 1921



The machine will cut practically every type of oil groove, including straight, cross, and right- or left-hand helical, on internal and external surfaces. The chuck, which is of the three-jawed scroll type, is attached to two upright steel posts at the top of the machine, and is adjustable up and down to accommodate various lengths of bushings or other work. Work up to 4½ in. in diameter may be held in the chuck body with no overhang, while work up to 6 in. in diameter can be mounted on top of the chuck or held in a special fixture. The stroke of the crank is adjustable from ⅛ to 7 in. Feeds are both by hand and automatic. Height, about 4 ft. Floor space, 24 in. in diameter. Net weight, 650 lb.

Drill, Post, Electric
Black & Decker Mfg. Co., 661 Liberty St., Baltimore, Md.
"American Machinist," March 24, 1921



The device adapts a standard portable electric drill to use as a drill press for heavy drilling or precision work. The vertical column or post is a steel shaft 1 7/16 in. in diameter and is clamped to the wall by means of brackets at the top and bottom. The device is adapted to the use of ¾-, ½-, 7/16-, ⅜- and ¼-in. portable electric drills, which can be quickly attached and detached. The table and the bracket carrying the drill can be raised, lowered or swung around on the post. A helical spring returns the drill to the top position when the feed lever is released. The feed lever gives a ratio of 6 to 1. The outfit is adapted to garages, wheelwright shops and general machine shops.

Boring Machine, Horizontal
Machinenfabrik Hinwil, Hinwil, Switzerland.
"American Machinist," March 24, 1921



The machine is intended for medium sized work. The spindle is 3 in. in diameter with a 28 in. length of power feed. It runs in tapered phosphor-bronze bushings, and is fitted with a faceplate having gear teeth and engaging with the single back gear. The back gear and the 4-step cone together give eight spindle speeds, ranging from 9.8 to 250 r.p.m. The boring bar has four power feeds obtained through a quick-change gear box. The work table has power-driven longitudinal, cross and vertical feeds. A safety device prevents the simultaneous engaging of the longitudinal and the cross feeds. Net weight, 6,100 lb.

Clip, paste on 3 x 5-in. cards and file as desired

Like the other two books in the series it gives practical suggestions as well as more or less theoretical discussions of the phases of the labor problem with which it concerns itself.

The author points out the experimental nature of most of the service work that has so far been done and states as his purpose the presentation of the experiences of others to protect the experimenter from the same pitfalls that they have encountered.

Elementary Machine Shop Practice. By James A. Pratt, M. E., director, Williamson Free School of Mechanical Trades. D. Van Nostrand Co., New York. 320 pp. 201 illustrations, 15 tables.

A text book covering the elementary fundamentals of machine-shop practice both as to bench and machine work. The book is well written and the instructions for doing the several classes of work are given with clearness and in detail. Even a layman, after perusal of this book, should have a pretty clear idea of the general way in which work is done in the ordinary machine shop. Diagrams of machines are given together with reference keys and the names of the parts. The contents includes chapters on the following: Bench work; Supplies and Miscellaneous Tools; Hardening and Tempering; Machine Adjustments; Equipment; General Tools; Lathe Tools; The Lathe Back Rest, Follow Rest, Compound Rest; Eccentric Turning; The Drilling Machine; The Shaper; The Slotting Machine; The Grinding Machine; The Milling Machine; Gearing; The Planer; Machine Shop Calculations; Machine Glossary; Course Outline.

Scientific Paper, No. 408. (Effect of the Rate of Cooling on the Magnetic and other properties of an annealed eutectoid carbon steel.) Bureau of Standards, Department of Commerce, Washton, D. C.

Specimens of a eutectoid carbon steel were cooled from 800 deg. C. in air, in lime, and at various rates in a furnace. The effect of these rates of cooling on the magnetic properties, viz., maximum and residual induction, coercive force, permeability, and the magnetic reluctivity relationship, also on the resistivity and scleroscope hardness are shown in tables graphically and their significance discussed. Micrographs illustrating the structure are presented. It is shown that the change in structure from an essentially sorbitic one to "divorced" pearlite causes a gradual shifting of the bend in the reluctivity line and a greater difference between the values of the "real" and "apparent" saturation intensities.

Anyone wishing a copy may have same by addressing a request to the Bureau.

Financial Engineering. By O. B. Goldman, Professor of Heat Engineering at the Oregon State Agricultural College. 271 pp. 6 x 9 in. Illustrated with diagrams and tables. Published by John Wiley & Sons, Inc., New York City.

Starting from the eminently sound proposition that technical engineering must be supplemented by financial engineering to make a complete harmonious system, the author proceeds to develop the theory and practice of the latter art. Although the book is primarily for the practicing engineer it has served admirably as a text book in several courses.

The subject is treated under eight chapter headings: Introduction; Cost Segregation; Fundamental Financial Considerations; Basic Costs; Vestances; Unit Cost Determination; Determination of Size of System for Best Financial Efficiency; Determination of Type and Size of Units.

Many practical examples of cost and efficiency determinations and numerous tables of useful figures for various units and combinations are given. The costs may be reduced to current values by dividing by the relative purchasing value of the dollar today as compared with the dollar of the date for which the figures are given.

Labor Legislation of 1919. Bureau of Labor Statistics, U. S. Department of Labor, Washington, D. C.; four hundred and nine 6 x 9-in. pages.

A general summary and review of labor legislation for the fiscal year ended Dec. 31, 1919. The subject matter covers a wide and varied field, giving some consideration to such matters as wages; hours of work; health and safety laws; insurance, pension and retirement funds; vocational training, and laws enacted to decide labor disputes. A large section of the book is devoted to a review of the individual laws passed by the several states, governing their own particular labor situations.

Pamphlets Received

Our New Place in World Trade: Guaranty Trust Co., New York City. A twenty-four page booklet containing an intelligent discussion of present American trade in foreign countries and a prospectus of the future. Several illustrations help to impress the reader with the ideas conveyed in the text.

Pittsburgh's Industrial Predominance: The Chamber of Commerce, Pittsburgh, Pa. A well-made-up brochure illustrated with several views of Pittsburgh's industrial and commercial centers as well as scenic beauty. The steel works of Pittsburgh, greatest in the world, are given much space, and various other industries are described at great length.

The Centrifugal Creamer: Engineering Foundation, 29 West 39th St., New York City. One of the "Research Narratives," five-minute stories published by Engineering Foundation as a means of stimulating interest in research work. This pamphlet takes up the discovery and eventual perfection of a machine for separating cream from milk by a centrifugal process.

Trade Catalogs

Grand Rapids Grinder Book. The Grand Rapids Grinding Machine Co., Grand Rapids, Mich. Catalog, 48 pages, 8¾ x 11¼ in. describing and illustrating a line of drill grinders, cutters and tool grinders, and tap grinders.

Flexible Shafts and Equipments. N. A. Strand Co., Chicago, Ill. A twenty-eight-page catalog, No. 21, 7½ x 10¾ in., describing and illustrating flexible shafts as manufactured by this company.

Portable Welding and Cutting Apparatus. Electric Arc Cutting and Welding Machine Co., 152 Jelliff Ave., Newark, N. J. A fifty-two-page illustrated catalog describing some particulars of portable cutting and welding machines, electrodes, supplies and accessories as manufactured by the above company.

C. H. Magnetic Chucks. The Cutler-Hammer Manufacturing Co., Milwaukee, Wis. A fourteen-page catalog describing and illustrating magnetic chucks, also giving the rating of chucks manufactured by the above company.

Grand Rapids Combination and Drill Grinder. Grand Rapids Grinding Machine Co., Grand Rapids, Mich. Circular 8½ x10¾ in. illustrating and describing the combination tap and drill grinding machines; also giving the specifications of same.

Economizer Drinking Fountains. Manufacturing Equipment and Engineering Co., Boston, Mass. A four-page circular illustrating and describing an economizer and drinking fountain having two sets of cooling coils; also a recent price list on all the company's drinking fountains, wash bowls, metal furniture, etc.

Wash Bowls and Lockers. Manufacturing Equipment and Engineering Co., Boston, Mass. A four-page circular describing and illustrating various types of wash bowls, storage cabinets and lockers made by the above concern.

Thor Portable Electric Drills. Independent Pneumatic Tool Co., 600 West Jackson Boulevard, Chicago., Ill. A four-page circular, No. 36, 3½ x 6¼ in., describing and illustrating the new Thor electric drill stand including complete specifications.

Davis-Bournonville Oxy-Acetylene Apparatus. Davis-Bournonville Co., Jersey City, N. J. A fifteen-page catalog 6 x 9 in., describing and illustrating acetylene generators, welding and cutting torches, pressure regulators, portable outfits and welding supplies.

Starrett Tools. The L. S. Starrett Co., Athol, Mass., Catalog No. 22, 5½ x 7½ in., three hundred and fifty pages describing a complete line of Starrett measuring tools and precision gaging instruments, including rules, protractors, steel tapes, squares, inclinometers, calipers, dial test indicators, micrometers, gages and many types of fixtures and attachments.

Kidd Efficiency Steels. Kidd Drawn Steel Co., Aliquippa, Pa. A 20 x 28-in. table showing the decimal equivalents of fractions of an inch and intermediate sizes of drill rods.

Hydraulic Wheel Presses. The Hydraulic Press Manufacturing Co., Mount Gilead, Ohio. Catalog No. 47 illustrating and describing, with full descriptions, a line of different types of wheel presses built by this company.

International Business Machines. International Time Recording Co., of New York, N. Y. A circular just issued describing a line of recording locks, autograph locks, and time recording clocks.

C-H Electric Apparatus. Cutler-Hammer Manufacturing Co., Milwaukee, Wis. A catalog combining several bulletins which contain dimensions with prices, of electric controlling apparatus. The pages are cut for fly-leaf folder and will fit a pocket-size notebook.

Sprague Ventilating Fans. Sprague Electric Works of General Electric Co., New York, N. Y. Two small folders describing several types of electric ventilating fans for stores, homes, factories and offices.

C-H Elevator Controllers. The Cutler-Hammer Manufacturing Co., Milwaukee, Wis. This booklet, containing 40 pages, describes and illustrates a line of elevator controllers and accessories, with tables giving motor, fuse and wire ratings.

Trucks. Hyatt Roller Bearing Co., 709 Sixth Ave. at 41st. St., New York, N. Y. This company gives a new truck report covering the advantages and methods of installation of Hyatt bearings for trucks of all kinds.

P & H Shovel Attachment. Pawling & Harnischfeger Co., Milwaukee, Wis. Pamphlets announcing the new shovel attachment for P & H types 205 and 206 excavator cranes.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A firm of ship repairers in France desires to purchase electric welding outfits, complete, from motor to welders' gloves and face protectors. Quotations should be given f.o.b. New York or c.i.f. French port. Cash to be paid. Correspondence should be in French. Reference No. 34908.

The purchase is desired by a firm in The Netherlands of equipment for factories in France, such as sugar mills, cotton mills, wood and steel working machinery. Quotations should be given c.i.f. port of northern France. Reference No. 34932.

A mercantile firm in Italy desires to purchase bronze valves, iron tubing and fittings, and iron plates. Quotations should be given c.i.f. Italian port. Reference No. 34913.

An inquiry has been received from a man in Jugoslavia for the purchase of several boring machines for petroleum, and also for about 80 miles of pipe line for gas transportation. Reference No. 34917.

Forthcoming Meetings

The 1921 annual meeting of the American Society for Testing Materials will be held at Asbury Park, N. J., on June 20 to 24, with headquarters at the New Monterey Hotel. C. L. Warwick, Engineers Club, Philadelphia, Pa., is secretary.

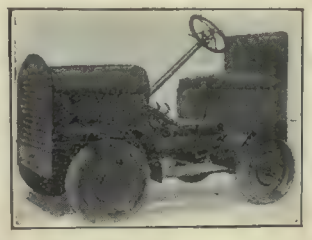
The eighth annual convention of the American Drop Forge Association and the Drop Forge Supply Association will be held at Chicago, Ill., June 22 to 24 with headquarters at the Congress Hotel.

The American Society for Steel Treating will hold its annual convention and exhibition at Indianapolis, Ind., on Sept. 19 to 24.

Condensed-Clipping Index of Equipment

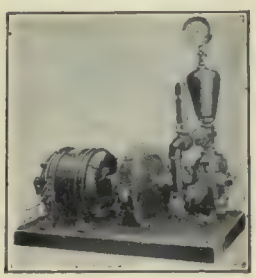
Patented Aug. 20, 1918

Tractor, Industrial, Gasoline
Reliance Trailer & Truck Co., San Francisco, Cal.
"American Machinist," March 24, 1921



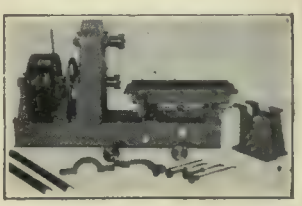
The machine is adapted to both pushing and towing. The wheels are equipped with Timken bearings, and the axles are said to be heavy enough to support a load of 2 tons. A heavy, perforated, steel bumper plate in front protects the radiator. The machine is provided with fenders, running boards, and an upholstered spring seat having a back. The tractor is 6 ft. 6 in. overall in length; 50 in. overall in width; has a 42-in. tread and a 50-in. wheel base. It can turn in a circle 12 ft. in diameter on the inside. The maximum running speed is 11 miles an hour. A five- to six-ton load can be towed by the machine, as built, and the ballast box under the seat can be filled with weights to increase the traction.

Pump, Oil, Rotary, Motor-Driven
S. F. Bowser & Co., Inc., Fort Wayne, Ind.
"American Machinist," March 24, 1921



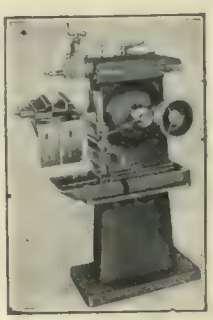
The pump is intended for transferring oil from one place to another, as unloading tank cars. The motor is connected to the pump by means of reduction gears of the herringbone type, the gear being cast iron and the pinion bakelite. The outfit is mounted upon a cast-iron base. The pump is of the rotary type, it being said that it contains only two moving parts, each part being self-supporting and having clearance around it, so that wear and friction are greatly eliminated. The device can be set to automatically by-pass when a predetermined pressure has been reached. The pump is made in seven sizes to fit pipe line from ¾ to 3 in. in diameter. The motors required are from ½ to 15 hp.

Burning-in-Machine, Universal
Canedy-Otto Mfg. Co., Chicago Heights, Chicago, Ill.
"American Machinist," March 24, 1921



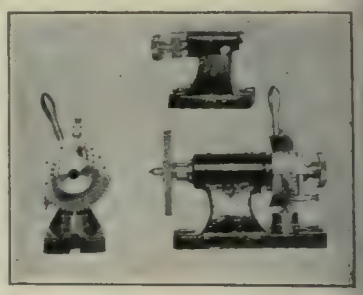
This burning-in and running-in machine is intended for use on automotive engine bearings. It is stated that the machine can be used for any type of motor. The table is raised and lowered by means of a single control. It is grooved and allows the motor clamps to be adjusted to the size of the motor. The center of the table serves as a sump or crankcase for the motor. The clutch is of a heavy toggle type, driving through a silent chain. It is said that the operation is so noiseless that the operator can test the timing of the motor or detect noises after the bearings have been run in. Twenty horsepower is sufficient to run the machine to its capacity under the most severe conditions and with the largest of motors.

Shaper, 9-in.
Carl Pletz & Sons, 3116 Spring Grove Ave., Cincinnati, Ohio
"American Machinist," March 24, 1921



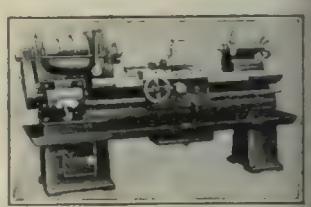
The machine can take cuts up to 9 in. in length, and is intended to handle small shaper work in the toolroom, die shop and experimental shop. It is particularly adapted to small keyseating work. The swivel table is of box section and secured to the saddle with four bolts. It can be swiveled on a horizontal axis to any angle, and a dowel pin locates it at zero. The vise is provided with hardened steel jaws, and it can be swiveled to any angle, the base being graduated. The drive is by a three-step cone pulley, which runs on a sleeve, thus taking the pull of the belt off the pinion shaft. The main bearing is bronze-bushed and provided with an oil reservoir. The shaper can be furnished either without the pedestal for bench use, or mounted on it, as shown.

Indexing Head, Rapid, "Lightning"
Geiras Manufacturing Co., Inc., 417 East 156th St., New York N. Y.
"American Machinist," March 24, 1921



It is stated that the head can be easily operated by one movement, in a fractional part of a second, from practically any position at the front or end of the milling machine. With nine index plates any division from 2 to 100 with the exception of prime numbers above 40 can be cut. There is no complete circle of holes, but only from to 2 to 5 holes in any one row. An adjustable arm on the plate end of the head is the key for the index plate and spindle, and it has a spring plunger at the end to set in the proper row of holes. A plunger on the base engages the notches on the edge of the plate. The standard device consists of an indexing head, the tailstock, driving plate, draw tube for collets and nine index plate. The swing is 12 inches.

Lathe, "Rapid Production," 16-in.
Oliver Machinery Co., Grand Rapids, Mich.
"American Machinist," March 24, 1921



The machine has been simplified over past models, so that it does not contain features not necessary for production work. It is very heavily constructed throughout, with the working parts well guarded. The headstock is driven by a wide belt on a three-step cone pulley. Each step of the cone is large in diameter, so that a powerful drive can be obtained. The large lever shown in front of the headstock operates the clutch for starting and stopping. The headstock can be furnished without back gears, with single back gears, or with double back gears. Four feeds are provided for the carriage through the quick-change gear box. The toolpost is mounted directly on the cross-slide, no swiveling slide being used.

Ladle, Crane, Teapot-Spout
Whiting Corporation, Harvey, Ill.
"American Machinist," March 24, 1921



The spout is formed by the lining, being reinforced by two channels. It is stated that, because of the good balance obtained, the trunnions can be placed nearer the center line of the bowl, thus insuring easier handling while pouring; and that the bowl of the ladle, being of one-piece riveted construction, has little tendency to warp out of shape from usage. The ladle is self-skimming. It may be used with either brick or ganister lining, the latter being somewhat easier to form. It is manufactured in twelve standard sizes, having capacities from 700 to 10,500 lb. of steel.

Drop Hammer, Steam, Quick-Acting
Massillon Foundry and Machine Co., Massillon, Ohio
"American Machinist," March 24, 1921



The hammer is built in sizes of 400, 600 and 800 lb. capacity, but other sizes can be built to meet special requirements. It can be operated by compressed air in place of steam, if so desired. The housings and base are steel castings and the cylinder is a semi-steel casting. The construction permits of the ready removal of damaged push-bolts. The guide-adjusting screws are threaded through nuts set in open pockets in the side housings.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Mass., New Bedford—G. G. Sylvia, 543 Union St.—repair equipment for garage.

Mass., East Boston—(Boston P. O.)—A. Limole, 32 Shelby St.—small repair equipment for garage.

R. I., Providence—H. Gladstein, 5 Ambrose St. repair equipment for garage.

R. I., Providence — A. J. Martin, 259 Plain St.—repair equipment for garage.

N. Y., Buffalo—The Houde Eng. Corp., 1392 West Ave., manufacture of automobile shock absorbers, A. B. Shultz, pres.—machinery for proposed factory, including lathes, etc.

N. Y., Buffalo—F. Wittmeyer, 2611 Seneca St. F. Wittmeyer, Purch. Agt.—small sash and door sticker.

N. Y., New York—Kleinert & Son, 920 Brook Ave.—two small punch presses, 1 small shaper, 1 small screw machine 1 in. bore, 1 milling machine dividing head.

N. Y., Coney Island — M. C. Illions & Sons, Carousell Wks.—18 in x 16 ft. engine lathe.

N. Y., New York—R. Gair, 350 Madison Ave., manufacturer of paper boxes, etc.—1 sensitive drill press

N. J., West New York—The Omar Co., 220 17th St.—Wells cutter grinder No. 160 and No. 162.

Va., Petersburg—L. J. Moore Hardware Co.—one bench lathe.

La., New Orleans—The Lemmon Bros., 1501 Esplanade Ave.—8 in. or 12 in. screw cutting bench lathe for a garage and a ⅜ stock electric drill, (used).

Pa., Frankford (Philadelphia P. O.)—The Pruyn Ball Bearing Wks., 4408 Paul St.—Four Baird-Warner silent, oblique, cast, octagonal tumbling barrels.

Wis., Milwaukee—Zwebell Bros., 482 Milwaukee St., A. R. Zwebell, Purch. Agt.—machine shop equipment including lathe.

Ill., Pesotum—The Bd. Educ., c/o C. W. Meneley, Clk.—manual training equipment for high school.

La., New Orleans—H. Messner, 824 Girod St.—electric drill, wrenches and woodworking tools for automobile repair shop, (new and used).

Mich., Menominee—The Lloyd Mfg. Co.—one automatic surface grinder and one automatic knife grinder.

Wis., Milwaukee — J. Broenen Co., 410 Madison St. — manufacturer of carriages, lathe and drill press.

Wis., Milwaukee—Amer. Metal Products Co., 671 Kinnickinnic Ave.—G. Staal, Purch. Agt.—lathes and drill presses

Wis., Milwaukee — Auto Mutual Service Co., 208 Palace Theatre Bldg.—A De Pierre, Purch. Agt.—lathe, drill press and grinders for garage and service station.

Wis., Milwaukee — The Nordstrom Vulcanizer Co., 2706 St. Paul Ave., C. Nordstrom, Purch Agt.—small lathe, 3 grinders and blacksmith shop equipment.

Ia., Davenport—G. A. Koester, 711 Perry St.—lathe, drill press and emery wheel.

S. D., Aberdeen—The Bd. Educ., c/o F. Swanson, Clk.—manual training equipment for high school.

S. D., Watertown—The Bd. Educ., c/o J. W. Dougherty, Pres.—machine shop and manual training equipment.

Que., Montreal — The Governors of the Catholic High School, 36 St. Catherine St. —$6,000 worth of equipment for manual training dept., etc.

Machinery Wanted

N. Y., New York—The Banner Silk Knitting Mills, Ralph St. and Grandview Ave., Brooklyn—One No. 306 B. Oster motor driven pipe machine.

La., New Orleans—H. Messner, 824 Girod St. woodworking machinery for automobile repair shop, (new and used).

La., New Orleans—S. J. Pitrie, 629 Baronne St.—equipment for vulcanizing automobile tires.

La., New Orleans — The Van Cleave Garage, 2547 Ursulines St., E. L. Van Cleave, Proprietor—One 3 wheel jack.

O., Cincinnati—The Globe Chemical Co., 727 Ridgeway Ave., F. C. Grote, Purch. Agt. —crusher and grinder to crush soda ash, capacity 500 lb. per hour and a pulverizing mill for Flour-spar to have 1,000 lb. per hour.

Wis., Eau Claire — E. Miller, 313 Eau Claire St.—excelsior making machinery.

Wis., Milwaukee—E. & W. Mfg. Co., 325 Oregon St. manufacturer of trailers and trucks—annealing ovens.

Wis., Milwaukee—Zwebell Bros., 482 Milwaukee St., A. R. Zwebell, Purch. Agt.—additional machinery for machine shop.

Que., Longueuil—E. Charron—complete equipment for sash and door factory.

Que., Quebec—The J. Tanquay Shoe Co., King St.—complete machinery for shoe manufacturing plant.

Metal Working

NEW ENGLAND STATES

Conn., Fairfield — The Porcupine Co., Wordin Ave., Bridgeport, will soon award the contract for the construction of a 1 story, 130 x 320 ft. plant for the manufacture of boilers, etc., on the Post Rd., here. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Consult. Engrs.

Conn., Hartford—Cohn & Feinsilber, 585 Prospect St., are having plans prepared for the construction of a 1 story, 50 x 90 ft. addition to garage. Estimated cost, $20,000. B. A. Sellew, 721 Main St., Archt.

Conn., Hartford—J. Tamburro, 6 Alden St., will build a 1 story garage on Weathersfield Ave. Estimated cost, $25,000.

Mass., Boston — Funk & Wilcox Co., Archts., 294 Washington St., will soon award the contract for the construction of a 6 story addition to garage for the Y.D. Service Garage, Inc., 341 Newbury St. Estimated cost, $600,000. Noted June 2.

Mass., Cambridge—The McKinley Motor Co., 215 River St., has awarded the contract for the construction of a 1 story, 50 x 100 ft. garage on River St. Estimated cost, $20,000.

Mass., East Boston—(Boston P. O.)—A. Limole, 32 Shelby St., will soon award the contract for the construction of a 1 story, 50 x 100 ft. garage on Princeton and Shelby Sts. Estimated cost, $15,000. S. S. Eisenberg, 46 Cornhill St., Boston, Archt.

Mass., New Bedford—G. G. Sylvia, 543 Union St., is having plans prepared for the construction of a 1 story, 80 x 100 ft. garage on James St. Estimated cost, $15,000. Private plans.

Mass., New Bedford — J. Telciano, 267 Allen St., is having plans prepared for the construction of a 1 story, 50 x 75 ft. garage. Estimated cost, $10,000. A. Lawrence, 1328 Rockdale Ave., Archt.

N. H., Berlin—The city has awarded the contract for the construction of a 1 story, 20 x 60 ft. garage and 1 story, 30 x 30 ft. blacksmith shop. Estimated cost, $15,000. Noted Feb. 3.

N. H., Berlin—M. J. Sutton has awarded the contract for altering a 2 story garage. Estimated cost, $20,000.

N. H., Charlestown—The Bowen Motor Power Co. is having new plans prepared for the construction of a 2 story, 57 x 165 ft. garage on Main St. Estimated cost, $80,000. G. W. Griffin, 72 North Main St., Concord, Archt. Noted April 15.

N. H., Nashua—F. H. Putman, Amherst and Broad Sts., has awarded the contract for the construction of a 1 story, 60 x 115 ft. garage and repair station on Amherst St. Estimated cost, $15,000.

THE WEEKLY PRICE GUIDE

This Week's Market

No change in copper. Tin has fluctuated greatly in the last week, going as low as 28¾c. per lb., in 25-ton lots. Zinc unchanged, but lead is off ¼c.

The market for shop supplies is very weak, and prices are useful only as a guide.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.50
Northern Basic	25.32
Southern Ohio No. 2	27.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	34.26
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	26.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	*25.00
CHICAGO	
No. 2 Foundry local	23.00
No. 2 Foundry, Southern, sil 2.25@2.75	28.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.46
Basic	23.96
Bessemer	25.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.23	$3.33	$3.09	$3.23
Soft steel bars	3.13	3.23	2.99	3.13
Soft steel bar shapes	3.13	3.23	3.48	3.13
Soft steel bands	4.18	4.28	6.25	
Tank plates	3.23	3.33	3.78	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	4.25	4.00	4.13
No. 12	3.15	4.30	4.05	4.18
No. 14	3.20	4.35	4.10	4.23
No. 16	3.30	4.45	4.20	4.33
Black				
Nos. 17 and 21	3.75	4.80	4.80	5.20
Nos. 22 and 24	3.85	4.85	4.85	5.25
No. 25 and 26	3.90	4.90	4.90	5.30
No. 28	4.00	5.00	5.00	5.40
Galvanized				
No. 10 and 11	4.00	4.75	5.00	5.70
No. 12 to 14	4.10	4.85	5.10	5.80
Nos. 17 and 21	4.40	5.15	5.40	6.10
Nos. 22 and 24	4.55	5.30	5.55	6.25
No. 26	4.70	5.45	5.70	6.30
No. 28	5.00	5.75	6.00	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$4.73	$4.63	$4.25
Flats, squares and hexagons, per 100 lb	5.23	4.63	4.75

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 3/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.50	8.00	8.25
Spring steel (light)	8.00	7.00	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.20
Hoop steel	3.64	3.69	3.83
Cold rolled strip steel	8.00	8.25	7.90
Floor plates	5.30	3.09@3.40	5.78

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of April 13, 1921:

BUTT WELD

Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
1 to 3	62½	50	⅛	33½	18½
			1 to 1½	35½	20½

LAP WELD

2	54½	41	2	30½	16½
2½ to 6	58½	45	2½ to 4	34½	22½
7 to 12	54½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	60½	49	1 to 1½	35½	21½
2 to 3	61½	50			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	52½	41	2	31½	18½
2½ to 4	56½	45	2½ to 4	34½	22½
4½ to 6	55½	44	4½ to 6	33½	21½
7 to 8	50½	37	7 to 8	24½	12½
9 to 12	45½	32	9 to 12	19½	7½

Malleable fittings, Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	14.25
Tin in 5-ton lots	30.25
Lead	5.25
Zinc	5.75
ST. LOUIS	
Lead	4.85
Zinc	5.35

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	21.75	22.50	23.50
Copper wire (carload lots)	15.75	17.50	20.00
Brass sheets	17.00	21.00	20.75
Brass pipe	20.75	24.00	24.50
Solder (half and half) (case lots)	24.00	23.50	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier. add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	15.00
Cleveland	18.00
Chicago	18.75

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	41
Electrolytic	43

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots..... 10.00

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.00
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	$10.00
Copper, heavy, and wire	9.00	9.50	9.00
Copper, light, and bottoms	8.00	8.00	8.00
Lead, heavy	3.25	4.00	3.75
Lead, tea	2.00	3.00	2.75
Brass, heavy	6.00	6.00	9.00
Brass, light	4.50	5.00	5.00
No. 1 yellow brass turnings	5.00	5.00	5.00
Zinc	3.00	3.00	3.50

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.4	25.50@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.75
Chicago	20.50
Cleveland	22.50

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	43.50	35.00
Commercial	30.00	15.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$2.00	1.60
Hot pressed hexagon	List	2.00	1.60
Cold punches hexagon	List	2.00	1.60
Cold punched square	List	2.00	1.60

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	50%
Cleveland	75–10%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50–10%	60–10%	50%
1¼ and 1½ in. by 3 in. up to 12 in	50%	50–5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $4.00 Chicago..... $4.00
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $3.75 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅜ by 6 in. and smaller	40%	50–10%	40%
Larger and longer up to 1 in. by 30 in.	40%	50%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	50%	60%	45%
Tinned	45%	60%	30%

Structural, ⅜, ½, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.65 Cleveland...$4.60 Chicago...$4.88 Pittsburgh...$3.70
Boiler, same sizes:
New York...$4.75 Cleveland...$4.70 Chicago...$4.98 Pittsburgh...$3.80

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	25.50
Brass	20.00	23.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼-2 in., inclusive in rounds, and ¼-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$7.00 per 100 lb.; New York price is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	9.00@12.00	12.50	14.25
Colored mixed	6.50@ 9.50	9.50	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$3.25@ $3.75
Prompt foundry	4.50@ 5.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.80	$0.88	$0.87
5-gal. cans	.83*	1.03	1.12

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

R. I., Providence—A. J. Finan, 83 Standiford St., plans to build a 1 story garage and service station on Plain St. Estimated cost, $30,000. Private plans.

R. I., Providence — H. Gladstein, 5 Ambrose St., will soon award the contract for the construction of a garage and service station on Shawmut and Kane Sts. Estimated cost, $20,000. Private plans.

R. I., Providence — B. Kauffman, 109 Bway., plans to build a 1 story garage and service station on Federal St. Estimated cost, $6,500.

R. I., Providence—R. E. Arter, 276 West Exchange St., will soon award the contract for the construction of a 1 story garage and service station to cover 18,000 sq.ft. of floor space on North Main and Frost Sts. Estimated cost, $75,000. C. H. Lockwood, 171 Westminister St., Archt. Noted June 9.

R. I., Providence—S. Bomes, 71 Farragut Ave., will build a 1 story garage and service station on Warrington St. Estimated cost, $30,000. Noted March 10.

R. I., Providence — A. J. Martin, 259 Plain St., plans to build a 1 story, 60 x 110 ft. garage and service station on Plain St. Estimated cost, $30,000. Private plans.

R. I., Providence—W. A. Mulry Co., 97 Empire St., has awarded the contract for the construction of a 1 story, 120 x 135 ft. garage and service station on Elmwood Ave. and Russell St. Estimated cost, $75,000. Noted April 21.

R. I., Providence—J. H. McElroy, 37 Tyndall Ave., plans to build a 1 story garage and service station on Broad and Corinth Sts. Estimated cost, $35,000. Private plans.

MIDDLE ATLANTIC STATES

N. Y., Brooklyn—Walzer Bros., 44 Court St., will build a 1 story, 100 x 175 ft. garage on North 8th St. Estimated cost, $50,000.

N. Y., Buffalo—The Houde Eng. Corp., 1392 West Ave., is having plans prepared for the construction of a 2 story, 37 x 100 ft. factory for the manufacture of auto shock absorbers on West Ave. Estimated cost, $18,000. G. W. Wolf, 1377 Main St., Buffalo, Archt.

N. Y., Long Island City—The Interstate Land Holding Co., c/o F. S. Parker, Archt. and Engr., 44 Court St., Brooklyn, has had plans prepared for the construction of a 2 story, 100 x 215 ft. service station on William and 12th Sts. Estimated cost, $100,000.

N. Y., New York—C. H. Burdett, c/o C. B. Meyers, Archt. and Engr., 1 Union Sq., is having plans prepared for the construction of a 2 story, 85 x 100 ft. garage, at 553 West 133d St. Estimated cost, $90,000.

N. Y., New York—I. Langer, 700 Trinity Ave., is having plans prepared for the construction of a 1 story, 100 x 160 ft. garage on Jumel Pl. near 167th St. Estimated cost, $50,000. Dunnigan & Crumley, 394 East 150th St., Archts. and Engrs.

N. Y., New York—S. Marer, c/o Dunnigan & Crumley, Archts. and Engrs., 294 East 150th St., is having plans prepared for the construction of a 2 story garage on University Ave. near 195th St. Estimated cost, $60,000.

N. Y., New York—L. H. Redner, 200 West 71st St., is having plans prepared for the construction of a 2 story garage at 327 West 69th St. Estimated cost, $100,000. C. B. Meyers, 31 Union Sq., Archt. and Engr.

Pa., Philadelphia — H. Shaprio, 2d and Oakland Aves., is having plans prepared for the construction of a coal trestle, office and garage. Estimated cost, $150,000. Clark & Dudnick, Drexel Bldg., Archts. and Engrs.

Pa., Pittsburgh—The Oliver Iron & Steel Wks., 10th and Muriel Sts., has awarded the contract for the construction of a 4 story, 60 x 120 ft. addition to its factory on 12th and Muriel Sts. Estimated cost, $125,000.

MIDDLE WEST STATES

Ind., Elkhart — The Haynes Realty Co. plans to build a 5 story, 80 x 110 ft. office and garage building. Estimated cost, $100,000. A. H. Elkhart & Son, Haynes Bldg., Archts.

Ind., Evansville — The Tri-State Motor Corp. plans to build a 3 story, 67 x 130 ft. garage and salesroom on 1st and Locust Sts. Estimated cost, $75,000. Shopbell & Co., Furniture Bldg., Archt.

Ind., Ft. Wayne—The Visible Pump Mfg. Co. has awarded the contract for the construction of a 2 story, 80 x 80 ft. factory and office building. Estimated cost, $75,000.

Ind., Indianapolis—The Amer. Valve & Tank Co. plans to build a 1 story, 50 x 150 ft. factory for the manufacture of valve and steel products on Mars Hill. Estimated cost, $30,000. Private plans.

Mich., Detroit — A. E. Harley, Archt., 2631 Woodward Ave., will soon award the contract for the construction of a 2 story, 110 x 125 ft. garage and service station on Grand River and Arcadia Aves., for Cross & Moore. Estimated cost, $125,000.

O., Dayton—The Platt Iron Wks. Co., Valley St., plans to build a 2 story factory for the manufacture of pumping equipment on Keowee and Valley Sts. Estimated cost, $60,000. Private plans.

O., Dayton—C. Sheffer Co., South Main St., has awarded the contract for the construction of a 1 and 2 story, 50 x 80 ft. dry cleaning plant including office building and garage on Main and Apple Sts. Estimated cost, $60,000.

STATES WEST OF THE MISSISSIPPI

Ia., Davenport—G. A. Koester, 741 Perry St., has awarded the contract for the construction of a 3 story, 64 x 150 ft. salesroom and garage on Grady St. between Front and 2d Sts. Estimated cost, $150,000.

Mo., St. Louis—O. J. Popp, Archt., Odd Fellows Bldg., will receive bids until June 23 for the construction of a 1 and 2 story, 100 x 150 ft. factory for the manufacture of wire on Chouteau and Spring Sts., for the Usona Mfg. Co., c/o F. C. Long, Pres., 826 South 18th St. Estimated cost, $75,000.

Mo., Trenton—The Chicago Rock Island & Pacific Ry. Co., La Salle St. Terminal, Chicago, Ill., has had preliminary plans prepared for the construction of a 1 story, 85 x 400 ft. car repair shop here. Estimated cost, $75,000. A. T. Hawk, Archt. Noted June 2.

General Manufacturing

NEW ENGLAND STATES

Conn., Bridgeport — The Nichols Underwear Corp., 23 Benham Ave., is having preliminary plans prepared for the construction of a 2 story, 50 x 100 ft. addition to its factory. Estimated cost, $50,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Archts. and Engrs.

Conn., East Windsor—(Warehouse Point P. O.)—The Apothecaries Hall Co., Wholesale Druggists, 63 Bank St., Waterbury, has awarded the contract for the construction of a 1 story, 65 x 140 ft. fertilizer plant. Estimated cost, $30,000. Noted June 9.

Conn., Norwalk—C. H. Harris, Inc., 136 West 24th St., New York City, has awarded the contract for the construction of a 1 story, 100 x 200 ft. factory for the manufacture of windshields and other glass products on Main St. Estimated cost, $75,000. Noted May 26.

Conn., Stafford Springs — The Warren Woolen Co. has awarded the contract for the construction of a 3 story, 48 x 59 ft. factory for the manufacture of woolen goods on Furnace Ave. Estimated cost, $26,000.

Mass., Northampton — The Northampton Hosiery Co., c/o W. C. Van Brunt, Treas., c/o New England Tire & Rubber Co., Holyoke, plans to remodel hosiery mill on Clark Ave. Estimated cost, $25,000. Private plans.

Mass., Somerville—(Boston P. O.)—The Winchester Mfg. Co., 12 Beacon St., has awarded the contract for the construction of a 2 story, 55 x 125 ft. factory for the manufacture of novelties on Beacon St. Estimated cost, $50,000. Noted June 2.

Mass., Springfield—The C. P. Chase Co., 68 Birnie Ave., will soon award the contract for the construction of a 1 story, 40 x 120 ft. lumber mill, etc. H. L. Sprague, 310 Main St., Archt.

Mass., Springfield—The C. P. Chase Co., 68 Birnie Ave., has awarded the contract for rebuilding a 1 story, 50 x 150 ft. lumber mill plant which was recently destroyed by fire. Estimated cost, $25,000.

MIDDLE ATLANTIC STATES

N. Y., Buffalo—The Hall Baking Co., 2381 Fillmore Ave., has awarded the contract for the construction of a 2 story, 50 x 102 ft. factory. Estimated cost, $60,000. Noted Feb. 17.

N. J., East Orange — C. B. Comstock, Engr., 110 West 40th St., New York City, will soon award the contract for the construction of a 3 story top and 5 story side addition to bakery here, for the Ward Baking Co., Southern Blvd., New York City.

SOUTHERN STATES

Fla., New Smyrna — J. N. McGaughey plans to build a 10 ton ice plant. Estimated cost, $25,000.

Fla., Wauchula—J. G. Fancy and Associates, Ft. Meade, plans to build an electric ice and cold storage plant, here. Estimated cost, $50,000.

MIDDLE WEST STATES

Ind., Indianapolis—The Bookwalter-Ball Co., Century Bldg., has awarded the contract for the construction of a 1 story, 60 x 208 ft. printing plant at 429 North Capitol Ave. Estimated cost, $30,000.

Ind., Princeton—The Hudson Baking Co. plans to build a 2 story, 60 x 130 ft. bakery, here. Estimated cost, $40,000. Fowler, Choppel & Troutman, Evansville, Archts.

Mich., Bay City—The Wildman Rubber Co., c/o J. C. McCabe, Secy., 316 Phoenix Bldg., has awarded the contract for the construction of a 3 story, 60 x 360 ft. tire factory. Estimated cost, $300,000.

Mich., Saginaw—The Booth & Boyd Lumbe Co., Baum and Holden Sts., is having plans prepared for the construction of a 1 story, 72 x 400 ft. woodworking factory. Estimated cost, $40,000. Cowles & Mutscheller, Chase Blk., Archts.

Wis., Haugen—The Haugen Box & Crating Co., c/o E. Brunett, plans to build a 3 story, 60 x 95 ft. box factory on Main St. Estimated cost, $40,000 Architect not selected.

Wis., Neenah—The Valley Paper Co., c/o W. F. Wolf, Pres., Appleton, plans to build a 60 x 120 ft. paper mill on Main St., here. Estimated cost, $100,000. Architect not selected.

STATES WEST OF THE MISSISSIPPI

Mo., Joplin—The Duplex Tire & Rubber Co., New Yates Hotel is having plans prepared for the construction of a 3 story, 100 x 300 ft. factory. Estimated cost, $150,000. R. W. Crissey, Pres. Osborn Eng. Co., 2848 Prospect Ave., Cleveland, O., Archt. and Engr. Noted June 2.

CANADA

Que., Quebec—The Canada Candy Mfg. Co., St. Dominique St., will receive bids until June 30 for the construction of a 3 story, 50 x 82 ft. factory. Estimated cost, $100,000. J. A. Caron, c/o Owner, Archt.

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Comparison of Various Types of Ball Bearings

Relation Between Over-all Width Tolerances and Radial Play Mathematically Demonstrated—Difference in Radial Play Before and After Mounting

By H. R. REYNOLDS and R. W. SELLEW
The Fafnir Bearing Co., New Britain, Conn.

WITHIN a comparatively short time a great deal of attention has been paid to the general subject of ball bearings. Several national engineering societies have appointed committees to work together in an attempt to obtain better standardization. A list of acceptable tolerances has already been prepared covering all of the external dimensions of a ball bearing, namely, the outside diameter, the bore, and the over-all width. Manufacturers and users have accepted these tolerances and have thereby improved the position of ball bearings quite appreciably. In addition to the above standard tolerances, many users of ball bearings are specifying definite limits of radial play.

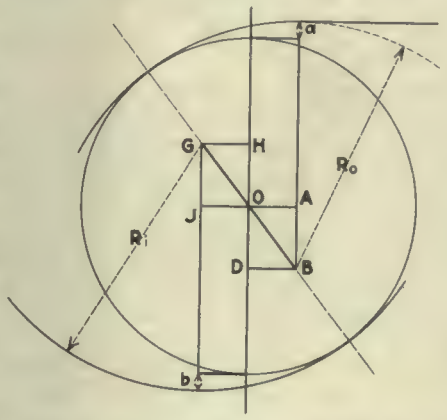


FIG. 2. PARTIAL SECTION OF CONE OR OPEN SIDE TYPE OF BEARING

From the remarks and mathematical proof further on in this article it will be seen that there is a definite relation between the over-all width tolerance and the radial play. To explain this more clearly it must be stated that the width tolerance is used in connection with the distance from one side of the outer ring to the opposite side of the inner ring. This is true only for the so-called open-side types of bearings. Fig. 1 shows the dimension on which the tolerance is used.

Proof of Relation Between Radial Play and Over-all Width Tolerances

It was stated above that there is a relation between radial play and over-all width tolerances. Before explaining the proof of this and determining a formula for the relationship let us define radial play. Radial play is the amount of shake or looseness between the inner and outer rings or raceways of a bearing in a direction at right-angles to the bore. In the diagram (Fig. 2) a partial cross-section of a cone or open-side type of bearing is shown. It is evident that as the radial play in this half of the bearing (the sum of the distances a and b) increases, the angle of contact also increases. Since points G and B are respectively the radii centers of the inner and outer races, if the angle increases there will be an increase in the axial distance between these centers. This axial distance is the sum of GH and DB. Any variation of this axial distance between centers results in a variation in the line-up of the two rings. This in turn results in a variation of the over-all width, due to the method of measuring this dimension as outlined above. In the ordinary type of radial bearing as shown in Fig. 3, this relative motion of the race centers is the end play. Thus we have a definite relationship, for any bearing, between the following three items, namely, the radial play, the end play, and the over-all width tolerance. It will be appreciated that an ambiguity results if a user specifies limits on more than one of these quantities at a time.

Development of Formula Showing the Relation of End Play to Radial Play

The formula giving the relation between end play and radial play is worked out below. This development is based on the specific conditions met in a cone type bearing. The translation of the result from one type to another is easily accomplished as will be explained.

In Fig. 2

$$(1) \qquad a = Ro - \frac{S}{2} - AB$$

$$(2) \qquad b = Ri - \frac{S}{2} - GJ$$

where,

Ro = outer ring race radius
Ri = inner ring race radius
S = ball diameter.

adding (1) and (2)

$$a + b = Ro + Ri - S - AB - GJ$$

$$\text{or, } AB + GJ = Ro + Ri - S - (a + b)$$

Let, $a + b = R = \frac{1}{2}$ the radial play.

$$(3) \quad \text{Then, } AB + GJ = Ro + Ri - S - R$$

$$(4) \quad \text{Also, } OB + OG = Ro - \frac{S}{2} + Ri - \frac{S}{2} = Ro + Ri - S$$

From the triangles, OGJ and OBD

$$(5) \quad (OB + OG)^2 = (AB + GJ)^2 + (DB + GH)^2$$

Let $DB + GH = E$ = axial displacement of race centers.

$\therefore$ From (5)

$$E = \sqrt{(OB + OG)^2 - (AB + GJ)^2}$$

substituting from (3) and (4)

$$E = \sqrt{(Ro + Ri - S)^2 - (Ro + Ri - S - R)^2}$$

Simplifying

$$E = \sqrt{2R(Ro + Ri - S) - R^2}$$

Since E is the axial displacement of race centers, in the above proof, we may obtain the end play of a radial bearing by multiplying E by two. This is necessary

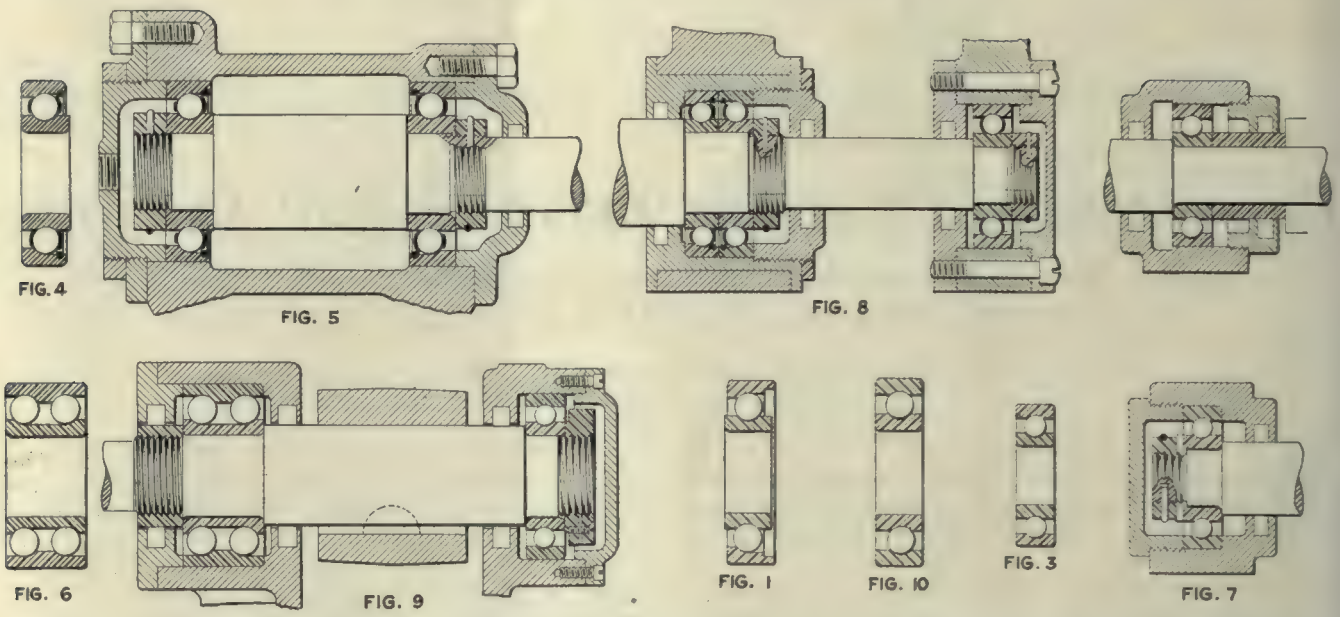


FIG. 1. WIDTH TOLERANCE ON OPEN SIDE TYPE OF BEARING. FIG. 3. ORDINARY TYPE OF RADIAL BEARING. FIG. 4. SINGLE ROW ANGULAR CONTACT TYPE OF BEARING. FIG. 5. ADJUSTABLE MOUNTING FOR BEARING SHOWN IN FIG. 4. FIG. 6. DOUBLE-ROW ANGULAR CONTACT TYPE OF BEARING. FIG. 7. USUAL METHOD OF MOUNTING RADIAL TYPE OF BEARING. FIG. 8. SAME CONSTRUCTION AS SHOWN IN FIG. 7, BUT USING THREE BEARINGS. FIG. 9. A SIMILAR MOUNTING TO THAT SHOWN IN FIG. 8, BUT HAVING LESS BULK. FIG. 10. THREE POINT CONTACT TYPE OF BEARING

because both the inner and the outer rings may be displaced to either side of the ball centers. Since R was used to represent only one-half of the radial play, care must be taken in the use of this factor, also.

To clarify the above let us work out a specific example. Consider a single row radial ball bearing having a measurable radial play of 0.002 in., a ball diameter of 0.375 in. ($\frac{3}{8}$-in.), an outer ring race radius of 0.217 in., and an inner ring race radius of 0.203 in.

Let us determine the end play from the above formula:

$$E = \sqrt{2R(Ro + Ri - S) - R^2}$$

from above.

$Ro = 0.217$

$Ri = 0.203$

$S = 0.375$

$R = 0.002 \div 2 = 0.001$

then,

$$E = \sqrt{2 \times 0.001\ (0.217 + 0.203 - 0.375) - (0.001)^2}$$

$$= \sqrt{0.002\ (0.045) - 0.000{,}001}$$

$$= \sqrt{0.000{,}090 - 0.000{,}001}$$

$$= \sqrt{0.000{,}089}$$

$$= 0.0094$$

Since E is only one-half of the total end play we have as a final result, twice 0.0094 in. or 0.0188 in.

The Effect of the Above on the User and the Manufacturer

It is apparent that if it is desirable to keep the end play down to small limits the radial play must be very small indeed. However, as pointed out in a recent article by one of the authors, the effect of too small an amount of radial play is a decided shortening in the life of the bearing. It is very necessary as a result of these facts that a user be very familiar with the subject before he attempts to specify either radial or end play. He must realize, for example, that there is a considerable expansion of the inner ring when it is forced over a shaft. This naturally reduces the radial play and under extreme conditions may cramp the bearing. To state it differently, the radial play of a bearing unmounted is entirely a different matter from the play in the same bearing after mounting. It is a very safe idea to get the recommendations of the bearing manufacturer before specifying limits for any but the external dimensions of a bearing.

Various Types of Bearings; The Combined Capacity Type

End play, which has been demonstrated, is also attended by radial play, and is in some types of bearings deliberately built in. In other types it is a defect. For instance, the so-called combined capacity type of bearings owe their ability to carry both thrust and radial loads to an angularity of ball contact with the grooves or races of the surrounding rings. This type of bearing appears, in cross-section, like the radial type shown in Fig. 3.

Single Row Angular Contact Type

A single row angular contact type of bearing is shown in Fig. 4. Here, as shown, the ball contact is not radial but at an angle with the axis of the shaft. This bearing requires an adjustable mounting as shown in Fig. 5, and requires considerable initial load to maintain the balls in proper contact with their races. This load, however, does not add to the load applied to the bearings due to the service requirements. In addition to this feature the ultimate load is carried by a majority of the balls instead of by only a few. This is made clear when we consider a radial type of bearing under purely radial load. As a maximum only one-half of the balls can be under load at the same time. Now consider a thrust bearing of the ordinary type under a purely thrust load. Here all of the balls are under load and each is taking its share. The angular contact type is virtually a direct combination of these two and, conse-

quently, the number of balls under load is somewhere in between one-half and all of them. For certain combinations of load this type is superior.

It may be stated, however, that conditions which demand such a bearing are seldom met. While it is well known that the greater the angle of contact the greater the thrust load capacity, still all so-called radial bearings instantly become angular contact upon the application of thrust and to such a degree as to be able to withstand the load satisfactorily. In connection with this, let us state a fact which is little realized, that a given radial bearing will last longer under a combination of thrust and radial load than under the same amount of radial load only.

The angular contact type is the only satisfactory bearing for use where dirt and corruption are present, since, due to its adjustable feature, it is possible to compensate for wear. Made of proper materials and well designed, it is an easily recognized big brother to the cup and cone bearing of earlier days. The perfect bearing of this type would be designed with the ball contact angle a resultant of the combined radial and thrust loads which would mean simply variations of radial or end play. As a final description of this type, let us say that it is simply a sloppy radial bearing.

Where only one bearing can be applied it is essential that either a double row angular contact or a single or double row radial type of bearing be used. The sloppy construction of the single row angular contact type would cause both end play and vibration.

The double row angular contact type, shown in Fig. 6, possesses all of the advantages of the single row series in that it can carry both radial and thrust loads. It also has the added advantage of being a unit and being capable of taking thrust from either side. It can be locked in position without danger of overload from initial adjustment. It has no slop or radial and end play and in such places where there are changes in temperature which would cause shaft expansion and contraction, due to these conditions, it stands alone.

Where smooth running with a minimum of friction and an absence of end play are prime requisites, as in machine tool and grinding spindles or other machine parts, these bearings, due to the fact that the initial load from adjustment, as in the case of the single row angular-contact type, is unnecessary, render much more efficient service.

This brings us to the discussion of the well-known radial type of bearing which we have referred to several times (Fig. 3). The usual method of mounting is illustrated in Fig. 7. Here if radial play is present, after mounting, it is immediately noticeable in spindle vibration. The standard limits of radial play to which most manufacturers hold their product minimizes this trouble. The particular mounting shown is the only one that satisfies the requirements of good practice. It will be noticed that one bearing is locked both ways to prevent end motion of the spindle, and that the other is free to float in its housing. This allows very nicely for any increase in shaft or housing length and prevents any possible cramping of either bearing. This construction is sometimes used with the single row angular contact type by using three bearings. A mounting of this sort is shown in Fig. 8. This is a bulkier arrangement than a similar mounting shown in Fig. 9. Here a unit double row angular contact type is used to answer the same purpose. The type discussed above (see Fig. 8) requires a special pair of bearings or else it is liable to destruction by too generous an adjustment, since the standard type has an outer ring narrower than the inner.

It may appear to some readers of this article that the three point contact type of bearing, shown in Fig. 10, is the preferred form. There are perhaps two good reasons for at first forming this opinion. First, it seems as if both radial and end play are practically eliminated, providing conditions are at all ideal. Second, there is a chance for considerable angularity of contact as indicated by the dotted line.

The end play, however, does exist, when we consider the inner ring, as does its accompanying radial play. If it did not exist to a degree great enough to allow the angularity of contact indicated, free or pure rolling motion would be hindered. On the other hand, if they (radial and end play) existed in too great an amount, pure rolling would again be lessened. From the above it will be seen that this nicety of fit is commercially impossible of achievement. This fact is demonstrated by the greater friction and shorter life of this type of bearing.

Is Superficial Training Satisfactory?

By W. K. Campbell

It is my personal observation that we are trying to make mechanics by other methods than the old basic principles as laid down by our forefathers, namely, the apprenticeship training.

A man is taken into our machine shops, and in many cases is taught how to run only one particular machine and then kept on that one machine indefinitely. To be sure he becomes a specialist on that machine, not because he is brainy, but in spite of himself. No wonder he is able to produce more than a man who might manipulate the same machine intermittently. After awhile the operator, from his association with his shopmates and due to environment and shop talk, conceives the idea that he is a machinist, leaves his job and seeks employment in another shop as a "machinist." He is engaged and his new foreman having learned his trade in the old-fashioned way, begins to wonder what manner of man he is if this new addition is a "machinist."

How different this is from our school system! First comes the primary grades (modern times precede this now with the kindergarten where they teach the letters and their sounds as well as their combination in words) then the grammer grades, the high school, then either the technical, academic school or college, and through all this time a general training and development of the mind to handle general subjects. Only after this training does one then attempt to specialize. True, after the first two years in technical school or college one may, to a certain degree, take up a line that will develop into a special line, but to complete a specialization they must do a great deal of post-graduate work, such as is done by our doctors, lawyers, etc., and if this method is essential in professional lines, why is it not just as essential in industrial lines?

Fortunate is that organization that has always adhered to the apprenticeship method, for they have developed a line of mechanics that will produce the goods, and no matter where they may roam they can not help but reflect credit on their Alma Mater.

I do not believe we can get along indefinitely on substitutes for fundamentals and I still think we must adhere to the thorough rather than the superficial training if we are to keep our place as the leader in the industrial world.

Another Method of Machining Connecting Rods

Unusual Methods and Fixtures—Facing Both Ends of a Boss at Once—Drilling Machine with Special Attachment—Boring Two Rods in One Operation

BY FRED H. COLVIN
Editor, *American Machinist*

MACHINING the connecting rods for the White motor involves the use of some interesting fixtures, and methods which are somewhat unusual. The rod and cap are forged in one piece, as can be seen at *A* in Fig. 2.

The first operation is the rough drilling of the holes in the substantial fixture shown, the ends of the rod being centered by forks operated by the handle *A*, Fig. 1. The strap *B* carries the adjusting screw *C* and the ring nut *D* adjusts the support for the small end of the rod so as to take care of the variations in the forging.

Next comes the rough facing of the bosses, this being done in the special fixture shown in Fig. 2. One of the rough bored rods is shown at *A*. The hook clamps *B* and *C* go over the rod and hold it in position. The stop *D* prevents the rod being fed down too far. The four rotary facing cutters are provided with pilots which enter the holes at each end and help to guide the cutters. These facing cutters are driven from the

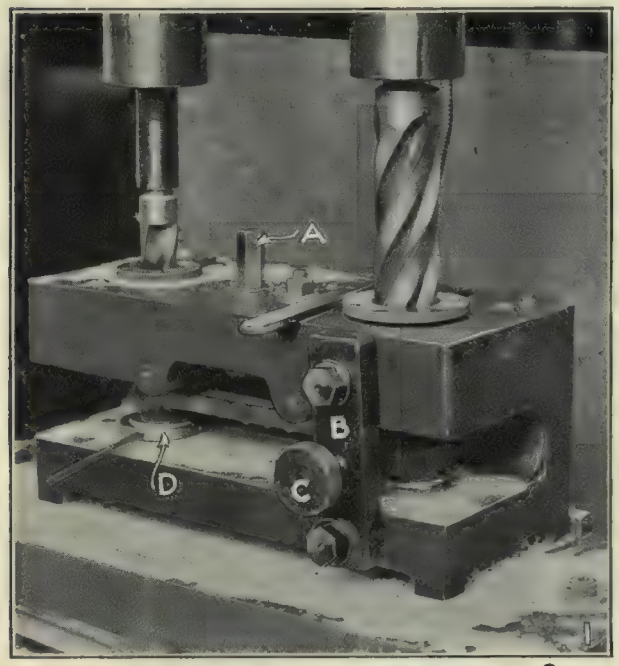


FIG. 1. ROUGH BORING BOLT HOLES.

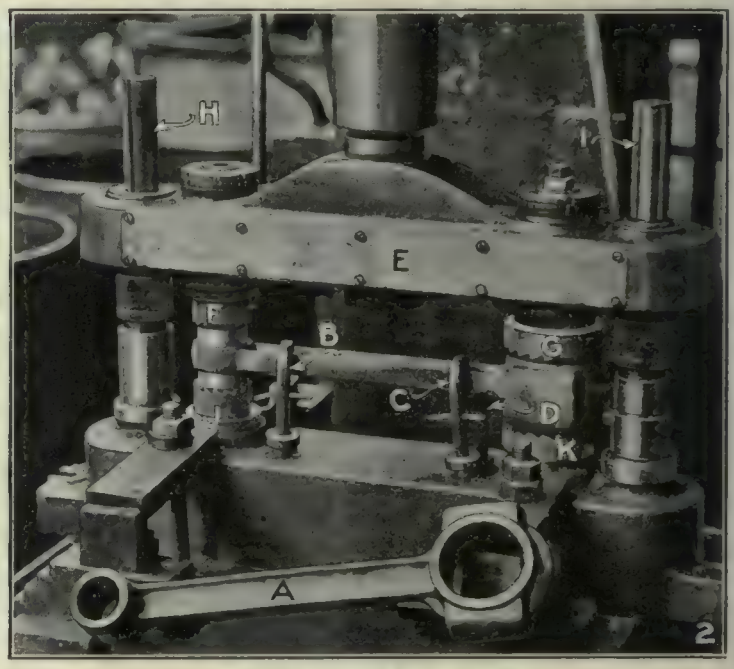


FIG. 2. FACING BOTH ENDS

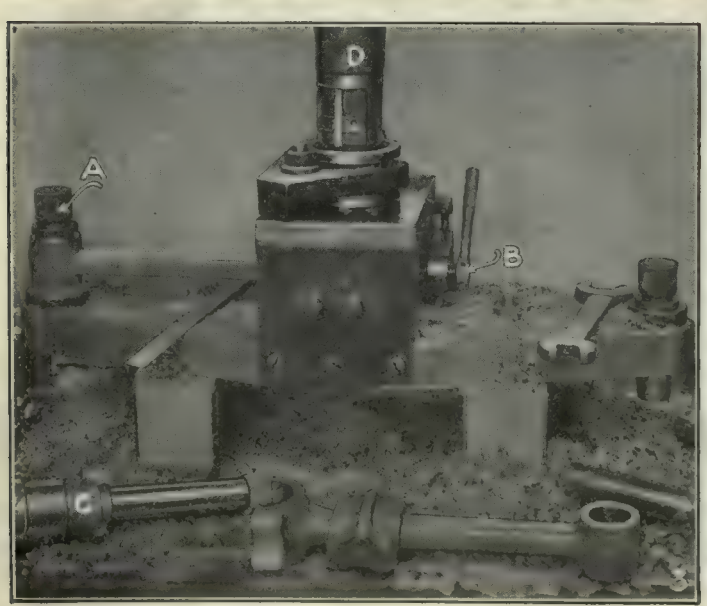


FIG. 3. FINISH BORING ROD AND CAP.

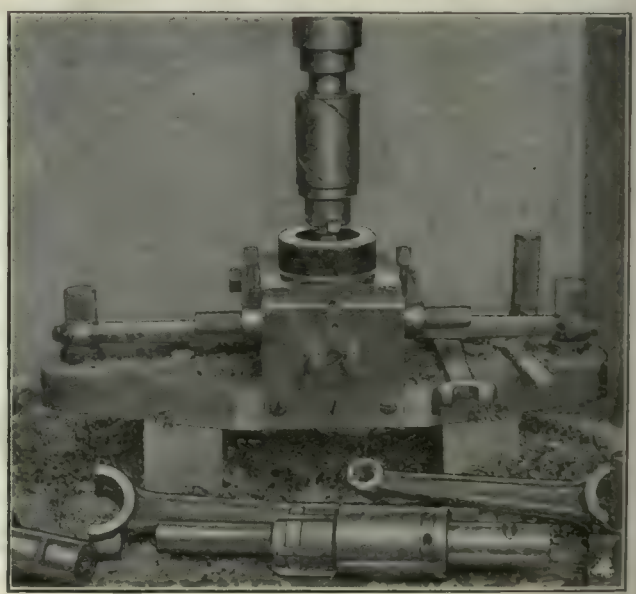


FIG. 4. FINISH BORING TWO RODS

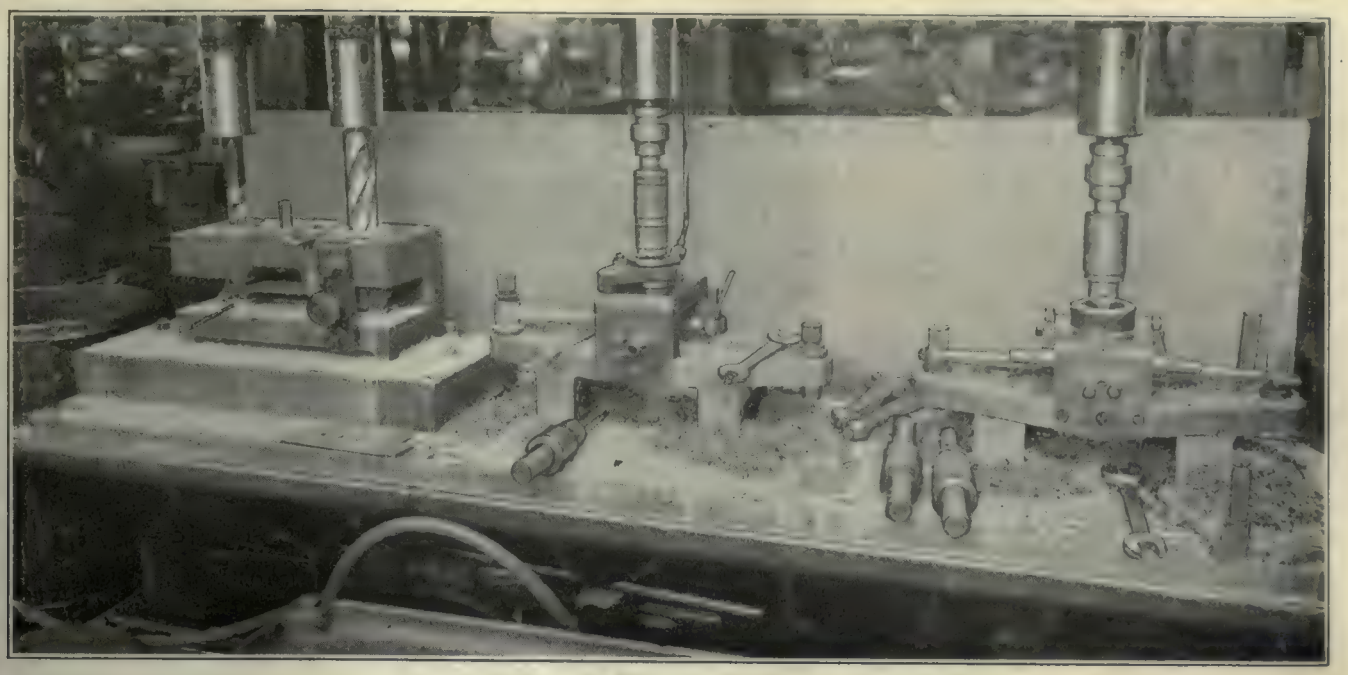


FIG. 5. THREE OPERATIONS ON ONE MACHINE

drilling machine spindle through gearing enclosed in the upper head *E*. The two upper cutters, *F* and *G*, are driven directly by this gearing while the lower cutters are driven by means of the splined shafts *A* and *I*, which in turn gear back to the lower facing cutters *J* and *K*. This device faces all four sides at one setting.

The caps are cut off with a thin saw or slitting cutter. Then the large ends of the rods are rebored in one of two ways, in the fixture shown in Fig. 3.

In the first case, the rod and cap are being bored together, the rod being located from the small hole by the pin *A*. The cap is held in position by a suitable clamp operated by the capstan-head screw at *B*. The rod and cap are then bored together using first a double ended cutter as at *C*, and then the inserted bladed reamer at *D*. These tools are both guided by suitable bushings in the lower part of the fixture.

Fig. 4 shows another method of using this same fixture. In this case, two connecting rods are bored instead of a rod and cap. The large ends of the rods are located by similar clamps as in the case of the bearing cap and the work proceeds in much the same way. It will be noted that in this case, the connecting rod is made to be split on the small end, while in the previous illustration it was a solid end rod. These rods are for different sizes of motors.

A sort of composite view of these operations is shown in Fig. 5, all being arranged on a four spindle drilling machine. The rough drilling is shown at the left, the rod and cap is being bored in the center and the two rods are being bored together at the right.

Draftsmen's Expectations

BY P. A. FREDERICKS

The accompanying chart shows in rather striking form the reasonable expectations of any young man who takes up drafting as a vocation.

The explanation is as follows: A boy of good qualifications, who is well adapted for drafting room work, should advance in ability according to the notes in the upper squares, though it will require hard work and outside study. If he does so advance, his worth (as represented by his salary should rise according to the curve which can be read against the index of percentages at the left.

Exceptional ability and exceptional hard work may show the higher or "mechanical engineer's curve." Lack of study will certainly show the lower or "lazy man's curve," and this in certain cases will also be the curve of the man totally unfitted. The reason for the lower salary of such a man will be that when he reaches for instance that tenth square in the year column, he will

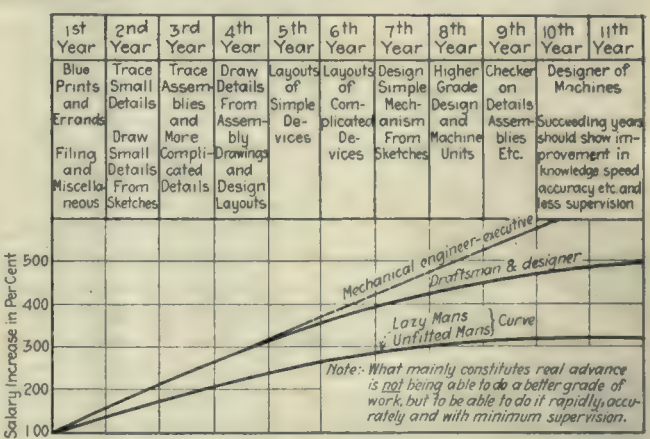


CHART SHOWING PROBABLE INCREASES IN PAY ACCORDING TO ABILITY AND SERVICE

be only in the fifth square in the ability curve and his salary will suffer accordingly.

To start in the lower left-hand corner a boy should: (1) Be adapted for drafting by inclination and ability. It is hard to state what qualifications are required with any exactness, but a reasonable aptitude in mathematics and a liking for mechanics must be included; (2) he should be reasonably quick and willing to be taught; (3) he must be ambitious and willing to study; (4) he should have some high school training, preferably have been graduated from high school, though it is not impossible to overcome a handicap in this direction if caused by anything other than dullness or stupidity in the branches of mathematics or similar subjects.

Methods Used in Locomotive Driving Wheel, Axle and Crankpin Work

Present Practice on Several Classes of Work in the Southern Pacific Shops —Allowance Required for Shrinking Tire on Driving Wheels

By FRANK A. STANLEY

AMONG other interesting features of the toolroom at the Sacramento shops of the Southern Pacific Co. are the gages for driving wheel centers and tires by which these parts are respectively turned and bored to give proper allowances for shrinking on the tires.

A set of such shop gages is shown in Fig. 1. These gages are regularly checked for accuracy by means of master gages, a set of which is shown in a heavy wooden case in Fig. 2. The master gages are made to the dimensions given below. The allowances for boring various sizes of tires for the desired shrinkages range as shown in the table for driving wheels from 45 to 84 in. nominal outside diameter.

pressure suffices to loosen the tire which is then slipped off.

The pressures used for forcing axles and crankpins into driving wheel hubs varies somewhat with different shops but probably a fair average is based upon not over eight tons' pressure per inch of diameter for axles forced into cast-iron wheels and ten tons' pressure per inch of diameter of fit where the axle is forced into cast-steel hubs. In some cases reported from important plants the pressures per inch of fit diameter have been considerably higher than the above, particularly with cast-steel hubs.

There are some interesting points connected with the pressing in and out of axles and crankpins. The

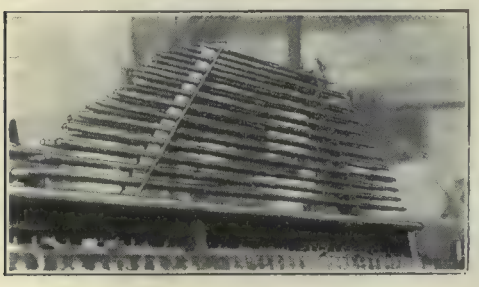
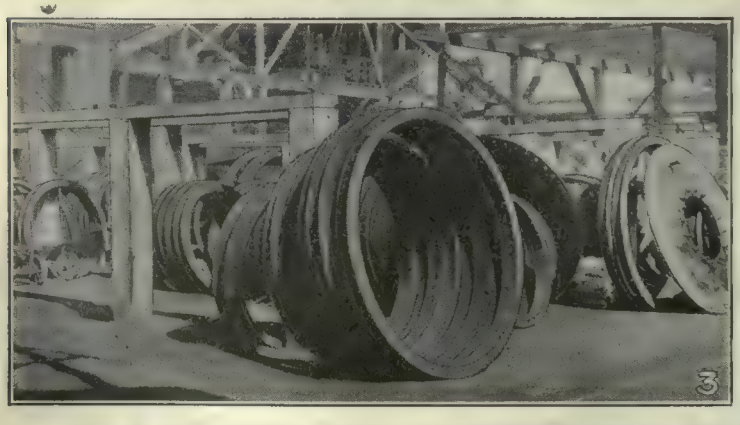




FIG. 1. SET OF ALLOWANCE GAGES FOR DRIVING WHEEL CENTERS AND TIRES. FIG. 2. MASTER GAGES

The general view, Fig. 3, illustrates the yard storage for driving wheel tires where each size is placed in a separate section of the storage space. In Fig. 4 a number of oil heater rings are shown hung up on racks for use on different sizes of tires. These use fuel oil and the method of application in the removing of tires from wheel centers is illustrated in Fig. 5. The pair of mounted wheels is picked up by the yard crane and placed upon a rigid support in the form of a fixed trestle; then the heater ring is brought into place around the tire and the oil jets from the perforated ring are ignited. A few minutes' application of the heat developed by the fine oil spray under air

character of the surface finish of the axle and the bore of the wheel has much to do with the total pressure required in forcing the two parts together, and the length of the fit is also a factor to be considered. The effect of the presence of the tire on the wheel is of interest in this connection. The shops referred to above remove tires before dismounting or mounting wheels. It has been found that a 10-in. axle which would press into the wheel hub under a total pressure of 120 tons (or ten tons per inch of fit diameter) when the tire was off, required 160 tons' pressure with the tire in place. In removing an axle of similar size it was found that 300 tons' pressure would not start



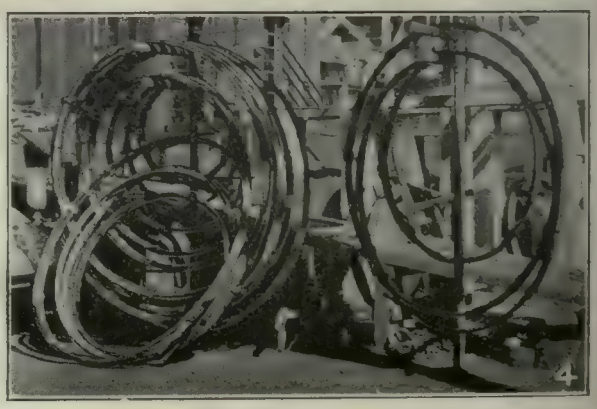


FIG. 3. AN ORDERLY YARD STORAGE SYSTEM FOR DRIVING WHEEL TIRES. FIG. 4. OIL HEATER RINGS FOR VARIOUS SIZES OF TIRES



FIG. 5. METHOD OF USING OIL HEATER RINGS FOR REMOVING TIRES

the axle with the tire in place. Similarly with crankpins, it is the practice to remove the tire before forcing out old pins or pressing in new ones.

Taking a number of driving wheels to be re-fitted with new pins it will be found that the holes in the crankpin boss on the wheels will vary $\frac{1}{64}$ in. in diameter or more and as a consequence each hole must be measured accurately with an inside micrometer for the sizing of the crankpin to give the necessary press fit allowance. From this measurement the outside micrometers may be set to size for the pin diameter.

The Use of the Rolling Tool in the Lathe

The burnishing tool or roller is commonly employed in railroad shops for such work as finishing axle journals, piston rods, crankpins, etc. An application of this kind to a crankpin is shown in Fig. 6. The pin is here shown gripped at one end in a four-jaw chuck while the other end is carried by the tail center of the lathe. The roller is seen in operation on the side rod bearing of the pin.

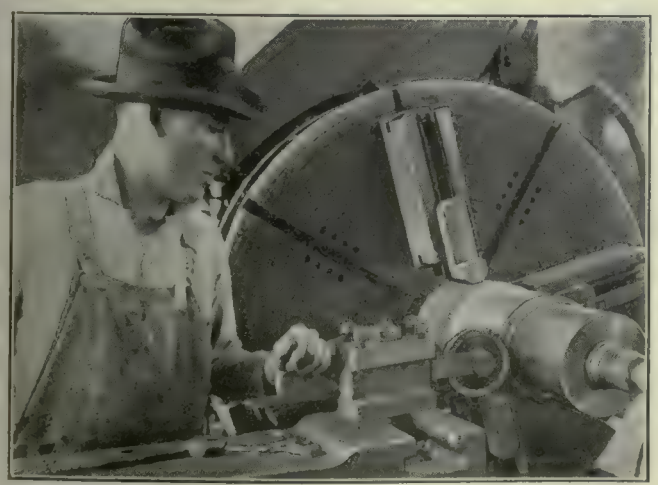


FIG. 6. ROLLER OR BURNISHING TOOL AND APPLICATION THEREOF

The burnishing tools or rollers are usually made up of a single roller in a heavy holder for the lathe toolpost. The speed of operation at this shop is somewhat higher than the cutting speed for turning and will run 75 to 90 ft. per minute depending upon the diameter of the crankpin. The amount of metal compressed is about 0.006 in. so that if the turning is smooth one passage of the roller is sufficient. Where $\frac{1}{32}$ in. of metal is left after turning the roller is fed across the work twice, with a feed of $\frac{1}{16}$ in. per revolution of the work.

The roller is 4 in. in diameter by $\frac{3}{4}$ in. face and is made of tool steel hardened and ground inside for the spindle bearing surface and ground outside for the working surface. It is provided with an oil hole and a channel for lubrication of the spindle bearing and the outside of the roller and the surface of the work are well oiled during the burnishing process. This type of roller forms a smooth surface. The metal is compressed to a tough burnished skin well suited to resisting wear and giving smooth operating conditions. There has long been discussion in railroad shops over the respective merits of the rolling and grinding processes for this kind of work. Many mechanics maintain that the burnished rolled surface gives the greater resistance to wear and smoother running conditions. On the other hand, advocates of grinding say that the abrasive process gives a more accurate surface and that after the pin has become worn in heavy service and it is again trued up by some form of turning machine, the original rolled surface is lost anyway.

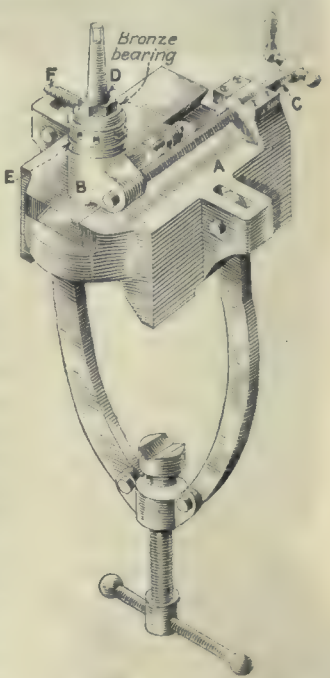


FIG. 7. PORTABLE KEYWAY CUTTERS FOR AXLES

The line drawing, Fig. 7, shows a portable device for milling the keyways for eccentrics on driving axles from 7 to 9½ in. in diameter. The frame *A* clamps over the axle and carries at the top a horizontal, sliding head *B* which is operated by handle and screw *C* to feed the end mill along the work in a path parallel to the axis of the axle. The spindle *D* for the end mill is adapted to be driven by an air motor. This spindle is mounted in a quill or sleeve *E* which is provided with a bronze bushing to form a bearing for the spindle. Sleeve *E*, which carries the cutter, is adjusted up and down in sliding head *B* by means of pin holes in the enlarged head at the upper end. The position of the sleeve and cutter as set for a given depth of cut is maintained by the clamp device *F* which is threaded internally to act as a locknut on the sleeve.

Dies for removing burrs from threads on crankpins are made of soft steel for the body. The bodies are made in halves, which are tongued together and secured by $\frac{5}{8}$-in. bolts and nuts. Each half of the body is provided with three radial slots cut $\frac{1}{4}$ in. wide x $\frac{3}{8}$ in. deep to receive the inserted chasers. The chasers are

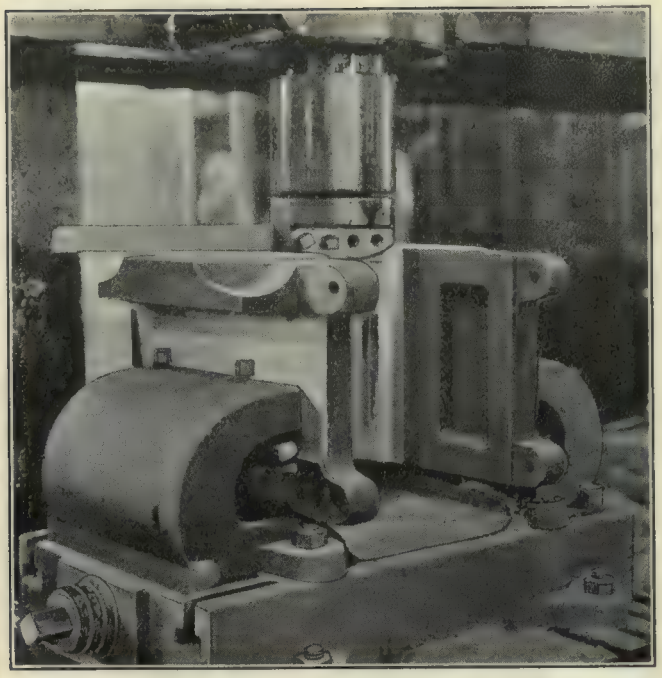


FIG. 8. FACING TOOL FOR DRIVING-BOX AND METHOD OF GRIPPING WORK WHILE TAKING A CUT OVER 10 IN. WIDE

$\frac{1}{4}$ x $\frac{1}{2}$ in. x $1\frac{3}{4}$ in. long. Two 1-in. x $13\frac{3}{4}$-in. handles are tapped in from opposite sides of the die body.

Driving Box Tool

The boring and facing of driving boxes at this shop is accomplished with a two-spindle machine, one spindle of which will be seen in Fig. 8. This shows the method of gripping the box in a two-jaw fixture which centers the work while boring out the brass. The long tool in the spindle chuck is seen in operation facing the broad lateral bearing which is babbitted into channels formed in the end of the box. The facing of the broad surface is done with the spindle running 65 r.p.m. After the face has been machined about to the desired thickness the spindle is stopped and then started again very slowly and allowed to make a couple of

SHRINKAGE ALLOWANCES FOR DRIVING WHEEL CENTERS AND TIRES

Nominal O.D., in In.	O.D. of Wheel Center	I.D. to to Bore Tire	Nearest Size in 64ths	Shrinkage Allowances
45	38	37.9603	37-31/32	0.0397
51	44	43.9505	43-61/64	0.0495
55	48	47.9500	47-61/64	0.0500
57	50	49.9406	49-15/16	0.0594
63	56	55.9308	55-59/64	0.0692
69	62	61.9209	61-59/64	0.0791
73	66	65.9144	65-29/32	0.0856
77	70	69.9078	69-29/32	0.0921
79	72	71.9045	71-29/32	0.0955
81	74	73.9012	73-29/32	0.0988
84	78	77.8947	77-59/64	0.1053

revolutions at a low speed to just scrape the surface and give it a smooth finish free from chatter marks. The length of the cutting portion of the facing tool is over 10 in. It has a slight clearance and a cutting lip is formed by making a half-round groove along the length of the cutting edge to give a keen cutting action.

The boring tool which machines the inside diameter of the brass is rotated at the same speed as the facing tool and is given a feed of $\frac{1}{32}$ in., two cuts being taken. About $\frac{1}{16}$ in. in depth is taken for the roughing cut and $\frac{1}{32}$ in. for finishing. The boring tool has a special guard which is made of sheet metal and has a hinged flap at the front. After the boring operation has been started the flap is dropped to inclose the work and tool and so prevent chips from flying. After the boring is completed the guard is lifted clear leaving the work as shown in Fig. 8. with the surface clear for the facing and corner rounding operations. The latter is accomplished with a tool like the boring cutter but having a liberal fillet to sweep out the corner of the brass to the desired radius.

Give a Man a Chance

By Ira E. Andrew

In the month of January, 1920, having recently been released from the Army I took the position as foreman of the tool department in a machine tool building plant where there was a force of about ten toolmakers. My first job was to make myself known to the men and to find out each man's ability and experience. I found by spending about a week's time with them that there were about five good men and two or three would need a good part of my time. I commenced by giving each man a chance at different work on fixtures and all around tool work, making it a point to tell him before giving him a fixture or tool to build, that I was there to instruct him and to help in every way I could on the difficult parts, such as figuring out angles, etc. Then I would give the man the prints and assembly drawing going over each detail and explaining it to him. By this method I found that several of the men had only operated a lathe or milling machine. Many of them could not lay off and bottom a job to save their souls.

In a short time I had every man on the job taught the operation of each machine and how to set up a job so that at the end of three months most of them could produce very close and accurate work.

I found by this method I had built up a good set of workmen for the concern and I found also that the men were more willing and were glad to do most anything I asked them to do. In a short time fellows that had only operated a lathe were able to do most anything and were drawing a larger pay than they had been able to do before.

I think if a few foremen I know would spend more time in helping the men under them they would find the men more capable and willing to help their foreman over hard jobs some day and be more valuable than lathe or milling machine hands.

"Give a man a chance; he is human like the rest of us" is my motto.

Identifying Steels

By John Homewood

In order that proper heat-treatment may be given to different kinds of steels, distinguishing marks of colors are placed upon the bar by various users. These usually consists of a color system that varies in different shops.

Each manufacturer of steel takes a certain pride in his particular grade and welcomes any effort to segregate it. It seems to the writer that the manufacturer could go a little farther and have his distinct symbol impressed upon the steel during its final rolling or by a separate operation. This identifying impression should extend throughout the length of the bar so that, no matter how small the piece, it could be recognized without the aid of tests.

This would protect the manufacturer of the steel and would be a great help to the user.



The Foreman and His Job

Suggestions for live foremen who wish to go up the ladder, and for firms who want better shop executives

By FRED H. COLVIN
Editor, American Machinist

FIRST impressions do much in forming opinions and have a direct bearing in the shop as well as elsewhere. The new man's treatment the first day in the shop can easily affect his attitude toward the men and the shop itself. It can enlist the man's best efforts or antagonize him, depending on the way he is received.

One of the best ways of considering such a problem is to put yourself in the place of the stranger who is coming in, and think how you would like to be treated under similar conditions. You would want to feel that you were welcome but it would be embarassing to have a great fuss made over you. You would not mind a joke at your expense, but it would set much better after you had become acquainted than it would the very first day you were there. You don't want to be either fussed over or neglected, but you do want to feel as soon as possible that you are one of the family and that you are not under suspicion of any kind.

Much of the feeling of strangeness which any man feels in a new job can be dispelled by a little thought and care on the part of the foreman and of the men. And in this the men are very apt to reflect the attitude of mind of those higher up. Much of the neglect of consideration for the new man however, comes from thoughtlessness, rather than any desire to be disagreeable or unfriendly. The average man means to play square but he is frequently unkind if not positively cruel, from a failure to appreciate the new man's point of view, an inability to put himself in the other man's shoes.

In shops where they consider men as "hands," or as sort of animated attachments for the machinery, practically no attention is paid to the new man. He is seldom welcomed in any way but is left to his own resources and made, quite unconsciously, to feel that he is an outsider. Such an attitude costs real money in lessened production and in the lack of interest which it creates. Just how much this amounts to is extremely difficult to say but there can be no question as to its having its effect.

Showing the Plant

A few shops go to the other extreme and send a new man with a guide to inspect the whole shop before he starts to work. He gets the atmosphere of the whole place, sees the kind of work that is being done and imbibes the spirit of the institution from the guide. He is shown the location of the hospital; the locker rooms, wash rooms, toilets, shower baths if there are any, and this attention gets him into the right spirit before he starts to work. When he finally lands in his department to begin work the foreman greets him pleasantly, introduces him to the other men and starts him at work with as little disturbance as possible.

Neither the foreman nor the men watch the new man very closely in this kind of a shop. We all know how nervous it makes many men to be under close scrutiny especially when the work, the machine and the surroundings are all new. Any instruction necessary is given as pleasantly as possible, suggestions are given as to the peculiarities of the work or of the machine and then, so far as possible, the new man is let alone. With this kind of treatment the new man does not hesitate to ask necessary questions, either of the foreman or of the men. With the proper spirit in the shop, and this must always be reflected from the management down, a new man will not be allowed to make many mistakes as the men will give him all the assistance possible. This greatly reduces the amount of spoiled work and consequently increases the output of the shop.



SHOWING THE NEW MAN OVER THE SHOP

There are, of course, many shops where it may not seem advisable to go to this extreme of conducting new men on a tour through every department. But it is much better to err on the side of paying too much attention rather than of not paying enough to get a man well started on the new job. The main thing is to make the man feel at home, to avoid the feeling of strangeness so far as possible. And when this comes from both the foreman and the men themselves, it adds more than we may think to the output of the department.

The least that can decently be done however is to send a messenger with the new man and introduce him

to his foreman in a human manner. It smoothes the way for future pleasant relations. There is no excuse for sending a new man wandering around by himself, trying to locate his foreman and his department.

No one expects or wants the men in any shop or any department to be angels and to refrain from a little harmless joking or "kidding" as it has come to be called. When joking is done in a friendly spirit it helps to smooth the serious spots in life which all encounter from time to time. But unpleasant hazing of the new man is a dangerous experiment in most cases, and does not add either to the harmony or to the output of the department.

If the shop has any special sort of system, and most shops have whether they always know it or not, it is time well spent in making clear to the new man just what his part in the plan is. He must know where he fits in if he is to merge into the organization without disturbing is equilibrium. If there is any special method of payment, any bonus system, any mutual aid or similar organization, he should know all about it before he starts in. The more he knows about the plant, assuming of course that it is really a good place to work, the more efficient he will be and the more valuable to himself and to you.

The Foreman's Influence

The foreman who has been loyal to his job and has never tried to put over anything which was not fair, can be a tremendous force for good in introducing any new plan or method, whether this be a question of wage payment or the introduction of a new machine. And in the ever changing problem of human relationship in and out of the shop, this is an important function.

Many new plans are being considered, a lot of them along very advanced lines which will go far to improving relations in many industries. Some of these plans include various kinds of bonuses; sometimes the purchase of stock; health and accident insurance; building or housing projects and similar plans. In all of these schemes, and many of them are good from every point of view, it is first necessary to "sell" the idea to the men, in other words to make them see its advantages so that they will *want* it rather than to have them *accept* it, perhaps under protest.

The first thing for a foreman to do is to study the proposed plan and convince himself that it is all that it is claimed, all that it appears. If any point is not clear, he should find out all about it. In other words he must first sell the idea to himself, must thoroughly believe in it, before he attempts to sell the plan to his men. He must remember that his reputation for honesty and square dealing is at stake, and that this is far more important than any job can be. Under no circumstances must he do anything which might lose the confidence which is reposed in him.

If it is a question of a bonus plan or piece-rate, he must be prepared to hear both sides, to discuss both sides of the question with the utmost frankness and show in every way that he means to play fair, clear down to the last detail. Any foreman who has established a reputation for fairness in such matters will find that he can wield a big influence for good along many lines, and make himself more valuable by so doing

For his own guidance in judging the merits of such cases it is well for the foreman to consider carefully some of the outstanding traits of human character. Even if some of his experiences have made him pessimistic he should remember that the average man plays the game squarely, as he sees it, else we couldn't do business on a credit system as we do. On the other hand he must remember that mighty few men are so constituted that they can look at things in quite the same light when they have no financial interest at stake. This does not by any means imply dishonesty, but the risk of something in the way of money gives almost any man a keener sense of responsibility which it is very difficult to get in any other way.



GIVING THE NEW PLAN THE "ONCE-OVER"

It may be used as a principle that men will take more interest in anything in which they are financially interested. And this applies equally to bonuses for work done, to athletic and other associations, to insurance, etc. And it is not entirely on account of the amount of money involved but rather because a feeling of responsibility has been aroused.

This factor may also be utilized in extending the self-governing principle in the shop, by making the actions of the group affect the individuals which comprise it in some definite and concrete manner. One of the simplest examples of this is the use of the group or gang bonus, which makes the bonus that comes to each man depend upon the ouput of the group or gang rather than solely on the efforts of the individual. Some object to this principle as subordinating the individual effort. But it is not the work done by any one man in a group that counts, but rather the amount of completed and finished product that brings the money into the treasury.

Every Man a Sub-foreman

The great beauty of the group bonus idea, without regard as to the details with which it is worked out, is that it tends to make the group self governing and removes much of the "bossing" function of the foreman. Where the bonus or extra reward depends on the combined efforts of the whole group, every man in it becomes a sub-foreman and does all in his power to prevent anyone falling down on the job. If there is any good reason for a man falling behind with his work the rest of the gang will pitch in and help him out. But if it is a case of loafing on the job, there will be no need for the boss to fire him. The men will attend to that.



THE WAY THE MEN HAND OUT THE BLUE ENVELOPE

This same principle can be applied to many phases of shop government, and it has its good points. It is the same in the case of sick benefits from a mutual aid society of any kind, where the men pay all or part of

the dues. The men themselves can be depended upon to prevent any malingering, or playing off in order to collect dues for sick benefits.

In the same way some shops plan to have the men take a hand in the deciding of piece-rates, in methods of doing new jobs and in the hiring and firing of men. This may sound like handing the shop management over to the men but it isn't so much so as it may seem. And it makes all decisions a part of the day's work with the men. When some of their own number have a hand in making decisions as to rates, etc., there is little excuse to find fault with them.

One of the large department stores in Boston, Filenes, has worked out a rather interesting development of this method in connection with the discharge of any of the working force. If the men or women discharged feel that they have not had a square deal, they can enter a protest and ask for a hearing before a committee. They can be represented by any counsel they desire. The committee decides as to the justice of the discharge and its decision is final. *And every member of the committee is an employee.*

This might sound dangerous, but it has been in use for a number of years to the satisfaction of both sides. A noted jurist who examined much of the evidence brought before this committee, considers that the decisions have, on the whole, been as fair as could be expected in any court of justice.

Some Features of Forced Lubrication

SPECIAL CORRESPONDENCE

The problem of lubrication is of vital importance to the life and satisfactory performance of any machine. This is particularly true in the case of high-speed machinery and the experience of the automobile engineer, driver and mechanic has a direct bearing on the subject.

The use of high-speed, heavy-duty motors has practically compelled the use of forced-feed lubrication by means of the hollow crankshaft. Even the lower priced motors have been forced to this method in some cases. But the practice differs widely both as to the manner of handling the flow of oil and the kind of bearings used on the pins and shaft.

In theory the oil under pressure should form and maintain an oil film between the bearing surfaces. And in the most carefully built motors there is a definite allowance or clearance between these surfaces to be occupied by the oil. This allowance varies from 0.0015 to 0.0025 in., and with heavy oil pressure this allowance does not produce a loose bearing. Without it the bearing must be practically metal to metal to avoid a knock or pound.

The maintenance of this oil film under various running conditions is something of a problem owing to the varying expansion of the different metals used. But its existence must be a reality when we learn of motors which have run over 150,000 miles before it became necessary to take up the bearings.

Just where and how to introduce the oil to the bearing is another problem. In the case of crankpin bearings, it is found best to drill the oil hole in the pin at such an angle to the throw as will feed the oil to that part of the bearing which is at the least pressure, or at least not to feed at the point which will be up when the piston receives either the compression or the explosion of the fuel.

The question of grooves in the bearing is also under dispute. Some of the best motors not only omit oil grooves of all kinds but have no space at the joint between cap and rod. This is accomplished either by omitting all shims or by using shims with a babbitt face and boring them with the rod so as to present an unbroken surface to the pin and the oil film.

IMPORTANCE OF END CLEARANCE

End clearance in a bearing must also be considered. It must be large enough at its highest temperature to allow sufficient oil to flow to keep the bearing cool. On some motors this flow of oil is sometimes four or five times the capacity of the crankcase per minute. In one case, with a normal supply of 1½ gal. in the crankcase, the maximum oil flow is 6 to 8 gal. per minute when the motor is under severe load.

The importance of this end clearance was demonstrated at some tests of aluminum connecting rods in a racing-car motor. The pin bore directly in the aluminum rod and the first rods failed because the ends of the bearing had expanded lengthwise, shut off the oil flow and seized the shoulders at the end of the pin. By allowing sufficient end clearance it was found that an oil film of practically constant thickness could be maintained at any temperature. The increasing heat expands the bearing diameter of the rod, and if the metal can flow endwise, the bearing will maintain its oil film.

Another important point is the dissipation of heat generated by the revolving pin or shaft. Large shafts are desirable to avoid springing and "whipping" but they can only be kept cool enough to run by maintaining a constantly flowing oil film and also by paying proper attention to the bearings themselves.

Here again racing-motor practice and experience has been of great value. It is stated that no motor can live through a 500-mile race with bearing shells in the rods unless extreme precaution is taken. In many racing motors the bearing metal is cast into the rod, perferably under pressure. Some use a shell bearing but solder it into the rod, first tinning the rod.

Where bushings or shells are not soldered in place, extreme care is taken to be sure that they have a full, smooth bearing in the rod and that no dirt or even oil gets on these surfaces. Racing-motor mechanics are very particular to clean their hands thoroughly before putting the shells in place. Then they clean the rod and bearing in gasoline, let this evaporate and put the shell solidly in place immediately.

All this precaution is to insure maximum radiation or transference of heat through the rod. The rod with the bearing cast or soldered into place is considered the best for long runs and heavy duty.

In some high-grade motors the main bearings are poured into a cast-iron or steel shell so as to insure an expansion in the bearing which more nearly equals that of the shaft itself than where bronze is used. The great object is to maintain an oil film of constant thickness and of a volume which bears a direct relation to the work being done by the motor.

The effect of these studies and experiments has been to greatly increase the life and reliability of motors. Can we apply some of these lessons to similar conditions in machine-tool work? We lack the heat due to the burning of fuel in the internal-combustion motor, but we do get heat from various sources, such as electric motors. How far can we use pressure lubrication on machine tools to advantage?

A History of Post-War Crises—II

The Period from 1860 to the World War—The Effects of War on Finance and Industry—A Summary of Post-War Booms and Crises

By H. H. MANCHESTER

WHILE it is perfectly evident that in the post-war crises considered thus far, there have appeared similar features so regularly as to become almost monotonous, it might be argued that the underlying industrial systems then were so different that the periods reviewed furnish no analogy to the present. But we shall find the same common features reappearing in the crises since 1860. This suggests that the course of these events depends more upon human psychology, which always remains the same, than it does upon the methods of industry.

If this is true the argument from analogy between the past and the present is merely taking it for granted that mankind in general will act very much the same in the near future as it has in the past in a similar series of events.

The English Crisis of 1866

In 1866 in England, there was a severe crisis which may be laid to the over-speculation caused by the Civil War in America, and the Seven Weeks' War in Europe between Prussia and Austria. The crisis seems to have come on unexpectedly. "During the early part of the year," according to the "Annual Register," "it was commonly asserted that trade was healthy," though the "Register" stated that the crisis which followed, "was the inevitable reaction from the speculative mania and inflated commercial transactions of the preceding year, which had launched so many shallow and fallacious schemes upon the world."

In April a speculative railway failed, and on the tenth of May, "the stoppage of the great discount establishment of Overend & Gurney produced universal consternation. . . . No single bankruptcy perhaps, ever caused so great a shock to credit. The following day produced the wildest agitation which has ever been known in the city, and the government was compelled, as in 1847 and 1857, to authorize the Bank of England to issue notes beyond the legal limit. . . . The rate of 10 per cent discount lasted from the eleventh of May to the seventeenth of August. . . . For some months after the panic, English credit fell into entire disrepute on the continent."

The principal cause of the crisis was probably the rapid expansion of trade unsecured by the provision of an adequate pecuniary reserve.

The period required for recovery in which we are especially interested, may be traced in the reviews of the time.

Of 1867 the "Annual Register" said, "The financial collapse continued with little abatement throughout the year. Commerce and credit did not display their wonted elasticity in recovering from such disorder." The *London Times* of Jan. 1, 1868, declared: "The war in Germany precipitated a break-up of all the general financial speculations of Europe . . . railway revelations have since spread ruin where all parties thought themselves secure."

Concerning 1868 the "Annual Register" declared: "The commercial depression which has lasted since the spring of 1866 still continues to be felt." The *London Times*, however, said that there had been "an uninterrupted though slow recovery of trade."

Even in 1869, times seem to have been scarcely normal, for the *London Economist* stated: "The return to financial and commercial activity during the year which has just passed over our heads, has been slow." This is evident from the record of price changes in England. On 31 important articles with the prices of 1860 considered as 100, those of 1866 were 133, those of 1867 were 115, and those of 1868 were 99. It was not until 1869 that prices began to rise again, then reaching 105.

In the United States the years immediately following the Civil War showed ups and downs but no crisis.

Of 1865, in April of which the war closed, Dun's annual circular declared: "The year which has just closed, taken as a whole, has been one of remarkable prosperity in all commercial pursuits." Concerning 1866, the year of the English panic, Dun's circular said: "It may be safely said of 1866, never before was there less money realized from a volume of trade of the same extent. . . . Generally speaking, manufacturers have produced more than the demand of the market, and importers have imported largely in excess of their requirements. . . . With the return of peace the tendency toward undue credit transactions is again becoming apparent and it is much to be feared that the excessive stocks both of manufactured and imported goods have recently caused an expansion in this direction which if persisted in may result disastrously."

Failures and Liabilities

1865	530	17,625,000
1866	632	47,433,000
1867	2,386	86,218,000
1868	2,197	57,275,000

Prices with those of 1860 considered as 100 were in greenbacks, 217 for 1865, 191 for 1866, and 172 for 1867. Wages in the meantime were in greenbacks, 143 for 1865, 152 for 1866, and 158 for 1867.

It is clear from the evidence given above, that there was nothing in the United States in the first few years after the Civil War, which could really be called a crisis—nothing at all comparable to the English crisis of 1866.

The nearest approach to a panic in this period in the United States, was the Black Friday which took place Sept. 24, 1869. This resulted from an attempt to corner gold by Jay Gould and James Fiske. At first this was apparently successful. Gold advanced on Thursday from 137 to 144, and on Friday to 162. The Government then offered to sell four millions, which broke the corner, and reduced the premium on gold to 133. The panic, however, left some fifty failures in its wake. Since those who were boosting gold did it on the strength of the irredeemability of the greenbacks, the breaking of the corner was a triumph for those who believed in the ability of the Government eventually to redeem its promises. In other words it was a victory for the optimists as against the pessimists.

The crisis of 1873 may be considered a delayed explosion resulting from the over-activity and speculation which followed the Civil War, but it must be kept in mind that the first manifestations of this crisis were in Europe, and in Austria and Germany were the result of the wild stock jobbing which followed the Franco-Prussian War.

The first sign of the panic occurred in Vienna. In the five years before 1873 state concessions had been given to more than a thousand corporations with a capitalization of one and one-half billion dollars. The corporation form of business was just being introduced and was being developed to an extreme. Failures began in Vienna the last of April, and on May 10 occurred a panic which soon spread all over Austria. Committees of assistance were formed in all the principal towns, which guaranteed funds to those worthy of credit and did considerable good, but the panic had gone too far to be stopped in Austria or for that matter in Europe.

Effects of Franco-Prussian War on Germany

The next country to feel its effects was Germany. The quick winning of the war against France had produced the greatest commercial, as well as political enthusiasm in Germany. According to the *Bankers' Magazine* of London, "When these inflated notions were culminating, French milliards were poured into the German treasury. With these funds the most extravagant notions of wealth and of future progress took possession of the new empire . . . and almost immediately a violent fever of excitements began."

Another contemporary review likewise laid the source of the trouble to the indemnity: "Anomolous as such a proposition appears at first sight, the payment of the French indemnity has been the leading stimulus of the enormous amount of unsound financial enterprises which have been started in Germany. . . . Endless banking, finance, and other companies were floated; the most glowing prospects were everywhere held out; the wildest adventures were eagerly patronized in the general rush for gain."

The first important German city to be affected was Frankfort; then Hamburg and Berlin. In some cases bank shares dropped over 80 per cent, while the stocks of 34 companies declined about 70 per cent. The general collapse lasted two months and affected the whole country, while the depression which followed lasted several years.

Conditions in America Prior to 1872

In spite of a fall in prices after the Civil War, there is no doubt that times continued very good in the United States until 1872. Manufactures in the United States were more than twice as much in 1870 as ten years before, while New York bank clearings were almost three times as much. The Civil War had shown the tremendous importance of railroads, and especially of connecting the Pacific Coast with the East. The Homestead Act of 1862 helped greatly to settle the West and gave another impetus to the building of railroads. Altogether the railroad mileage increased from 35,000 in 1865 to 53,000 in 1870, and to more than 72,000 in 1873, an increase of over 100 per cent in eight years.

In 1873, however, when the financial panic abroad led to a more rigid examination of American enterprises it began to be realized that while the new American railraods would eventually pay it would be a number of years before they could yield a dividend. Investors in Amsterdam, Hamburg, and other northern European cities who had invested heavily in American securities, were compelled by the panic there to throw them on the market and this helped to spread the crisis to America.

From the description in the *Bankers' Magazine*, the crisis here burst suddenly:

"On Saturday, Sept. 13, Wall Street was startled by the failure of Kenyon, Cox & Co., bankers. This house was regarded as among the strongest, but having made large advances to the Canada Southern R.R. Co., was unable to meet its engagements. A decline in the price of stocks followed and much uneasiness ensued. . . .

"On Thursday morning, the eighteenth . . . when it was reported that the well-known firm of Jay Cooke & Co. had suspended, the excitement became intense. . . . The cause assigned is their large investments in railroad bonds, particularly those of the Northern Pacific." Many suspensions followed, and at noon Saturday the twentieth, the stock exchange was closed until further notice.

The effect of the panic of 1873, probably because the boom which it burst was very widely extended, endured longer than usual and developed into several years of hard times.

An indication of how slowly conditions improved is given by the statistics on failures. In 1872 these mounted to $121,000,000, in 1873 to $228,000,000, almost twice as much, and while they dropped to $155,000,000 in 1874, they rose again to $202,000,000 in 1875.

Prices in gold which had reached their peak in 1866 had dropped gradually until 1869 and then risen again until 1872. From this date they dropped steadily until 1879 when they reached a point somewhat below the 1860 level. Wages in gold reached their highest point in 1872, which was 50 per cent above the level of 1860, and then dropped gradually until 1876, when they were still 35 per cent above the 1860 level.

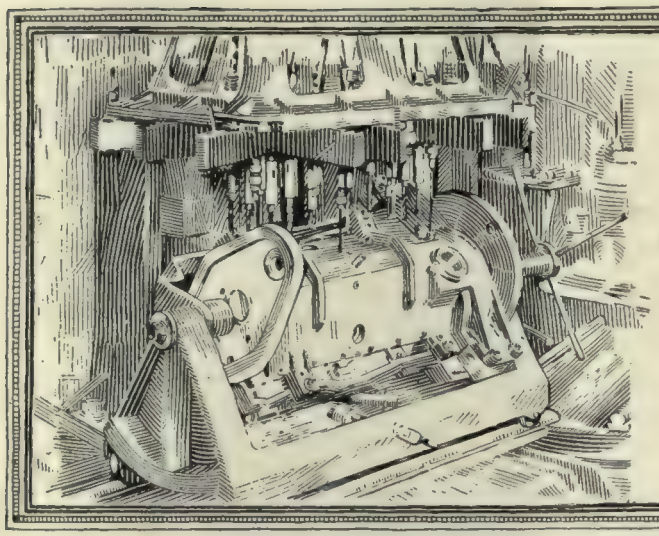
Post-War Booms and Crises Regular Occurences

In order to apply the data we have gathered thus far to the present situation, it is best to summarize the general principles discovered. The most obvious fact is that all of the big wars for the past five hundred years have been followed by boom times that have almost inevitably been short and in most cases have led to some sort of crisis, or at least to a sudden fall in prices which have returned more or less nearly to the pre-war level.

The reason for this seems to be that during the war there is naturally a concentration of production on war supplies and a restriction in non-war fields. When the war is ended, although the production of munitions ceases, the peace industries leap forward in a sudden reaction which carries prices to heights that cannot be maintained. The market is usually over-estimated and a drop follows which puts industry back to nearly a pre-war level.

In almost every case the boom has started a year or two after the war, has lasted for a year or so, and then broken. The subsequent fall in prices has not taken longer than between one and two years; after which conditions became normal once more. The fall in prices at the end of the boom has frequently been more severe than necessary—in other words, after a severe disturbance the pendulum always swings too far.

Wages in contrast with prices have regularly been slower to rise and slower to drop. It has usually required a severe crisis and an extended period of hard times to bring them down to the previous level.



Tool Engineering

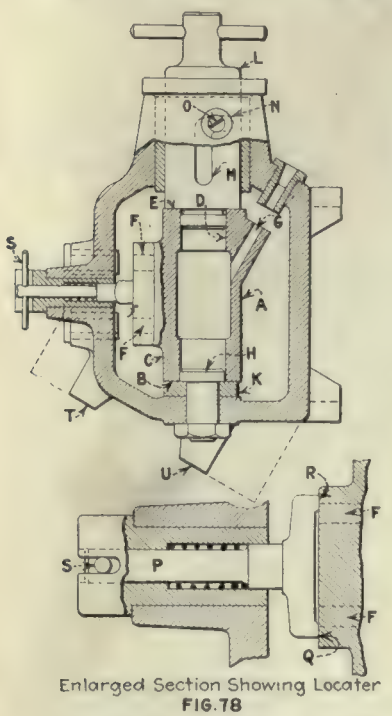
By

Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
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Closed Jigs for Angular and Straight Holes—Locating and Assembling Jigs —An Example for Practice

WHEN large castings are to be drilled from several sides, the jig is frequently made in trunnion form, but when the work is comparatively small it is customary to provide for drilling the holes from various directions, by making it possible to set the jig up in different positions as required. When some holes are to be drilled straight and others at an angle in the same jig, care must be taken that projecting knobs, setscrews or other protuberances, do not strike the surface on which the jig is resting. In Fig. 78 a closed jig is shown for the work *A* which has been previously machined in a turret-lathe operation at *B*, *C*, *D* and *E*. There are four holes to be drilled at *F*, arranged at the four corners of a rectangle. There is also an angular hole to be drilled at *G*. The work is located on the fixed plug *H* at one end of the jig and rests on the hardened ring *K*. At the other end a plug *L* is used as a locater. It will be noted that this plug is arranged so that it can be operated quickly. The method used is an application of the familiar form of bayonet-lock, the plug being slotted at *M*, and the slot having an angularity at *N* to provide for locking by means of the teat screw *O* which engages with the slot.

As it is necessary to locate the finished pad containing the four holes *F* in such a way that the holes mentioned will be square with the finished surface, a locater must be provided. The form of locater used is shown in an enlarged section. The plug *P* is made with a double end at *Q* and *R* so that these two points bear against the casting and straighten it up in relation



Enlarged Section Showing Locater
FIG. 78

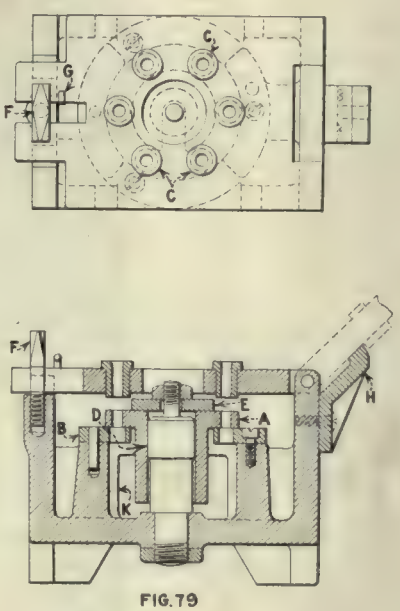


FIG. 79

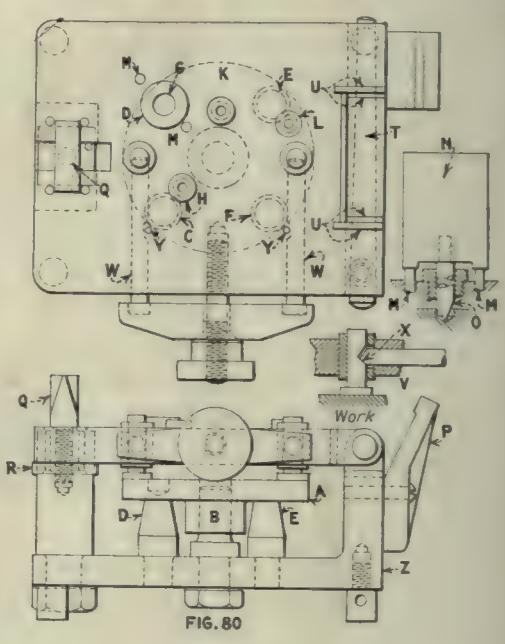


FIG. 80

FIG. 78. CLOSED JIG FOR ANGULAR AND STRAIGHT HOLES. FIG. 79. SIMPLE TYPE OF CLOSED JIG. FIG. 80. BUILT-UP JIG OF REPRESENTATIVE TYPE

For the authors' forthcoming book. All rights reserved.

to the finished surface. The plug is mounted in a bushing and is controlled by a spring. The end of the bushing is slotted to receive a pin *S* which keeps the locater in its correct position, provides a means for withdrawing it when inserting the work, and acts as a restrainer to prevent it from coming out of the bushing. It can be seen that the action of the locater is practically automatic after the work is placed in the jig and it tends to straighten out the finished surface and thus bring it in to its true position while the plug *L* is being operated.

As originally designed four feet were provided at *T* and *U* in order to give support while drilling the angular hole *G*. The construction would be much improved by extending these feet and separating them farther, as indicated by the dotted lines, in order to give greater stability.

A conventional form of closed jig is illustrated in Fig. 79. The work *A* locates on a hardened plate *B* which is set in the body of the jig. The bushings *C* are carried in the leaf. The work locates on a central stud *D* and is clamped by means of C-washer *E*. Provision is made in the leaf for the nut on top of the C-washer in order to bring the leaf as close to the work as possible. The leaf is changed by means of a quarter-turn screw shown at *F* and a stop-pin is provided at *G*.

Attention is called to the leaf stop indicated at *H*. It is also well to note the manner in which the stud *D*, on which the work is located, is arranged and that the wall of the jig is opened up on two sides at *K* in order to provide for cleaning. It will also be seen that the work does not get a bearing on the stud *D* for its entire length as it is relieved at the lower portions, yet it gives ample surface for accurate location.

A number of units frequently used in the construction of built-up jigs have been illustrated and described in an earlier article. In the example shown in Fig. 80 some of these principles and units are illustrated.

The work *A* has been finished all over in a previous operation and it is located on the central stud *B* and also on the four pins *C*, *D*, *E* and *F*. The holes to be drilled are a blind hole at *G* and three smaller holes *H*, *K* and *L*. The depth of the blind hole is important and for this reason the leaf is provided with two hardened and ground stop-pins at *M*. The enlarged view shows the type of gage used for determining the depth of this blind hole. The hardened pins *M* act as stops for the gage block *N* and the point *O* gages the depth of the hole. If the hole is not deep enough the gage will not come down on the pins, while if it is too deep the gage can be turned around so that it will pass between the pins and strike on the sides.

This jig is provided with a leaf stop of standard form shown at *P* and the leaf is fastened by means of the quarter-turn screw *Q* and bears on the wear plates indicated at *R*. Provision is made for stopping the quarter-turn screw by means of the pin *S*. The construction of the hinge is of the approved method previously described, in which a taper pin *T* and wear plates at *U* are employed. The work is held firmly in position on the locating studs by means of a special equalizing clamp in the leaf. A sectional view of the construction is shown at *V*. It will be seen that the pins *W* are cut on an angle at the end *X* so that they exert a downward pressure on the pins which clamp the work. The action of the operating pins is limited by the slots at *Y* so that they do not disengage completely from the angular slot *X*.

This jig is built up from a standard angular plate *Z* and a number of units previously described have been used in its construction. It is an excellent form of jig because it can be made up from standard units to some extent, is very easily cleaned, quickly operated, and has every provision for adjustment and replacement to take care of wear. It may be argued that the clamping does not take place directly over the locating studs but it has been pointed out that this principle cannot always be followed, and in the case shown the work is sufficiently stiff that no danger of distortion need be apprehended.

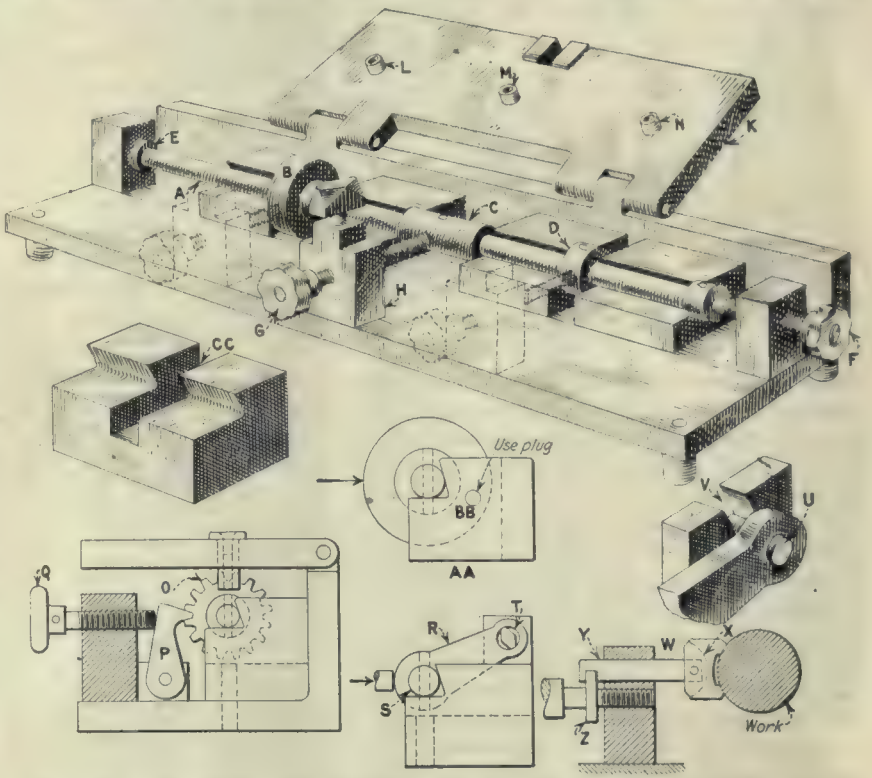


FIG. 81. LOCATING AND ASSEMBLING JIG FOR SHAFT AND COLLARS

Locating and Assembling Jigs

It is often necessary to assemble a number of pieces on a shaft in a certain relation to each other both radially and longitudinally. When this is necessary it is advisable to make use of a locating jig, an example of which is shown in Fig. 81. The work consists of a shaft *A* to which are applied several collars at *B*, *C* and *D*, fastened to the shaft by means of taper pins. The jig is of cast iron and the various units necessary are mounted on it. The shaft *A*, with collars *B*, *C* and *D* loosely assembled on it, is forced up against the hardened stud *E* by means of the thumbscrew *F*. Each of the collars is held in position and prevented from turning by means of a screw *G* mounted in a block *H*. The screws force the shaft over into V-blocks and longi-

tudinal location of the various collars is assured by the space between the various blocks.

The principle shown at *G* is also used at *B* and *D*, but the position of the unit is shown in dotted lines in order to make the illustration more clear. The leaf *K* is provided with bushings at *L*, *M* and *N* by means of which the holes are properly located. The work

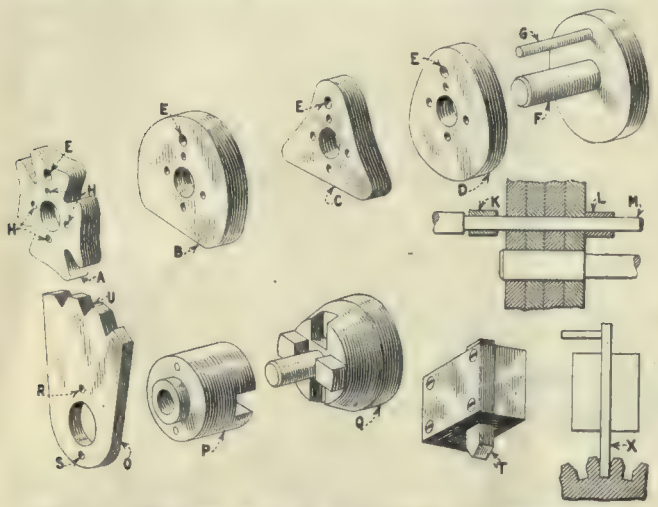


FIG. 82. EXAMPLES FOR PRACTICE IN DESIGNING LOCATING JIGS

being clamped independently of the leaf, a tapered reamer can be used to finish the holes after the leaf has been thrown back into the position shown. Applications of the principles shown can be used for other work of similar character.

It is frequently necessary to locate gears, cams, levers, or other parts on a shaft in a certain relation to each other. In cases of this kind it may be possible to use a jig similar to that shown but with different schemes for locating. The gear shown at *O* is to be assembled on a shaft and it is necessary that the gear teeth should have a certain relation to other members on the shaft. The pawl *P*, used to give this location, is operated by means of a thumbscrew *Q*. A spring can be applied to throw the pawl out of location when the screw is released.

Another example is shown at *R*. This is a lever which must be located on the shaft at *S* and in the correct angular relation to the hole at *T*. It is a simple matter to provide a pin at *T* to give the desired position, the pin being cut away as indicated in order to provide for slight variations between the center distances of the two holes. When pressure is applied in the direction indicated by the arrows the shaft will be forced into the V-block and the lever will be held in its correct position.

There are some cases where a pin is assembled in the lever arm as indicated at *U*. When this is the case a locating block may be slotted as at *V* to receive the pin. The angularity of this slot should be at right-angles to a center line passing through the two holes in the lever.

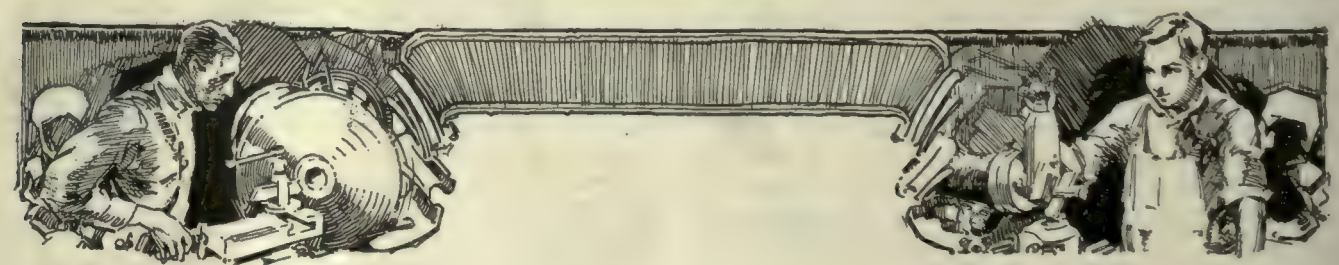
A method which can be used for locating work in a V-block is indicated at *W*. A swivel block *X* is mounted on the end of a stud *Y* and operated by means of a collar screw *Z*. This type of clamp has an advantage when it is necessary to guard against any turning action which might change the position of the work when clamping. Occasionally a collar must be located on a shaft in relation to a previously drilled hole such as that indicated at *AA*. The work can then be located in a V-block and a plug can be pushed into the collar at *BB*. This sketch also illustrates the slotting of a single V-block to provide for location instead of using several blocks as indicated on the jig. *CC* is also slotted but in a direction different from that in the example just mentioned.

When a series of parts is to be assembled such as the cams shown at *A*, *B*, *C* and *D* in Fig. 82, it is common practice to provide the cams with a driving hole such as that shown at *E* in each cam. This hole is carefully located and is used in cutting the cam and in assembling. The parts are generally set over a small plug similar to that shown at *F* and are located by means of the pin *G*. A pin of suitable size is made, either cast or built up, in such a way that the pieces are all located one over the other on the plug mentioned. A suitable clamp must be provided to hold the four pieces firmly in position. After they have been assembled the rivet holes *H* are drilled. It sometimes happens that the pin *G* is weak and is likely to be bent when in use. It is better to provide the jig with bushings as indicated at *K* and *L*. After this is done a plug *M* can be placed through all of the holes one after the other to give the correct location.

A good problem suggested here is the designing of a jig for drilling the rivet holes *H* in these cams.

Another example which offers a good problem is afforded by the parts *O*, *P* and *Q*. *O* sets over *P* and *P* over *Q*, and a locating jig is desired so that the rivet holes *R* and *S* can be drilled in their correct location. As an alternative we suggest that a locater similar to that shown at *T* can be used in the teeth *U* but if this appears too expensive a paddle gage or plug such as that shown at *X* can be used.

On certain classes of work assembling and locating jigs are of extreme importance and it is therefore a good idea for the designer to note the construction of the examples given very carefully and put into practice the various principles which have been illustrated and described. He will find it a decided advantage to design several jigs of this kind, using examples from his own practice and taking cases which are of particular interest rather than those which appear simple and easy to work out.



Programs of Apprenticeship and Special Training In Representative Corporations

By J.V.L.Morris



XIII—The Westinghouse Air Brake Co., Wilmerding, Pa.

Plan of Instruction Thorough—Number of Apprentices Small—Careful Selection of Boys—Class Work by Y.M.C.A. Director—Results of Training Excellent

IN THE plant of the Westinghouse Air Brake Co., employing a total of about 4,500 men, women and boys, there is a small but, judging by results, highly efficient apprenticeship department with an enrollment of thirty young men distributed among the three usual trades as follows: Machinists, 26; patternmakers, 2; molders, 2.

This provides a reasonable ratio of nearly one in five to the 150 toolmakers employed, but is only at the ratio of one in twenty-five to the fifty patternmakers in the works, a ratio which must be recognized as too low, since at least one apprentice to eight journeymen is quite evidently necessary to provide for replacements. As regards molders, here as in general, it has been found impossible to persuade sufficient apprentices to learn the trade in order to even provide for foreman replacements.

The general provisions for apprenticeship are under the direction of the supervisor, who devotes all of his time to this work. He is considered one of the best mechanics in the plant, and is apprentice trained. Much of the credit for the satisfactory showing of the department should be given to him. The following quotations from his program show the general plan followed:

"The machinists and patternmaking apprentices are indentured for a period of four years, or 10,000 hr. The molder apprentices are indentured for three years, or 7,200 hr. There is another class of special apprentices who are graduates of approved technical schools, and whose apprenticeship covers a period of two years; but none are at present enrolled on this basis.

"The first class, or regularly indentured, apprentices are required to be at least sixteen years of age, of good reputation and physically suited to follow the trade. All applicants are requested to present themselves for personal interview. If his general appearance is favorable and he appears to have an aptitude for mechanical work, the applicant is required to take examinations in arithmetic, spelling and writing, and must have a mark of at least 70 per cent efficiency in each study. Accuracy is one of the essential requirements in these examinations. For instance, if the applicant solves a problem, the solution must be correct in both principle and result to receive credit. In other words, if an error in multiplication is made, the applicant receives no credit whatever for the solution of that particular problem. In addition to these examinations, inquiry is made of the principal of the school from which the candidate comes as to his efficiency and general behavior, also as to how the candidate spends his evenings.

"If successful in the above examinations, he is asked

645

The Westinghouse Air Brake Company

APPRENTICE APPLICATION

(To be Filled Out by the Applicant Personally)

Trade applicant desires to learn ..... Date of Application ..... 191 ....

Name of applicant in full ..... Date of birth ..... Age .....

Address of applicant in full ..... Are parents living .....

Father's name in full ..... Address .....

Guardian's name in full ..... Address .....

Father's occupation .....

Present occupation of applicant .....

How long since applicant attended school? ..... Where? ..... Grade? .....

How far have you studied in Arithmetic? .....

How far have you studied in Algebra? .....

How far have you studied in Geometry? .....

Have you ever had any shop experience? .....

If so where? .....

If so how long? .....

Signature of Applicant.

Approved. Signature of Parent.

FIG. 58. FORM FOR APPLICATION FOR APPRENTICESHIP

to fill out an application blank, a copy of which is shown in Fig. 58, and which afterwards must be signed by either the parent or the guardian. If the applicant is accepted, he is indentured and arrangements are made for him to commence work. The indentured forms are made out in duplicate, one copy for the parent or guardian of the apprentice, and the other for the record and file of the company. As stated in the indenture, the first three months of service are considered as a probationary period, the continuation of the apprenticeship depending upon the progress of the apprentice in the shop and in the school.

Rates of Wages

"The wages are based upon an hourly rate, which is as follows:

"Machinists' and Patternmakers' Rate. The first six months, 14 cents per hour; the second six month, 17 cents per hour; the third six months, 19 cents per hour; the fourth six months, 22½ cents per hour; the fifth six months, 25 cents per hour; the sixth six months, 28 cents per hour, the seventh six months, 35 cents per hour; the eighth six months, 42 cents per hour. In addition to these wages, the apprentice receives bonuses as follows, provided his shop and class work records are 70 per cent or above: First year, $25; second year, $40; third year, $75; fourth year, $100, or a total of $240 in bonuses for the four years.

"Molders' Rate. The first year, 22½ cents per hour; the second year, 31 cents per hour; the third year, 39 cents per hour. In addition to these wages, the apprentice receives bonuses as follows, provided his shop and class work records are 70 per cent or above: First year, $50; second year, $100; third year, $150, or a total of $300 in bonuses for the three years.

"Reports showing the number of hours worked and the class of work performed, also the shop progress of the apprentices, are made out on a special form, being signed by the department foreman and afterwards by the apprentices themselves. They are forwarded the first of the following month to the general superintendent for approval, after which they are entered upon the office records. This arrangement requires the apprentice to sign his own record, and no records are made concerning any apprentice which are not read and signed by the apprentice. Every month a statement is forwarded to the parent or guardian of the apprentice, showing the averages attained by the young man in his studies at the apprentice school, which is conducted by the educational director of the Wilmerding Young Men's Christian Association, assisted by an engineer from the engineering department of the Westinghouse Air Brake Company. Also, at the end of each quarter, a report is mailed showing the school average for the three months and also the progress of the apprentice in the shop.

Work in the Shop

"In the shop, the apprentices are under the care of the supervisor of apprentices, and also under the foreman of the department in which the young man may be working; but the supervisor of apprentices has general charge of all the apprentices, and if they have difficulties to overcome they feel free to go to him for help and instruction. Thus, there is some one in charge of the apprentices to see that they receive the proper kind of shop training, which finally results in efficient workmen.

"The machinists' apprentice work in the shop is apportioned approximately as follows: Drill press, two months; lathe, nine months; shaper, one month; planer, two months; bench, twelve months; boring mill, three months; milling machine, nine months; drawing room, six months; and test department, four months. Total number for four years, 10,000 hours.

"The patternmakers' apprentice work is apportioned as follows: Sand papering, varnishing and plain turning, six months; plain bench work, six months; mechanical drawing (engineering office) six months; helping molder and coremaking (iron foundry) six months; pattern shop, advanced work, twenty-four months. Total number for four years, 10,000 hours.

"The molders' apprentice work in the foundry is apportioned as follows: Core making (iron foundry), 1,200 hours; cupola, 200 hr.; bench molding, 700 hr.; general molding, 4,900 hr.; general molding (brass foundry) 800 hr. Total number for the three years, 7,800 hours.

The Day School

"The Westinghouse Air Brake Co., recognizing the importance of the apprentices advancing as far as possible in their school work, instituted a day school educational department, in connection with the apprentice system which has been in force since September 1906, with very satisfactory results. The school work is conducted, as before stated, in the Wilmerding Young Men's Christian Association, and amounts to approximately eight hours per week for each apprentice, running nine months of each year of the four years, from September to July. The regular shop hourly rate is allowed while attending school."

Work in the Classes

The amount of class work is shown by the following schedule, in which the figures represent the number of hours in recitation per week:

	Monday	Wednesday	Friday
First Year	Algebra (1) Arithmetic (1) Spelling (1)	Algebra(1) Arithmetic (1) English (1)	Mechanical Drawing (4)
	Algebra (1)	Algebra (1)	Mechanical
Second Year	Physical (1) Spelling (1)	English (1) Shop Math. (1)	Drawing (3) Slide Rule (1)
	Tuesday	Thursday	Friday
Third Year	Geometry (1) Physical (1)	Shop Math. (1) Physics (1) Geometry (1)	Machine Design (1) Slide Rule (1) Shop Math. (1)
Fourth Year	Geometry (1) Electricity (1) Trigonometry (1)	Business English (1) Trigonometry (1)	Geometry (1) Machine Design (2)

One interesting feature in connection with the class work is that these classes are conducted the first hours in the morning, so that the apprentice who has class work will come into the class before he goes into the shop for the day, a feature which should result in better recitations. Also it will be seen that the apprentice is permitted to be absent from the shop three mornings a week for this school work.

"Upon satisfactorily completing the terms of the indenture, the apprentice is given a diploma properly filled out and signed by the officers of the company designated, with the company seal attached to the diploma."

The quality of the instruction in the shop and school is best shown by the product. This may be gaged from a tabulation by the supervisor of the exact location of each graduated apprentice at the present time, which list includes all of the seventy-four graduates, with the exception only of four whose location could not be dis-

covered. The writer has summarized this record as follows:

Number completing each course:			
Machinists			61
Patternmakers			7
Molders			1
Special Course in Mechanics			5
Total			74
Present employment of these graduates:			
Administrative		14	
General Manager	1		
General Superintendent	1		
Assistant General Manager	2		
Manager	1		
Superintendent Tool Design	2		
Foreman	6		
Assistant Foreman	1		
Technical		18	
Layout Engineer	1		
Efficiency Engineer	2		
Mech. Engineers & Tool Designers	3		
Instructors Manual Training	2		
Steel Inspector	2		
Physical Laboratory	3		
Draftsman	3		
Machinery Salesman	1		
Clerk, Cost Department	1		
Skilled Trades		34	
Machinist	18		
Toolmaker	6		
Patternmaker	6		
Die Maker	3		
Installer & Demonstrator	1		
Miscellaneous		2	
Physician	1		
Farmer	1		
Deceased		2	
Whereabouts Unknown		4	
Total			74

Another matter of interest brought out by this compilation of the present location of graduates is the proportion who have remained with the company. Of the seventy-two living graduates, the record shows that twenty-nine, or 40 per cent, are still in this same plant. This seems somewhat better than the condition in some plants and probably all that should be desired, as it is frequently to the apprentice's interest in acquiring a varied experience to take upon completing apprenticeship employment in several and diverse plants.

Analyzing the summary of present employment, we see that fourteen, or 20 per cent, are now holding executive or foreman positions, and that thirteen, or about the same percentage, technical positions. This shows that, in view of the fact that all these apprentice graduates are still young men, having in every case completed their apprenticeship since 1906, a very creditable number have found apprenticeship the first round of the ladder of industrial advancement. This may be accounted for in part by the careful selection of superior boys who would have gone ahead anyway; but, no doubt, in part by the greater amount of supplementary school training than is provided in many apprentice schools. It is believed, however, that much credit should be laid to the fact that good apprenticeship during the sixteen-to-twenty age-period provides the discipline and industrial intelligence that, for the purpose, cannot well be acquired by other means. Of the remainder, practically all are at skilled trades, and many of these men with maturity will doubtless advance to positions of responsibility; but, even though they do not, they are in highly useful and productive employment.

The Use of Paper and Wood in the Machine Shop

By John Mark May

The articles in the *American Machinist* by E. A. Dixie on "The Use of Paper in the Machine Shop," page 849, and by John Slocumb on "Wood Blocking and Boring-Bar Work," page 868 were both timely and interesting articles. As Mr. Dixie states that he hopes others may come forward with their knowledge of other uses for paper in the machine shop I am moved to offer my bit.

There was a great deal of trouble experienced and considerable time spent in removing a faceplate from a certain lathe. The class of work that was done on this lathe made it necessary to change from faceplate to chuck quite frequently and, I believe due to the fact that the spindle nose was fitted with a rather fine pitch thread and also that this particular lathe was used for fairly heavy work upon which good substantial cuts and feeds were used, it was a difficult job to loosen the chuck or faceplate on the spindle when a change was necessary.

A fellow workman suggested that a paper washer be placed between the collar of the spindle and the hub of the faceplate. A washer was cut from ordinary drawing paper and no further trouble was experienced. A washer would last for from about two to six changes. It would seem that in this particular instance the paper decreased instead of increased frictional resistance.

On this same lathe I frequently bored and faced bushings and cylinders in a way similar to that described by John Slocumb by using wood blocking strapped to the lathe carriage for a cradle into which the castings fitted; differing only in the respect that we used a wood block for the top, or holding down section, of the same width and thickness but somewhat shorter than the bottom pieces. This, we believed, gave us a more accurate setting due to fit on the casting secured nearly all the way around its outside surface instead of something less than half way around. This method is also more convenient for sizing for the casting fit.

On another class of work which required more than ordinary accuracy and on which there was so much machining to do that a piece was usually left in the machine over night and sometimes over a week end, it was found that sometimes the wood had changed its shape enough so that surfaces that had been finished previously did not run true with those finished later.

This error was entirely overcome by using four or more blocks bolted on separately with the end of the grain bearing against the work.

"Drill Jig for Small Pin Holes"

By F. J. Camm
Windsor, England

I was interested in the jig for small pin holes described on page 473 of *American Machinist*. I greatly fear, judging from long experience in such work, that this jig would be far from satisfactory as the bush is not carried sufficiently close to the work, thus allowing the drill to run and so enter the work out of center.

My experience goes to prove that such work can be satisfactorily done only if the rod is fed through a hole 0.001 in. or so larger than the diameter of the rod, the bushing being made to come flush with the circumference of this hole. The drill then has no tendency to run and is bound to enter the work diametrically.

The Art of Interviewing

Why the Employment Interviewer Should Be Tactful and Diplomatic—Classifying Applicants for Employment—Human Element First Consideration in Employment Office

By A. H. Rodrick
Recorder, U. S. Naval Labor Board

THE interviewing of applicants for employment in industries has developed to such importance as to be termed an art. It has become one of the most essential and vital branches of employment management for reasons which will appear later on, and because of this, too much stress cannot be placed on such an important subject.

When an applicant presents himself at the employment department it is well for the interviewer to consider the fact that the applicant is seeking employment for one of three chief reasons: He may be out of a job at the present time and need work. If he is still employed he may be there because he is dissatisfied with his present employment or employer. If this is not the case he is there because he has heard something attractive about your firm which is lacking in the plant where he is at present employed.

Let us consider the first reason, namely, that he is out of a job and needs work. He is ignorant of the employment status of your firm and does not know whether you are increasing or decreasing your force. The only thought in his mind is that he must have work, perhaps to support a large family. Yours may be the first employment office he has entered or it may be the last; entered perhaps, in a spirit of desperation. In an age of unemployment such examples are prevalent. In a case of this kind do not forget the human element. I know that every hour of the day the interviewer is pressed for time, and when the firm is not increasing its force there prevails a tendency to get rid of an applicant as quickly as possible. In following such practice you may be doing yourself and your firm a greater injustice than you are the man who stands before you.

Creating a Good Impression For Your Firm

Listen to his story. If it is too long suggest kindly that he condense it, and when you have fixed in your mind a digest of his case, if you believe it to be a deserving one proceed to explain and advise. The explanation of the employment status can be very brief; words to the effect that at the present time you are not increasing the force but that his name will be entered on the reserve list for future consideration when the services of additional men are needed. From your present and future attitude toward him he will decide for himself whether or not that expression is stereotyped. It is up to you whether he gains the impression that you are serious or bluffing.

Do not hold before his eyes pessimistic visions of the unemployment situation—he is pessimistic enough already. Neither be so optimistic that he would feel like quoting you as an authority to his friends, thus causing a stampede of applicants at your office at a later date. It were better that you make no reference to unemployment or conjecture as to when your plant will take on additional help, but deal solely with the individual—his welfare. Before you stands a man who is experiencing, maybe for the first time, what it means to be out of work. Perhaps you have never experienced that feeling yourself. Deal with him considerately and let the milk of human kindness flow in your veins. If you know of anyone in the same city who may need help, a card, with an introduction consisting of a few words, to your fellow employment manager or interviewer will help materially in settling the troubled mind of the applicant. Such a simple act of thoughtfulness may prove the means of stabilizing his ambition to renewed effort. In acting in this manner you are gaining one more individual who can be added to your list of personal advertisers—those who advertise your firm without receiving pay for their services.

Tact Necessary With Dissatisfied Applicants

If the applicant is not out of employment then he may be seeking a position in your establishment because he is dissatisfied with his present employment or employer. In such cases the greatest degree of care should be exercised in interviewing in order to safeguard the welfare of your own organization. In practically all such cases the applicant comes harboring a feeling of dissatisfaction and he is just seeking someone to whom he can confide his resentment, not thinking of the effect it will have on you. It is always best in cases of this kind to secure a thorough statement from the applicant and learn all the facts in his case before forming an opinion. Do not create the impression that you are not in sympathy with the action he has taken in seeking employment elsewhere, for to do so may defeat the very purpose of your interview. It is very true that some men who have become dissatisfied with certain foremen and certain working conditions have in other establishments proved to be not only satisfied but energetic, successful and progressive workmen. It is wrong to take the attitude that all men who become dissatisfied once will repeat the operation. For these as well as other reasons the interviewing of an applicant who is seeking a change of employment solely because of dissatisfaction should be carefully conducted, and no detail overlooked. If after you have carried on the proper line of examination and cross-examination, you feel convinced from the statements and answers made that the applicant's desire to leave his present employer is without good foundation, the interview need not proceed further. Of course you would not employ him, because you have no assurrance that should you do so he would not later do the same thing to you that he is now doing to his present employer.

It is also well to index the name of the individual in a separate file with a digest of the facts learned for future reference to prevent employment at a later date when the force has to be increased and labor is scarce. By refusing to employ an individual of such impulsive instincts you are doing nothing more than protecting your future turnover.

But suppose from the facts narrated, together with the appearance of the applicant and the impression gained from his method of conducting himself during

the interview, you do not consider him to be a grumbler, what course should then be pursued? Having learned the real reason for his present mental state, careful thought should be given to the question whether a condition similar to the one he has told about exists in your establishment. If so, steps should be taken to rectify it. If it does not exist, the probability of its occurrence should be considered, thereby placing yourself in a better position to arrive at a satisfactory adjustment in the future. If the applicant's cause of complaint is a reasonable one, the same thing is apt to happen in your plant at any time, and it is your duty to be prepared to rectify all such conditions and to prevent, should the occasion arise, any of your employees from having cause to lay bare disagreeable conditions to some other employment manager or interviewer, all of which naturally has its effect on the good-will of your business. What has caused one man to leave his employer may cause many to leave you.

If the applicant is not seeking employment for either of the two reasons mentioned then it may be that he is desirous of connecting with your firm because he has heard of advantages to be gained by working for you; advantages not found in other establishments. This applicant is before you as a result of some personal advertising for which your firm has made no pecuniary outlay. You should make every effort to ascertain just what it is about your business that has appealed so much to this individual as to cause him to want to leave his present employer and cast lots with you. When this has been disclosed you should then find out from what source the applicant has obtained his information. If it has come from one of your employees it shows that conditions are satisfactory to your personnel, which is a valuable asset to any plant.

Should the interviewer follow out the suggestions offered it is believed that he would soon realize that successful interviewing is an art.

The Origin of the Milling Machine

Origin of Machine Obscure—Was Probably First Developed by Clock Makers in 16th Century—History of the Machine in This Country

By L. L. THWING

IS commonly asserted with reference to inventions, that they appear in response to a definite demand. This is true in a certain limited sense. There has, for example, always existed a desire on the part of man to navigate the air and the depth of the sea, but this object was not accomplished until our mechanical assets had developed to include internal combustion engines. Steam carriages were used before rails were provided for them and were the first automobiles, but we had to wait for cheap manufacturing methods, good roads, pneumatic tires, and a wealthy civilization to support their manufacture on the present scale.

A definite device may be invented in response to a definite demand, or an "abstract" mechanism may be adapted to a concrete purpose. Alchemy and perpetual motion have occupied the time of many men with no direct results, but the byproducts have been the science of chemistry and many mechanical details which have been effectively adapted to other uses. Differential gearing was contrived and built to gain power, but proved to be only an absorber of it. It was a secret for over twenty years, from which its inventor received neither profit nor credit. Others re-invented it and received both.

That we should have a complete history of the development of any important mechanism that is more than one generation old, is extremely unlikely. Even in our own time we do not agree upon any one man as the inventor of the electric motor, the automobile, or the airplane. Suits for infringement of patents are abundant and even in the drafting room there is dispute as to who contributed the most to the design of a new machine. When we attempt to investigate the history of such an old device as a lathe we are fortunate if we can trace the steps in its development and assign to them approximate dates. We do not know the name of the man who built the first lathe, and it is highly improbable that we will ever know the name of the inventor of many of our most common mechanisms.

In view of these uncertainties it is not surprising that we are not agreed upon the inventor of the milling machine. We may assume, however, that the first man who conceived the idea of a rotary cutter was the inventor. He may not have made such a cutter, but he must have pictured in his mind some sort of mechanism to support and rotate it.

The first inventor and mechanical engineer who left any considerable record of his ideas and inventions, was Leonardo Da Vinci, born in 1454. His reputation as an artist is well known and if his record as an engineer is less so it is because engineering is a less popular subject and one whose tangible results cannot always be associated with the engineer's name. Da Vinci did, however, leave behind him a number of sketch books in which he was accustomed to record ideas, in the form of freehand sketches, that are remarkable when we consider the period in which he lived.

It would have been impossible in his day to build some of the machines which he suggests, but many of them have been re-invented, and are parts of our best engineering practice. Among other things are sketches of a lathe with a carriage driven by two screws and equipped with change gears for screw cutting. There are boring machines, sawing machines, universal chucks, and many other devices; but nothing suggesting the use of a rotary cutter. There are reciprocating saws, but no circular saws. If Da Vinci knew, or ever thought of the possible use, of a revolving cutter other than a drill he left no record of it.

If on this account we conclude that milling machines were the product of a later period, when is the earliest following date at which we might expect to find some evidence that they were used? It will be the next period whose manufacturing processes felt the need of the milling cutter. If it had happened that Da Vinci's books contained a sketch of a milling cutter, this would not mean that he had ever built one, as there was no demand for it in the fifteenth century.

As shown in H. H. Manchester's interesting articles in the *American Machinist*, there was an astonishing amount of ingenuity shown in the middle ages in the construction of various machines and mechanical contrivances. Strength however was the principal requirement. Accuracy, quiet running and finish were minor considerations. If a machine actually worked when turned slowly by hand, it was of small moment how much it rattled, rumbled or squeaked. The old "mill gearing" could be heard a mile away.

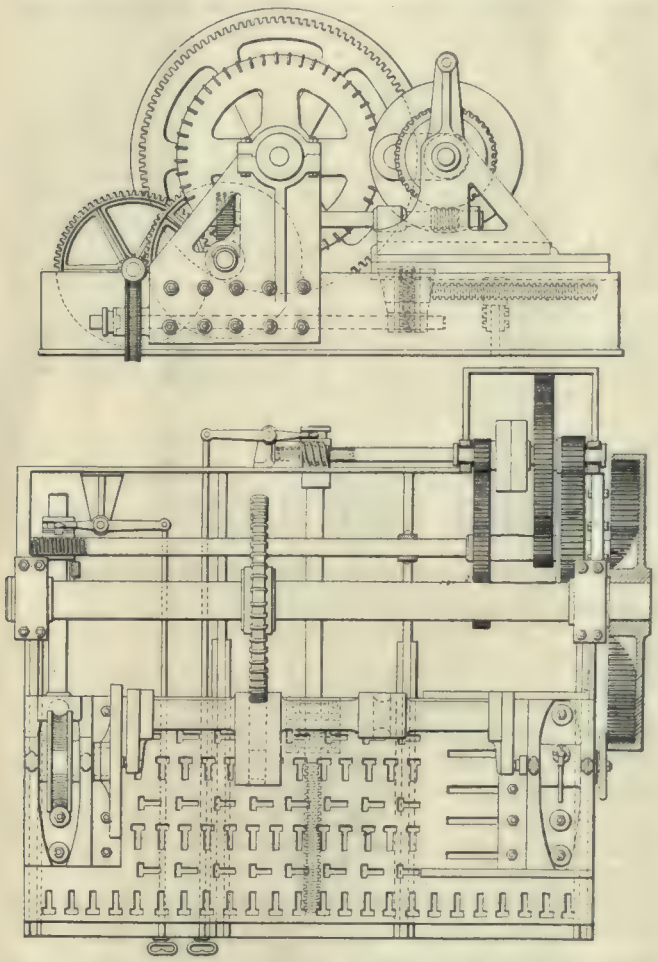


FIG. 1. CRANK MILLING MACHINE BUILT IN ENGLAND ABOUT 1845

In a few trades however the demand for accuracy was greater. Gunmakers, lockmakers and clockmakers required smoother working parts, and as these parts were small and could be turned on the pole lathes of that period, or, if irregular, could be filed out, the chance for securing this accuracy was more favorable than in the case of, say, a cannon boring machine.

Of these trades the clockmaker demanded the greatest accuracy and his product had the greatest number of duplicate parts. (I do not know how many teeth there were in one of the seventeenth century clocks, but there were a good many more than I should want to file out by hand.) The science and art of clockmaking had advanced considerably by 1650; different methods of escapement were discussed, and Dr. Robert Hooke, who is known to us as the inventor of the universal joint, is known to the watchmakers as the inventor of the balance wheel and the anchor escapement. Hooke has also been mentioned as one of the possible inventors of the milling cutter.

It is also true that gunmakers and lockmakers required many irregular shapes that were later responsible for the development of the milling machine in this country, but in their case the parts were larger and the average workman, then as now, could file out a better gunlock than he could a clock gear. Whether or not clockmakers did invent and use milling cutters we do not know, but it seems their need for them was pressing, and, furthermore, conditions were favorable.

Clockmakers were skilled mechanics, and the size and nature of the materials they used demanded little in the way of strength or rigidity. They were accustomed to the use of the lathe and files, and they sharpened their tools on grindstones. In an article on early methods in clockmaking the following method of making gears is mentioned: "by using a cutter revolving at 3,000 to 4,000 r.p.m., shavings come off like fine dust." This suggests a cutter with very fine teeth—in other words a rotary file.

In this connection it will be remembered that the French name for a milling machine is *machine á fraiser;* literally a "strawberrying machine." The roughened surface of a strawberry suggests a rotary file, and it often happpens that new devices are given names suggested by their similarity in appearance to familiar objects.

In the English edition of "Appleton's Encyclopedia," is found the following quotation from Dr. Robert J. Hooke, who was born in 1656. I have not been able to verify this quotation from any original source. Discussing the formation of a primitive helical gear, made by building up a number of thin gears he says "And this is always to be observed in the *cutting* of the teeth. The end of one sloped tooth on the one side, be full as forward as the thickness of the next tooth on the other side." The use of the word "cutting" is significant as it indicates that the gears were not cast or filed. They may have been milled out or cut out by some sort of a primitive shaper, or even punched out under favorable conditions.

Lastly, in 1867 the editor of the *American Artizan*, which was I believe the immediate predecessor of the *American Machinist*, in an article on milling machines says: "The original milling machine was a rotary file. It was used in the poppet head of a lathe, and a traverse carriage was attached to the wooden bedplates. It originated in gun shops, and was next used by sewing machine companies."

I do not know the date or authenticity of the quoted use of the milling cutter for clock gears, some French etymologist may upset the (not original) derivation of *"machine á fraiser,"* and it is quite possible that editors of the Civil War period were not as well informed as they are today; but these things constitute the circumstantial evidence in the case, and when on the other hand, we offer as direct evidence the statement of some man who lived over two hundred years ago, as proof of any claims, we are quoting someone whose reputation for knowledge and veracity is unknown to us.

It is, therefore, at least a plausible conjecture that milling cutters were used at least as early as the year 1700, and that the inventor was a clockmaker. The date 1700 is assumed because Noxon's "Mechanical Exercises" is quoted as having mentioned milling machines; circular saws are said to have been invented in Holland in the sixteenth century; and lastly, because there is a milling cutter said to have been owned by Jaques de Vaucasson, who died in 1784, and which is now in the possession of Brown & Sharpe.

If milling cutters were developed from rotary files it must have taken some years to accomplish that feat. It is conceivable that a man who had a grindstone, a file, and a lot of clock teeth to form, might have connected the rotary idea of the stone with the cutting action of the file and produced the first milling cutter, which, fixed in the poppet head of his lathe, constituted the first milling machine.

The earliest authenticated date for the use of the milling cutter is 1815. By this is meant that the evidence is not the printed repetition of hearsay. The book from which the illustrations of the two gear cutting machines are taken is from a collection of papers published by a prominent engineer in 1822, and the particular paper on gears was written in 1815. It is worthy of note however that the author does not consider milling cutters anyting of a novelty; which indicates that they were in use some years before 1815.

In 1885 the use of the milling machine had reached the point where it was a matter of discussion before the English Institute of Mechanical Engineers. The oldest milling machine known to any one of those present was a crank milling machine, said to have been built and operated in 1845. This machine is shown in Fig. 1, and the cut and description is taken from the *Practical Mechanics Journal*, Glasgow, 1848, as follows: "This may be described as a triplicate machine, including the lathe, the planing machine, and the cutting or boring machine. The specific employment of this machine is for finishing the crank arms of locomotive axles. On the cutter bar *C* is fitted a cast-iron disk with a series of cast-steel cutters *E* accurately formed to the curvature of the finished crank neck. By the arrangement of gearing, the cutters are caused to move at the rate of 28 ft. per minute . . . The weight of the complete

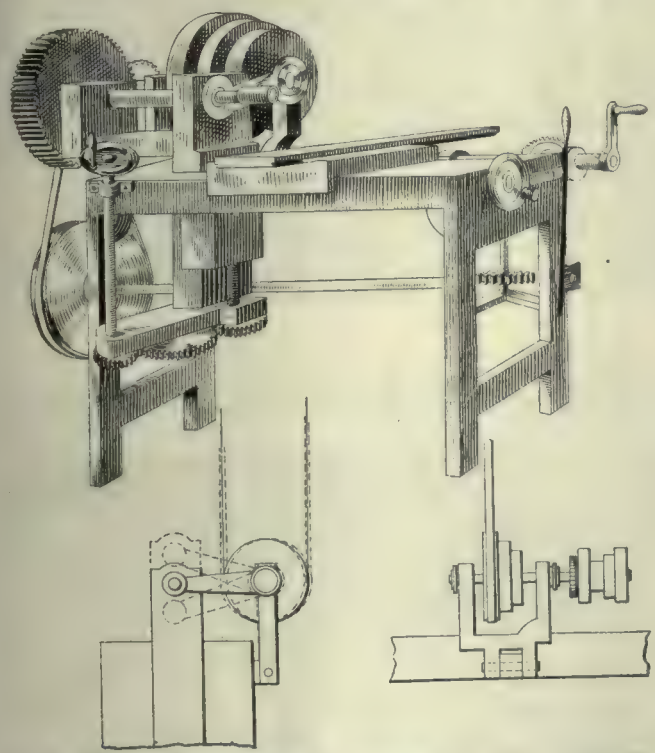


FIG. 2. MILLING MACHINE PATENTED BY W. H. ROBERTSON OF CONNECTICUT, IN 1852

machine is 7 tons, and it completes one crank block of 12-in. radius in 9½ hours."

This description is of additional interest on account of the use of inserted tooth milling cutters; the first of which we have any mention.

The history of milling machines in this country is briefly as follows: What was probably the first milling machine was built in 1818 by Robert Johnson, a gunmaker who settled in Middletown, Conn., in 1814. Johnson did not claim this to be his invention. Two others are also mentioned as pioneers: Robbins & Lawrence of Winsor, Vt., who are mentioned as having used a milling cutter in the lathe spindle and later developed a milling machine, a cut of which appeared on page 291, Vol. 32, of *American Machinist* showing nameplate and the serial number No. 21; and the Eli Whitney milling machine, now in the Mechanical Engineering Museum at Yale. This latter was built some time after 1815 and possibly as late as 1830.

There is no definite evidence at this time that any one of the above men is entitled to the credit of building the first milling machine in America. It is possible that the two last mentioned may have re-invented it without knowing that it had been used elsewhere at an earlier date. News travelled slowly in those days and Johnson may have had a milling machine in operation for years without its coming to the knowledge of Robbins & Lawrence.

The well known Lincoln miller takes its name from Levi Lincoln of the old Phoenix Iron Works, and a strong claim may be made for him as the inventor of this machine, about 1834. Francis Pratt, however, is generally mentioned as the designer of this machine, about 1855.

The first patent on a milling machine issued in this country was to W. H. Robertson, of Hartford, Conn., in 1852. This is shown in Fig. 2. It is not known that any machines were built after this model, but it shows an attempt to adapt a lathe for milling. It is essentially a Lincoln miller without the arbor support, unless the different method of raising and lowering the arbor would exclude it from that classification.

Wood & Light built millers in 1851, and the New Haven Manufacturing Co. at least as early as 1860. At this time there were several lines of development, the column and knee type of Eli Whitney and Robbins & Lawrence; the Lincoln type; Index Milling Machines; and shortly afterwards Brown & Sharpe's universal machine.

The Brainerd machine was the design of A. H. Brainerd, of the Union Vise Co., 61 Water St., Boston, and was first advertised in the *Industrial Monthly* in 1872. The Lipe (Syracuse) Universal, first advertised in 1882, had many features of design which were in advance of its time. The swivel plate was of large diameter; the index heads were more like later models; and the weight, 2,800 pounds, was heavy for its capacity. The design of the drive was unusual, and was discontinued by the later manufacturers of the machine.

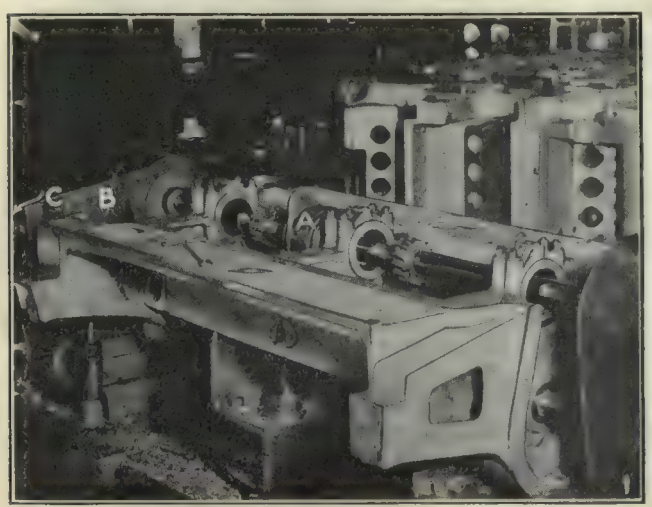
Even as late as 1882, milling machines were not common in machine shops, and were hardly used at all as an improvement on the planer. There is a discusion in the proceedings of the A.S.M.E., Vol. IX, led by J. J. Grant, which shows this very plainly. Since that time the development of the milling machine is familiar to most of us. The all gear feeds and speeds machine is about 20 years old now. The Lincoln millers, which seemed to be losing ground, regained it rapidly during the late war. Today continuous milling, automatic milling, and the question of additional overarm support seem to hold the center of the stage.

Details of Crankcase Work

Different Types of Reaming Fixtures—"Hand" Reaming by Pneumatic Motor—Running in Crankshaft Bearings by Power—Roller Conveyors as Labor Savers

SPECIAL CORRESPONDENCE

THE accompanying illustrations show the practice followed in crankcase boring by three different shops. Fig. 1 shows a crankcase of a Packard twin-six where the main bearings as well as the camshaft bearings are being bored on a special horizontal boring machine. This view shows the central support at *A* for steadying the boring bar and the arm *B* which carries a tool for facing the transmission end of the crankcase. The facing head has a star feed, the wheel being shown at *C*.



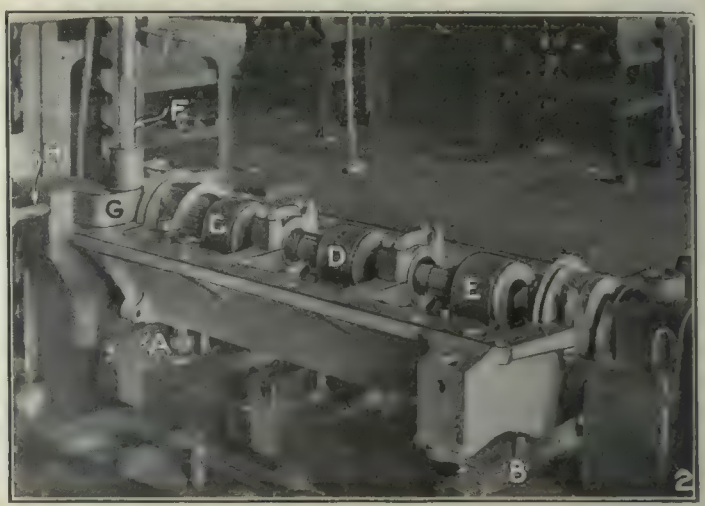


FIG. 1. BORING PACKARD MAIN BEARINGS. FIG. 2. THE STUDEBAKER METHOD

Reaming the Studebaker crankcase is shown in Fig. 2, the fixture having a number of interesting features. The crankcase is carefully supported on parallels as at *A* and *B*, the boring and reaming bars being substantially guided by the three bearings *C*, *D* and *E*. Reaming one of the vertical holes is shown at *F*. The reamer is guided by the block *G* which is held in position by the pin *H* but can be readily swung up out of the way for removing the crankcase from the fixture. This "hand" reaming operation is in reality performed by a pneumatic drill suspended by counterweights and free to move in any direction so as to remove any tendency of the reamer being forced to one side or the other.

Fig. 3 shows the outer end of the reaming fixture with the air motor which drives the reaming bar. This operation is also in effect one of hand reaming in which the power is supplied by the air motor shown at *A*. The large wooden block on the end *B* enables the operator to easily move the whole bar and motor forward by pressing against the block. The ease with which the air motor can float can be judged by the manner in which it is suspended. The bars *C* and *D* serve to support the handles of the motor and prevent it from turning. The form of quick coupling used is shown at *E*.

The crankshaft bearings of the Studebaker motor are run in on the stands shown in Fig. 4. Here the crankcase is held in place by the clamps shown, the crankshaft being driven by the pin type of flexible coupling at *A*. This coupling is moved in or out of contact by the lever *B*, making it also act as a clutch. The electric motor is in the box *C*, at the left.

After the crankcase is in place it is covered by a

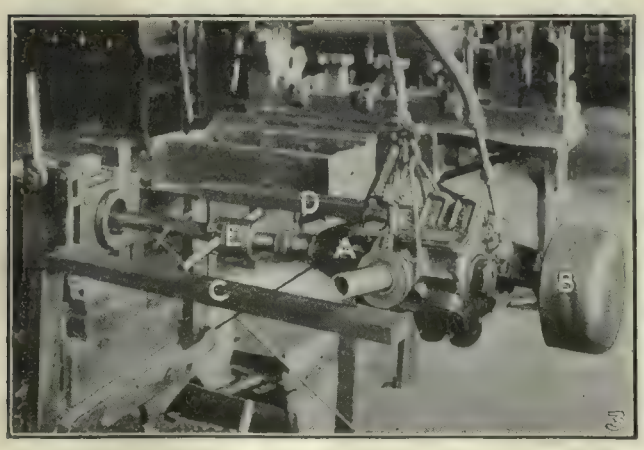




FIG. 3. HAND REAMING WITH AIR. FIG. 4. RUNNING IN THE CRANKSHAFT

pan, as shown on the other stands which are behind. These pans can be lifted up out of the way as at *D*. Oil is piped into the base of the stand so as to insure thorough lubrication.

The Essex shop uses a double-headed Baush horizontal drilling machine for boring and reaming as shown in Fig. 5. The crankcase is held in a substantial fixture provided with suitable clamps and guides for the boring bars and reamers.



FIG. 5. BORING THE ESSEX CRANKCASE

Although not the boring of crankcases, the illustrations in Figs. 6 and 7 show final operations on engine bases in the Oakland plant. Fig. 6 shows the extensive use of roller conveyors by means of which the castings are very easily moved from one machine to the next. Fig. 7 shows a little different type of roller conveyor which has narrow rollers on each side, leaving an open

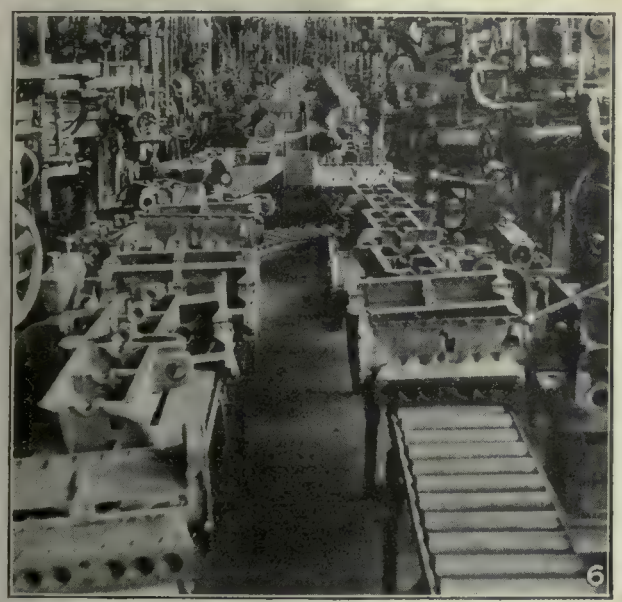


FIG. 6. IN THE OAKLAND SHOP.

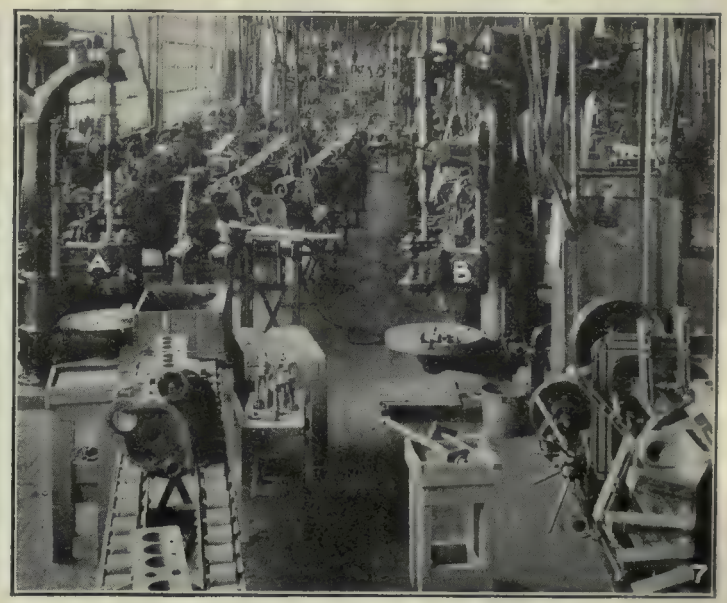


FIG. 7. ON THE WAY TO ASSEMBLY

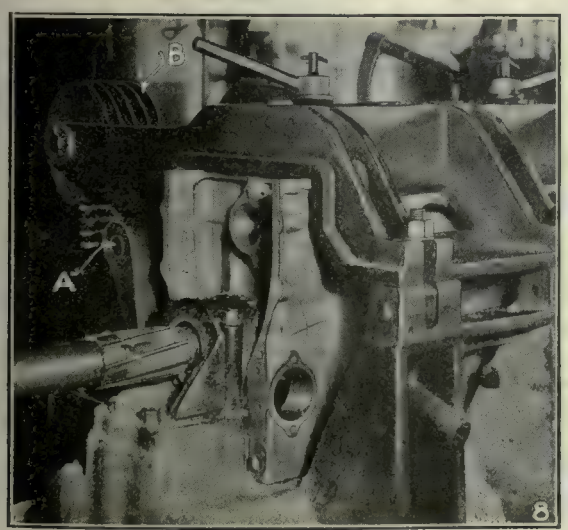


FIG. 8. REAMING CADILLAC BEARINGS.

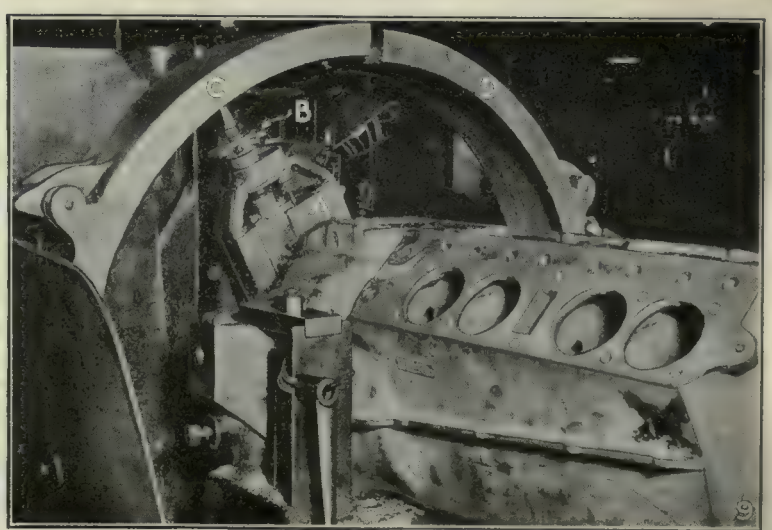


FIG. 9. FACING THE CRANKCASE

space in the center. This view also shows, in the lower right-hand corner, a horizontal boring machine with multiple spindles as well as special countersinking attachments on two of the drilling machines at *A* and *B*.

Two operations on a 90-deg. eight-cylinder motor at the Cadillac Shop are shown in Figs. 8 and 9. The end of the fixture, Fig. 8, shows its substantial construction and the way in which the upper part is fastened in position. It will be noted that the fixture is hinged at *A* and that a counterweight is provided at *B* so as to make it an easy matter for the operator to swing the upper portion out of the way as soon as it is necessary to remove the crankcase. This view also shows the reaming of the main bearings and gives some idea of the type of reamer used.

In Fig. 9 the end of the crankcase is being faced square with the bore by means of the facing head shown at *A* with the star feed at *B*. This method insures the end of the crankcase being faced square for the attachment of the transmission which is an important point.

The guard over the revolving facing head is also of interest, this being a channel-shaped casting which has the two pieces *C* and *D* hinged so as to be easily swung out of the way, avoiding all likelihood of accidents from anyone being caught as the facing head revolves.

Queries on Spindles and Bearings

By E. A. DIXIE

The inquiry under the above caption on page 466 of the *American Machinist*, will probably bring out much interesting data on the subject of lathe spindles and their bearings, a great deal of which will be contradictory.

We all have our favorite methods and materials of construction, but every once in a while one of our pet materials falls down on the job or one of our sure shot methods goes wrong, and on investigation we find that materials and methods, much like human beings, are apt to be influenced by environment. The conditions under which we learned to love and respect them were just as much responsible for their good behavior as were the inherent qualities of goodness and reliability which they were supposed to have possessed.

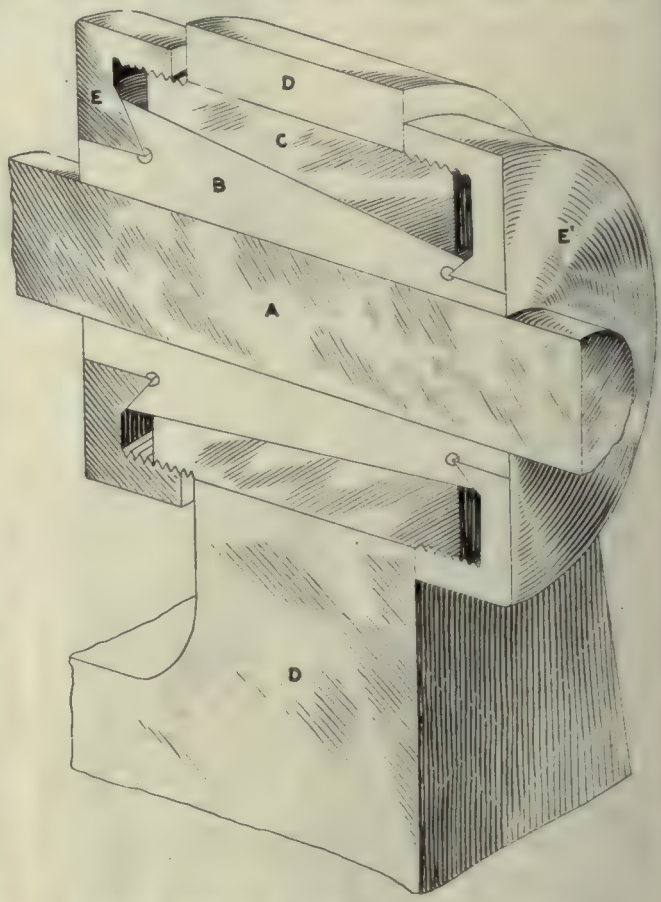
"What Form of Bearing Is the Best?"

I believe that the very best bearings for a lathe are two straight bearings in tapered shells. I do not refer to the usual type of tapered bearing shell with a thread on each end, carrying two flat faced nuts which merely determine its longitudinal position in its tapered seat. That kind of a bearing shell will not remain round when adjusted to take up its own wear and that of the journal. I *do* refer to the tapered bearing shell similar to the one shown in the illustration herewith. The main casting or lathe head *D* is bored for a forced fit for the sleeve *C*, which is machined all over before it is forced into the casting *D*. The bearing shell *B* has the usual grooves in it to permit contraction. At the ends it is provided with angular recesses. Projections of similar shape on the nuts *E* and E^1 engage in these recesses and keep the shell *B* expanded against its seat in the sleeve *C*. When this shell is *closed* by the nuts to adjust for wear, it is also *expanded* by them so that it has a full bearing in its conical seat and is therefore kept round. The main objection to all bearings of this type, however, is their excessive cost.

The next best bearing for a lathe is the plain straight split box type. These are not difficult to fit, are easy to strip and align in case of wear and are apt to wear approximately round.

Comparative Wear of Hard and Soft Spindles

Hardened and ground spindles, if properly cared for, will greatly outwear soft ones. Soft *turned* spindles are not round to begin with, consequently they give poor service for lathe spindles. Besides this, size for size, a



BEST FORM OF LATHE SPINDLE BEARING

hardened spindle is much stiffer than a soft one and stiffness in a lathe spindle is of the greatest importance.

Seldom is good honest work alone the cause of lathe spindle wear. Wear is generally caused either by grit which gets into the bearings or because they are allowed to get dry and the journal either "bugs up" or seizes. Once this happens, the spindle is likely to continue giving trouble until it is taken out and refinished. When dirt gets in, it usually imbeds itself in whichever member is the softer, that is if the spindle is softer than the bearing, the grit will charge into the spindle and the bearing will suffer the most wear. The reverse would be the case if the spindle is the harder.

Babbitt Bearings for Lathes

Properly fitted babbitt bearings give very satisfactory service in ordinary lathes but they would give poor service in a jump lathe. Babbitt is of little service where there is impact or shock, as for instance in the connecting rod or crankshaft bearings for internal combustion engines, unless there is a system of forced lubrication which keeps a film of lubricating oil all over the bearing surfaces at all times.

Babbitt bearings should be carefully run-in when new. When this is done, a glaze forms on the surface which is almost file hard and will resist wear to a high degree.

The interrogator asks "What is the best bearing mixture and what is the best way of applying it?" He probably had babbitt in mind when he formulated this question but as he was not specific, I will let him in on a secret.

The best bearing mixture is made from those gray irons which will give a *close-grained, somewhat hard casting.* The best way to apply it is to machine it a close fit for the headstock and bore it with a single pointed tool and a fine feed, or better still, grind it. Cut liberal oil grooves or make it of the ring or chain oiling type. After the spindle has been fitted, set the head up and run the spindle in. Use plenty of oil and keep a close watch on the bearings for several days. Open the bearings every few hours and inspect them carefully. After a while a "skin" will form on their surfaces. Once this "skin" has formed the bearing will run for all time if kept properly lubricated and clean.

The above reminds me of a trip I once made through the factory where they manufacture what I consider to be the best lathe in the world. While wandering alone in the shop, the designer of this great lathe came up and introduced himself. We were talking general shop matters when suddenly he shot at me:

"What is the best bearing metal for a machine?"

"That" said I, "is rather a big order to come so suddenly, but let us put it this way: Suppose I had to make bearings for all kinds of machines and was compelled to choose a single material from which to make them, then I would say good *close grained cast iron,* but if I had to sell the machines after they were built, *I would brass-plate the bearings where they were visible.*"

The designer threw back his head and laughed heartily. "That's just what we do, we make our bearings of . . . metal, but people are so stuck on bronze that we are compelled to put a brass cap on the bearing where it shows."

The only thing the matter with cast iron is its low price. Bearings made from it will usually give better service than those made from any other metal, but it is cheap and the customer thinks you are trying to skimp on material. So if you use it, *brass-plate it where it shows.*

After babbitt is cast into the bearings it should be condensed by rolling with a tool similar to a tube expander or by hammering with a pneumatic hammer or by hand. The bearing should then be bored slightly under size with a single pointed tool, then a button broach should be pushed through it. If an accurate fixture is used to guide the button broach the hole will not require correcting. If no fixture is used, the bearing will probably require scraping, which is poor practice but must be resorted to in aligning the bearings.

Carbon content has no effect on the running qualities of a steel shaft in a bronze bearing. A low-carbon steel shaft will run at ordinary lathe speeds just as satisfactorily as one made from a high carbon steel, but, other factors being equal, a high-carbon steel shaft running in a clean, well lubricated bronze bearing will show less wear than one of low-carbon steel.

A Profitable Business for the Machinist

By Donald A. Hampson

To the machinist who is tired of working for wages the automobile field seems to offer endless opportunity; and if he be a thorough mechanic who can surround himself with conscientious helpers, he cannot help but succeed in the repair field. Then there is the garage business in general, the gas-and-oil station, the selling of cars, storage battery work, radiator repairing, and tire mending; lines that can be specialized in and for which the machinist is as well qualified as any other man without business training.

There is another branch of the auto business which is singularly adapted to the machinist's previous training and in which there is almost no competition; cylinder regrinding. It is an acknowledged fact that grinding is the best way to finish cylinder bores, while it stands alone as the proper method of enlarging and truing up worn or scored cylinders. The speed with which the work may be done, the perfection of finish, the ability to remove a minimum amount of iron or to dress down a hard spot; all these things, and more, are points in favor of the grinding method of renovating used cylinders.

Now the mechanic who goes into the auto business generally hunts around to find a second-hand lathe, a drill press, a grinding machine or two, and maybe a shaper. These, with shafting and small tools and work benches, constitute his shop, which usually is located in the rear of some dark building whose front is reserved for car storage space. He knows that gas and oil sales will pay his rent, so he puts in the tanks and a supply of these liquids. By that time he has spent $5,000 for the equipment of an establishment that he thought would stand him in not over a thousand.

On the other hand, suppose the machinist puts all his money into one machine; a cylinder grinding machine that is absolutely first-class and the most efficient tool for the business. He spends an amount not over half of his $5,000 and he gets in return a machine complete with motor, emery wheels and fixtures all ready to run. A workbench with vise and a few tools are all else needed before opening the doors for business.

Such a business may well be conducted in a store on the main street of any town. It will draw trade and be a valuable asset to any community. With the machine placed in or near the front window the work is carried on in the best lighted space available and moreover it is carried on where it is a constant advertisement of the business. Any moving display attracts attention, while one so novel and touching a commodity so widely used, doubly attracts.

The owner of a car or a fleet of trucks knows that the average garage man would not install so complicated a machine as the cylinder grinder appears to be, nor would he be competent to operate it if he did happen to have one about. He knows that heretofore it has been necessary to send a cylinder block a long distance to the nearest big city to get the bore put in shape; waiting perhaps weeks for its return, or else he had to half-do the job by putting over-size pistons and rings in cylinders that were out of round or scored.

The man who has the initiative to go into the cylinder regrinding business right can make the same charges that are made in the big cities.

In all communities Fords predominate. Then, usually, there are one or two other cars that have been sold largely; such as, say, Buicks and Overlands. These three makes will include about a dozen designs or sizes of pistons. A stock of pistons for these in 0.005 and 0.010 in. oversizes would cost about as much as the garage man's stock of gas, oil and grease and the customer who is in a genuine hurry will always pay well for such foresight.

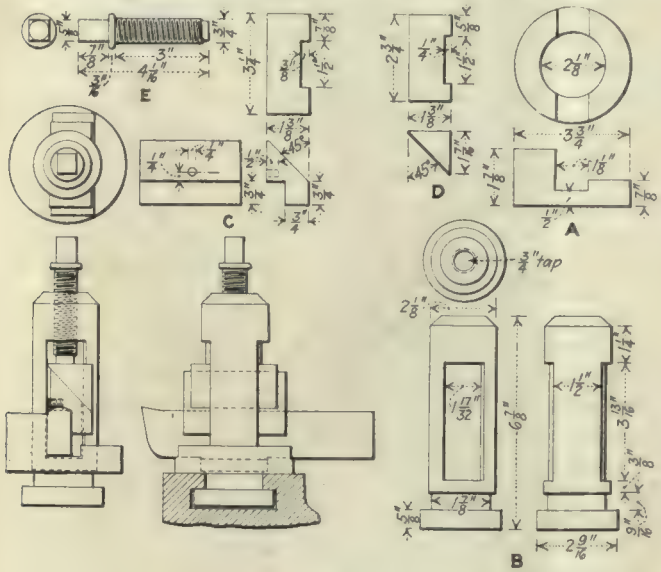
Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

An Improved Single-Screw Toolpost for the Lathe

By MARTIN H. BALL

The accompanying sketch shows a way of holding an ordinary lathe tool more rigidly to position on the toolblock with a single screw and with the minimum



IMPROVED FORM OF TOOLPOST

amount of alterations from the toolpost as most commonly made. I believe, as A. L. De Leeuw states in his article on "Metal Cutting Tools," page 168 of the *American Machinist*, that the use of the common form has become a matter of habit and is hard to get away from.

Most lathe operators have experienced trouble occasioned by the tool swinging round, the center of the setscrew acting as a pivot. It is not difficult to understand why such action occurs, as ordinarily the tool has no side support. Even when it is carefully set in the regular toolpost with a side bearing against the post, this point of bearing is so close to the pivoting point that its value is very limited.

In the improved type the lower side bearing is placed on the side that must bear the thrust of the cut while the upper side bearing is on the opposite side of the tool; always forcing the tool over until it gets a solid bearing in the direction of the side thrust. These side bearings extend along the length of the tool to about the extent of the ordinary toolpost bottom bearing, which is the diameter of the toolpost ring, or leveling plate.

The assembled view shows the general construction of an improved form of toolpost to be used on a standard 24-in. lathe. The ring *A* has a slot across the top, placed centrally and of a width that prevents the tool from having a bearing on the post *B*. A high portion on one side of the slot affords a substantial side support. *C* is the clamping member, with its upper surface made at an angle corresponding with the lower surface of the cap shown at *D*.

The setscrew *E* is standard and finds its seat on the cap, forcing the cap against the side of the post, and the cap in turn forces the clamp *C* against the top and side of the tool simultaneously. The cap and clamp are prevented from falling out of place when the tool is removed by a small spring plunger inserted in the side of the clamp and bearing against the slot in the post.

These members can be assembled or removed when the setscrew point is flush with the top of the slot in the post.

Increasing the Diameter of Work Before and After Threading

By E. A. DIXIE

Two rather interesting jobs have recently gone through the shop. By a peculiar coincidence they were both threading jobs and both had been made too small. In the one case the work was soft and in the other it was hard so that dissimilar expedients were resorted to in order to make corrections and save the work.

In the first instance about 50 spindles had been turned as shown in Fig. 1, the tapered end *A* to be threaded 12 threads per inch. Owing to a mistake on the part of the lathe hand the tapered ends were all turned about 0.01 in. too small.

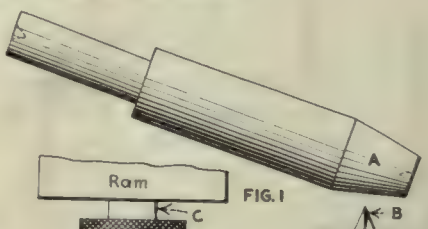


FIG. 1

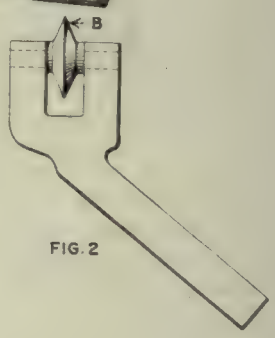


FIG. 2

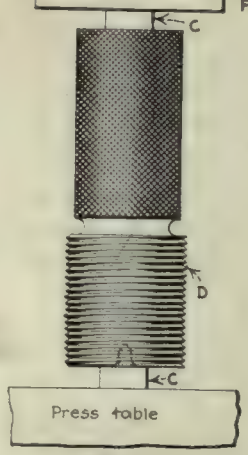


FIG. 3

FIGS. 1 AND 2. EXPANDING A SOFT THREAD. FIG. 3. EXPANDING A HARDENED THREAD

The threading was to be done on a lathe with a taper attachment and not until the first spindle had been threaded, and spoiled, was it discovered that the tapered part was too small in diameter to permit a full thread to be cut. However, the lathe hand who had the threading to do was a resourceful cuss so when he found that he had too little stock he proceeded to devise a method of putting some on where required.

In his kit was the knurl holder shown in Fig. 2, and for use in this he made the V-shaped roller B. This roller was of tool steel hardened and ground to correct shape for 12-pitch U. S. S. thread.

The tapered ends of the spindles were first threaded in the usual manner but not quite to full depth. The threading tool was then replaced by the thread-rolling outfit shown in Fig. 2, and the threads rolled to correct depth, The metal left at the bottom of the thread was displaced by the roller which caused it to flow up each flank toward the top. This increased the diameter of the threaded portion the desired amount. The resultant thread was accurate to size and had a highly burnished surface.

The other job was incidental to the making of a thread-gage.

This gage was an ordinary plug thread-gage 1¼ in. in diameter. It was made of machine steel carborized to a depth of about ⅛ in. After grinding the hardened thread a cast-iron lap was made and lapping proceeded with. Owing to some misadventure during the lapping operation the gage was lapped nearly a quarter of a thousandth too small.

The toolmaker on discovering his mistake made two hardened steel disks *C*, as shown in Fig. 3. One of these was placed under the end of the threaded portion of the gage *D*, and the other on top of the other end. A small teat at the center of each of the disks, entering the center holes in the ends of the gage, served to center the disks with relation to it. This assembly was placed under the ram of an hydraulic press and a pressure of about 10 tons applied. After the pressure was taken off the thread diameter was measured and found to have increased about 0.0002 in. Pressure of 20 tons was then applied and on measuring it was found that the gage had expanded nearly half a thousandth, which was more than enough to allow for finish lapping. Careful examination and measurement of the threaded portion failed to show change of any sort other than radial expansion. What apparently happend was that the ⅛ in. of "case" on the ends of the gage collapsed under the 20 tons of pressure, the unhardened steel of the core being pressed from both ends was compelled to expand, thus increasing the diameter of the gage.

Two Automatic Milling Machines

By Frank R. Shaw

The two machines described in this article were developed during the war for the manufacture of brass firing pins for use in the fuse of the French 75-mm. shell. While the machines are comparatively simple, the principles involved are somewhat unusual and may prove of interest and benefit.

The raw material was supplied as extruded brass bars of the shape shown in Fig. 1, and the finished article is shown in Fig. 2. It was necessary that the bars should have the upper part beveled on the two sides and grooved on the top lengthwise of the bar as shown at *A* and the same operation was to be performed crosswise of the bar on each piece before they were cut off.

The first operation was done by the machine shown in Fig. 3. A formed milling cutter was used, but the

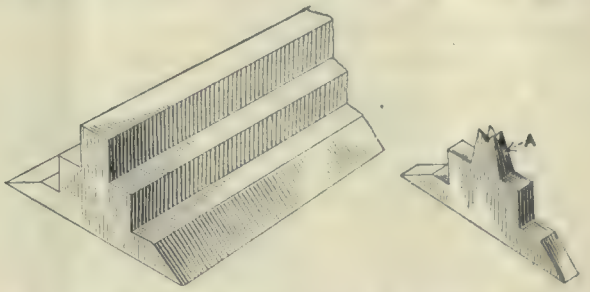


FIG. 1. BRASS BAR STOCK. FIG. 2. FINISHED PIECE. BRASS FIRING PIN

usual process of clamping the work to a moving table which would have required returning the table and reclamping several times on each bar was discarded

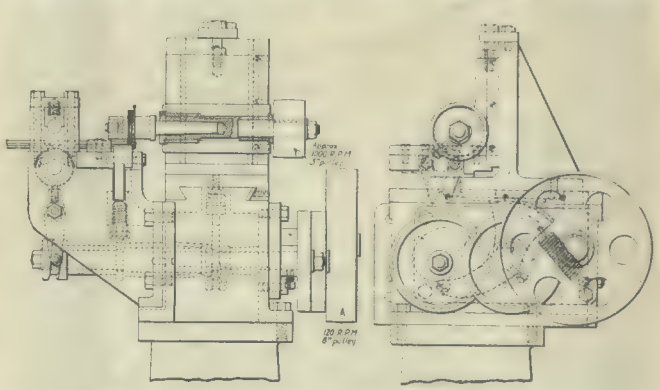


FIG. 3. MACHINE FOR BEVELING SIDES AND GROOVING TOP OF BAR LENGTHWISE

and the bars were fed continuously to the cutter by a pair of rolls under spring tension, the rolls bearing on the lower flange of the bar. A pair of guides were placed as close to the cutter as possible, as shown, and

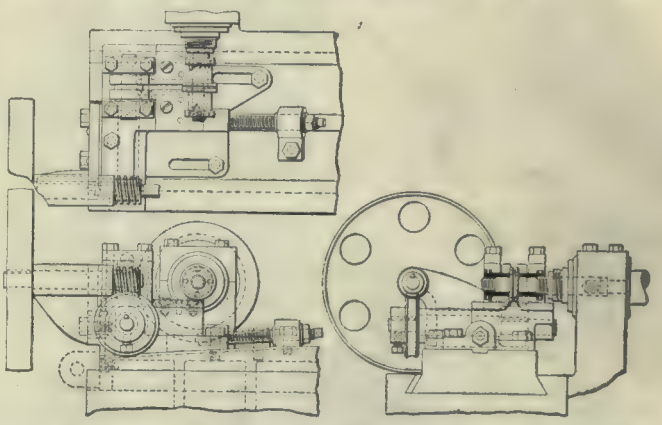


FIG. 4. MACHINE ON WHICH SAME OPERATION WAS PERFORMED CROSSWISE OF BAR

the cutter head was mounted on an inclined base, with a tongue, adjusting screw and clamp screws to get adjustment for height. The only difficulty experienced was that at first the bars were allowed to slide along the bench, developing friction enough to retard the feed. A few wooden rollers were mounted along the bench under the bars after which there was no further difficulty. The machine ran continuously with very little attention; only requiring the bars to be

started and the cutters to be sharpened occasionally.

The second operation was done by the machine shown in Fig. 4. The machine consisted of a base carrying a camshaft driven through a train of gears by a pulley at the end. On the top of the base was a bracket carrying a cutter spindle which was driven by another pulley. A vertical slide allowed adjustment for height of the cutters and the spindle traveled horizontally along a slide on the top of the base, this movement being produced through a segment with lever and cam from the shaft through the base. The lever was held against the cam by the spring inside the base. The bars were fed to the cutters by a pair of rolls as in the first machine, the rolls, however, being driven by a ratchet and pawl operated from a cam on the camshaft, thus securing the intermittent motion required.

In front of the rolls was mounted a pair of guides and between these and the cutters a pair of clamps operated by a wedge forced up between the lower ends by another cam. It will be seen that the cutters consist of a formed cutter for beveling and grooving the point and a saw mounted in the proper location for cutting off the pins. An adjustable stop was set into the front bearing of the spindle head to insure the pieces being cut off at the proper thickness.

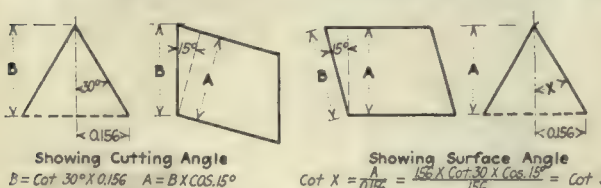
The machine did very satisfactory work and produced the pins at the rate of about 1,500 per hour.

Development of the Cutting Angle of V-Thread Tools

By JOHN H. MAGUIRE

The sketch shows the development of the cutting angle of a V-thread tool to the surface angle or the angle to which the tool is ground in order to have the proper form and clearance.

It is my experience that, though the shopman can get the proper form of thread, there are very few who have given the matter of grinding tools the proper



DEVELOPMENT OF ANGLE OF THREAD TOOL

attention. When a tool is ground with the right clearance and surface angles it retains its form for a much longer time than otherwise.

This diagram is the only thing I have ever seen that is simple enough to appeal to the average toolmaker as worth bothering with.

Though I have used the V-form in my example, the formula can be applied to any form of tool, it being necessary to substitute other values for the angles and given dimension. I use the V because it is the most commonly used. I have shown it to many toolmakers and all have commented on its being clear, and have invariably requested a copy.

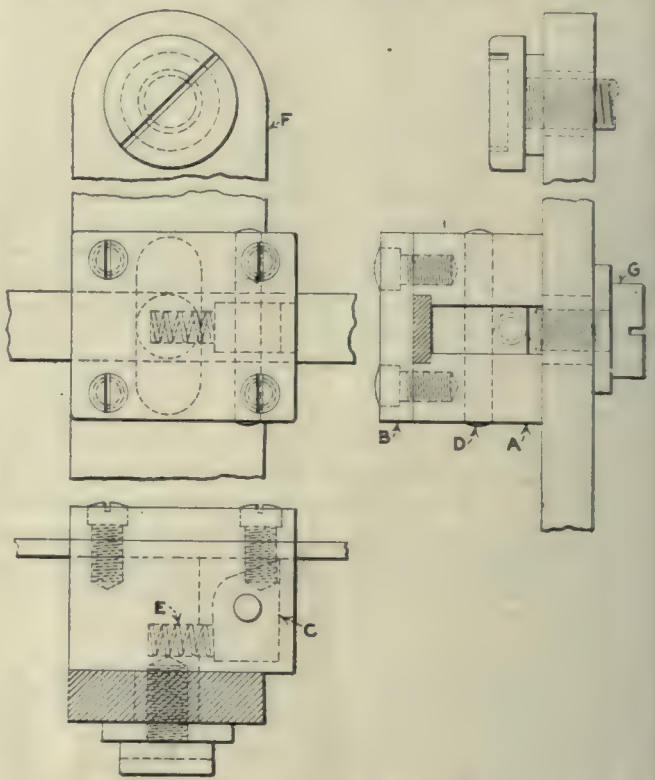
Feeding Device for Press Tools

By JOSEF RASK

It frequently happens when a die is designed and made, that the means for feeding the stock into it is neglected or omitted. It is usually left to the press-hand, to look after that end of the work as well as he can.

The sketch shows a device which was applied to a combination die into which a bar of $\frac{1}{8}$ x $\frac{1}{2}$-in. cold-rolled steel had to be fed.

The die itself was of a good construction but the only way to feed the stock was by hand. It had to



FEEDING DEVICE FOR PRESS TOOLS

be done rapidly and the sharp edges of the stock cut into the operators' hand, making the feeding difficult and retarding the work.

I came along to look after some parts of the die that had to be replaced, and the operator asked me if it was not possible to make something that would help him. Seeing that it was a simple matter, I made up a feeding device as shown in the sketch, applied it and found that it not only worked satisfactorily but increased the speed of the work as well.

The device is very simple and can be applied where semi-automatic operation can be used to advantage. Of course, a press equipped with automatic feeding attachments is preferable for quantity production, but for the small shop and under ordinary conditions this idea might be of value.

A is a block of steel in which a slot fitting the stock is milled. Apply *B* to the top of the block, thus providing a channel through which the work is guided into the die. *C* is a one-toothed pawl made of tool steel, hardened and ground to a sharp edge, which will grip the stock when the device is moved toward the die but will release when moved in the opposite direction. Drive a pin *D* through *A* on which the pawl can rock back and forth. A light spring *E* is applied in back of the pawl in order to hold it up against the stock. A lever *F* is pivoted to the die bed and held by a shouldered screw.

This lever is provided with a slot suitable to the movement of the device and the distance that the stock is to be fed for every stroke of the press. The

body of the device is provided with a stud fitting the slot in the lever and held to the same by a screw G under which a washer is placed to secure an easy sliding fit.

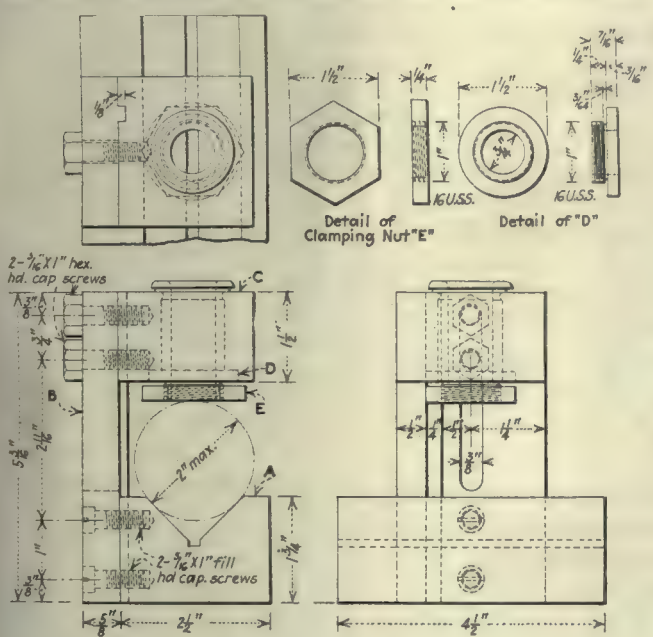
Jig for Drilling Transverse Holes in Shafts

By D. P. Roberts

The sketch shows a jig for drilling transverse holes centrally in shafts.

The upright piece *B* is attached to the V-block *A* by two $\frac{5}{16}$-in. fillister head screws set in flush with the surface so that they do not interfere when the jig is used in a vise on a drill press table. The movable block *C* is secured to the upright *B* by hex head capscrews and is adjustable to different heights to suit the work being drilled. The piece *D* is threaded for $\frac{1}{4}$ in. at the lower end with a fine thread, the upper portion being a force fit in the movable block.

In operation, the work is placed in the V-block, the hexagon head screws are loosened and the block lowered



JIG FOR DRILLING TRANSVERSE HOLES IN SHAFTS

until the nut *E* bears on the shaft to be drilled. The capscrews are then tightened, and the nut *E* adjusted until the work is firmly secured after which a drill bushing of suitable size is inserted.

A Recessing Tool for Automatic Turret Lathes

By E. L. Peterson

Some time ago the writer was requested to design a recessing tool, to be used in an automatic turret lathe for cutting inside recesses, as shown in Fig. 1. The problem in question was presented by the man in charge of the shop equipment at a large automobile factory, and I was asked to study the proposition thoroughly because a good recessing tool, it was stated, was needed in the shop for various purposes.

As a result the tool shown in Fig. 2 was built, tested out, and pronounced a "humdinger" by the shop supervisors. It works very satisfactorily.

The cutting tool *A* is carried by a slide *B*, through which a hole is made to fit the guide bar *C*. Slide *B* is dove-tailed in sleeve *E* which in turn is a sliding fit on shank *D*. A spring *F* tends to move sleeve *E* along

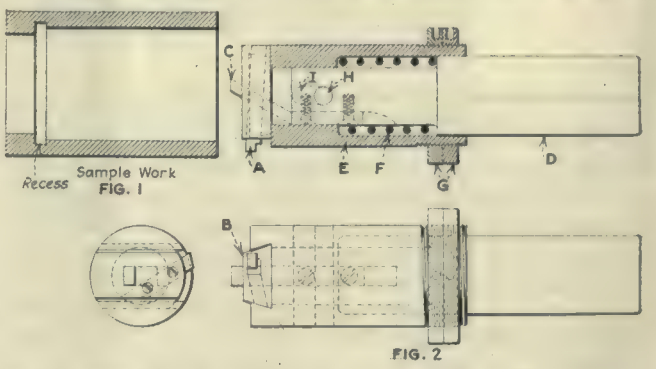


FIG. 1. THE WORK SHOWING THE RECESS. FIG. 2. THE RECESSING TOOL

shank *D*, but pin *H*, which is pressed in *D* and enters the oblong slot *I* in sleeve *E*, limits the movement of *D* in relation to *E*. The tool is held in the turret in the usual manner by means of shank *D*.

When the turret feeds the tool towards its working position the adjustable collars *G* on sleeve *E* engage the outer face of the work and sleeve *E* stops while the movement of *D* continues, and slide *B* is moved crosswise by means of the guide bar *C* which is fastened to *D*, thereby causing tool *A* to cut a recess in the work. The depth of the recess is dependent upon the angle at which the guide bar *C* and also upon the length the turret feeds after sleeve *E* has been stopped.

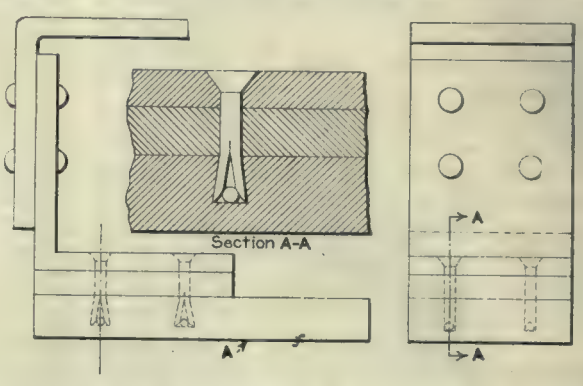
When the turret returns, the spring *F* holds sleeve *E* stationary until pin *H* engages the end of the slot *I* at which time the recessing tool has been disengaged from its working position permitting it to be withdrawn from the work.

Holding a Rivet in a Blind Hole

By F. G. McCormack

We had a job in the shop where it was necessary to rivet an angle and bar together with a filler between. The circumstances in this case made it necessary that the face *A* of the bar should be smooth.

We drilled the holes in the bar the size of the rivet shanks and inserted a dovetail cutter the same size as



SPLIT TAIL RIVET EXPANDED IN BLIND HOLE BY A BALL

the holes, milling first one side and then the other, as shown in the section *AA*. A ball was dropped in the aperture, and the split tail rivet driven in. We found this fastening to be permanent and successful.

IN THIS ISSUE

WE HAVE placed in the leading position this week an article by W. R. Reynolds and R. W. Sellew on "Comparison of Various Types of Ball Bearings." The authors show the relation between over-all width tolerances and radial play, these relations being mathematically demonstrated. They also take up the difference in radial play before and after mounting and the advantages and disadvantages of various types of ball bearings.

Colvin has two articles this week, pages 1068 and 1073. The first deals with the machining operations used in making connecting rods for the White motor, describing some unusual methods and fixtures. The second is the twelfth installment of his series "The Foreman and His Job." The specific subjects treated in the latter are the proper method of receiving the new employee in the shop and the foreman's influence in introducing new methods of manufacture or wage payments and new machines. In this connection, Colvin says, "The foreman who has been loyal to his job and has never tried to put over anything which was not fair, can be a tremendous force for good in introducing any new plan or method, whether this be a question of wage payment or the introduction of a new machine. And in the ever-changing problem of human relationship in and out of the shop, this is an important function."

Stanley, on page 1070, explains the method of handling locomotive driving wheel, axle and crankpin work in the Sacramento shops of the Southern Pacific Company.

The second of H. H. Manchester's short series, "A History of Post-War Crises," begins on page 1076. It takes up the period from 1860 to the World War, paying especial attention to the effects of war on finance and industry and furnishing a summary of post-war booms and crises. Mr. Manchester has discovered that " . . . the most obvious fact is that all of the big wars for the past five hundred years have been followed by boom times that have almost inevitably been short and in cases have led to some sort of crisis, or at least to a sudden fall in prices which have returned more or less nearly to the pre-war level." This statement jibes very nicely with one made by Professor Whitney, in our issue of last week, which was, "There is at least a strong possibility that the level of prices may ultimately go below those prevailing in 1913." As an isolated statement this quotation might give the wrong impression, but it will be remembered by those who carefully read the article referred to that it was qualified by the statements that such a low level of prices, if it should be attained, would not indicate permanently retarded business and that there can be a large, even an expanding volume, of business on a basis of low prices, as evidenced by experience in the United States during the period from 1873 to 1893.

Coming Features

At this time when nearly everyone has his attention focused upon educational matters, it is fitting that we run an article, such as will appear next week on the general subject "How Should the Engineer Be Educated?" Several men of authority have contributed brief statements that we are using to make up the article.

There will be a description by John Bath of some of the gages that he has developed. He has chosen as his title "New Light on Internal Measurements."

The second of the articles devoted to the description of types of plants will be in the next issue. It deals with the multi-storied shop of the American Tool Works Company.

The tenth installment of "Tool Engineering" will be the only series article.

The railroad article will be by Stanley; it tells of the use of the grinding machine in the railroad shop.

There will be another of the Puget Sound Navy Yard articles, this one dealing with special work.

The "Tool Engineering" article is rather short, covering only three pages. It begins on page 1078 and continues the subject of drill jig design. In this installment there are taken up closed jigs for angular and straight holes and locating and assembling jigs.

Morris, in his thirteenth apprenticeship article, describes the course used by the Westinghouse Air Brake Co., Wilmerding, Pa. The article parallels the previous ones, yet the contents add appreciably to the total information made available to our readers concerning the very thoroughly worked out courses employed by some of our largest manufacturers. Page 1081.

Next in sequence, page 1084, is a short article by A. A. Rodrick, Recorder of the United States Naval Labor Board, on "The Art of Interviewing." His statements are consistent with the ideas of many of the employment men of our large companies and other students of the personnel relation in industry.

This article is followed by the "Origin of the Milling Machine" by L. L. Thwing, an article of historical interest that gives the facts concerning the history of the machine in the United States and partially confirmed conjectures as to its origin and early development.

The last of the major articles is "Details of Crankcase Work," page 1088. This article, which is part of our special correspondence, describes various types of reaming fixtures, the value of running-in crankshaft bearings by power, and the use of roller conveyors.

EDITORIALS

One More Step Ahead

PRESIDENT HARDING has signed the budget bill which takes effect July first at the beginning of the new fiscal year. Thus we have taken one more step toward putting our Government on a business-like basis. Everybody has agreed for years that there should be a budget for national expenditures but the difficulty was always to get George up to the point of taking action. It is a matter on which the new administration deserves to be congratulated, not because the legislation is a party achievement, for its support has been largely non-partisan, but because the obstructions have finally been removed and the thing is done.

A word of warning to enthusiasts not to expect too much from the operation of a budget system may not be out of place. It must be remembered that perhaps seven-eighths of our annual expenditures will not be affected in any way by the introduction of a budget. The costs of previous wars are fixed charges which must be met.

Even conservative estimators, however, believe that it will be possible to save millions every year when the budget gets in working order. Three years, or even less, ago, mere millions would have seemed hardly worth bothering with but fortunately we have had a change of heart since then and economy has forged to the front. That this is true is an excellent augury for better times in the near future.

This Is No Time to Neglect Business

THERE are indications that some concerns are finding business much worse than it needs to be, by failing to take advantage of every opportunity that presents itself. There are many complaints that it takes longer to get answers to letters now than it did when every one was rushed. The same complaint reaches us concerning work to be done, such as castings, electroplating and the like. It seems almost unbelievable but the facts are there to prove it.

It is quite possible that the man who is far from busy himself feels that every one else is in the same boat and that a week's delay can make no difference to the man who writes for information. Nothing could be more in error or more fatal to the resumption of business. Orders are not coming to the man who sits at his desk and waits for the letter carrier to bring them in. They are going to the man who gets out and hustles, who keeps his name and his products everlastingly before those in his field. Every inquiry which is neglected may mean an order going to the other fellow, because men are not making inquiries for the fun of it, even though they do not buy immediately.

Now is the time to lay the foundation for future business by taking the best possible care of the orders which come your way. The men who are busy now are likely to be more busy and to be better customers as times improve. It is certainly desirable to see that they get the best service possible or they are likely to go elsewhere. And every customer lost makes it just that much easier for the sheriff to get the opportunity of tacking a foreclosure notice up on your door.

We are far from being pessimistic, but it is just as well to realize that some there be who will not survive the depression. And the first to go will be those who neglect opportunities for business, who wait for business to come to them as it did during the boom, and who fail to realize that only those who put up a stiff fight for business can hope to weather the storm.

The Permanent Tariff

THE emergency tariff law having reached a place on the statute books we are now called upon to consider the permanent measure which has been worked upon by the Ways and Means Committee for some weeks. As this is written full details of the new schedules are not available but those that have leaked out are not all promising.

Tariff legislation always has been and probably always will be a bone of contention in this and every other country. This bill will be no exception. Already violent protests on certain features have made themselves very evident and there are more to come.

The hope has been frequently expressed that the tariff makers would recognize the present as a propitious moment to institute a scientifically worked out tariff law, but the chances of realization of this hope are faint. Apparently class and sectional necessities are to rule over national advantages as in the past and the new law will leave us no better off than before.

The country, or at least its elected representatives, have not awakened to the fact that the war really made revolutionary changes in our economic status. The fact that we have most of the money in the world and are creditors of other nations to the extent of many billions which can only be repaid in goods does not seem to have penetrated if we are to believe the forecast of a high "protective" tariff to keep these goods out. We do not wish to be understood as condemning all tariffs, for we do not. Some of our industries need protection as a national insurance policy, and must have it.

From the point of view of the machinery builder the general tariff policy indicated is not cheerful. He must rely to a certain extent on foreign markets to absorb his surplus output and until they are in a sufficiently prosperous condition to pay for the machines they need, they might as well not exist at all. In other words we have got to trade if we are going to keep our mills and factories busy and trading never consisted of "everything going out and nothing coming in."

This tariff fight is a good one to watch, for your own interest is closely involved. Incidentally it may be well to put in an oar at the proper time. The President seems to be of the opinion that now is the proper time for his oar to be put in. His recent pointed remarks that Congress had been convened to act on tax and tariff measures were well merited. Let us hope they will be heeded.

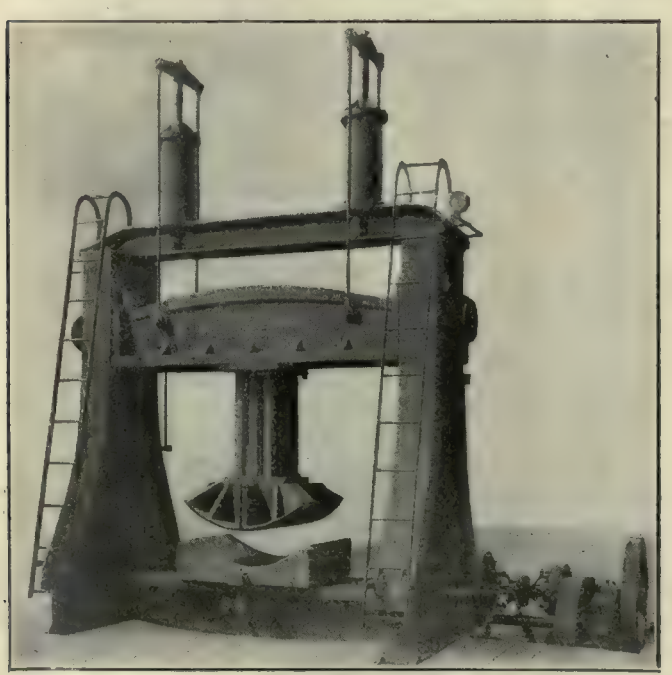
Shop Equipment News

Beatty Vertical Bulldozer

The Beatty Machine and Manufacturing Co., Hammond, Ind., has recently placed on the market the vertical bulldozer shown in the illustration. The principal features of the machine are claimed to be the simplicity of construction and the location of the driving parts. The main shaft is mounted through the lower bed instead of overhead, and the main side gears are enclosed in the box-type housing, with all intermediate gears fully enclosed. Clutches and high-speed bearings are easily accessible.

The side gears drive connecting rods secured to the crosshead. The machine is fitted with forward and reverse clutches which permit the machine to be reversed at any point of the stroke. It can be arranged for either belt or direct-connected-motor drive. The crosshead is fitted at both ends with bronze, tapered gibs for adjustment in case of wear to the slides. Air cylinders are used for counterbalancing the weight of the ram. All gearing is cast steel with cut teeth.

The bulldozer is especially adapted to work on steel cars, for the pressing and forming of such parts as diaphraghms, stakes, roofs, end sills and sheet-metal plate and bar parts. The dies shown attached to the machine are used for the forming of plates in tank-car tanks. The machine is built in sizes up to and including 500 tons ram pressure. The distance between the housings ranges from 8 to 12 ft.; and the vertical die space with the ram down and the adjustment in the center, from 24 to 72 in. The stroke varies from 18 to 24 in.; and the strokes per minute are 16 in the small



BEATTY VERTICAL BULLDOZER

size and from 8 to 10 in the large size. The smallest size weighs approximately 24,000 pounds, and the largest 120,000 pounds.

Stamets Gantry Drilling Machine

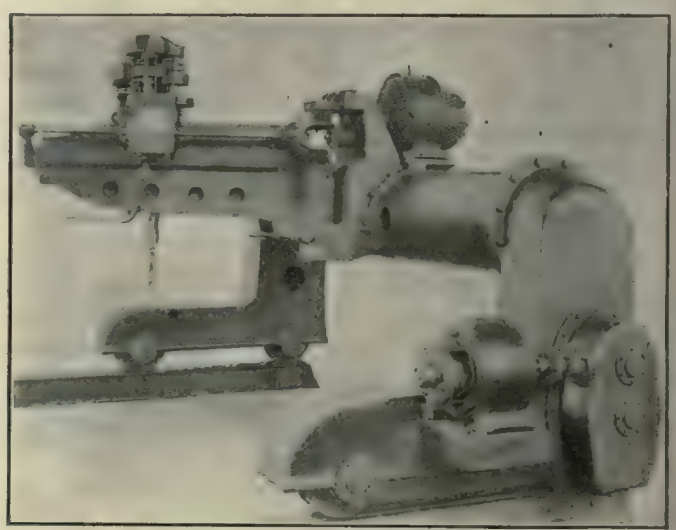
William K. Stamets, Jenkins Arcade Building, Pittsburgh, Pa., has recently brought out the gantry drilling machine shown in the accompanying illustration.

It will be seen that the machine is mounted on a track, the gage of which is broad enough to accommodate the plate to be drilled. The machine is traversed on the track by means of a motor provided with a suitable controller. The drilling head is mounted on the radial arm which swings on a support attached to the cylindrical crossbeam.

While the illustration shows but one drilling head and one radial arm, machines having several heads and arms can be furnished. Arms can be mounted on each side of the cylindrical crossbeam and more than one head can be mounted on each arm if desired.

The drive is by an electric motor mounted on the crossbeam. Either an a.c. multi-speed motor or a d.c. adjustable speed motor can be furnished.

The machine is adapted to the requirements of manu-



STAMETS GANTRY DRILLING MACHINE

facturers of steel cars, tanks, boilers or of any product where holes are to be drilled in plates.

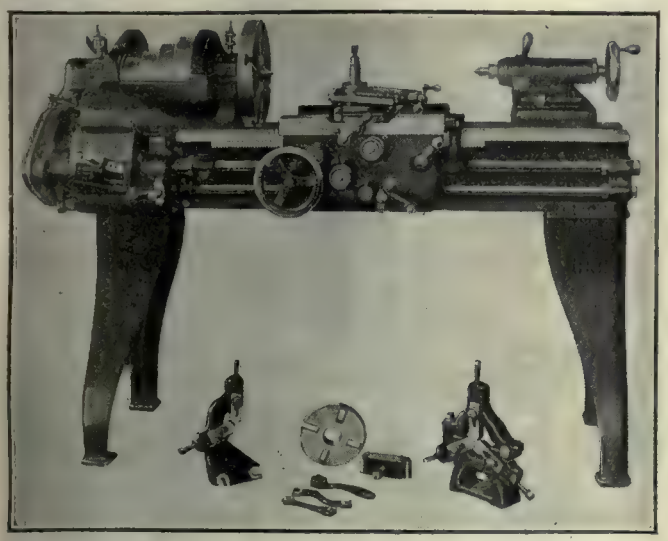
Since the machine is built only on order, the width of gage and number of arms and heads can be arranged to suit the purchaser.

"Economy" 12-Inch Quick-Change Lathe

A 12-in. swing lathe, shown in the illustration, has been added to the line of single-back-geared, quick-change engine lathes made by the Rockford Lathe and Drill Co., Rockford, Ill. A four-step cone pulley is provided for the drive, and is connected with back gears of a ratio of 8.06 to 1. The headstock bearings are made of a special composition metal. The spindle has a 1⅛-in. hole through it, permitting the use of draw-in collets up to ⅞-in. in capacity.

The tailstock is of the offset type to allow the compound slide to set parallel with the bed, and it is pro-

vided with a set-over for turning tapers. The carriage is provided with a thread indicator which can be disengaged when not in use, but which enables the proper engagement on a thread being cut without reversing the lathe. This permits both countershaft belts to run forward, thus giving sixteen spindle speeds. The apron has double bearings for all shafts, and the gears are of wide face and coarse pitch. All feeds are reversed in the apron, and their controls interlock with the bronze lead-screw nut, making it impossible to engage the lead screw and the feed shaft at the same time. A cam operates the lead-screw nut in one quarter turn. A redesigned quick-change gear box provides thirty-two changes of feed, obtained through sliding steel gears and hardened steel clutches. Special pitches of thread may be cut by substituting special gears on the quadrant. The lead-screw rotates only when in use for thread cutting.



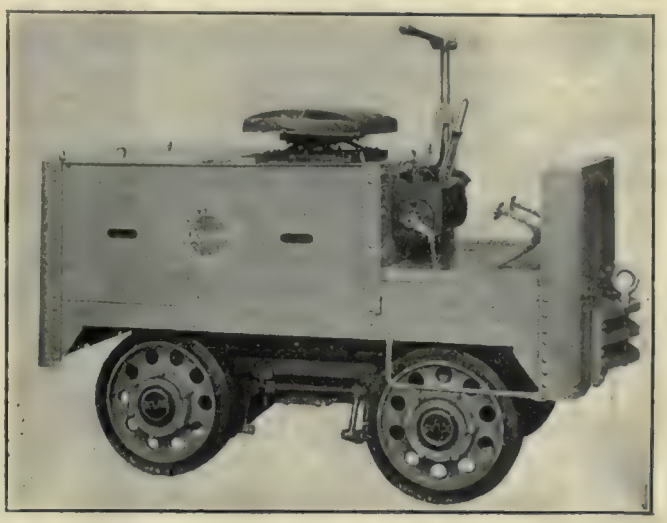
"ECONOMY" 12-IN. SINGLE-BACK-GEARED QUICK-CHANGE ENGINE LATHE

Specifications: Swing-over ways, 13 1/8 in.; over carriage, 6 5/8 in. Distance between centers with 5 ft. bed, 27 in. Lengths of bed, 5, 6 and 8 ft. Cone diameters, 3 3/4, 5 1/2, 7 1/8 in. Width of belt, 2 in. Cuts threads, 4 to 56 per inch. Feeds, 18 to 252 rev. per inch. Spindle speeds, 10 to 465 r.p.m. Size of tools, 1/2x1 in. Weight with 5-ft. bed: net, 1,300 lb.; domestic shipping, 1,520 lb.; export, 1,700 lb. Export box, 41 cu.ft.

Atlas Four-Wheel-Steer Tractor

The Atlas Car and Manufacturing Co., 1130 Ivanhoe Road, Cleveland, Ohio, has recently placed on the market the fourlwheel-steer tractor shown in the accompanying illustration. This tractor, designated at Type TE, uses electricity for the motive power and is designed for industrial transportation. The principal feature of the tractor is the four-wheel-steering apparatus which is said to make the machine convenient for use in places that might be difficult of access for tractors without this feature. The tractor can be furnished with either two or four-wheel drive. It can also be supplied as a four-wheel-drive rail locomotive by substituting flanged steel wheels for the rubber-tired ones and omitting the steer-mechanism. This is known as type RTE4, and is built for 20, 24, 30 and 36-in. gages.

The driving axles are of the full floating type with removable drive shafts. Bolted clutch plates are provided. Bearings are of the high-duty, ball, radial and radio thrust types, with oversize bearings in the wheels. The brakes are of the external contracting shoe type. The controller is of the drum type, entirely enclosed, giving three speeds in either direction. The circuit

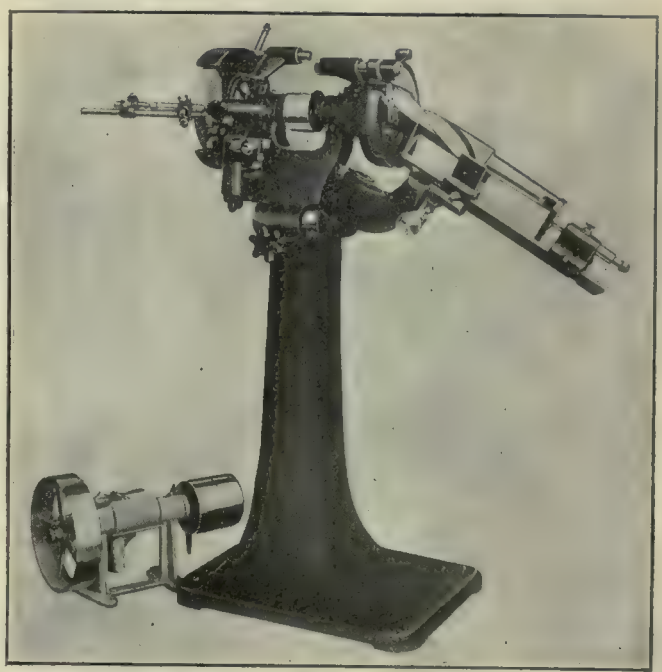


ATLAS FOUR-WHEEL-STEER TRACTOR

breaker is integral, operated by means of a pedal. A "Powerlock" differential is used. The tractive effort is under normal conditions, 400 lb. with an ultimate of 2,000 lb. The drive is through a bronze wheel and steel worm, entirely enclosed and immersed in an oil bath. The motor is of the vehicle type, entirely enclosed. Edison battery equipment 42 cells of A6 or G9 type being used. The speed is 6 miles per hour without load. The tires are solid rubber, and 20 x 3½ in. in size. Weight, with Edison battery, 3,700 lb.; with lead battery, 3,950 lb. Boxed for export, with Edison battery, 4,450 lb.; with lead battery, 4,550 pounds.

Grand Rapids Combination Tap and Drill Grinding Machine

The illustration shows the combination tap and drill grinding machine which has just been placed on the market by the Grand Rapids Grinding Machine Co., Grand Rapids, Mich. This machine is designed to meet the requirements of the shop having need for correctly



GRAND RAPIDS COMBINATION TAP AND DRILL GRINDING MACHINE

ground drills and taps, and is said to combine all the advantages of single-purpose machines. The machine automatically grinds the same taper and clearance on every flute. The drill-grinding side of the machine is equipped with a holder stop, which, working in connection with the base of the diamond truing device, automatically places the drill holder in proper relation to the face of the grinding wheel. This is said to be an exclusive feature of the machine.

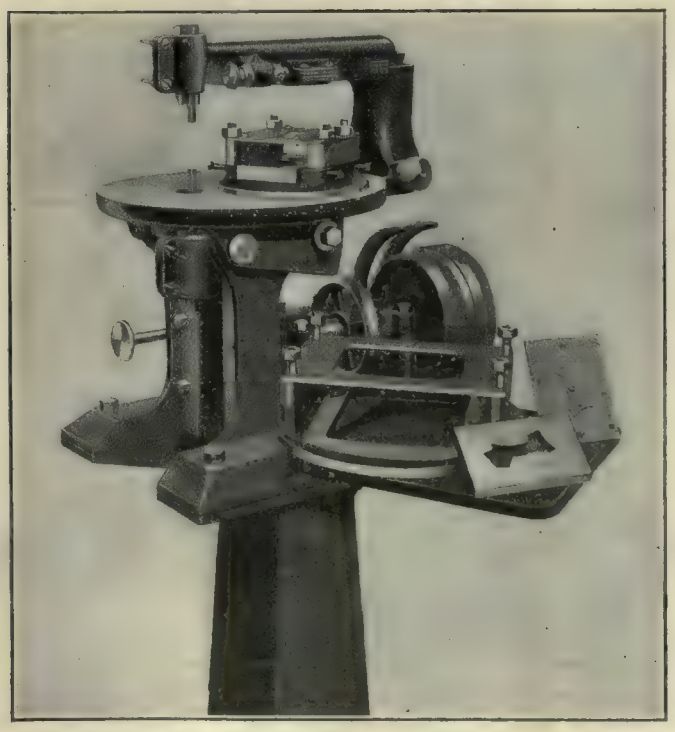
Both wheels of the machine carry a wheel-truing mechanism with diamond. With the No. 10-A and 10-B machines, two types of wheel-truing devices are furnishing, one for truing the periphery of the tap-grinding wheel, the other for truing the face of the drill grinding wheel. In the case of No. 20-B and 20-C machines, both wheels are cup shape and the diamond-truing device is arranged for keeping the face of the wheel in proper shape. Diamonds of approximately one-half carat are furnished for each wheel. The No. 10A machine grinds taps from No. 6 to 1½ in. and drills from No. 52 to ¾ in.; the No. 10B machine, taps from No. 6 to 1½ in. and drills from ⅛ in. to 1½ in.; the No. 20B machine, taps from ⅜ to 3 in. and drills from ⅛ to 1½ in.; and the No. 20C machine, taps from ⅜ to 3 in. and drills from ¼ to 2½ in.

Specifications: Spindle speed, 1,600 r.p.m. Diameter of grinding wheels, 8½ and 10 in. Speed of countershaft, 560 r.p.m. Height to center of spindle, 44 in. Floor space, 2 x 3½ ft. Net weight, 385 lb. for No. 10 grinder. 400 lb. for No. 20 grinder. Crated weight, 450 and 500 lb., respectively. Boxed weight, 550 and 625 lb., respectively. Export box, 16 cu.ft.

Hawkes Die- and Templet-Making Machine

The machine shown in the illustration is a die- and templet-making machine, which has been developed by R. L. Hawkes, 212 Niagara St., St. Catherines, Ontario, Canada. The machine is intended for the production of dies, punches, templets, and similar tools at a lower cost and in less time than is possible with hand work. It is stated that an unskilled operator can, with a few instructions, make accurate tools, ready to be hardened.

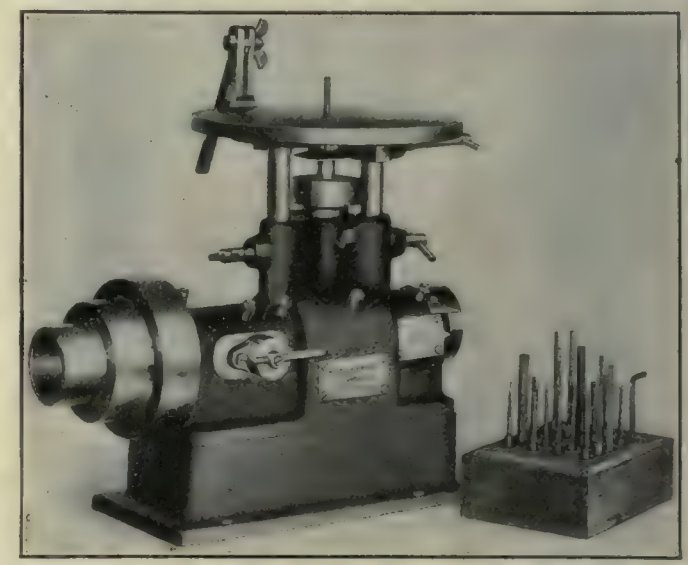
To operate, the die blank or templet is roughed out and then placed in the fixture shown on the table of the machine. Then the guiding finger, which projects downward from the overhanging arm, is set to follow the outline of a design or similar templet on the top of the fixture, the cutting tool, which is a file, following the design and thus shaping the work in the fixture. At any stage of the operation the file or the guiding finger may be moved, raised, or lowered, the fixture removed and the die checked from the back side for accuracy, after which it can be replaced and the operation continued as before. A micrometer dial at the right-hand side of the machine makes it possible to set the machine as accurately as desired. The file used is about 8 in. long and operates as a draw-file. Various shapes of files can be used according to the profile of the work.



HAWKES DIE- AND TEMPLET-MAKING MACHINE

Boston Universal Filing Machine

A bench filing machine having a reciprocating movement for using ordinary files in the regular manner, or a rotary motion for round files or special milling cutters,



BOSTON UNIVERSAL FILING MACHINE

is now offered to the market by the Boston Tool & Manufacturing Co., 262 Dover St., Boston, Mass.

The machine is little if any larger than the usual form of bench filing machine. The table can be tilted to any desired angle for the purpose of giving the requisite draft to dies, etc., and the machine is equipped with a three-step cone pulley.

An arm is supplied to be bolted to the table in such position that it will furnish a rigid support to the upper end of the file. The change from reciprocating to rotary motion is effected by turning the lever in front through a half revolution. The working parts of the machine are enclosed within the base and thus protected from dust and filings.

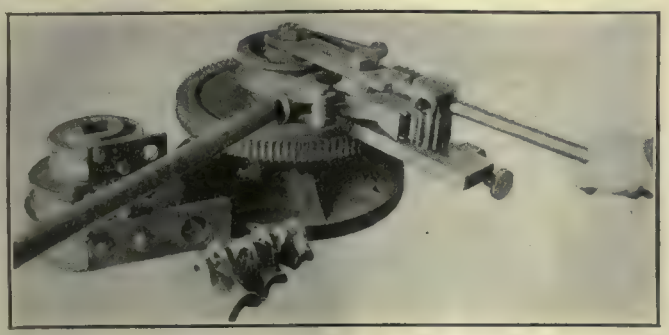
The manufacturers of the machine are prepared to furnish special files made with inverted teeth so that the pressure upon the work will always be downward whether using the reciprocating or the rotary movement; thus freeing the operator from the necessity of holding the work down.

The reciprocating files are made parallel so that the angle of clearance in the work is determined wholly by the angular setting of the table. The rotary files are tapered to suit the angle of clearance and the table set square with the axis of the spindle.

The machine occupies a bench space of about 9 x 12 in. and stands 11 in. high. The chuck is adapted to hold file shanks ¼ in. in diameter. The circular table is 7 in. in diameter and the stroke is sufficient to finish dies 1¼ in. in thickness.

Leonard Pipe-Bending Machine

The illustration shows a pipe-bending machine which has recently been placed on the market by the Leonard Machine Works, 1023-27 Race St., Philadelphia, Pa. This machine is made in three sizes, No. 1, which bends pipe from 0 to ½ in., No. 2 from 1 to 2 in., and the No. 3 from 2 to 4 in. The No. 1 machine, which is shown,



LEONARD PIPE-BENDING MACHINE

can be furnished with or without a floor pedestal, while the No. 2 and No. 3 sizes are furnished with the floor pedestal as regular equipment. Each machine is equipped with four forming heads and four bending shoes, and special shoes can be furnished for handling unusual work.

The machine consists of a cast-iron base, in the center of which is a solid steel spindle. Tightly fitted to this spindle is a ratchet wheel, and keyed on above the ratchet wheel is an arm which is free to swing around the spindle. The arm, which is of cast steel, has several tapped holes in which the center studs for the shoe-carrying gear segment and pinion are mounted. The pinion is made of steel and case-hardened, and has two large holes at the top drilled at right angles to each other, and in which the hand-lever is inserted when operating the machine.

To operate, the pipe is slipped through the guard that protrudes from the forming head, and then the small pinion is rotated until the shoe is in contact with the pipe. As the hand lever is swung around, the pipe is bent at the forming head. Suitable forms and shoes are made for each size pipe. The machine with all forms for 1, ¾, ½, and ⅜-in. pipe weighs 115 lb., and with a stand, 225 pounds.

Changes in B & S Small Tools

The latest micrometer depth gage, made by the Brown & Sharpe Manufacturing Co., Providence, R. I., and shown in Figs. 1 and 2 is obtainable with either a 2½ or 4 in. base. It is furnished complete with three measuring rods which enable readings from 0 to 3 in. to be taken by thousandths of an inch, the micrometer screw having a movement of 1 inch. The selected rod can be placed in position by removing the cap *A*, Fig. 2, which when replaced brings the nut on the rod against the seat *B*. Using the nut as a shoulder permits individual adjustment of the rod. Adjustment is provided for wear of the threads on the micrometer screw.

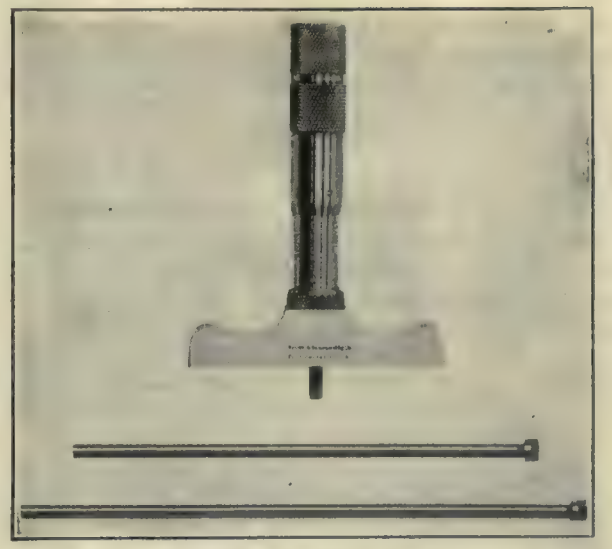


FIG. 1. B & S MICROMETER DEPTH GAGE

The tempered hook rules Nos. 320 and 325, now have a reversible hook of simple design and are provided with a shoulder to assist in setting dividers and calipers. The hook is held firmly and squarely on the rule by a screw and can be easily removed to permit the use of the rule alone.

The center heads now furnished with the combination squares are ground so that both arms are of equal length and the points, *A* and *B*, Fig. 3, are equidistant from the

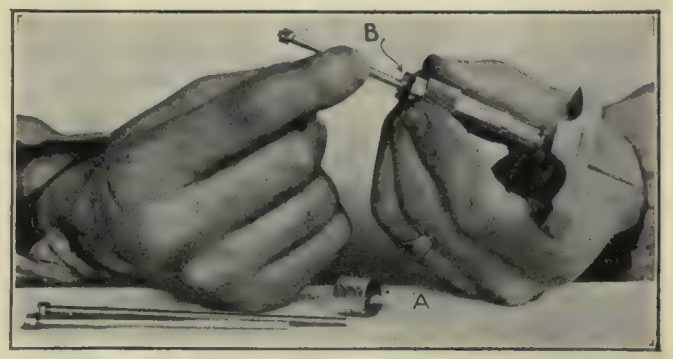


FIG. 2. METHOD OF INSERTING MEASURING RODS IN DEPTH GAGE

edge of the scale. This permits the use of the center head on work of large diameter as shown by the dotted arc.

Vernier calipers Nos. 570 and 571 either in English or metric measure are now made to read outside dimen-

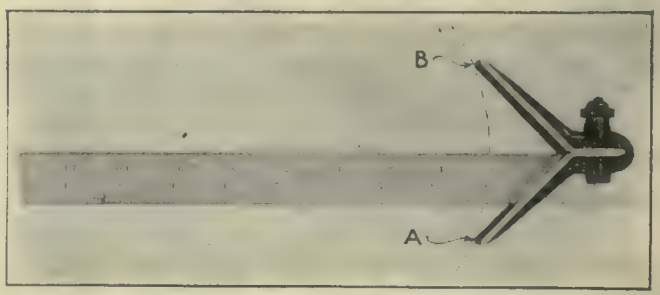


FIG. 3. B & S CENTER HEAD

sions on one side and inside measurements on the other, each side having its own vernier. The readings are direct, that is, there are two deductions to be made for

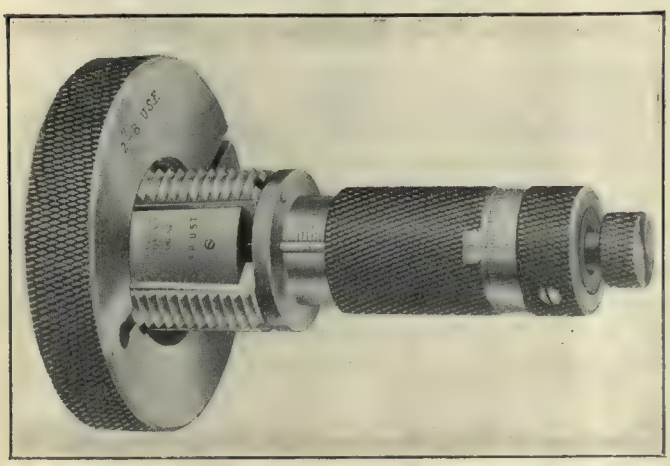
thickness of the jaws as formerly. The above changes also apply to the 10 in. vernier height gage No. 585.

Thickness gage No. 644 is now furnished with blades 3 in. long and ½ in. wide, no change being made in the number of blades or their thickness.

The Bath Internal Thread Micrometer

A tool, by means of which measurements of internal threads may be easily and accurately made, has been developed and is manufactured and marketed by John Bath & Co., Inc., Worcester, Mass.

This tool, as shown in the accompanying illustration



THE BATH INTERNAL THREAD MICROMETER

is distinctly a thread micrometer. With it the size of a tapped hole, ring thread gage, or other internal thread may be obtained directly in units of tenthousandths of an inch.

The four measuring jaws are supported and held in alignment by close fitting dovetail slots in the body of the micrometer, and may be adjusted for size by means of a micrometer screw and graduated sleeve. The moving parts are nicely lapped and fitted without play and the micrometer is claimed to be as rigid as a solid plug, thus enabling any number of persons to secure the same measurement on a given piece.

The micrometer is first ground and lapped when set at the nominal hole size, after which it is ground when set at the smallest, and also at the largest dimension. This subsequent grinding relieves the threads at each side of the center of the measuring jaws and insures line contact free from interference due to the change in the angle of the helix from the smallest to the largest measurement.

Adjustment is provided so that when wear occurs on the measuring jaws, the micrometer may be referred to the master reference ring, and set correctly to size, the wear being then taken up on the graduated collar which is provided with serrations for each tenthousandth of adjustment.

The micrometer can be furnished, with any number of threads per inch, in sizes from 1 to 5 inches in diameter.

Black and Decker Portable Electric Grinder

The Black and Decker Mfg. Co., 111 S. Calvert St., Baltimore, Md., has perfected a portable electric grinder which embodies the principal features of the portable electric drill (made by the same concern). The grinder, as shown in Fig. 1, is equipped with a pistol grip and

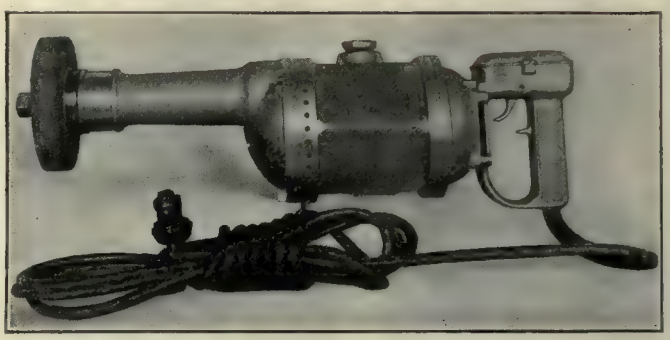


FIG. 1. BLACK AND DECKER PORTABLE ELECTRIC GRINDER

trigger switch which, it is claimed, gives the operator entire control over the tool at all times, making it unnecessary to shift either hand to start or stop it.

While this machine is essentially a portable grinder, it is supplied complete with quick detachable base and adjustable toolrest, as shown in Fig. 2, so that it can be used with equal facility as a bench grinder. Besides the base, the equipment includes two 5 x 1-in. grinding wheels one fine and one coarse, a wire brush wheel, and a rag buffing wheel. This outfit is intended to take care of any grinding, cleaning, buffing or polishing jobs around garages, service stations, vulcanizing shops, machine shops or foundries.

The machine is equipped for grease lubrication throughout, has forced air cooling, chrome-nickel steel gears and shafts, and aluminum alloy housing. The grinder can be operated with either direct or alter-

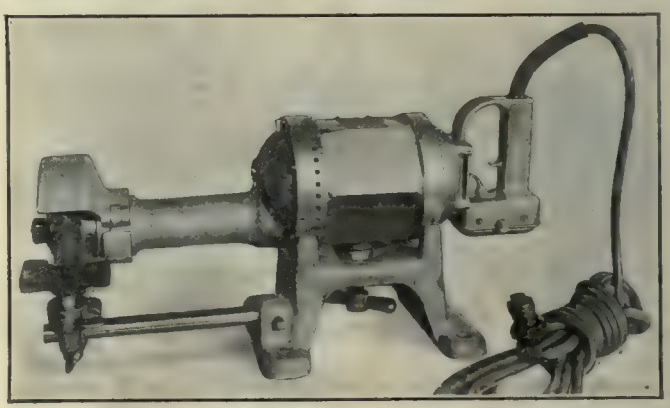


FIG. 2. GRINDER WITH BASE AND TOOL REST

nating current, as desired. The principal specifications are: motor, ½ hp.; speed, no load, 3,200 r.p.m.; wheel size, 5 x 1 in.; diameter of wheel arbor, ⅜ in.; and net weight without base, 21 pounds.

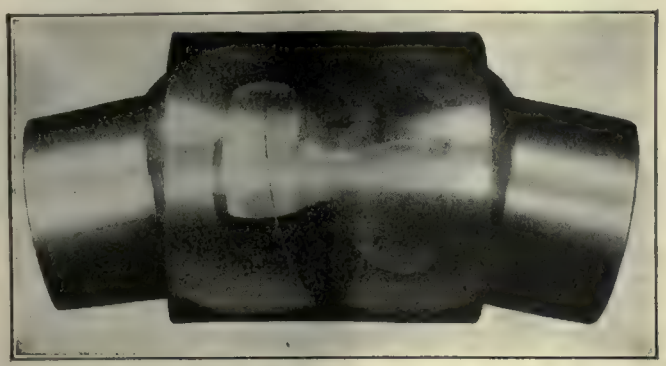
Whitney Free-Floating Coupling

The Kay Manufacturing Co., South Norwalk, Conn., has recently placed on the market the Whitney free-floating shaft coupling, the construction of which can be seen by the accompanying phantom view of the device. The coupling allows for both parallel and angular misalignment of the shafts being connected, as well as providing for axial movement, such as the floating of an armature.

The power is transmitted from the driving to the driven hub through a floating link. A casing surrounds the parts, the hubs being prevented from slipping out by retaining rings fastened in the ends of the casing by means of screws and fitting on the spherical inner

ends of the hubs. There are no projecting flanges or pins on the coupling, the exterior of which is smooth so as not to catch the clothing of a workman. The coupling is small in diameter, and compact and simple in construction. The device is adapted to the coupling of line shafts, to the connection of motors and generators, and to any use where it is necessary that two connected shafts should each run freely in their own bearings and not bind because of misalignment.

The hubs have square holes cast in the large ends, into which the ground ends of the semi-steel link fit. The link can thus slide in the holes and swivel in any direction, because of the rounded shape of its ends.



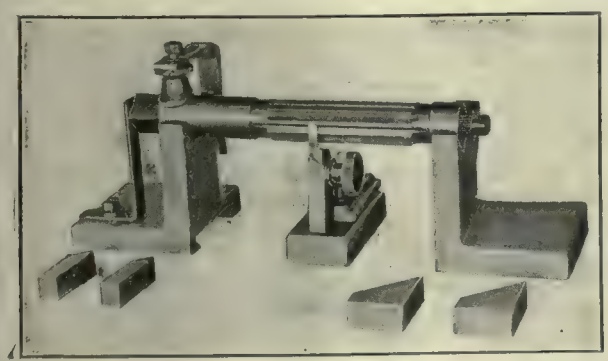
WHITNEY FREE-FLOATING SHAFT COUPLING

The smallest part of it is thicker than the shafts being connected, so as to provide sufficient strength to transmit the torque.

The coupling is said to provide a positive driving joint with but little back lash and great flexibility, and to operate smoothly and without noise at any speed. It is made in sizes to fit shafts from $\frac{7}{8}$ to $6\frac{1}{2}$ in. in diameter, although couplings having special and tapered bores can be furnished. The outside diameters vary from $2\frac{1}{4}$ to 14 in., the overall lengths from $4\frac{3}{4}$ to 24 in., and the maximum speeds from 3,600 to 900 r.p.m.

G. L. Wood "Common Sense" Reamer-Grinding Attachment

The illustration shows a reamer-grinding attachment recently placed on the market by G. L. Wood, 16 Stafford St., Worcester, Mass. The device is known as the "Common Sense" reamer-grinding attachment, and although adaptable particularly to hand expansion



"COMMON SENSE" REAMER-GRINDING ATTACHMENT

reamers having pilots, it is applicable also to the grinding of machine reamers, boring bars, pin-cutter bars, and taps. Reamers from $\frac{1}{2}$ to 2 in. in diameter can be held.

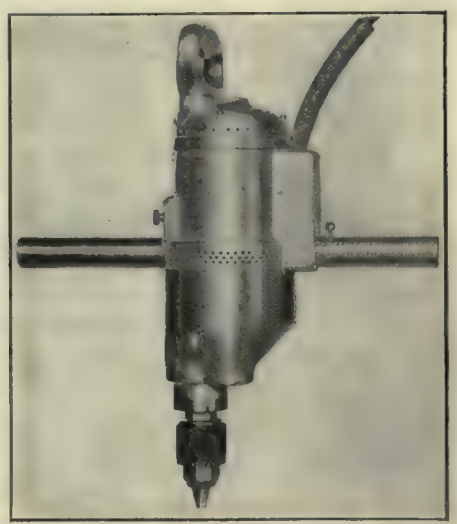
The reamer is expanded a sufficient amount to permit of the removal of the dull edge, and is then ground to size. It is said that the reamer can be kept to proper size throughout its entire length as long as it is expandable. Since the work merely rests in V's, reamers mounted on shafts can be ground without removing them from the shafts. Machine reamers can be ground without the use of the center hole on the reamer end of the tool, if necessary, by merely transposing the standard and allowing the reamer end to extend over one standard. The cutters of boring bars can be ground without removing them from the bars, any angle of rake or clearance up to 5 deg. being obtainable.

The device consists of two V-notched standards, a tooth rest to prevent the work from turning, and three sets of parallel blocks. The standards are made in two sizes, and a stop or friction device adjustable to either standard is provided. The standards, as well as the tooth rest, are machined to dovetail on standard grinding machine tables, and they are held in place by means of set screws. The position of the tooth rest can be controlled by means of a set screw. The parallel blocks are provided for raising the work up to the proper height on the two standards, and they give $\frac{9}{16}$-, $1\frac{1}{8}$- and $1\frac{11}{16}$-in. raises.

Machine and hand taps can be reground when broken, by cutting off the broken end and grinding any angle of taper and relief by the use of the tooth-rest gage.

Louisville Two-Speed Portable Electric Drill

The Louisville Electric Manufacturing Co., Thirty-first and Magazine Streets, Louisville, Ky., has recently developed a line of portable electric tools such as drills, grinders, motors, etc., among which is the No. 3 two-speed Universal drill shown in the illustration. This drill operates on either direct or alternating current. The speed changes are obtained by shifting a small knob located close to the handle, which can be done while the drill is running at full speed. The switch for operating the motor is controlled by a small knob on the handle. The gears are made of heat-treated chrome-nickel steel. The frame is of aluminum throughout and is force-ventilated for cooling. Jacobs chucks are a part of the standard equipment.



LOUISVILLE TWO-SPEED PORTABLE ELECTRIC DRILL

The drill shown has a capacity of $\frac{1}{2}$ in. on high speed and $\frac{3}{8}$ in. on low speed. It is equipped with ball bearings throughout. The diameter of the gear case is 5 in. and the spindle is offset $1\frac{3}{8}$ in. from the side of the frame. The length over all is $17\frac{1}{2}$ in. and the weight $19\frac{1}{2}$ lb. A breast plate, interchangeable with the spade handle, can be furnished.

Pipe Dreams of a Tramp Machinist—Johnny Inspects the Sprinklers

By GLENN QUHARITY

The Brookdell shops were equipped with sprinklers even earlier in the game than many other shops, for our old Mr. Brooks was quite a progressive man and quick to see the advantage of any new device that would benefit his business or insure its continued activity.

From the nature of the business conducted the plant was what modern insurance men would style a "bad risk" because of the vast quantities of stored lumber, the huge dry kilns and, further, from the presence near the center of the plant of a detached brick building



JOHNNY VERSUS SEVENTY-FIVE POUNDS OF WATER

where no work was ever done after nightfall, where no man dared go with matches in his pocket, and before entering which the night watchman used to set his lantern down in the yard—"the celluloid room."

In my apprentice days every room bristled overhead with sprinklers; every room had at least one standpipe pipe with permanent hose connections, and the yard was underlaid with water mains with hydrants at every point of vantage; all connected to a powerful waterwheel driven centrifugal pump located in the wheel pit, where no fire could ever put it out of business, and controlled by gates outside the shop.

The sprinkler system demanded constant pressure, for it was what is now called a "wet" system with water always at the sprinkler heads, and this pressure was supplied from a small reservoir on the hillside above the town. For this reason the pressure was somewhat higher than is usually obtained on similar systems supplied by tanks—about 75 lb. per square inch. That such a plant has stood for over seventy years—not all of it all that time—in a town with no fire protection without a serious fire speaks well for the foresight and vigilance of its executives.

All piping in and about the plant, whether steam, water or gas—we had a private gas plant 50 years ago—was under the supervision of the "boss of the machine room" (we didn't know what a "master mechanic" was in those days) and his boys made all necessary repairs and additions and saw to it that everything, especially the fire-protection service, was always in readiness for action.

We even had an "injin"—one of the old time double pumps on wheels, operated with long hand levers; but this was more ornamental than useful after the big power pump was installed. The "fire brigade" had rubber boots, red shirts, helmets, 'n everything, which they dutifully donned whenever we had a picnic. If ever a fire started there wasn't time.

All this has, perhaps, little to do with Johnny and the sprinklers, but it serves to show how Johnny came to be on inspection duty one Saturday afternoon.

All the old-time sprinkler heads had a screw in the side that could be partly withdrawn for testing purposes. If this screw upon being taken out did not allow water to escape there was something wrong with the pipes that had to be investigated there and then. It was not necessary to take this screw clear out—in fact it was highly desirable *not* to take it out—in order to be sure that the pipes were clear, for if the screw came out and the water was "there" somebody was going to get very wet before it could be put back.

Johnny was making the rounds one Saturday p.m. with stepladder, screwdriver and bucket, the latter to keep the slop off the floor and machinery, and had nearly completed his job when he arrived at the pattern shop. The patternmaker kept his particular stock of pattern pine and other choice woods in an overhead sling, same as most patternmakers do, and there was one sprinkler head over this sling that was so close to the lumber beneath it that Johnny could reach it only by crawling over the lumber and lying on his back under the sprinkler.

It was hot up there; Johnny was tired of his job and was dreaming of what he was going to do tomorrow after Sunday school. Besides, he had left his bucket out of reach. Somehow that darned screw got out and went rattling down in the chinks between the planks on which he was lying, and—the water was *there;* 75 pounds of it.

Johnny got his thumb over the hole and frantically searched under him with his left hand for the missing screw; meanwhile hollering for help. If you have ever tried to hold 75 lb. of water with your thumb, even though the orifice is only ⅛ in., you know what Johnny was up against.

Though the patternmaker was out, Johnny's cries were heard and the youngest cub came running to see what the trouble was. As his face rose over the edge of the stack of lumber like a full moon on a rainy night Johnny's thumb slipped long enough for Cub to get a shower of water in his eyes, and he hastily retreated: calling back to Johnny to "hold 'er till I shut off the valve in the branch."

His idea of shutting the valve in the branch was first to assemble all of his comrades that he could find to take a peek at Johnny holding back the flood like the little Dutch boy we used to read about in the "Third Reader," who saved the town by holding his thumb in a hole in the dyke, until Johnny, sensing the cause of the delay, let go his hold, crawled out from under the gushing sprinkler and slid to the floor.

He was very wet and very mad; but the patternmaker, who came rushing to the scene to find what the fuss was about, was still madder when he found that "a passel of damfool boys had ruined a thousan' dollars worth o' patt'n lumber."

The valve was shut, the screw found and replaced, and the drenched lumber hauled out and sent to the dry kilns; the boys doing the hard work. Johnny was sore—where the patternmaker hit him; and Cub got a licking after six o'clock.

Johnny and me didn't speak for nearly two weeks.



NEWS SECTION

Three Washington Conferences

The Fourteenth Annual Conference on Weights and Measures was held at the Bureau of Standards on May 23-26. Invitations had previously been sent to the governors of states, mayors of various cities, and weights and measures officials throughout the country. The governors of those states which do not maintain an office of weights and measures were in every case urged to appoint delegates to the conference and many took advantage of this opportunity to send a representative to the Bureau. Manufacturers of apparatus and persons engaged in weights and measures work for industrial concerns, associations, etc., were also present. Several of the manufacturers had on exhibition various weights and measures appliances, including liquid measuring pumps, machines for automatically measuring the yardage of cloth, scales of all sorts, etc.

The main object of these conferences is to secure uniformity in weights and measures standards and laws and in the enforcement of the latter. Only fundamental questions of weights and measures are considered; the aim of the conference being rather to direct the general subject than to go too much into detail. Among the speakers were: Mr. Herbert Hoover, Secretary of Commerce; Dr. S. W. Stratton, Director of the Bureau of Standards, and numerous officials of State Weights and Measures Departments. The subjects treated included the sale of bread by weight, detection of shortages, weighing of coal, and tests of liquid measuring pumps.

Aeronautical Safety Code

On May 13, a conference was held in Washington to consider the development of an Aeronautical Safety Code for which the Bureau of Standards and the Society of Automotive Engineers have been designated as the joint sponsors by the American Engineering Standards Committee. This conference was attended by representatives of the War, Navy, and Post Office Departments, The National Advisory Committee for Aeronautics. The National Safety Council, Manufacturers' Aircraft Association, and the Insurance Underwriters, as well as representatives of the two sponsors and the American Engineering Standards Committee.

It was the sense of this conference that a safety code ought to be developed without delay and that a committee should at once be formed which would include representatives of all organizations interested in this subject as well as those which were present at the conference. Invitations have, consequently, been extended to other interested organizations.

Standard Tests for Automobile Brake Linings

At a conference recently concluded at the Bureau of Standards, recommendations were made for a standard method of testing brake lining materials for automotive purposes. The engineers of the Bureau discussed these recommendations with representatives of nearly all the manfacturers of this class of material, as well as of the Motor Transport Corps of the Army and the Standards Committee of the Society of Automotive Engineers.

In view of the very large quantities of brake lining material used in automotive vehicles today, the establishment of standard test conditions which may be used by all makers and large users and which can form the basis for purchase specifications is of considerable importance, not only to the industry but also to the public. Such standards carefully planned tend to bring about a greater uniformity of the materials concerned, and by establishing a better understanding of the essentials leave the manufacturer free from unnecessary restraint in other directions, so that he may use all his energy and ingenuity towards the improvement of the materials and his methods of production.

The Steel Treating Society Convention

The National headquarters of the American Society of Steel Treating has announced the list of manufacturers who have contracted for space to exhibit their products at the Indianapolis Convention and Exhibition Sept. 19 to 24.

While the date for the opening of the Convention is still three months off, the 50 firms listed below have arranged for space. There are a large number of uncompleted contracts in the National office, and indications are that the Indianapolis show will be larger than the one held in Philadelphia last fall.

The interest being aroused on the part of the members of the Society and the exhibitors assures a very large attendance. This year, more manufacturers will have their exhibits in operation than in any previous exhibition. An excellent opportunity will be afforded to observe manufacturers' products under actual operating conditions.

A list of exhibitors to date follows:

Selas Co., Economic Gas Appliances in operation; Chas, Englehard, Recording Instruments in operation; Smith Gas Engr. Co., Produce gas machines in operation; Geo. J. Hagen Co., oil and Gas furnaces in operation; Westinghouse Elec. & Mfg. Co., elec. appliances in operation; Brown Instrument Co., Recording instruments in operation; Midvale Steel & Ord. Co., operating exhibit of steels; Indianapolis Drop Forging Co., forgings in operation; Calorizing Corp. of Pittsburgh, Calorizing process in operation; Deeds Commercial Laboratories, Carb. Compounds in operation; Leeds & Northrup Co., Elec. fur. and record. instrs. in operation; Tate-Jones & Co., furnaces; Armstrong Cork & Insulating Co., insulating materials; Taylor Instrument Co., Pyrometers in operation; Ludlum Steel Co., steels; Marschke Mfg. Co., Elec. grinders and buffers in operation; Simonds Steel Co., steels and saws in operation; General Electric furnaces in operation; Wm. Ganschow, gears; Bristol Company, recording instruments in operation; Eaton Elec. Furnace Co., electric furnaces in operation; Bethlehem Steel Co., steels; Spencer-Turbine Co., blowers in operation; Driver-Harris Co., alloy pots and boxes; Crucible Steel Co. of America, steels; Electric Steel Co. of Indiana, castings; Halcomb Steel Co., steels; Atlas Crucible Steel Co., steels; Bell & Gossett, case hardening materials; Iron Age, publications; Deeds & Chapin, "Cinch" cement; General Alloys Co., alloy pots and boxes; Electrical Refractories Co., refractory materials; W. S. Rockwell Co., oil and gas furnaces; Electric Alloy Steel Co., alloy steels; Colonial Steel Co., steels; Herman A. Holz, Inc., metallurgical equipment; Imperial Drop Forge Co., forgings; Vanadium Alloy Steel Co., steels; Heppenstall Forge & Knife Co., die blocks; E. C. Atkins, metal saws and cutting machines; Mahr Mfg. Co., furnaces.

Poles Anxious to Buy Goods Here

Caesar Lozinski, director of the Polish purchasing bureau in the United States, who has just returned from an extensive trip in Poland, has issued, through the American Polish Chamber of Commerce, 40 West Fortieth Street, a résumé of conditions in this country and of its needs.

"Polish manufacturers are in the market to purchase American tools and machinery needed to equip their factories for raising the basis of production to the pre-war level," said Mr. Lozinski. "It is hoped that it will not be necessary for Poland to import large quantities of foodstuffs this year. The present outlook for the crops is favorable, and, barring untoward events, domestic production should supply the country's needs in this respect. But large quantities of machine tools, electrical machinery, chemical apparatus and equipment parts for the existing factories will have to be imported by Poland from America or from her European competitors in these lines, according to the attractiveness of the terms offered.

"Ever since the signing of the peace with the Bolsheviki, the feeling of security in Poland has been growing. The army has been demobilized until at present only about 300,000 men are under arms. There is a marked desire on both sides to open up trade over the Polish-Russian border and already a very considerable movement of persons and trade is going on. In spite of handicaps, private enterprise is finding a way to get into Russia. What Poland most desires from this country is the investment of American capital in Polish industries. It is difficult for Americans to realize that in spite of the low value of the Polish mark, Poland is very much alive. Everybody is working. The standard of living is improving."

"Garabed" Amendment Suggested

An amendment to the "Garabed' 'resolution adopted by Congress February 8, 1918 has been introduced in both the houses of Congress. The amendment proposes to make section 3 of the original resolution read as follows:

"That if such demonstration shall, in the opinion of the said scientists, prove the practicability of said discovery or invention, and that it can substantially effect the purpose set out in section 1 of his resolution, the said Garabed T. K. Giragossian shall be recognized by the United States Government as the original discoverer, inventor and legal owner of the invention or discovery and of any improvements pertaining thereto that may be made by said Garabed T. K. Giragossian. The certificate of said commission of scientists, to the effect that said discovery or invention is practicable, as aforesaid, shall constitute the said Garabed T. K. Giragossian the legal owner of and entitle him to all the rights and benefits of said discovery or invention for a period of seventeen years. The right is reserved to the said Garabed T. K. Giragossian, his heirs and assigns, to take out patents for his aforesaid discovery, invention, or for any improvement or device pertaining thereto."

It is amazing that, with so many vital problems before the country members can be found who will waste time and money on things of this sort. The merits of "Garabed" have already been investigated by a competent commission and found wanting.

Business Conditions in Germany

By Our Berlin Correspondent

The acceptance of the ultimatum, foreshadowed in the last Berlin letter in these columns, is an event which in its importance and consequences for Germany can hardly be overrated. The retrograde movement, which could be observed in all branches of the country's economical life, characterized by the tendency to let everything drift, has come to a halt, and the people are again looking the future in the face. The Upper Silesian problem is, however, still causing great anxiety, and until it is settled definitely it can hardly be expected that brain and will power, which of late have become more and more an inert quantity, will move on the road which the country will now have to traverse. The future can hardly be recognized yet even in dim outlines, and it will probably take months until the business man will be able to shape his course with a certain amount of confidence. During the past months of unsettledness, the same disastrous state of affairs which followed the revolution has again come into effect, characterized by speculation taking the place of calculation.

To restore the normal order of things in this respect will be the first task of the business world. It can only be performed by general confidence gaining ground once more. This process will necessarily be a lengthy one, as the confidence of the broad public had during the time between the end of the War and the settlement of the reparations been deliberately undermined by Government and press, in the propaganda for obtaining the best possible terms. So thoroughly has public opinion been shaken in this respect that there is at present, with a few exceptions, no one in Germany who believes that the terms of the London ultimatum can be fulfilled at present or in the future. The first duty the present Government will have to perform is to abolish the system of pessimistic propaganda which had been poisoning the public mind, thereby checking enterprising spirit everywhere. A slight improvement in this respect is already noticeable, as is proved by news which recently have gone through the press, of a kind which only a few weeks ago would have been suppressed by the editor of every German journal. A striking instance of such news is the public admission that there exists a decided glut on the brown coal market for months, resulting in discharge of labor and shortening of working time. Although the hue and cry was chiefly for the lack of bituminous coal, the state of affairs on the brown coal market may be considered a gage of the real conditions.

Raising the Reparation Funds

The main question by which the country is now confronted is how to raise the tribute to be paid under the London ultimatum. That it cannot be done by the country's revenues is made evident by the returns published for the last revenue year, which runs from the 1st of April, 1920, to the 31st of March, 1921. According to these returns, the total revenue of the country was 73,000,000,000 marks, while the expenditure amounted to 89,600,000,000 marks, resulting in a deficit of 16,600,000,000 marks, which has to be balanced by public loans. In the current year the deficit is estimated at 30,000,000,000 marks, in which sum, there is, however, included a payment of 27,000,000,000 marks toward reparations. Import duty netted only 305,000,000 marks (paper), as against 721,500,000 gold marks in 1913, giving an indication of the extent of import in comparison with pre-war years. The coal tax produced 4,670,000,000 marks, the tax levied on business turnover 4,200,000,000 marks, and the export tax 2,230,000,000 marks.

The Government revenue is based upon a very elaborate scheme of levying, handled by an enormous staff of officials, the majority of which are new to their present occupation. This machinery is only slowly coming into its swing, but its progress has been marked by a steady increase of revenue. It is also to be expected that the state railroads, which have so far been sapping a good deal of the country's revenues, will again come on a paying basis, the rates for passenger and goods traffic having been raised up to 65 per cent, and economy is being enforced with increasing effectiveness. Still it is being recognized that there is no room for the billions of gold marks to be paid annually in the framework of the present taxation system. New taxes will have to be devised, and the Government is looking for the additional revenue required to that part of the population which is economically in the strongest position, *i.e.*, the producers.

It has been said so often by almost everyone in authority that it has become a rigid principle that the country's strength and capability to cope with the reparation duties rests with production. The producers themselves, however, are at a loss to recognize how this principle will work in actual practice. That the production must be increased at an enormous rate to produce such values as are required is a matter of course. The present capacity of the whole industry is, so the foremost economists of the country assert, hardly adequate for the purpose. To increase it does not present such difficulties to the manufacturing world as does the marketing. Numerous and strong barriers are standing in the way of disposing of German products on foreign markets, quite apart from the present business dullness. To achieve the end in view it is commonly believed to be necessary that German products can be manufactured so cheaply that they will surmount all such barriers, and restore purchasing power.

One of the captains of German industry, expressing no doubt the opinion of most of his brethren, recently held out that the "discount of hatred"—a word coined for the margin by which German manufacturers felt themselves compelled to underbid foreign rivals—would have to be large enough to break with elementary force all obstacles artificially raised against German goods abroad. For carrying this out, only one way appears to be open to the majority of manufacturers, that is the extension of regulation working time, and the reduction of wages. The first instance of a step made in the latter direction is that of a large Western copper mining company, the Mansfeld Works, which have cancelled their present wage agreement, with a view to enforce reduced wages. The result of the strife which is bound to ensue is awaited with keen anxiety in the industry, as no doubt it is symptomatic. Without making an attempt at prophecy, it may be said that the experiment of the Mansfield Work is premature, and open to failure.

The Return of Piece Work

The problem will no doubt soon be tackled from another end, of which signs are already perceptible, that is by the return to piece work. It must be remembered that after the revolution piece work was abolished throughout the country. Later on, however, it was reinstated, but only partly. All wage agreements existing provide that in the case of workmen accepting piece work they receive minimum wages, with the payment for piece work overriding. Although the result of this system is so far quite satisfactory, it does not produce the utmost efficiency now required. Manufacturers are as a rule quite prepared to give the workman an income which in the aggregate would be higher than his present pay, if it based purely on piece work. Under such circumstances the whole problem would appear to be quite simple, but it is nevertheless fraught with considerable difficulties. To attain the end in view, the industry will have to traverse a long and thorny road. The workman will not easily abandon what he believes to be one of the most valuable achievements of the revolution—a fixed income, and the abolishment of what he calls sweating practice. He may even be more amenable to the attempts at extending regulation time.

Negotiations between trade union leaders on the one side, employers' societies and government officials on the other side are actually being carried on, with the object to make stipulations for one or two hours' overtime. The basic conditions upon which the workmen are prepared to enter into such discussions are the fixation by law of the eight-hour working day, in order to guard against overtime automatically becoming part of the regulation time, and that the overtime work should only benefit the workmen on the one hand, and the country on the other, but under no circumstances capitalism. Whether anything will materialize soon from the negotiations is, at the present extent of unemployment, rather doubtful.

From all these schemes is peculiarly absent the problem of raising the production by improved mechanical facilities and better organization. The reason for this is that possibilities in this direction are hardly realized, much less admitted. One of the first persons in authority to admit them was Dr. Walter Rathenau, the president of the AEG (General Electric Company), as has been mentioned in the last letter of your Berlin correspondent. It transpires that Dr. Rathenau has been severely censured for this admission, but it is significant for the policy of the present Government that it has since then offered Rathenau the Ministry of Reconstruction. (At the time this is written it has not become known whether he has accepted.) In favor of Rathenau speaks the wonderful organization of the large enterprise he is presiding over, and his clear insight into all phases of the production process. Moreover, he is one of the few industrial leaders who is not closely leagued to the Rhenish-Westphalian iron and steel industry, which managed to obtain such predominating and not entirely wholesome influence in the administration of the country. A person of Rathenau's authority would indeed be needed to initiate progress in the direction mentioned.

Everything in Germany is now done through the manufacturers' organizations, which have managed to gain a strong position of authority over the individual manufacturer. These organizations are mostly indifferent—not to say in opposition—to further "mechanification" of labor, which is shown by the half-hearted way in which the "Committee for Economical Production" is treating such matters. The reason, of course, is the enormous amount of capital investments and work which a radical reformation of the production toward highest efficiency and economy would entail. A striking illustration of this attitude is the case of the coal mines of the Ruhr district, which stand in urgent need of new equipment. The cost of modernizing these mines, whereby their efficiency could be raised from 30 to 50 per cent, is estimated at 9,000,000,000 marks. It is a peculiar fact, and characteristic for the incoherency of mind prevailing throughout the country, that with the haggling of who is to bear the burden of this investment the mines are allowed to be run down, and the whole production to rest solely on the quantity of manual labor. At the same time enormous sums, far exceeding the amount required, are invested in public utility works, like the construction of inland waterways and hydro-electric power stations, schemes which will bear fruit only in a rather remote future.

Manufacturers Organizations

The whole production problem is, however, bound to be carried forward by sheer force of necessity. Hand in hand with the problem goes the movement for the liberation of the export from all fetters. This movement, which has been mentioned in these columns several times, is growing stronger every day. It is chiefly supported by the trade, while the producers' organizations are divided in their opinion. The latter are only unanimous with respect to the abolishment of the export tax, which has been levied up to now to an extent of from 2 to 10 per cent of the value of exported goods, and which it is argued cannot be allowed to continue as a separate item alongside of the export tax to be raised as a part of the reparation terms.

So far the decontrol movement has had the result that a number of products have been freed from export control, mostly however raw products, which is a peculiar fact, as the chief efforts are directed toward the decontrol of finished products. The resistance with regard to the latter mainly rests with the organizations of the manufacturers, which are fearing that upon decontrol an extensive underbidding will commence. The advocates of decontrol are arguing that the country should neglect for the time being all efforts to exact the best possible prices on foreign markets in favor of a large volume of exports. The question of prices should be left to the judgment of the individual exporter, who is now able to survey his own possibilities. Cases are frequent of official export offices compelling manufacturers to quote at prices which far exceed current quotations in foreign markets. It is a fact that the individual exporter is frequently better informed of foreign prices than the export offices, whose chief business it is to be conversant with them. The policy recommended by the free trade advocates amounts to dumping on a large scale, in the hope of stimulating consumption, and gaining a firm foothold on foreign markets.

No Business Revival Before Fall

The business situation remains utterly dull. The outlook for the next months to come is still very gloomy, and a revival is not hoped for until fall. A considerable step forward has been made by the Government issuing an assurance that the tax

raised in foreign countries on German products, which is to be paid from the purchase price, will be refunded to the German exporter. Under the stimulus of this assurance, business relations, especially with England, are being gathered up again where they had been dropped under the effects of the sanctions. The regulation mentioned is, however, of a transitory nature only. It is clear that the Government cannot go on to reimburse manufacturers from public revenues, and a way will have to be found for unburdening the tax on broader shoulders. In the meantime, a movement becomes noticeable mainly in the machine building and iron and steel industry to circumvent the export tax, by transferring part of their manufacturing into other countries. Austria for instance has lately been flooded with tentative offers for the purchase of factories, or of co-operation. Hungary also has been drawn into the circle of possibilities, and it is reported that Stinnes, who always seems to be the first on the field, has lately acquired the controlling interest of large Hungarian concerns, the Rima-Muranyer iron works, the Schlick-Nicholson machine factory, and of the shipbuilding works Ganz-Danubius.

Inquiries from abroad are coming in again in increasing numbers, a factor which is raising hopes. It is also expected that the sanctions will soon be cancelled, doing away with the customs barrier, which already has become a rather painful thorn in the flesh. From the industry in the Cologne district discharge of workmen and reduction of working time is reported in numerous cases. The Rhenish industries have formed a strong organization, with the object of balancing as much as possible the evil effects of the sanctions. Manufacturers of kindred products have formed combines, which are working in close conjunction. Most of these organizations have decided to bear the burden of the export tax from the occupied territory into the interior of Germany, in order to enable the industry to compete with that of the unoccupied part of the country.

Delays in Shipments

The customs barrier has become the operating field of extensive red-tape practice from the side of the Interallied customs organization as well as by German officialdom. The consequence is considerable delay of shipments, and the clogging of frontier stations. Although there is no duty levied on shipments coming from the occupied zone on the German side, an elaborate system has been established for controlling such shipments, with the object of keeping out undesirable foreign products, which might enter through the occupied territory. The opinion prevails in the Rhineland that it is the intention of the Interallied Commission to handle the sanctions with a view to detach the province more and more from the mother country, and to make it economically an independent unit—a policy which would have been ruinous to a large number of factories. The at first unbending attitude of the Rheinish industry has therefore in the course of time weakened considerably, and the cancelling of the sanctions is looked forward to with growing impatience.

The situation of the industry in the interior has undergone very little change. Manifest signs of distress like in the Rhineland are absent, although unemployment is spreading further. The extent of the unemployment may be gaged by the publications of the National Ministry of Labor, which states that in April, 1921, the number of workers engaged in concerns badly employed has risen from 38 per cent in March to 43 per cent in April, while those engaged in works sufficiently employed had decreased from 30 to 28 per cent in the same time. Of two million metal workers, 10.2 per cent were working short hours. This percentage was at the middle of January 6 per cent, at the end of January 7.1 per cent, end of February 7.9 per cent, and end of March 8.3 per cent. In the metal industry, where business conditions are exceedingly depressed, only 2.6 per cent of the workers are engaged in works well employed, while in the case of 18.1 per cent the employment is satisfactory, and for 79.3 per cent, that is more than three-fourths of the total employed in this industry, the employment was reported to be bad. Shortening of working hours, and discharge of workmen are taking place in this industry in an increasing extent. With the sole exception of works with orders for the railroads, the drop of employment is general.

Railroad Material for Russia

In the iron and steel market business continues within narrow limits. Satisfactory demand is only reported for railroad material for German and Russian account. The decontrol of this market, resulting in heavy underbidding of the previous prices, has so far failed to act as a stimulus to buying. The same can be said of the foundry industry, where heavy reduction of prices also produced little result. An exception in this respect is only presented by the Berlin foundries, which so far have sufficient business on hand.

Little Machine Tool Building

In the machine building industry the demand has come to an almost complete standstill. Up to the middle of April, shortening of working hours and discharge of workmen has taken place in comparatively few cases, but they have increased at an alarming rate since the end of April. A number of machine tool works have lately discharged from 10 to 30 per cent of their workmen. Of 238,000 workmen employed in the machine building industry, more than three-fourths have at the end of April been engaged in works badly employed, and only in the case of 23 per cent was the employment reported to be fairly adequate. The number of unemployed in this industry is increasing in all parts of the country. Most pronounced is the business depression in the machine tool industry, which now forms one of the worst employed branches of the machine building industry. The situation of several works in this industry has become rather critical. This is evidenced by agents having been empowered to sell machines from stock "at any reasonable price."

It is rather astonishing to see how the majority of manufacturers are weathering this lull of business. The fact is that many of them have become more and more dependent on bank loans, and as private-owned concerns find less willing support from this side than joint-stock companies, reorganization of private-owned concerns into joint-stock companies is making increasing headway. In the machine tool industry, for instance, nearly all works of note have now been transformed into joint-stock companies, or are in the course of doing so.

The unemployment problem is under such circumstances causing the Government considerable concern. Communities and provinces are urged to provide emergency work, mostly in the building line. Many schemes have been devised for this purpose, but as the central Government has withdrawn financial support, and leaves the burden of financing to the exchequers of the municipalities and provinces, slow progress is being made in this direction. This has lately caused the Government to devote attention to provide facilities for the unemployed to find vacancies. A bill has been submitted to the Reichstag for abolishing private employment agencies, and handling the business through public organizations. This scheme is causing strong opposition in the industry, as it is feared that red tape must produce more harm than good. Besides, the bill contains several clauses which raise the suspicion that pressure can and would be exercised for employing men without sufficient qualifications. The arguments offered against the scheme are based upon bad experiences made in one German province, where the provincial Government has already monopolized the employment agencies, with absolutely negative result.

Army Ordnance Association Establishes New York Post

Over two hundred members of the Army Ordnance Association and former ordnance officers met in the Engineering Societies Building on June 15th and formed the New York Post, with headquarters at Governors Island. The new post will be the central organization for the Second Corps area.

General C. C. Williams, Chief of Ordnance, opened the meeting and called attention to the need for ordnance reserve officers and for a post to carry out the ordnance organization plans of the General Staff. He then turned the meeting over to the temporary chairman, Guy E. Tripp.

Mr. Tripp introduced Major Brett, Ordnance assistant in the office of the Secretary of War, who described in outline the plans of the General Staff for the organization of the Ordnance Department under the act of June, 1920. Major Brett stated that the work had been divided into three sections: engineering, design and preparation of plans; organization for military and industrial purposes; and production and plans for production. Funds are available for the first of these and the organization scheme for field duty has been completed. The greater part of the forces consists of the organized reserve and the need, therefore, is for some 5,000 reserve officers, of whom less than half have been commissioned. Looking to the future when the present trained officers will have gone back to civil life it seems that the only source of replacement is the R.O.T.C. Unit in the engineering school. Such units exist at Massachusetts Tech., Yale, Cornell and Wisconsin.

The chairman then asked Major Coombs to form a resolutions committee and Colonel Morris a nominating committee, the committees to withdraw and present recommendations. The resolutions committee brought in a report suggesting a form of organization which was adopted and the following officers were chosen to serve for the first year: President, Guy E. Tripp; 1st Vice-president, Colonel Warren; 2d Vice-president, Major Maish; Secretary-Treasurer, Captain Wilkins. Committees on programs, membership, military preparedness and industrial preparedness were also appointed.

Philadelphia Foremen Meet

About 700 foremen and forewomen have attended instruction classes under the direction of the Philadelphia Association for the Discussion of Employment Problems during the last year.

The foremen's group is open to men and women employed in a supervisory capacity by any firm that is a member of the association. In addition to the regular weekly classes, meetings for the entire group are held monthly.

Membership now consists of 102 manufacturing and commercial companies, representing about fifty different industries and businesses here. This membership totals 5,000 individuals, including employers and employees, about 20 per cent of them women.

The two other sections include the managerial group, including presidents, managers, engineers and superintendents, and the personnel group, consisting of personnel supervisors, employment managers, doctors and service workers.

Charles E. Brinley, of the American Pulley Co., has been elected president, succeeding A. E. Chevalier, who retains his position on the Executive Committee. Prof. Joseph H. Willits, of the University of Pennsylvania, was elected vice-president; John M. Williams, of the Fayette R. Plumb Co., secretary; W. M. C. Kimber, of Leeds & Northrup, treasurer, and A. J. Churchill is executive secretary.

India's Production and Consumption of Coal

By ALEXANDER W. WEDDELL
(Consul General Calcutta)

According to the recently issued report of the Department of Statistics ,India, on the production and consumption of coal for 1919, the country's total production in that year amounted to 22,630,000 tons, of which 98.3 per cent was obtained from the Gondwana system of strata (chiefly composed of sandstone and shales deposited in fresh water and by river). British Provinces are credited with the production of 21,770,000 tons, of which Bihar and Orissa produced 15,120,000 tons and Bengal 5,780,000 tons. Thus the output of these two Provinces alone amounted to 92.5 per cent of India's total, 87 per cent of the total being derived from the two fields in Damodar Valley, Jherria producing 12,146,000 tons and Raniganj producing 6,815,000 tons. The Native States produced only 860,000 tons, of which 660,000 tons is crdeited to Hyderabad.

There are over 200 joint-stock coal companies at work in India, whose combined authorized capital totaled 140,300,000 rupees with paid-up capital of 86,800,000 rupees and debentures issued to the extent of 2,400,000 rupees.

The report estimates that the consumption of the total available supply of 1919 was distributed about as follows: Railroads, 27.3 per cent; bunker coal and Admiralty and Royal Indian Marine shipping accounts, 10.7 per cent; iron and brass foundries, 5.7 per cent; cotton mills, 4.7 per cent; jute mills, 4 per cent; consumption at collieries and wastage, 12.2 per cent; and other forms of industrial and domestic consumption, 35.4 per cent.

Some coal was imported but this only amounted to 38,180 tons in 1920, while in the same year the exports were 679,769 tons.

Reclaiming of Foundry Sands

A co-operative study of the problems encountered in the reclaiming of foundry sands is to be made by the Bureau of Mines and the American Foundrymen's Association.

Business Conditions as the Big Banks of the Country See Them

The National City Bank's Observations on Industry, Capital and Interest

The industrial situation in this country continues to be uneven and on the whole without pronounced development. The industries making goods of common consumption and in which depression has existed for practically a full year, such as the manufacture of clothing and shoes, have experienced a revival, old stocks having been depleted to a point where dealers are obliged to buy to supply current trade. Hides and leather are in better demand and bringing better prices. Wool purchases by manufacturers have not been in proportion to the orders for cloth on their books, but they have been buying continuously and the tone of the market has been better, although prices are not much higher.

The iron and steel industry, which in past times has been considered the best index of general business conditions, is at the lowest level of production in many years, with no trustworthy signs of improvement aside from the general factors of the situation named above. It is waiting on better net revenues for the railroads, a revival of construction work, and more general prosperity.

Credit Conditions

Although the volume of bank credit still is much above normal proportions it has been largely reduced since the first of the year, and the strain at the centers is much reduced. Apprehensions as to unfavorable developments in the credit situation as a whole are no longer seriously felt. The money markets are easing slightly, as bank loans are reduced, reserve bank rates in this country having been generally reduced from ½ to 1 per cent during the past month. The Bank of England rate has been reduced from 7 to 6½, and the Bank of Sweden rate from 7½ to 7. The Norwegian rate is 7 and the Danish rate 6½. The security markets have given a good account of themselves, the flotations in this country having been very large and well taken. In London the financial markets have been steady, notwithstanding the grave industrial situation.

Interbank borrowing among the Reserve banks has increased during the past month, the banks directly serving the chief agricultural districts requiring aid to enable them to meet the legitimate demands arising from the activities of the spring season. This has been expected and is necessary. Credit must be found to carry on the productive processes of the country. Obviously every section and interest is served by so doing. There will be no prosperity for "big business" or little business of any kind unless production goes on—little freight for the railroads, trade for the cities, or deposits for the banks, if the crops were not forthcoming.

The Scarcity of Capital

During the war the whole world violated economic principles, centering all thought and effort upon winning the war. Credit was created without stint, and interest rates kept artificially low. Instead of restricting private consumption in order to release productive capacity to the government and to supply the government with real capital, we undertook to provide the government with purchasing power through the private use of bank credit, on a great scale. We borrowed as individuals and turned the proceeds over to the government. Probably no other course was practicable, but this inflation of credit resulted in the great rise of wages and prices. We got away from all standards of value. Finally, when an effort was made by the bankers to stop the tide of inflation, interest rates inevitably went up, and have remained up, although now softening a little, as progress is made in restoring normal conditions between capital and credit.

During our Civil War, when the Government paid its expenses largely by printing the greenbacks, the greenbacks depreciated in value and were finally brought to par with gold in 1879. This time our paper money was kept at par with gold, but the purchasing power of our whole body of money, gold included, depreciated almost as much as the greenbacks did in their day. Federal Reserve credit was regarded as good as gold, but the profusion with which it was issued had the effect of depreciating gold, as any substitute which is "just as good" will depreciate the value of the thing it imitates.

Interest Rates for Capital

Interest rates cannot be regulated arbitrarily; they must correspond to the relation between the supply of available capital and the demand for it. That has been affected by the war, and is still affected by taxation, high cost of living, unremunerative returns upon great sums of capital invested in railroads and public utilities, credits granted to Europe, and finally the industrial disorganization which is rendering business enterprises unprofitable and tying up large amounts of capital in frozen assets. Interest rates will come down as new capital is accumulated, and that will be promoted by a general understanding of the fact that the entire community is served by such accumulations, no matter who owns them. There is no remedy for a scarcity of capital but more capital.

The Money Question

Nine-tenths of the erroneous thinking about money is due to confusing money as a medium of exchange with capital. Money is a convenience in effecting the exchanges but it does not take the place of capital. The money question always has been a subject of controversy, and it is not easily elucidated in all its details, but there are certain broad propositions which most people are able to grasp, and which when agreed to will dispose of many of the most plausible fallacies. It is a safe rule in the business world not to try to get something for nothing, and in the world of applied science not to try to get more out of any combination than the sum of all that is put into it. By the same reasoning it is safe to conclude that a people cannot make themselves rich by printing money or by any other scheme for making credit take the place of capital. There is a hole in every such proposition somewhere.

War Prosperity a Delusion

It does not stand to reason that the unproductive expenditures which the United States made on the war could be the basis of a higher permanent level of prosperity than it had ever known before. Real prosperity comes by an increase of the supply of wealth which one way or another contributes to the well-being of the population, and the expenditures upon the war do not come under this description. And yet a great many people who considered that they were very prosperous during the war and in the two years following are convinced that that state of prosperity might have continued indefinitely if the bankers had not arbitrarily restricted the manufacture of credit. They do not see that a settlement day need ever have come, or that a reaction was inevitable.

Taking the country as a whole the wartime prosperity was a delusion. Those who actually improved their position did so at the expense of others. Normal relations were violently disturbed, with the result that some were gainers while others were losers, and many were temporarily deceived into thinking themselves gainers when in fact they were not. A good many people were consuming principal when they thought they were living on income, and many were happy and wasteful under conditions which could not possibly be lasting. The people who gained unearned profits by the sudden rise of prices should have known that such a disturbance of normal conditions involved the probability of a reverse movement, and all those whose incomes increased faster than their accustomed expenditures should have known that this was a temporary gratuity at the expense of the letter carriers, school teachers and millions of other people whose expenditures increased more than their incomes.

The economic law eventually levels out all such inequalities and restores the normal balance. The people who at first had the best of the disturbance are the chief complainants now.

The Cleveland Trust Company Sees Basis for Confidence in Trade Revival

Apparent price stabilization of many fundamental commodities at a level upon which trading can be confidently resumed is the outstanding business development of the past month, says the Cleveland Trust Co. in its midmonth Business Bulletin for June.

"These are commodities that have world-wide markets and they were among the first to enter upon the long price decline that has continued for more than a year and has been the most severe in our economic history," says the bank. "Now there is increasing evidence that a turning point has come and that we shall see in the next few weeks and months a stabilization in the values of such products as these, while the prices for other products continue to fall in line with them.

"As confidence in price develops in one line after another the industries affected take a renewed activity, and as each industry increases its activities it helps other industries. Such improvements are already noticeable in the cases of leather, silk, cotton, wool, copper, lead, flour, cement and meat."

Constructive Developments

Other constructive developments of the month pointed out by the bank include decreasing unemployment in Cleveland, gains in new building, prospects for improvement in the iron and steel industry, and the receding number of commercial insolvencies. It is observed, however, that business failures may increase when trade revival begins. This is because some firms, able to bridge the present crisis, may not be strong enough to survive active competition.

"Offsetting the depressing factors in the immediate outlook of the steel industry are a number of constructive influences. These include the improvement in the railroad situation, the better prospects for the farmer, the rising tide of building construction, and the fact that the extreme slump in steel production is out of proportion to the smaller decline in the general level of business activities.

"Each of these factors should exert an important bearing upon developments in the steel industry and, combined, they offer the hope that present plant operations of from 25 per cent to 30 per cent will be raised as high as 50 per cent before the end of the year.

"The one bright spot of activity in the coal industry is located in the regions supplying fuel for lake shipments to the Northwest. Operations in these districts are at about 70 per cent of capacity compared with 45 per cent for the country as a whole.

"During the past month security prices have declined under the depressing influence of reports of low earnings and cutting or passing of dividends. This sort of decline in security values has virtually been a feature of the later stages of previous business depressions. The average price of 10 Cleveland industrial stocks by June 10 had fallen three points under the extreme low reached in December."

Exposition at Portland, Oregon

Another step has been taken by way of preparation for the International Exposition to be held in Portland, Ore., in 1925. The Senate has passed a bill authorizing the President to invite foreign countries to participate in the exposition. The exposition is intended to celebrate the completion of the transcontinental and Pacific highways, the centennial of the invention of the electro-magnet and to exemplify the development of hydro-electric energy.

Meeting of the Purchase and Stores Division of the American Railroad Association

The annual meeting of the Purchase and Stores division, known as Division 6, of the American Railroad Association, was held in the Blackstone Hotel, Chicago, on June 9 to 11, 1921. There seemed to be a general feeling that the meetings were in a manner interrupted, due to demands of other pressing railroad problems upon the time of some of the officials taking part in the meeting. However, the interruptions did not prevent the presentation of a number of committee reports and papers of more than passing interest to officials engaged in this branch of the railroad industry.

The general committee of Division 6 reported on a plan covering the organization of the Purchase and Stores division of railroad service. The committee called attention to the outstanding fact that the maintenance of necessary stocks of materials and supplies for railroad needs involved the investment of 35 per cent of the gross earnings of the road. The care and custody of the material represented by this investment, as well as the necessity for a more effective and systematic means of controlling it than has hitherto generally existed on railroads, should be recognized as of sufficient importance to demand the best effort of a department organized exclusively for this service. The officers and employees of such a department must, in all respects, rank with officers and employees of other operating departments, both in the divisional and general organization. Recommendations in regard to the organization of these departments were made and from past experience it has indicated that the roads might thereby substantially reduce a portion of their operating expenses. Other recommendations included that of organizing on all railroads a purchasing department that shall be in charge of a general purchasing agent. He should buy all material and supplies of every description required for use by the railroad. The stores department shall be in charge of a general storekeeper, who shall be responsible for the custody, care and distribution of all materials not actually used. He shall have direct charge of all material not in actual use, including scrap and second-hand material and the reclaiming of usable material. In his charge will be the primary accounting for the receipt and disbursement of all material.

Another recommendation was that there should be the closest co-operation between the purchasing and stores department, and that both these branches of the service should be under the control of a single executive officer in exclusive charge of supplies. This form of organization has the advantage of concentrating responsibility and authority over unused material in the hands of a single department which can be held to strict accountability.

The third recommendation was for the adoption of a uniform method of accounting for materials and supplies by all railroads and suggested that this shall be in accordance with the standard material classification prepared and recommended by the former Railway Storekeepers' Association.

Unit Piling for Counting

J. A. Stuart, general storekeeper, C. B. & Q. R.R., reported on the subject of "Unit Piling for Counting." His paper was much to the point and some of the matters suggested there may be just as valuably applied in the manufacturing field of storekeeping as they are useful in railroad work. He said that to keep stock and have it available when needed, and at the same time to do this with a minimum investment, is the primary work of a storekeeper; in other words, to keep a sufficient stock and yet not keep more than is sufficient. Anything which will help us to improve our present stockkeeping methods or which will enable us to get as good service as we are getting now at a lower cost, is desirable.

On the subject piling in units he said that when material is being placed in stock a certain number of pieces are designated as a unit and as the material is stored it is separated so that each unit contains the designated number of pieces and each unit is in some way separated from the other units of the same material and stands out alone so that, in counting the stock, the stockman counts the units and not the items. For example: If machine bolts were piled in units of one hundred each the stockman would count the units and would not attempt to count the bolts. If the pile contained eight units he would count the units and know he had 800 bolts. If the units were properly separated it would hardly be necessary even to count the units for just in the time it would take him to look at the pile, he would also be able to see that the eight units contained 800 bolts. In case one of the units should be broken so that there were eight full units and part of the ninth, it would, of course, be necessary to count the number of bolts in the broken unit in order to get an accurate count of the pile.

In the same way a great many other items, in fact, practically all items of storehouse material may be piled in units.

A plan of far-reaching importance was that reported by the joint committee of the Mechanical and Purchase and Stores Divisions of the association, concerning the joint inspection of standard material. The plans discussed included first, a regional plan whereby the roads with inspection forces would handle all inspection for other roads in certain regions. Second, by a central bureau of inspection organized and operated by the association but without testing laboratories. It was decided that with either plan the roads interested must necessarily agree on uniform material specifications which would naturally be those of the association covering such standard materials as air-brake and signal hose, air coupling gaskets, couplers and coupler parts, axles, springs, wheels, side frames, bolsters, brake beams and journal bearings. The majority of the committee was of the opinion that the regional plan of inspection by certain roads for others would not work out satisfactorily, primarily because of sources of material are largely confined to a restricted area and the burden would fall upon a comparatively few roads operating in that area. These roads would have to increase their inspection and testing facilities, and, further, such an increase in their work might result in discrimination in favor of their own material under certain conditions of pressure for material.

The Central Bureau of Inspection under the control of the association appeared to the committee to possess the greatest practical value, provided always that the railroads now purchasing material without inspection could be brought into the organization and made to stand their pro rata share of the expense. The manager of such a bureau should have unquestioned authority to rule on all disputes between his inspectors and manufacturers, and there should be no appeal from his decision. In order to complete the plan the roads now inspecting their own standard parts would have to agree to turn this part of their work over to the Central Bureau and stand their share of the expense in addition to continuing their inspection forces on other material. As far as certain large railroads are concerned this would seem to indicate additional expense without benefit, but experience may prove otherwise.

The committee on the reclamation of material reported that they had been unable to locate any new processes as suitable for reclamation purposes other than those generally covered in previous reports. It is now noticeable that all railroads are reclaiming very closely. Investigations of scrap disposed of by sale shows a considerable improvement over previous years. One of the new features of reclamation and one which is being developed rapidly is the welding of materials by the electric or oxyacetylene process of welding. The success of these processes depends to a large extent upon having competent operators and requires constant personal supervision on the part of the officer in charge. It is recommended that attention be paid to facilities for pre-heating for welding, as this important feature at a small cost frequently lessens the cost of welding. The pre-heating furnaces are also of a great deal of value in annealing work after it has been welded, thus preventing fractures from stresses caused by expansion and contraction.

The meeting of the mechanical section was postponed to June 29th and 30th and transferred from Hotel Drake to Hotel Blackstone.

Iron in Manchuria

The Peking Government has sanctioned the working of the iron deposits in Kungchanling, under Chino-Japanese joint management. Permission to work the deposits was originally granted by the provincial authorities in 1916, but the final sanction by the Peking authorities was withheld until recently. An analysis of the ore shows that it contains 71.20 per cent of iron; 0.32 per cent of silicic acid; 0.024 per cent of sulphur; and 0.017 per cent of phosphorous. The deposits extend over a very large area and it is calculated that not less than 200,000,000 tons are available.

Washington Notes

By PAUL WOOTON
(Washington Correspondent

Every effort is to be made to secure the prompt enactment by Congress of Senator Stanley's bill amending the revised statutes relative to patents which will require manufacture within continental United States of any article covered by a patent granted a foreigner.

In recommending the legislation to the Senate, the committee on patents pointed out that the War Department noticed in April that a large number of applications of patents were being filed by Germans. Many of these have been assigned to various German companies, including that of Frederick Krupps of Essen. An investigation by the War Department of 228 of these applications which related to ordnance disclosed the fact that all were assigned to the Krupps company. Of the 228 applications it was found that 26 related to artillery fire-control devices, 18 to electric-control apparatus, 9 to fuses for projectiles, 6 to gas engines and appurtenances, two to gyroscopes, 17 to guns and their appurtenances, 3 to metals and processes for producing metals, 10 to naval firing-control devices, three to projectiles, 14 to railroad artillery, 11 to self-discharging wagons (railroad cars and other forms of wagons) and 24 to tools and apparatus for ordnance production.

The Secretary of War approves the legislation in that it prevents foreigners from securing United States patents for the sole purpose of protecting them against American manufacture of the articles covered by such patents. Secretary Weeks points out that under the present law foreigners enjoy the same protection and monopoly as to patent rights as do American citizens. In cases where patented articles are fully protected by the United States patents, it is of little consequence how high an import duty is placed on articles manufactured under such patents in foreign countries since they are not manufactured in the United States and are necessary to the carrying on of our industries and must be imported regardless of the high tariff.

Secretary Weeks believes that the Stanley bill insures the foreign holder of the patent a reasonable return on his invention and at the same time insures the United States a domestic source of the product.

Motors Replace Horses

The extent to which horses are being displaced by motor vehicles is shown by the report of the Bureau of Census covering the number of horses in various cities. The decrease in the number of horses in New York in 1920 as compared to 1910 was 40 per cent. The percentage of decrease in certain other cities is as follows: Chicago, 44 per cent; Boston, 43 per cent; Cincinnati, 36 per cent; Cleveland, 30 per cent; Pittsburgh, 46 per cent; Baltimore, 48 per cent, and Philadelphia, 38 per cent.

Shell Steel Sold

The Ordnance Salvage Board has accepted the bid of Max Soloman of Pittsburgh for 21,000 tons of shell steel and shell steel forgings. The amount involved is $217,251. Mr. Soloman was the highest of 15 bidders.

Ordnance Claims Settled

During March, April and May the War Department adjusted 33 Ordnance claims involving the payment to private manufacturers of $7,451,964.86. There still are 113 claims awaiting settlement. These claims aggregate $34,990,238.38.

American Locomotive Co. Orders Boring Mills

The American Locomotive Co. has recently placed an order for six 90-inch boring mills for work in the firm's various plants. The machines are being built by the Colburn Machine Tool Co., 1038 Ivanhoe Road, Cleveland, Ohio, which concern co-operated in the development of the mill with the Dale Machinery Co., 54-60 Lafayette St., New York City and 541-7 W. Washington Blvd., Chicago, Ill.

The design of the machine conforms to the standard specifications of the American Locomotive Co. for a heavy-duty wheel boring and turning mill of the movable cross-rail type. The machine will be belt driven by an individual variable-speed motor, and a disk clutch provided in the drive. A separate motor will be used for moving the cross rail, which can be raised 46 in. above the table.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Lathe, Geared-Head, "Sterling"

Shepard Lathe Co., Rising Sun, Ind.

"American Machinist," March 17, 1921

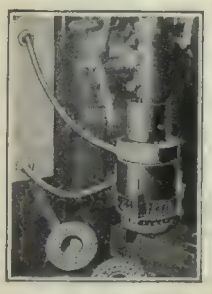


The "Sterling" lathe, previously described on page 1061, Vol. 50, of the American Machinist, is now made with a completely inclosed, geared head and with a single-pulley drive. It can be driven from a countershaft or furnished with a foot-power drive. In the illustration it is shown equipped with an individual motor mounted on top of the headstock and belted to the pulley. The motor is small enough to be driven by current from an ordinary lighting circuit, without additional power wiring or control. The lathe can be furnished with either a plain or a gap bed, and with standard or bench legs. The machine is said to be especially adapted for use in garages, training schools and repair shops, and for experimental work and light manufacturing. Two of its features are stated to be the facts that there are no shifting belts nor shifting gears.

Drilling Head, Multiple-Spindle, "Newmanco"

Newman Manufacturing Co., 717 Sycamore St., Cincinnati, Ohio

"American Machinist," March 17, 1921



The device is intended for the drilling simultaneously of a large number of small holes; the head shown drilling 69 holes in a gas-burner casting. It is provided with a water jacket, through which water is circulated in order to cool the head and to keep both it and the drills from overheating. The device is intended for use upon a standard drilling machine, but can be built to suit any particular machine and also to meet the individual requirements of the work. It should be noted that the lower ends of the drills are steadied by means of a plate provided with hardened bushings, the plate being so fastened in position that it can be pushed close to the head as the drills advance into the work.

Testing Machine, Impact, Continuous and Alternating

Pittsburgh Instrument and Machine Co., 40 Water St., Pittsburgh, Pa.

"American Machinist," March 17, 1921

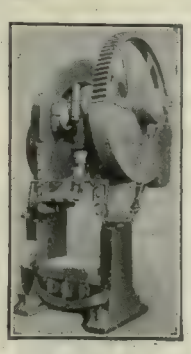


The machine is intended for the testing of metals for fatigue and impact fatigue, the action conforming closely to the actual working conditions of metals subjected to repeated shocks and stresses. The piece rests on two bearings, so that the point of the ram is central with the notched part. A feeding attachment, run by the motor, turns the specimen halfway around between each blow, for the so-called "alternating" test, or, by means of a special attachment, through 1/25 of a revolution for the "continuous" test. The machine delivers about 85 to 100 blows per minute. The ram is raised by a cam and then allowed to fall on the test piece. An electric motor, driving through a worm and gear, furnishes the necessary power. As soon as the test piece breaks, the machine stops.

Press, Trimming

Massillon Foundry and Machine Co., Massillon, Ohio

"American Machinist," March 17, 1921

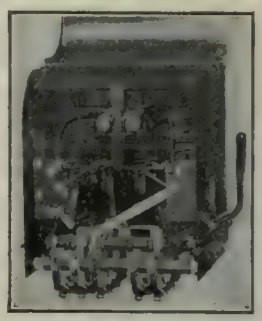


All clutch parts are inclosed and run in an oil bath. The clutch jaws are hardened steel and can be replaced without removing the gear. The clutch body has a square hole that slides on a squared portion of the shaft. The clutch can not repeat and a second stroke requires a full series of motions of the tripping lever. The main frame is made of semi-steel castings with legs cast integral. All main gears and pinions are of open-hearth steel with cut gear teeth. The press is made in suitable sizes, to trim forgings up to the maximum capacity of any drop hammer. A small outboard shear is provided at the flywheel side of the machine. The press is made either for belt drive, or with a platform for mounting the motor at the top of the frame and in the rear, so that the motor can be belted directly to the flywheel.

Starter, Auto-Transformer, Induction-Motor

Cutler-Hammer Manufacturing Co., Milwaukee, Wis.

"American Machinist," March 17, 1921

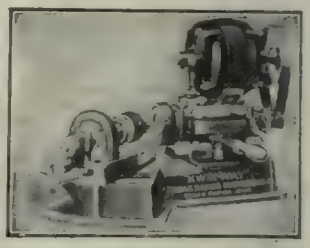


The starter is for standard squirrel-cage induction motors. The device consists of two auto-transformers, commutating mechanism, low-voltage release and duplex overload relay, all enclosed in a sheet-metal case with the operating lever outside. The case is reinforced with angle iron, and has a hinged cover which can be lifted, as shown, to expose the transformers and relay. The transformers and case are carried directly on the supporting brackets and may be mounted on the wall or switchboard. The oil-immersed commutating mechanism is placed at the bottom of the case and may be exposed for inspection. The starters are made in various sizes for the operation of two or three-phase induction motors rated between 5 and 100 hp., on standard commercial voltages between 110 and 2,200 and at frequencies of 60, 50, 40, 33 and 25 cycles per sec.

Valve-Facing Machine, "Kwik-Way"

Cedar Rapids Engineering Co., 902 North 17th St., Cedar Rapids, Iowa

"American Machinist," March 17, 1921



The device is intended for the purpose of refacing automotive valves, preparatory to grinding them with a grinding compound in place in the motor, as is the usual practice. It is claimed that by this method, but very little fine grinding with compound need be done with the valves in place. The valve is held by means of a chuck, and is rotated while in contact with the abrasive wheel. The spindle of the grinding wheel runs in ball bearings. It is stated that the chuck which holds the valve is capable of centering it, even though the stem be worn. Both the grinding wheel shaft and the chuck shaft are mounted on sliding carriages. The angle of the face ground upon the valve can be varied from 25 to 65 deg. The machine can accommodate valves having heads up to 3 in. and stems up to ½ in. in diameter.

Attachment, Milling and Grinding, Bench Lathe

A. F. Robbins Co., 85 Moody St., Waltham, Mass.

"American Machinist," March 17, 1921

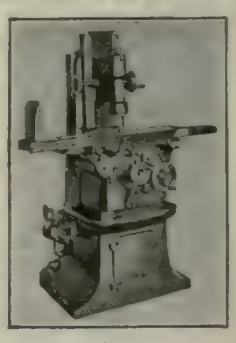


This combination adjustable milling and grinding attachment is intended for use on bench or other small lathes, for the purpose of performing small milling or grinding operations without removing the work from its mounting on the faceplate or in the spindle of the lathe. The stationary base attaches to the toolblock of the lathe by means of two flush-head screws. The device swivels upon a central stud rising from the stationary base, being held and secured thereto by a quick-acting clamp. The spindle-carrying member is arranged to slide vertically upon two pillars set into the swiveling base and tied together at the top by a rigid crossbar. Spindles for carrying various kinds of milling cutters and grinding wheels are provided. Provision is made in the vertically sliding member to insert an overarm, by which the outer end of the cutter spindle can be held rigid.

Grinding Machine, Surface, Vertical-Spindle, No. 3

Abrasive Machine Tool Co., East Providence, R. I.

"American Machinist," March 17, 1921



The tool is intended for small work, both in the toolroom and on regular production, being adapted to the squaring of the ends of shafts held on centers, the surfacing of small pieces held on magnetic chucks, and especially for the resharpening of pilot dies. The machine has a capacity of 22 in. longitudinal feed, 8 in. transverse feed, both automatic, and 10 in. hand vertical adjustment. The wheel spindle is carried on ball bearings and all of the high-speed shafts run on ball bearings. Wheels up to 5 in. in diameter can be used. All belts are enclosed, also the moving parts, so that the safety of the operator is promoted. The machine can be equipped with either a countershaft or a concealed motor drive. Provision is made for the use of water, so that wet grinding can be done.

Business Items

The Markwood Motor Co. has increased its capacity by moving to 1015½ East Capital Ave., Springfield, Ill. Machinery is to be installed and manufacture begun at an early date.

The Hydro Appliances Ltd., with $200,000 capital, has been organized at Port Robinson, Ont., Canada, to manufacture household electrical appliances.

The Ford Motor Co. will erect a $400,000 assembling plant in Hamilton, Ohio, with an output of 30,000 cars yearly. Cincinnati and Columbus plants will be merged and moved to Hamilton to obtain lower freight rates, it is said.

The Sandusky Foundry and Machine Co. has purchased adjoining properties which include dockage, to take care of their business, both present and future, and for which new machinery has been installed.

The Durant Motors announce that a new factory will be built at Oakland, Cal., to handle their Pacific coast business. This will be known as the Durant Motor Co., of California. Construction is scheduled to begin at once.

The Chicago sales offices of the New Departure Mfg. Co. have been removed from 2721 South Michigan Ave. to the Peoples Gas Building, 122 South Michigan Ave.

The Greenfield Tap and Die Corporation has purchased the entire capital stock of the Greenfield Machine Company, of Greenfield, and also of the Morgan Grinder Co., of Worcester, Mass. The purchasers will continue to operate both plants in their present location, although it is expected that the Worcester plant will be eventually closed. The organization of both plants remains the same with E. F. Smith president and Joseph G. Stevens treasurer of the former, and Raph L. Morgan president, L. M. Crittsinger treasurer, and Charles E. Hildreth general manager of the latter.

The Electric Machinery Mfg. Co., with a capital of $1,000,000, has been formed to take over the business of the old Electric Machinery Co., both of Minneapolis. The new president is Silas McClure, who bought the old concern from the receiver. Other officers include C. T. Jaffray, president of the First National Bank, E. W. Decker, of the Northwestern Bank, S. V. Wood, of the Minneapolis Electric Steel Castings Co., and E. W. Backus, of the Backus-Brooks Lumber Co. They will manufacture electrical devices as before but on a much larger scale.

The American Valve and Tank Co., of Delaware, will erect a plant in Indianapolis, Ind., and production is hoped for within three months.

Peter A. Frasse Co., 417 Canal St., New York, has been appointed sole agent for the Rivett products, made by the Rivett Lathe and Grinder Co., of Boston, Mass.

The W. H. Phelps Co., of Springfield, Mass., has been organized and incorporated with a capital stock of $750,000 to engage in the manufacture of chains, etc. The officers of the company are president, Wendell P. Phelps; and treasurer, Henry S. Wright, both of Springfield, Mass.

The George E. Lavietes Co., of New Haven, Conn., has recently been organized and incorporated with a capital stock of $50,000 to engage in the manufacture of hardware, etc. The incorporators are George E. Lavietes and M. Lavietes, and Emmanuel Thorner, all of New Haven.

The Rockville Iron Foundry Co., of Rockville, Conn., has been recently incorporated under the laws of the State of Connecticut. The capital stock is $50,000 and the incorporators are H. B. Murlless and S. Murlless, both of Rockville, and Andrew L. McCarthy, of Hartford. The concern has a plant on East Main St., Rockville.

The Kay Manufacturing Co. has been organized in South Norwalk, Conn., with George A. Kay as president, Lawrence F. Whitney as secretary and Clinton C. Hubbel as treasurer. The company is incorporated under the laws of the State of Connecticut to do a general manufacturing and sales business, but is at present handling only the Whitney free-floating shaft coupling.

Personals

S. B. Chase has recently joined the western sales division of the Heald Machine Co., Worcester, Mass., manufacturers of grinders and magnetic chucks, etc. Mr. Chase was formerly connected with the Waltham Wheel Co., Waltham, Mass., manufacturers of abrasive wheels, etc.

Oskar Kylin, who for the last five years has been chief engineer and a member of the executive board of the Foster Machine Co., Elkhart, Ind., has been appointed General Sales Manager, in addition to his other duties.

Robert S. Gans, in charge of sales and development of new products for the Raymond Engineering Corporation, New York, has been elected vice-president of that organization.

W. Barton Eddison, inventor of the jet entraining apparatus of the Surface Combustion Co., has been awarded the Edward Longstreth Medal of Merit by the Franklin Institute.

Colonel Washington A. Roebling, who was the engineer in charge of construction of the Brooklyn Bridge, and who recently observed his 84th birthday, has been elected to the presidency of the John A. Roebling Sons Co. He succeeds his nephew, the late Karl G. Roebling.

W. L. Neff, formerly with the New York office of the Brown & Sharpe Mfg. Co., is now the New York representative of the Davenport Machine Tool Co., of Rochester, N. Y.

Alexander B. C. Hardy, for four years president of the Waterloo Carriage Company, was elected last week president and general manager of the Olds Motor Works, Lansing, Mich. Recently he was made a member of the General Motors Corporation committee as its director of outside concerns.

W. E. Corey, chairman of the Board of the Midvale Steel and Ordnance Co., has been elected a director and a member of the Executive Committee of the International Truck Co., replacing Ambrose Moorell, deceased.

Warren F. Kendrick has left the employ of the Ford Motor Company as designing engineer to become sales engineer for the Griscom-Russell Co., Chicago, Ill.

M. E. Peck has been elected Secretary and assistant Treasurer of the Terminal Engineering Co., Inc., New York.

J. F. McGonigal, Mechanical Engineer, formerly of the Foamite Company and J. H. Potter, Mechanical Engineer, a graduate of New York University, have joined the Terminal Engineering Co., Inc., New York. M. E. Lyle for many years with the Columbia Graphaphone Company has been elected a Vice-President of the Terminal Engineering Co., Inc., New York and is directly responsible for new business.

Th. H. Nakken, E. E., of Rotterdam, Holland, is arriving Saturday on the S. S. "Rotterdam." Mr. Nakken is well known in the Netherlands for his research work and experiments in the field of transferring light into electric current. Mr. Nakken is coming to America to study the latest developments in this field and also to purchase additional laboratory equipment. His experiments thus far have been confined to automatic telephone exchanges, telegraphing pictures and entire letters instead of words, and in photographing sound, which is of great importance in the moving picture field. His headquarters while in America will be at 44 Beaver St., care of Alliance Transportation Co.

Bombing Tests

A special news article describing the bombing tests to be conducted by naval aviators on June 21, will appear in the American Machinist. The Washington correspondent of the American Machinist has been invited by the Secretary of the Navy to witness the bombing experiments against former German warships.

Obituary

William A. Jones, president of the W. A. Jones Foundry and Machine Co., died on May 30th.

Edward F. Cooper, sales manager of the Disston Saw Works, died suddenly on June 10th in a room at the Manufacturers Club in Philadelphia. Mr. Cooper was 63 years old and had been associated with the Disstons for many years.

A. C. Loomis, aged 59, died on June 10th at his home in West Orange, N. J. He had been connected for 31 years with the Edison industries, and was engaged in experimental work in the phonograph department at the time of his death.

William Browne Cogswell, founder of the Solvay Process Co., died on June 7, at the age of 86. Primarily a civil and mining engineer, he was always a geologist and chemist. The combination made it possible to induce the Belgian Solvays to sanction the expansion of their manufacturing process to America, at a place which he perceived was almost ideal for such an enterprise. A graduate from Rensselaer Polytechnic Institute in 1882, he served an apprenticeship at Lawrence, Mass., under John C. Hoadley, after which he took up railroading in Ohio.

During the Civil War he received a civilian appointment as mechanical engineer in the navy, his work including several naval repair shops on land and also a floating repair shop which was unheard of at that time. Among the jobs handled was the casting and machining of a 500-lb. cylinder head for one of the monitors, a really notable feat for a converted whaling vessel.

Among his other notable work was the building of the Clifton suspension bridge at Niagara Falls, the development of the lead mines at Mine La Motte, Mo., and finally his work with the development of the Solvay process in this country.

Forthcoming Meetings

The fall national convention of the Society of Industrial Engineers will be held at Springfield, Mass., October 5, 6 and 7. The main subject will be "Industrial Stability," covering production, distribution and sales, finance, accounting and personnel.

The Committee on Convention and Exhibits of the American Foundrymen's Association, after carefully considering the question of hotels, exhibits, etc., have decided to hold their next convention in either April or May of next year, 1922. The exact date and the place of meeting will be announced later.

Announcement has just been made that circumstances have necessitated the postponement of the annual convention of the Mechanical Section of the American Railroad Association that was scheduled to be held in Chicago on June 15-16-17 at the Drake Hotel. The new dates that are announced for this convention are June 29 and 30 and it has been transferred to the Hotel Blackstone. Those intending to attend this convention should note not only the change in date but also the change in the location of the convention meetings.

A Branch Cash Register Plant for Germany

The National Cash Register Co. has a branch plant near Berlin, Germany, which is nearing completion. It is claimed to be a model five-story factory which will employ German workmen under American supervision and it is expected that cash registers will begin to be manufactured within a few months.

There were difficulties in the way of securing raw materials, and also in obtaining permission to bring in sample machines and special tools. Permits were finally granted, however, both in this case and for the Ford Motor plants. The hiring of men is also a problem, as once hired it is very difficult to discharge them owing to the regulations of the Central Employment Agency, which handles all problems of this kind.

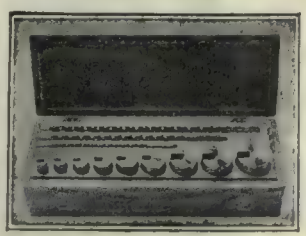
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Keyway Set, "Broach-Well"

Velco Manufacturing Co., Inc., Greenfield, Mass.

"American Machinist," March 24, 1921.



This set of broaches is intended for cutitng keyways in bores, the tools being particularly adapted to shops where the nature of the work does not require a broaching machine. The tools are grouped in convenient sizes, so that a wide range of standard keyways can be cut. By the use of special broaches, keyways of special shape may be cut. A tool-steel broach or cutter bar of the staggered-tooth type is guided in a bushing fitted to the bore in which the keyway is to be made. The keyway is cut by pressing the broach through the work in an arbor press.

Drilling Machine, Three-Spindle

Langelier Manufacturing Co., Arlington, Cranston, R. I.

"American Machinist," March 24, 1921.

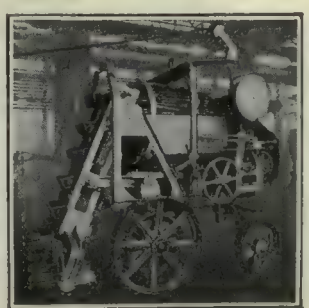


The machine is intended for the drilling simultaneously of three ⅜ in. vent holes in the cover of a storage battery. There are two horizontal spindles and one upright spindle, the latter being inclined to the rear at an angle of 8 deg. with the vertical. The drills are held in chucks fastened to the spindles. The two horizontal spindles are driven by separate belts from the overhead countershaft. The vertical spindle is driven in the same manner, the belt passing over the two idler pulleys at the top of the column. The feed of the arms is operated by hand, the movements being so connected that only one lever is necessary to cause the motion of the spindles. The machine is mounted upon a stand, which provides a shelf for the holding of work. The work is secured in position for drilling by means of a special clamping arrangement.

Cutting and Screening Machine, Sand

The Whiting Corporation, Harvey, Ill.

"American Machinist," March 31, 1921.

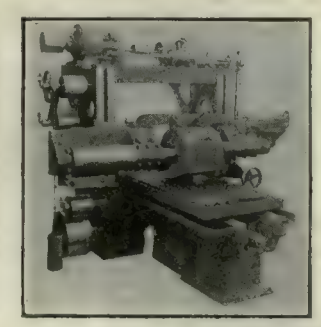


The machine cuts, aerates, screens and tempers molding sand at one operation. It travels across the floor, cutting and screening the sand as it goes, handling, under average conditions, one cubic yard of sand per minute, as shaken from the flask. Rapidly revolving blades cut and aerate the sand and at the same time throw it toward the center of the machine, where it is gathered by the bucket elevator and conveyed to the revolving screen, which removes the refuse. The operation is entirely automatic power being furnished either by electric motor or gasoline engine. Two cutting speeds are available. The steering mechanism will allow of turning in very narrow quarters.

Grinding Machine, Surface, Oscillating

Springfield Manufacturing Co., Bridgeport, Conn.

"American Machinist," March 31, 1921



The machine is of heavy construction, carrying two wheels each 20 in. in diameter and 6½ in. wide on a spindle 3½ in. in diameter and mounted in bearings 18 in. long. The spindle is driven direct from the motor, the belt running over a drum pulley connected directly to the spindle. The oscillating motion of the spindle is produced by means of a crank on the right-hand end of the cross rail. The machine shown has capacity to grind 5 ft. long, 30 in. wide and 18 in. high, and it takes 52 in. between the uprights. Weight, 15,645 pounds.

Cutters, Milling, Inserted-Tooth

Cleveland Cutter and Reamer Co., 1619 Merwin Ave., Cleveland, Ohio.

"American Machinist," March 24, 1921.

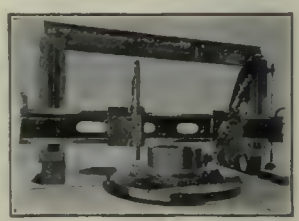


The cutter at the left is for side milling and the one at the right for face milling. The body of the cutter is made of machine steel, and blades of either carbon or high-speed steel can be furnished. The blades have corrugations on their backs, the corrugations fitting into corresponding grooves in the slots of the cutter body. The blades are clamped in position by means of wedges driven into slits between alternate blades. In order to preserve the diameter of the cutter, the blades can be moved outward as they become worn, the size of the smallest step being the pitch of the grooves. The side milling cutters are made in diameters from 6 to 12 in., being 2 in. in width. The face milling cutters are made in a width of 2¾ in. and with diameters from 5½ to 9½ in.

Boring Mill, 16- to 22-ft.

Pulaski Foundry and Manufacturing Corporation, 2422 Euclid Ave., Cleveland, Ohio.

"American Machinist," March 31, 1921.



This vertical boring and turning mill is built in four sizes, from 16- to 22-ft. swing. The table is driven through an external gear of large diameter and is supported by a step bearing and an annular bearing running in oil. The table spindle runs in two adjustable bearings of large size. The boring bars are carried by heavy saddles and can be set at angles up to 90 deg. in one direction and 45 deg. in the other The feeds are variable from 0 to ¾ in. per table revolution. Nine table speeds are available with the constant-speed driving motor. The cross rail is elevated and lowered by a separate motor.

Grinding Machine, Drill

Bickford-Switzer Co., 50 Norwood St., Greenfield, Mass.

"American Machinist," March 31, 1921.

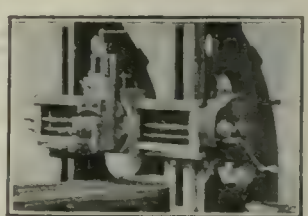


The machine is intended for the sharpening of twist drills from ⅛ to ¾ in. in diameter. The drill is held in a chuck and by the turning of a crank, it is given a combined rotative, eccentric and swinging motion. The two lips are brought consecutively in contact with the grinding wheel. The grinding is said to be always central and true with the axis of the drill. The abrasive wheel is driven directly by means of a small electric motor. The carriage carrying the drill chuck can be moved towards the wheel by means of a hand-lever moving horizontally. The crank at the left is turned by hand, so as to produce the necessary motion of the drill.

Planer, Rapid Power Traverse for

Cincinnati Planer Co., Cincinnati, Ohio.

"American Machinist," March 31, 1921.



The device is intended for rapidly traversing by power the head on the cross-rail of 24 x 24-in. heavy-pattern planers. The device can be put in operation instantly, and when in operation the crank handle does not revolve. It is furnished on planers having either one or two heads; and in the latter case either head can be moved independently, or both heads can be moved simultaneously in either direction. All gearing is completely inclosed.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Conn., Bridgeport—The Bradford Mach. Co.—cutter and grinder.

Conn., South Norwalk—The Neptune Hardware Co.—One No. 78 Wilmarth and Norman surface grinder, capacity, 8 x 22 x 11 in. with standard equipment, one No. 2 Reid surface grinder, belt driven, with regular equipment and one 12 in. x 6 ft. Style E Star lathe quick change gear, compound rest and complete standard equipment.

N. Y., Garden City, L. I.—The Adams Trailer Corpn., manufacturer of trailers—one U. S. portable electric grinder complete.

N. Y., Long Island—The City Boro. of Queens, Borough Hall—U. S. bench grinder with 2 wheels, fine and coarse, 12 in. x 1¼ in.

N. Y., New York—The Boucher Cork & Mach. Co., 216-222 West 18th St.—one No. 1 Universal Grinder with standard equipment, one No. 2 Greenfield Universal Grinder with standard equipment and one No. 1 Greenfield plain grinder complete with countershaft, one back rest, two 10 x ¾ in. wheels, etc.

N. Y., New York—The Dye Products and Chemical Co., 200 5th Ave.—one No. 300 A pipe threading machine, belt driven, complete with counter shaft, etc.

N. Y., Rochester — Page & Natapon, 17 South Water St., contractors and builders, N. Natapon, Purch. Agt.—woodworking machinery.

N. Y., Rochester — Page & Natapon, 17 South Water St., contractors and builders, N. Natapon, Purch. Agt. — medium size jointer and 36 in. band saw.

N. J., Jersey City — The Acme Handle Co., 228-232 Orient Ave.—one 9 in. x 4 ft. lathe with complete standard equipment.

Pa., Philadelphia — The Bd. Educ., 198 Chestnut St., M. E. Savage, Supt. of Supplies—lathes and milling machines.

Pa., Philadelphia—The Lester Piano Co., 1306 Chestnut St., A. Lester, pres.—one 30 in. lathe and 1 power pipe threading machine up to 4 in.

Pa., Philadelphia—The W. P. Miller Co., 452 York Ave., manufacturer of paper boxes—one 16 in. power drill press.

Pa., Philadelphia—The G. Sachsenmaier Co., 926 North 3d St., manufacturer of steam machinery—double action drawing Henderson No. 301 press or its equal.

Va., Wytheville—R. P. Johnson, manufacturer of machinery, etc., O. M. Johnson, Purch. Agt.—one 20-24 in. x 6-8 in. double surfacer planer and matcher, to weigh from 3,500 to 5,000 lb., (used).

W. Va., Clarksburg—The Eagle Convex Glass Specialty Co., Box 525, F. Aucremanne, Pres.—beveling machinery and silvering equipment for mirrors and special machine to bevel circles and ovals economically.

N. C., Elkin—The Elkin Furniture Co., R. L. Hubbard, Secy. and Treas.—woodworking equipment, including planers, moulders, shapers, tenoners, sanders, joiners, dove tail achines, rip band, and cut-off saws, glueroom equipment, etc.

Tenn., Chattanooga—M. B. Parker, 1921 Oak St., manufacturer of machinery, etc.—one 36 in. lathe, belted type, to take not less than 16 ft. between centers, (used). One 48 x 48 in. x 16 ft. planer, belted type, with two rail heads.

O., Cincinnati—The Kant-Skore Piston Co., Spring Grove Ave. and Gerrard Sts., J. J. Hater, Treas.—automatic machinery for the manufacture of automobile pistons.

O., Cincinnati—The Kant-Skore Piston Co., Spring Grove Ave. and Garrard Sts., H. J. Hater, Treas.—grinders, lathes, spindle drills and reamers. (See machinery wanted.)

O., Cleveland — The Windau Tool Co., 1565 East 17th St.—small or medium punch press and small or medium hand screw machine, (used).

O., Columbus—The Atlas Chain Hoist Co., 327 West Broad St., manufacturers of chain hoisting equipment, J. H. Burwell, Supt.—one 18 or 20 in. lathe and drill press.

Mich., Detroit — Standard Computing Scale Co., 1118 Library Ave.—band saw and outfit, 30 in. or over, (used).

Wis., Jefferson—F. Schulz, 100 "C" St.—lathe and grinder for use in garage.

Wis., Milwaukee—G. Heise, 883 21st St.—drill press for use in garage.

Kan., Rosedale—Sheldon Tool Co.—stamping presses.

Machinery Wanted

Conn., Middletown — The Forest City Laundry Co., 56-66 Hamlin St.—modern laundry equipment.

Conn., New Britain—J. Niedzwiecki, 215 Farmington Ave. — modern bakery equipment.

Conn., Stamford — Cohn & Abrams, 545 Main St.—equipment for candy plant.

N. Y., Brooklyn—The Brooklyn Eastern Dist. Terminal, 86 Kent Ave., R.R. Terminal—Crescent 38 in. heavy band saw, 38 x 2 in. wheel and 30 x 36 in. table, etc.

N. J., Irvington—The F. C. Messa Co., manufacturer of porcelain supplies — one circular saw machine for 12 in. circular saw, 1 in. arbor, 6 circular saws 12 in. diameter and 15 gage.

N. Y., Rochester—The Alent Mach Tool Co., 479 St. Paul St., machinery manufacturers, N. Alent, Purch. Agt. — cylinder grinding machine, (used).

N. J., Trenton—The Trenton Poster Advertising Co.—electric paste mixing machine for proposed poster factory.

N. C., Henderson—The Carolina Bagging Co., S. S. Parham, vice-pres.—special machinery for the manufacture of horse collar pads, back bands and horse collars of cotton canvas.

Md., Baltimore — The Whiting-Turner Constr. Co., Stewart Bldg.—one pneumatic grouting machine, similar to Caniff, one Erie class B and Marion 61 steam shovel and one steam or belt-driven air compressor, two-stage, 1000 to 1,500 cu.ft. per minute capacity.

Va., Richmond—D. J. Donati, 3210 Williamsburg Ave., manufacturer of fiber boxes—machinery for cutting, forming and making boxes of fiber board.

Ill., Oregon—The Paragon Fdry. Co., J. Reed, pres.—5 ton crane and other equipment for new foundry.

Wis., Fond du Lac — B. F. Sheridan, Route 6—modern creamery and refrigerating machiery.

Wis., Milwaukee — The Alexander Co., 309 East Water St., A. A. Alexander, Purch. Agt.—manufacturer of children's garments-power stitching machines.

Wis., Milwaukee—The Arlington Candy Co., 272 16th St., C. Metrie, Purch. Agt.—candy and confectionery making machinery

Wis., Milwaukee—The Kielsmeier Co., 119 Huron St., R. Kielsmeier—special cheese making machinery, power driven.

Tex., Three Rivers—The Three Rivers Glass Factory, C. R. Tips, pres.—glass making machinery.

Ont., Bowmanville—C. Rehden & Son—electrical equipment for proposed foundry.

Ont., Dresden—The Ontario Beet Growers Assn. Address H. J. French, R.R. 3—machinery for handling beets and making sugar.

Ont., Ottawa—The Ottawa Paper Box Co., Albert St.—machinery to replace that which was recently destroyed by fire.

Ont., Toronto—The Hydro Electric Comn. of Ontario, A. Bock, Chn.—one rotary converter, weight 40 ton for Niagara Falls plant.

Ont., Wallaceburg — W. McLean—necessary machinery for planing mill.

Metal Working Shops

NEW ENGLAND STATES

Mass., Dorchester—P. Bichekas, 1226 Massachusetts Ave., will build a 1 story, 40 x 66 ft. garage on Massachusetts Ave. Estimated cost $12,000. Noted June 2.

Mass., East Long Meadow—Fire recently destroyed the plant of The New England Steel Castings Co., on Shaker Rd. Company is undecided whether to rebuild old plant or erect a new one. Loss, $100,000.

Mass., New Bedford—M. J. Phelan, 116 South St., has awarded the contract for the construction of a 1 story, 80 x 110 ft. garage on Austin St. Estimated cost $20,000.

Mass., West Newton—E. Page, Bigelow Rd., will soon award the contract for the construction of a 1 story garage. Estimated cost $25,000. Ripley & De Boutillier, 45 Bromfield St., Boston, Archts.

THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.50
Northern Basic	25.32
Southern Ohio No. 2	27.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	34.26
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	26.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	*25.00
CHICAGO	
No. 2 Foundry local	23.00
No. 2 Foundry, Southern, sil 2.25@2.75	28.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.46
Basic	23.96
Bessemer	25.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.23	$3.33	$3.09	$3.23
Soft steel bars	3.13	3.23	2.99	3.13
Soft steel bar shapes	3.13	3.23	3.48	3.13
Soft steel bands	4.18	4.28	6.25	
Tank plates	3.23	3.33	3.78	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	4.25	4.00	4.13
No. 12	3.15	4.30	4.05	4.18
No. 14	3.20	4.35	4.10	4.23
No. 16	3.30	4.45	4.20	4.33
Black				
Nos. 17 and 21	3.75	4.80	4.80	5.20
Nos. 22 and 24	3.85	4.85	4.85	5.25
No. 25 and 26	3.90	4.90	4.90	5.30
No. 28	4.00	5.00	5.00	5.40
Galvanized				
No. 10 and 11	4.00	4.75	5.00	5.70
No. 12 to 14	4.10	4.85	5.10	5.80
Nos. 17 and 21	4.40	5.15	5.40	6.10
Nos. 22 and 24	4.55	5.30	5.55	6.25
No. 26	4.70	5.45	5.70	6.30
No. 28	5.00	5.75	6.00	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$4.73	$4.63	$4.25
Flats, squares and hexagons, per 100 lb	5.23	4.63	4.75

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 5/32, 8½c. per lb.; ¼, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.50	8.00	8.25
Spring steel (light)	8.00	7.00	10.50
Coppered Bessemer rods(base)	8.00	8.00	6.20
Hoop steel	3.64	3.69	3.83
Cold rolled strip steel	6.00	8.25	7.90
Floor plates	5.30	3.09@3.40	5.78

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of April 13, 1921:

BUTT WELD

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
1 to 3	62½	50	⅜	33½	18½
			1 to 1½	35½	20½

LAP WELD

2	54½	41	2	30½	16½
2½ to 6	58½	45	2½ to 4	34½	22½
7 to 12	54½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	60½	49	1 to 1½	35½	21½
2 to 3	61½	50			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	52½	41	2	31½	18½
2½ to 4	56½	45	2½ to 4	34½	22½
4½ to 6	55½	44	4½ to 6	33½	21½
7 to 8	50½	37	7 to 8	24½	12½
9 to 12	45½	32	9 to 12	19½	7½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	14.25
Tin in 5-ton lots	30.25
Lead	5.25
Zinc	5.75
ST. LOUIS	
Lead	4.85
Zinc	5.35

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	21.75	22.50	23.50
Copper wire (carload lots)	16.00	17.50	20.00
Brass sheets	16.25	20.00	20.75
Brass pipe	19.00	22.00	24.50
Solder (half and half) (case lots)	22.00	23.50	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	14.25
Cleveland	16.00
Chicago	18.75

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	41
Electrolytic	43

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots..... 10.00

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.00
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	$10.00
Copper, heavy, and wire	9.00	9.50	9.00
Copper, light, and bottoms	8.00	7.50	8.00
Lead, heavy	3.25	3.50	3.75
Lead, tea	2.00	2.50	2.75
Brass, heavy	6.00	5.50	9.00
Brass, light	4.50	4.00	5.00
No. 1 yellow brass turnings	5.00	4.50	5.00
Zinc	3.00	2.50	3.50

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.4	25.50@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.75
Chicago	20.50
Cleveland	22.50

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	41.00	35.00
Commercial	30.00	14.75	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

This market is very soft, and our quotations for the present are useful only as a guide.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$2.25	1.60
Hot pressed hexagon	List	2.25	1.60
Cold punches hexagon	List	2.25	1.60
Cold punched square	List	2.25	1.60

Semi-finished nuts, $\frac{5}{8}$ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	50%
Cleveland	80%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50–10%	60–10%	50%
1¼ and 1½ in. by 3 in. up to 12 in	50%	50–5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York ..... $2.00 Cleveland..... $4.50 Chicago..... $4.00
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $3.75 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅜ by 6 in. and smaller	40%	60%	40%
Larger and longer up to 1 in. by 30 in.	40%	50–10%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	50%	60–10%	45%
Tinned	45%	60–10%	30%

Structural, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.65 Cleveland...$4.25 Chicago....$4.88 Pittsburgh. $3.70
Boiler, same sizes:
New York...$4.75 Cleveland...$4.35 Chicago....$4.98 Pittsburgh. $3.80

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	21.00	25.00	25.50
Brass	19.00	23.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ½-2 in., inclusive in rounds, and ½-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$7.00 per 100 lb.; New York price is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	9.00@12.00	12.00	14.25
Colored mixed	6.50@ 9.50	9.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$3.25@$3.75
Prompt foundry	4.50@ 5.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.80	$0.88	$0.87
5-gal. cans	.83*	1.03	1.12

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount. Business is good in white lead.

Conn., Ansonia—The Ansonia Electric Co., 55 Main St., will soon award the contract for the construction of a 2 story, 60 x 200 ft. plant. Estimated cost $250,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Engrs. and Archts. Noted June 9.

Conn., Hartford—J. B. Kaufman, 432 Windsor Ave., will soon award the contract for the construction of a 1 story, 50 x 110 ft. garage on Windsor Ave. Estimated cost $25,000. B. A. Sellew, 721 Main St., Archt.

Conn., Hartford—The Prospect Garage, 585 Prospect Ave., is receiving bids for the construction of a 1 story addition to its garage on Prospect Ave. Estimated cost $20,000. B. H. Sellew, 721 Main St., Archt.

Conn., New Britain—The Mendel Sicklick, 107 Bossett St., has awarded the contract for the construction of a 1 story, 60 x 70 ft garage on Arch St. Estimated cost $10,000. F. C. Walz, 407 Trumbull St., Hartford, Archt.

Conn., New Haven—F. T. Hershkowitz, 401 George St., will build a 1 and 2 story, 44 x 160 ft. garage, etc., on George St. Estimated cost $25,000.

Conn., Waterbury—The Dexter Baking Co., North Main St., is having plans prepared for the construction of a 1 story, 60 x 100 ft. garage. Estimated cost $20,000. J. S. Ladow, 51 Leavenworth St., Archt.

Conn., Windsor—S. Maislen, 356 Windsor Ave., is having plans prepared for the construction of a 1 story, 50 x 80 ft. garage on High St. Estimated cost $15,000. Dunkelberger & Gilman, 721 Main St., Archts.

R. I., Pawtucket—W. R. Nichols, 161 Hunt Ave., will build a 1 story, 50 x 104 ft. garage on Arthur and Brooks Sts. Estimated cost $15,000.

Vt., Rutland—W. H. Williams has awarded the contract for the construction of a 67 x 128 ft. garage, etc., on West St. Estimated cost $42,000.

MIDDLE ATLANTIC STATES

N. Y., New York—J. Reinschmidt, c/o Dunnigan & Crumley, Engrs. and Archts., 394 East 150th St., will soon receive bids for the construction of a 1 story, 125 x 140 ft. garage on Jerome Ave., near Belmont St., Bronx. Estimated cost $50,000.

N. J., Trenton—J. A. Roeblings Sons Co., 612 South Broad St., wire rope manufacturers, will build a 2 story, 500 x 850 ft. addition to its plant on Lalor St. Estimated cost $150,000.

Pa., Pittsburgh—W. W. Martin Co., 5847 Center Ave., will soon award the contract for the construction of a 3 story, 100 x 140 ft. auto sales and service building on Ravenna St. and South Highland Ave. Estimated cost $150,000. Private plans.

Pa., Turtle Creek—Struble & Riley will soon award the contract for the construction of a 2 story, 74 x 165 ft. sales and service building on Grant St. Estimated cost $100,000. S. C. Richards & Co., Braddock, Archts.

Md., Frederick—The Star Motor Co. is building a 1 story, 50 x 60 ft., machine shop.

SOUTHERN STATES

Va., Bristol—The Bristol Stove & Fdry. Co. is enlarging its plant. J. C. Rucker, Secy. and Treas.

Ala., Birmingham—The Atlas Mch. & Supply Co., 1 South 20th St., is building a 66 x 101 ft., machine shop. Estimated cost $10,000.

MIDDLE WEST STATES

O., Cleveland—M. Freedman, 4715 Woodland Ave., has awarded the contract for the construction of a 1 story, 82 x 105 ft. garage at 8400 St. Clair Ave. Estimated cost $80,000.

O., Cleveland—E. Friedman, 980 East 70th St., will soon award the contract for the construction of a 1 story, 66 x 140 ft. garage and commercial building at 6937 St. Clair Ave. Estimated cost $40,000.

O., Cleveland—The New Center Garage Co., c/o H. E. Emerich, 15205 St. Clair Ave., will soon award the contract for the construction of a 2 story, 55 x 150 ft. garage and commercial building on Holmes and St. Clair Aves. Estimated cost $60,000. H. W. Steffens, 13000 Forest Hill Ave., Archt.

O., Cleveland—The Sterling Brass Co., 4610 St. Clair Ave., will soon award the contract for the construction of a 2 story, 75 x 90 ft. foundry and machine shop, on East 93rd St. and Catherine Ave. Estimated cost $80,000. A. Sogg, 319 Hippodrome Bldg., Archt. Noted Apr. 21.

O., Cleveland—P. M. Platten, 348 Engineers Bldg., has awarded the contract for the construction of a 1 story, 45 x 137 ft. commercial and garage building on East 133rd St. and Niles Ave. Estimated cost, $40,000.

Ind., Richmond—The Grim Auto Co., 7th and Sailor Sts., plans to build a 2 story, 71 x 104 ft. garage and service building on 7th St. Estimated cost, $75,000. C. E. Werking & Son, Palladium Bldg., Archts.

Ind., Terre Haute—The Terre Haute Boiler Wks., 1225 7th Ave., plans to build a 1 story, boiler factory on North 13th St. Estimated cost $75,000. Private plans.

Ill., Aurora—The Miller-Bryan & Pierce Co., 225 River St., manufacturer of typewriter supplies, has awarded the contract for the construction of a 3 story, 60 x 150 ft., factory. Estimated cost $60,000.

Wis., Park Falls—Greissinger Bros. have awarded the contract for the construction of a 1 and 2 story, 50 x 68 ft. garage and repair shop. Estimated cost $45,000.

Ill., Oregon—The Paragon Fdry. Co. is having plans prepared for the construction of a 1 story, 100 x 200 ft. foundry. Estimated cost $50,000. J. Reed, pres. N. E. Buser, Mt. Morris, Archt.

Minn., Minneapolis—The Kremer Motor Co., 1518 Hennepin Ave., will soon award the contract for the construction of a 2 story, 50 x 150 ft. garage at 1411 Yale Pl. Estimated cost $70,000. P. E. Crosier, 916 New York Life Bldg., Archt. Noted May 5.

Okla., Sapulpa—The Sapulpa Motor Co., Main and Hobson St., is having plans prepared for the construction of a 1 story, 140 x 140 ft. garage. Estimated cost $80,000. Monnett & Reid, 409 Empire Bldg., Oklahoma City, Archts.

Tex., Dallas—The Flippen Auto Co., 2021 Cedar Springs St., will soon award the contract for the construction of a 2 story, 100 x 200 ft., garage on Ross Ave. Estimated cost $125,000. Barclebaugh & Whitman, South West Life Bldg., Archts.

CANADA

Ont., Bowmanville—C. Rehden & Son have awarded the contract for the construction of a 1 story foundry on Scogog St. Estimated cost $60,000. Noted Apr. 28.

Ont., Toronto—C. A. Ward, 26 Oxford St., plans to build a 1 or 2 story, garage on Oxford St. Estimated cost $35,000. Architect not selected.

General Manufacturing

NEW ENGLAND STATES

Me., Dexter—D. Whiting & Sons, Charlestown, Mass., are having plans prepared rebuilding creamery, on Grove St., which was recently destroyed by fire. Estimated cost $25,000. Haven & Crosby, 40 Court St., Boston, Mass., Engrs. and Archts.

Conn., Hartford—The Graphic Arts Co., 74 Union Pl., is having plans prepared for the construction of a 3 story, 50 x 150 ft. plant for getting out advertising material, etc., on High St. Estimated cost $80,000. Buck & Sheldon, Inc., 60 Prospect St., Archts. and Engrs.

Conn., Meriden—C. E. Schunack, 24 Randolph Ave., has awarded the contract for the construction of a 2 story, 40 x 50 ft. and 14 x 42 ft. additions to his box factory. Estimated cost $18,000. Private plans.

Conn., Middletown—The Forest City Laundry Co., 56-66 Hamlin St., will soon award the contract for the construction of a 1 story, 50 x 100 ft. laundry on William St. Estimated cost $20,000. W. D. Johnson & Co., 174 Bond St., Hartford, Archts. Noted May 5.

Conn., New Britain—The Niedzwiecki Bakery, 215 Farmington Ave., will soon award the contract for the construction of a 2 story, 45 x 65 ft. bakery on Farmington Ave. Estimated cost $30,000. H. A. Ludorf, Mutual Bldg., Archt. Noted April 7.

Conn., Stamford—Cohn & Abrams, 545 Main St., are having revised plans prepared for the construction of a 3 story, 40 x 85 ft. candy factory on Beckley Ave. Estimated cost $40,000. W. R. Steinmetz, 441 Atlantic Ave., Archt. Noted Apr. 7.

MIDDLE ATLANTIC STATES

N. Y., Brooklyn—The Erie Dyeing and Processing Co., 2765 East 55th St., Cleveland, O., will soon award the contract for the construction of a 1 story wool dyeing plant, on Nassau Ave. near East 14th St., here. Estimated cost $125,000. S. H. White, 1032 Schofield Bldg., Cleveland, O., Archt.

N. Y., Buffalo—J. Christensen, 633-639 Genesee St., has had plans prepared for the construction of a 1 and 2 story factory for the manufacture of wagons, auto bodies, etc. Estimated cost, $12,000. J. A. Brown, 778 Genesee St., Archt.

N. Y., Mt. Vernon—The Willow Brook Dairy Co. will receive bids about July 7, for the construction of a 1 and 2 story dairy, to include a garage and power plant. Estimated cost $250,000. McCormach Co., Century Bldg., Pittsburgh, Pa., Engrs. and Archts. Noted Mar. 31.

N. J., Trenton—The Trenton Poster Advertising Co. will build a 4 story, 100 x 150 ft. factory on East State St. Estimated cost $100,000. Noted Mar. 31.

SOUTHERN STATES

Va., Richmond—D. F. Donati, 3210 Williamsburg Ave., manufacturers of fibre boxes, has awarded the contract for the construction of a 50 x 50 ft. factory. Estimated cost $8,000.

N. C., Elkin—The Elkin Furniture Co. plans to rebuild shop recently destroyed by fire. R. L. Hubbard, Secy. and Treas.

MIDDLE WEST STATES

O., Cincinnati—The Hyde Park Dairy Co., 3755 Edwards St., is having preliminary plans prepared for the construction of a 2 story, 32 x 86 ft. dairy. Estimated cost $45,000. H. W. Voelz, 86 Michigan St., Milwaukee, Wis., Archt.

O., Cleveland—The Prinz-Biederman Co., West 6th St. and Lakeside Ave., manufacturer of clothing, plans to build a 3 story factory on McCrocken Rd. Estimated cost $250,000. W. B. Fish, Treas. Architect not selected.

Ind., Indianapolis—Best-Grand Laundry, North Capitol Ave., has awarded the contract for the construction of a 2 and 3 story, 67 x 200 ft. laundry on North Capitol Ave. Estimated cost $100,000.

Wis., Milwaukee—The Atlas Bread Co. is altering and making a 2 story addition to its bakery. Estimated cost $150,000. McCormack Co., Century Bldg., Pittsburgh, Pa., Engrs. and Archts.

Wis., Racine—The Fox Ice Co., Liberty St. will build a 1 story, 124 x 198 ft. artificial ice plant. Estimated cost $50,000.

WEST OF THE MISSISSIPPI

Mo., Webb City—E. Webb, Bway. and Webb Sts., plans to build a 2 story flour mill. Estimated cost $30,000. Architect not selected.

Minn., Paynesville—Farmers Co., c/o J. A. Jerabek, Secy. Treas., plans to build flour mill. Estimated cost $50,000. Architest not announced.

Tex., Kerrville—Amer. Legion Memorial of Texas, Austin, will open bids about Aug. 15, constructing twenty to twenty-five 1 and 2 story buildings, here, to form tubercular sanitorium. Plans include complete refrigerating and ice plant. Estimated cost $1,500,000. Phelps & Dewes, 715 Gunter Bldg., San Antonio, Tex., Archts.

CANADA

Ont., Dresden—The Ontario Beet Growers Assn. plans to build a beet sugar factory. Estimated cost $100,000. Address H. J. French, R. R. 3.

Ont., Windsor—Seguin Bros., 906 Parent Ave., will soon award the contract for the construction of a 1 and 2 story, 36 x 143 ft. printing plant on Wyandotte St. Estimated cost $40,000. G. J. P. Joques, 4 Sandwich St., W., Archt.

Que., Joliette—Joliette Cigar & Tobacco Co., St. Marc St., is having plans prepared for the construction of a 3 story, 150 x 200 ft., tobacco factory. Estimated cost $150,000. G. H. Rivest, Joliette, Arct.

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How Should the Engineer Be Educated?

Engineering Education as It Is and as It Should Be — Views of Prominent Educators and of Employers of Engineers

The Theoretical Engineer: What is He? Is There a Place for Him? How Should He Be Trained?*

By F. L. Bishop
Dean, School of Engineering, University of Pittsburgh

I BELIEVE it essential that every man should be trained broadly for his duties as a citizen, as well as specifically for his work as an engineer. Every engineer should be a gentleman and a scholar in the broadest sense of the word. His culture should not be inferior to that of the minister or of the lawyer. His knowledge of present-day affairs should be comparable with the importance which the engineering profession occupies at the present time in the activities of the world, and this is known as the Engineering Age.

A survey of the demands for engineers by one familiar with industrial needs in this country seems to point clearly to the necessity of developing two different types of engineers—the general engineer, and the theoretical engineer.

The first type, the general engineer, for which there is a demand by the industries, is the man who has a broad general knowledge of engineering subjects and can apply that knowledge in an effective way to present engineering problems. He must have ability to command men, a knowledge of the applications of economic principles to industries, and a broad training in the so-called humanities, since he is the man in contact with men of other types in other fields of human activities.

The theoretical engineer is a man who is highly trained in the fundamentals of science and mathematics and can apply the results of research to engineering science; who possesses the instinct of the research man and who is willing to devote his entire time to highly technical engineering problems.

The development of science and industry has been likened to the discovery and development of a new country. First we have the explorer who penetrates the unknown jungle and brings back to the world the knowledge of the possible riches existing. He makes these explorations for the love of adventure and discovery. He is the man of pure science who discovers by his theoretical discussions and in his laboratory the unknown laws of nature without a thought as to their practical application. Following the discoverer come the pioneers who go forth to blaze the trail that civilization may follow. They are the men who link up the discovery of the explorer with the known world. They may be likened to the theoretical engineer who takes the new discoveries of pure science, examines them, determines what their application may be to a given industry, and indicates the manner in which they may be effectively applied. Having determined this, the information is given to the general engineer who proceeds to manufacture a new product or apply the new law to an old product for our benefit. Thus a new discovery in science is made a part of our civilization.

The position of the theoretical engineer then lies between that of the pure scientist on one hand and the general engineer on the other. He must be conversant with methods and processes of reasoning of the pure scientist on the one hand and of the general engineer on the other. He must have a proper sense of relation between the value of a fact as a scientific discovery and its possible value as applied to industry. He must be a man of vision with a keen imagination and the ability to see into the future of an industry. He must be able to take the deduction of the scientist and present it in a form that will appeal to the so-called practical man.

It is essential that the theoretical engineer should have for his background a knowledge of the industries and how scientific discoveries, as such, are applied.

This can be obtained only by actual experience in industry. This experience should be obtained at as early an age as possible. I believe the knowledge of industry which the theoretical engineer must have can best be obtained in some form of the so-called co-operative system of engineering education. There have been many misconceptions as to the aims and objects of this system. It is not a panacea for all the faults of our educational system nor will it take a boy without brains and provide him with them. Neither is it aimed to make the engineering student a practical machinist, surveyor or whatnot. The object of the co-operative system, as I see it, is to give him a background upon which he can base his theoretical courses and it provides the necessary inspiration. It makes these courses real; he appreciates their value. It also makes him a better citizen. It does not supplant but supplements his scholastic training. It is a correlating factor.

Criticism that the engineering schools have weakened their theoretical and laboratory courses in order to introduce more practical work is appearing with greater frequency. I think possibly that the criticism is well taken with respect to certain schools and it is in my opinion a direct result of the agitation in regard to engineering schools which took place during the war. The faculties of engineering schools have had an epidemic of taking advice from practicing engineers in regard to the curriculum of the schools. It was impossible for the faculties of the schools to overlook or sidetrack these recommendations because many times they were presented by extremely influential alumni and oftentimes the advice was timely and much to the point.

However, teaching is in itself possibly the greatest of all professions and the members of a faculty under-

*Résumé of remarks by Dean F. L. Bishop at joint meeting of the New York Section of the A.S.M.E. and A.I.E.E. on "Engineering Education," held April 22, 1921.

stand quite clearly just what the boy from high school can absorb. The practicing engineer seldom has any conception of these limitations and this is why there have been some notable failures where men who have practiced engineering for twenty years attempted either to teach in or administer engineering schools.

The result has been that in some schools the so-called practical courses dealing with specific forms of engineering have replaced certain courses dealing with fundamentals.

Knowledge of the fundamentals of engineering science is, of course, the aim of engineering schools. Of the engineering school graduates on the eminent list of Dr. Walters, registrar of Lehigh University, 74 per cent ranked upon graduation in the highest two-fifths of their classes and accordingly had a knowledge of engineering fundamentals above the class average. Less than 8 per cent were in the lowest two-fifths. Hence a knowledge of the fundamentals of engineering science, it seems safe to say, is clearly more important than the 15 per cent assigned to it by the popular engineering opinion as expressed in the Mann report.

Then what does the Mann vote show? The vote emphasizes personal qualities in engineering leaders and the present study of Dr. Walters attesting the intellectual power of engineering leaders (as shown by scholastic rank and later by achievement) taken together, furnish an instance of positive correlation between intellect and character. In other words those men who ranked high in the knowledge of fundamentals also rank high in character, judgment and efficiency. Thus, the scholastic standing of the engineering graduate is a measure of his character and his judgment and his efficiency.

The theoretical engineer then should be trained in an institution in which the fundamentals of engineering and science are thoroughly taught. If he ranks high in his scholastic standing and these fundamentals are taught by competent teachers, he will also rank high in judgment and efficiency, the chief characteristics which will make him a successful engineer.

Good Judgment or Common Sense Most Valuable Attribute for Engineers

By Knox Taylor, C.S.C
President, Taylor-Wharton Iron & Steel Co.

An engineer should be educated to know a great deal about a few things and a little about a great many things. Where should the line be drawn? That is the great question. To draw it properly is a matter for judgment, and good judgment is so rare! How much time, money, and even life, is wasted through poor judgment! Too much emphasis cannot be placed on educating to develop good, sound judgment, for without it nothing else avails.

Good judgment is often called "horse sense" or just plain, good common sense, and how many so-called well educated men we meet who do not have it. A man who does not possess it in at least a considerable degree is just not an educated man, and cannot be an engineer in the true sense. Good judgment is obtained only in part from books or the laboratory. It is obtained for the most part from the fullness of life's experiences. A full life must have lots of study, with a lot of other activities. Some of the studies must be thorough and intensive, enough so that the student will realize that much that has been pointed is either wrong, or, upon proper analysis, points to some entirely different conclusion than that previously assumed. This develops individual thought and judgment through analysis and discrimination. Every subject cannot be so fully studied, but ordinary study in any one subject helps to acquire education by only a general or superficial study of other subjects. The other activities in a man's education, outside of study or laboratory work, should develop the human side, and how to get results for, with and through other people.

You see so many men who cannot get on well with others. They may be wonderfully well informed scientifically or technically, but they are not good members of a group or team. They are not cheerful, courageous, or considerate, or they have been too busy (with less important things) to learn how to secure any one or all three of these Christian characteristics.

What I have said applies to learning all through life, but of course especially to the school and college age. I think I have made it evident that in my opinion the engineer should have the broadest possible foundation. If this is sacrificed to a great deal of early trade or technical work, time is gained at first and lost later, never to be made up again. What a rich world this would be if only we could profit more by the experience of others. So many lack the judgment to do it.

Fundamentals vs. "Practical" Training*

By Prof. Comfort A. Adams
Chairman, Division of Engineering, National Research Council

Science and industry started a long way apart, each holding the other largely in scorn or contempt. The first attempt to bridge this gap was the establishment of the profession of engineering; but industry was at first so inappreciative of the scientifically trained men, and put so much pressure on the engineering schools to produce "practical" men, that the scientific foundation which underlies any sound knowledge of engineering was grossly slighted and slurred over in order to give time to the practical applications. This condition still exists to a deplorable extent in most of our engineering schools, and the worst of it is that the student thinks he is getting sound fundamental training; in fact, he often complains that it is too much so. He is led through a superficial analysis of certain types of problems without knowing that it is crudely approximate and without any encouragement to make the subject his own, to think for himself, or to get to the bottom of anything; in fact, he often does not understand the meaning of the words he employs. This is the reason for his thinking the instruction too theoretical. If he really understood, if he had the real grasp of the subject which comes from understanding, he would not only appreciate and enjoy the work but would in most cases be enthusiastic about it.

I would not make these statements if I could not prove them to be true; they are the result of thirty years of teaching engineering, together with a wide practical experience and contact with engineers in their everyday work.

In defense of those employers who still distrust the conclusions of the scientifically trained men, it might be explained that far too often the man in question is not *sound* in his scientifis knowledge, but is merely fluent in the lingo, including mathematics. In other words he is not only superficial but also lacks the prac-

*Substance of the remarks made by Professor C. A. Adams at joint meeting of the New York Sections of the A. S. M. E. and A. I. E. E. on "Engineering Education," held April 22, 1921.

tical knowledge and is, therefore, often even less safe than the superficially trained engineer. However, examples of the revolutionary industrial accomplishments of men with a sound scientific training are too numerous to mention.

Thus it is that with few exceptions the engineers do not bridge the gap between science and industry, and although they have accomplished wonders in the development of our industries, the time has come when much more must be done if we are to keep abreast of world competition and the demand on the part of labor for greater reward and more leisure. Moreover, although we have prided ourselves on the rapid development of our natural resources and our resulting prosperity, it has been at the expense of gross wastefulness and the rapid exhaustion of many of our vital resources.

There is thus a crying need for a more thorough education of our engineers in fundamental science and a corresponding grave responsibility is placed upon our engineering colleges, most of which now provide a grossly superficial training.

This training can hardly be called "education" as it is rather more a process of cramming a mass of superficial information.

What we really need is a training which will supply a foundation of fundamental science, stimulate the desire to understand and know the reason why, a habit of critical analysis whatever the problem, and of clear, straight, sure-foot unbiased thinking rather than the habit of loose thinking cultivated by the uncritical memorizing of some one else's superficial analysis; the habit of laying a sound foundation and building one's own structure thereon rather than unintelligently copying some one else's structure and trying to hang it in mid-air without a foundation.

Moreover, this same spirit and habit of mind is sorely needed in all professions, in all departments of life. A little more of it applied to some of our social, economic and world problems would greatly clarify and simplify the process of solution.

Importance of Co-operation Between Graduate Engineers and Faculty Men

By Colonel W. C. Spruance
Vice-President, E. I. du Pont de Nemours & Co.

The interesting and enlightening discussion of "The Theoretical Engineer" at the joint meeting of the New York sections of the A. S. M. E. and A. I. E. E. was a material contribution to the subject, and among others the views of Professor C. A. Adams and Dean F. L. Bishop were particularly noteworthy.

It has doubtless occurred to many who in recent years have devoted considerable thought to this problem that there has so far been inadequate co-operation between the staffs of the educational institutions on the one hand and the practicing engineers or employers on the other; and that the problem would be more satisfactorily and promptly solved and the type of engineering education improved and stabilized by a more systematic co-operative effort on the part of those who develop the engineering undergraduate and those who later employ him and thereby further influence his development. It seems obvious that this problem is a dual one.

The modern professor of engineering doubtless knows far more than the practicing engineer or corporation executive how much the student can absorb and when, but the teacher is not as good a judge of what the student should learn to fit him for contact with the world in capacities which the average member of the staff of an educational institution does not and cannot experience himself, due to the very nature of his occupation and responsibilities. There is much to support the opinion that it is quite impracticable for both groups to qualify by alternate engagement in teaching and practicing engineering. Why not, therefore, rely upon the professor to determine *when* and in large measure *how* the student should be taught and look to the engineering alumni to indicate the *objectives* of engineering education; the professor and the alumnus to determine jointly *what* the student should be taught and both to adopt some practical scheme by which they could keep in reasonable touch with the student for from three to five years after graduation? It is a fair theory not only that an engineering education is by no means complete at an earlier day, but that association by the professor and the employer with the product of the engineering educational institution is bound to react favorably on the efficiency of both in the discharge of their joint responsibilities to improve, stabilize and standardize engineering education.

To Dean Bishop's Class I, the theoretical engineer, and Class II, the general engineer, might be added Class III, viz., the man who appreciates and takes advantage of an engineering education and attains success in business or corporation activities without at any time in his career being either a professor or a practicing engineer. Of these three classes it may be argued that numerically the first is the smallest and the third the largest; a more or less natural result when one considers the comparatively small percentage of preparatory school graduates who, though eligible for an engineering education and of such caliber and inclination that such an education is not wasted upon them, can survive the unavoidable processes of elimination before any marked success is attained as a professional, theoretical or practicing engineer.

Broadly speaking, Class III might be considered as requiring a four year undergraduate engineering course leading to a degree, which might be described as the counterpart of the academic degree of A.B. and to be known as B.E. or E.B. (bachelor of engineering); Class II requiring the aforesaid four year course plus a post-graduate year in general engineering, with a degree of G.E. or E.G., and Class I the four year course with one or more post-graduate years leading to a specific degree in engineering such as M.E., C..E., or E.E., et cetera.

Professor Adams aptly and clearly emphasizes the importance of including in any adequate engineering education the fundamentals of science and engineering and directs particular attention to the danger of wasting the student's time in so-called practical instruction.

In these three classes of engineering education, instruction in the fundamentals and also the "humanities" appears to be not only essential but readily procurable in a four year undergraduate course which the modern professor can evolve with ease; specialization to be largely considered a function of post-graduate study.

Many have noticed and commented upon the apparent failure on the part of the professor to sufficiently appreciate the fact that a relatively small number of engineering graduates is required to meet current demands in the ranks of professional educators and specialized practicing engineers and the relatively large number

which, if they have the benefit of proper engineering training, with its peculiar advantages of discipline and intensive study, etc., the industrial, commercial and financial worlds require.

It seems to be generally admitted that a general engineering course is growing rapidly in popularity and that it is the best type of education for the man who is ultimately to qualify as a corporation executive, not only in industrial but financial and other lines. The requirements of modern business in the direction of sales, purchase and production are generally best met by the engineering rather than the academic or even "scientific" graduate; it being assumed that in the last analysis the best type of engineering education is in reality a combination of academic and scientific courses.

As to the object of an engineering education, a well-known professor of engineering used to tell his students that his principal object was to teach them to teach themselves, which reflects a viewpoint that is well worthy of careful consideration by both the student and the graduate engineer. As to the method of teaching, probably but few professors of mathematics voluntarily help the student to a realization of the justification of a study such as calculus. The average student knows that "mathematics train the mind," but many are far along in calculus before the professor volunteers the information, if in fact he ever does, that a practical application is found in the steam engine indicator diagram and a student's interest in calculus can be greatly stimulated by a few minutes' talk by the professor on this subject and without the necessity of having him actually take or figure out a dozen or more indicator cards.

To summarize: It would appear that further co-operative effort between the professor on the one hand and the other members of the engineering world on the other would add much to the early and satisfactory solution of this problem, provided the former was relied upon to evolve a curriculum to produce engineering graduates with qualifications to be laid down by the latter, and that they join forces in a practical way to assist and guide not only the undergraduate but also the young graduate engineer.

Desirable Training for Engineering Students

By Colonel Moorhead C. Kennedy
Vice-president, Pennsylvania Railroad

In reply to your request for an expression of opinion on what I consider the essentials of engineering teaching, I would include three cardinal points: (1) An exhaustive grounding in fundamental theory in the branch of engineering in which the student will be graduated. (2) a sufficiently broad background of general education that in after life will fit the engineer to take his place in the community on equal footing with its leaders; (3) a systematic effort to include in the curriculum such contacts with up-to-date engineering practice as will serve both to stimulate the undergraduate mind and teach the relationship of theory to practice.

If he is to take the place in the life of the nation for which engineering education should preliminarily fit him, the graduate engineer should be more than a skilled technician. This fact is being increasingly recognized by the colleges.

Reverting to the third of what I consider the three cardinal points, I will say as a Princeton engineering graduate of 37 years ago that my belief in the need for intimate contact between the university and practicing engineers in the successful and active pursuit of their profession is based upon an outstanding recollection in my own case of what would have been of essential help had it been included in the engineering course at that time. Such contact is well secured by engineers of acknowledged standing coming to the university and supplementing the instruction of the teaching staff by *a message of the practical application of the principles of technology in that branch of the profession in which the particular engineer is engaged.*

Another valuable asset, and one that often may be directly applied in the teaching itself, is found in an assembly of carefully prepared technical data and exhibits contributed by industrial plants, public utilities and others, and so arranged as to visualize the processes of manufacture, the methods of administration and organization and the relationship of the several branches of engineering to the integral parts of such organizations.

It may interest your readers to learn that just such a plan is being carried out at the present time with exceedingly gratifying results at Princeton University, whose engineering departments are about to be expanded. Under the leadership of the Princeton Engineering Association, a body of engineering graduates of that institution, a plan has been worked out that has been accorded able support by a large number of executives in varied lines of industry and among the public utilities.

Whatever the engineering graduate of our colleges is, he should be fundamentally sound in theoretical education and broad in general vision.

Broad Training in Fundamentals Should Be a Part of Engineer's Education

By R. E. Anderson
Treasurer, Winchester Repeating Arms Co.

If there is any one thing upon which all parties agree with reference to engineering education, it is that engineering education as it exists today requires considerable revision before the results produced will be satisfactory. Such a revision obviously calls for full and close co-operation between those experienced in the employment of engineering students and those experienced in their education.

The employer of engineering graduates is probably better qualified to determine what the product of the engineering school should be than is the teacher of engineering students. On the other hand, if the specifications for the product of the engineering school are determined, the pedagogical expert is far better qualified to determine the educational processes which will produce the required result than is the employer of engineering graduates.

The problem might be likened to that of a person or corporation who desires to have a bridge built across a stream. The "owner" would designate what stream is to be crossed, what loads are to be carried and the general type of structure desired. The designer would then fill these specifications by determining the stresses and strains, the scantling of the various members, the design of the riveted joints, etc. The result would be unhappy if the designer attempted to persuade the owner to have the bridge cross some other stream and the result might be equally unhappy if the owner attempted to design the riveted joints.

It would seem that if this fundamental distinction in the functions to be performed by those who are interested in the revision of engineering education were more clearly appreciated, the progress made would be both more certain and more rapid.

There is justification for the belief that engineering education, provided it be upon a sound basis, forms the best training for industrial success. The reason lying back of this is that it tends to develop the power and habit of analysis and if rightly directed leads to the desire and ability to undertake constructive work.

But the development of analytical power is useless unless accompanied by the appreciation of relationship to the activities of the world at large. It is, therefore, of prime importance that emphasis be placed upon breadth of training, including knowledge of industrial and commercial principles, administration and the structure of society in general, as well as strictly technical subjects.

It is of course necessary that the engineering graduate have sufficient command of technical detail to enable him to make a reasonable start in his profession. On the other hand, it must be clearly recognized that whatever success he attains will grow principally out of his experience, and that the best that his technical education can do for him, otherwise than to give him the initial start, is to qualify him to make the best use of the experience which he gains after leaving college.

It is my belief that the acceptable engineering course will not over-emphasize shop practice or manual skill, either in shop, field or drafting room, but will be strong in such fundamentals as mathematics (both pure and applied), English, economics, business law, psychology, etc., with ample opportunity for developing qualities leading to courage, decision and accuracy of judgment. The part played by athletics and other extra-curriculum activities will not be overlooked.

However, the construction of the curriculum must be left to the pedagogue. What the pedagogue must produce is a man capable of straight and accurate thinking, with his creative powers awakened and with a breadth of vision that will lead him to seek his ultimate place outside the doors of the drafting room or laboratory.

It should not be overlooked that if the engineering school is to take responsibility for producing an engineering graduate who will meet the specifications of the employer, it must take responsibility also for the raw material which it uses.

Applying Machine Shop Methods to Building Construction

By Donald A. Hampson

A plant manufacturing portable shop cranes and other labor-saving appliances recently decided to erect a foundry on a plot of ground partly covered by an unused brick building.

Labor in the building trades was high and business in the crane line happened to be slack just then, so the helpers in the shop were asked how they would like to try their hands at building instead of being laid off. The helpers took the job and the chief engineer went ahead and planned the work and the building. As "The shoemaker to his last," so the crane builders made use of their own product and their own methods on this work and their methods were in marked contrast to builders' usual methods. Moreover, the work was done in two-thirds the time the contractors had said was possible. The building to be razed was two stories high with a steep peaked roof. As contrasted with the time-honored gin pole, the engineer made up one of his portable machine-shop cranes in heroic size, knocked a hole in the roof, and placed the top through the opening. With this device all the roof timbers were lowered to the ground, one man on the crane handle below lowering them and moving the crane along as fast as the man above could get to the next beam. This crane is shown in Fig. 1 alongside the remains of the building with only 10 ft. of brickwork to be taken down. When the job was over, the mechanism of the crane was put back in stock and the A-frame cut down to commercial size; but before this was done, the crane was used to erect the bents and other structural steel.



FIG. 1. CRANE USED TO RAZE THE OLD BUILDING

Fig. 2 shows an end of the foundry when the building was almost completed. Another crane is shown here.



FIG. 2. CRANE ON ROOF OF NEW BUILDING

In the left foreground is the cupola section of the plant, on the uncovered roof of which is placed this stock shop crane. This one was disassembled, carried to the roof in pieces by one man, and there reassembled. Its position on the roof is over the cupola foundation and its purpose to raise the sections as they are erected.

Some less spectacular building operations were carried out in quick time by departing from conventional methods and substituting others of a nature such as the engineer uses in planning a series of manufacturing operations. This concern "Took its own medicine" to the tune of a several-thousand-dollar saving. The work is a fine example of what mechanical ingenuity and training can do when applied in other fields.

New Light on Internal Measurements

Holes Measured by Line Contact—Measuring Surfaces Cleaned With Soap and Water—Oil Film Prevents Accurate Measurement

By JOHN BATH

MANY have pondered over the famous question: "Will a 2-in. plug enter a 2-in. hole?" We have all heard arguments, more or less convincing, pro and con and also can we bear witness to the skillful avoidance of the issue by many authorities. The subject

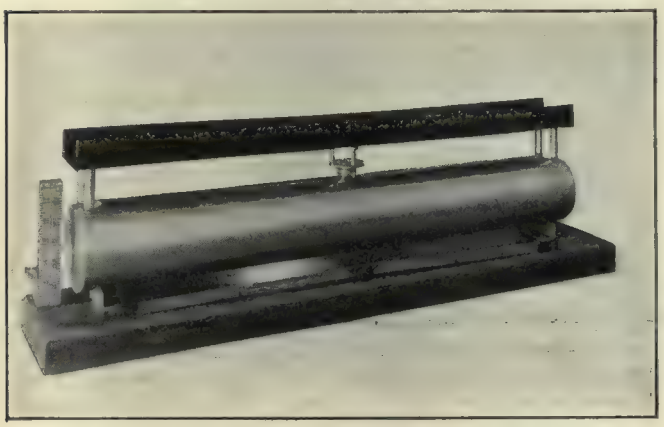


FIG. 1. NOTHING IS RIGID. LIGHT WAVES SHOW THE 5-IN. DIAMETER STEEL BAR TO BEND UNDER PRESSURE OF THE FINGERS

has been so beclouded by mystery because of conditions that were unknown and hitherto unknowable, that in view of recent developments in the art of internal measurement it is worthy of careful reconsideration. Let us, then, first look into certain fundamentals and learn to recognize the true meaning of some of the conditions which have hitherto been but imperfectly understood.

Hardened steel is the most elastic of metals, while cast iron ranks high in rigidity. All supposedly rigid supports, braces and structures bend and distort upon the application of force, however slight. This elasticity of steel is very strikingly demonstrated by means of light waves as indicated in Fig. 1, where a round bar of steel 5 in. in diameter by 28 in. in length is supported at each end and is susceptible to appreciable deflection at the center by the pressure of the fingers.

This demonstration, described in the *Scientific American* for May 15, 1920, proves rather convincingly that there is no such thing as absolute rigidity. Indeed any one who has observed this experiment and has seen for himself how this massive bar will bend and buckle under the pressure of the human hand, may easily imagine a ring gage behaving as if it were made of rubber instead of hardened steel.

There seems to be among mechanics a certain belief extant that a good gage steel should not expand when warmed, nor contract when cooled. This belief is erroneous. Such a steel would cause endless trouble for the reason that the work would change while the gages would not. A 4 in. piece made to gage at a temperature of 80 deg. F., about 12 deg. above standard temperature, would be three ten-thousandths undersize when measured at 68 deg. Neither aluminum, which expands about twice as fast as ordinary steel, nor "invar" steel with its nearly zero coefficient of expansion, are good materials of which to make gages.

It is by no means a new conception to compare a machined surface with a plowed field; when one views such a surface under a very powerful microscope he gets just this impression. The operation of grinding smooths the rough and uneven surface left by a cutting tool much as a harrow levels off the furrows of the field. Lapping starts in where grinding leaves off, and though far from smooth to the microscope, a lapped surface may be produced having the lustre of a mirror and flat to within a millionth of an inch.

These characteristics of machined surfaces must be understood when designing instruments for the taking of fine measurements. It subsequently will be shown that for contact points for measuring machines certain forms are better adapted than others to the securing of uniform results.

Everyone that has to do with the taking of close measurements knows the desirability of line contacts. Consideration of the surface conditions outlined in the foregoing paragraphs show that point-, or even ball-contacts, would be more than likely to take cognizance of some minute surface depression and could not, therefore, be depended upon to indicate true diameters or surface distances.

The line contact is a fundamental principle already incorporated in approved devices for measuring shafts,

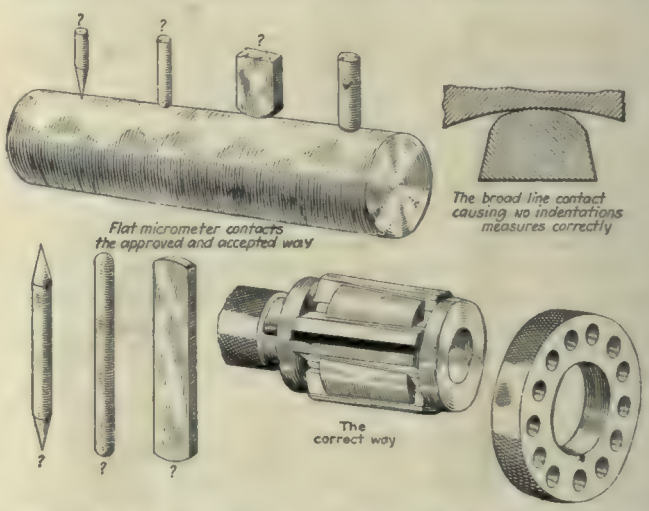


FIG. 2. VARIOUS FORMS OF CONTACTS FOR MEASURING CYLINDRICAL SURFACES

plugs, and other cylindrical objects, and is of equal importance in the measurement of internal diameters. Referring to Fig. 2 it should be obvious that the needle points would be unsuitable for two reasons: they would tend to enter minute depressions in the surfaces of the part being measured and thus indicate a false measurement; and they would tend to cause indentations where none existed or deepen already existing ones, thereby aggravating the trouble.

The use of four parallel pieces with cylindrical surfaces making a broad line contact with the surface to be measured is the ideal condition for measuring internal diameters. The broad areas in contact assure that

there shall be no indentation of the surface; no measuring of already existing indentations; but a firm true contact over the whole interior surface.

The internal micrometer shown in Fig. 3 has been designed to measure the diameter of holes. This tool takes into consideration all of the conditions of surface characteristics hereinbefore outlined and meets them all. Not only that but it also clears up a deal of the mystery that has hitherto surrounded the relation of accurate cylindrical plugs to their corresponding rings.

It has heretofore been possible to determine the size of a lapped hole only when the corresponding plug entered it. Until this occurred the workman had no means of knowing whether or not the hole he was lapping was round or parallel, or how much more material he must remove before the final size was reached.

All workmen dread the sizing of holes that must be accurate to the ten-thousandth of an inch. When working upon a shaft or other similar piece they have ample opportunity to test the diameter and condition of the surface of the work, and may know at any time just how much is left to be done, but the sizing of a hole to fit a cylindrical plug is like working in the dark; the workman cannot know anything more about it than that it is "nearly to size," until the plug falls through and the work is spoiled.

The exact size of a lapped hole may be measured only when the surfaces of the hole and of the contact points of the measuring tool are clean and dry. Under these conditions only is it possible to secure the metal to metal contact that assures accurate results and allows two individuals to reach the same conclusions or one person to obtain the same measurement twice alike.

Soap and Water Does the Trick

The use of soap and water to clean highly finished surfaces of steel is, perhaps, a somewhat radical proceeding when viewed in the light of established customs, but it serves the purpose admirably; removing all grease, grit, etc., and leaving no residue, as is the case with gasoline, alcohol and other mediums.

After all the surfaces have been washed clean and dried with a clean cloth or with new tissue paper, the plug is entered in the ring and the jaws expanded by turning the micrometer screw until the jaws bear as evenly as possible upon the interior surface of the ring. Upon rotating the ring after contact has been established, it will screech and the movement will be jerky. The screeching tells us that the moving metallic surfaces are in contact, while the jerky or non-uniform movement indicates high spots, or a lack of roundness, which there is no mistaking. The plug either moves freely or else it sticks; there is no mid-point. It is possible in this way to detect errors of surprisingly small magnitude; errors amounting to no more than a few millionths of an inch.

After having found the exact size of a hole, with the surfaces in contact clean and dry, one is astonished at the changes which take place when oil is introduced. Oil of any kind (preferably castor oil) overcomes the friction which caused the screeching and the jerky irregular movement; making the rotation of the plug smooth and noiseless. With oil present one can no longer distinguish the high spots from the low ones; both ring and plug will seem to be uniformly round.

Furthermore, with oil present the plug can be expanded by means of the micrometer screw, until it is several ten thousandths larger than the ring without materially increasing the effort required to rotate the plug. The oil has entirely destroyed the "feel."

There is shown in Fig. 4 a 2½ in. diameter ring gage which is of exact size, and within it an adjustable plug gage that is 2½ in. plus one-half of one thousandth; that is, 2.5005 in. When the plug and ring are clean and dry, considerable force is required to enter the plug in the ring. The plug, if it is started at all, must be moved with a mallet. Clearly, the plug has expanded the ring and is held firmly by the pressure of the expanded metal.

Castor oil is now introduced between the jaws of the

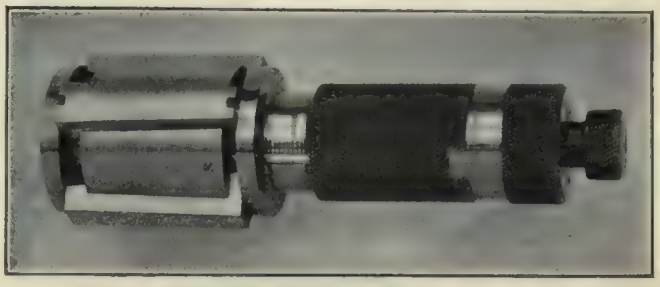


FIG. 3. THE BATH INTERNAL MICROMETER

plug until the interior surface of the ring is flooded, and by pounding and driving, the plug is started. Once the oil has worked in between the surfaces in contact further movement is easy; so easy in fact that if the plug is held in a vertical position, as in the illustration, the ring will slide slowly down of its own weight, and this notwithstanding the fact that the plug is five ten-thousandths *larger* than the hole in the ring.

Similar demonstrations have been made quite frequently with a ring and solid plug; usually for the purpose of showing the perfection of the fit. The demonstrator would carefully oil the plug, start it in the ring, keep it moving by wringing and sliding it, and finally pull it out. "There!" he would exclaim, "A perfect fit."

If, then, you, as one of the audience, should try the experiment it would be perhaps with difficulty that you would get the plug entered in the ring and moving. All at once the plug would stick, and to save your life you could not start it. Neither could the demonstrator; without a mallet.

An Imperfect Fit

This form of demonstration was mystifying and in reality was also misleading. It showed not an example of a *perfectly* fitting plug and ring, but an *imperfectly* fitting one. If the ring happened to be out of round the film of oil first made it correspond to the shape of the plug and then, if the plug was larger than the ring, expanded the latter until the plug could enter.

As long as the plug was kept moving the oil film remained distributed between the surfaces in contact, thus keeping the ring expanded and making the movement easy. With a momentary pause in the movement, the oil would be squeezed out by the pressure, the metallic surfaces would come in contact, and movement would no longer be possible.

The presence of the oil film between the surfaces in contact makes accurate measurements impossible. It seems somewhat strange that in machine design and construction cognizance is taken of the oil film in bearings and allowances made for it, while in accurate gage work it is assumed to have no thickness at all and may safely be ignored. Oil on a gage plug and ring covers

up the defects; hides the errors; makes it easy for an oversize plug to enter the ring by distorting the latter.

The lubricating film of castor oil or of heavy cylinder oil is from two to five ten-thousandths of an inch in thickness. A ring is actually expanded more by the introduction of the oil than it was without it; yet the oil enables the plug to moves freely in a ring that would promptly grip it beyond the possibility of movement by any pressure that could be exerted by hand if the oil film were not present.

The Mysterious "Holding" Film

Distinct and separate from the lubricating film is another film about which little is known, and concerning which much mystery has prevailed. It may be called the "holding film."

All mechanics are familiar with the experiment of wringing together flat pieces, such as gage blocks, and having them stick sufficiently to withstand a considerable pull. This adherence is due, we have been told, to the action of the force known as adhesion, a powerful attraction of the molecules of the metal one for another.

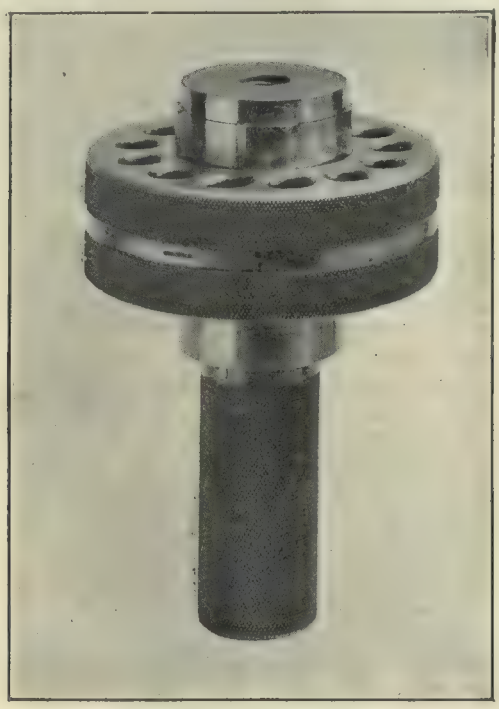


FIG. 4. SURPRISING RESULTS INDUCED BY THE PRESENCE OF OIL ON THE SURFACES IN CONTACT

This is not true. From experiment and observation we have determined that as a matter of fact two gage blocks previously cleaned with soap and water will not adhere. If, however, two such gages are allowed to stand a sufficient length of time after washing, a film of moisture will be deposited from the air that will cause them to adhere. Moisture from the breath or oil from the finger, if it is allowed to reach one or both of the clean surfaces, will quickly bring about the same result.

Thus two precision gage blocks adhere together, not because of molecular attraction but because of the surface tension or capillary attraction of a film of moisture between them. The optical glass flat, which is simply a perfectly flat test surface of glass used for measurement by means of light waves, allows this holding film to be seen plainly. With the optical glass coming into contact with a steel gage block the holding film may be seen to move about from place to place as the two pieces are moved one upon the other.

The more this film is distributed by moving the surfaces back and forth the thinner it will become; and the more nearly perfect the two surfaces, the greater will be the force necessary to separate them.

This condition exists, of course, between two blocks of steel, but because of the opacity of both blocks it has been impossible to observe it until the glass flat was available.

By optical measurement we know that the thickness of the film between two surfaces properly wrung together is about one or two, and seldom more than three, millionths of an inch; an amount so very small as to be negligible in all ordinary work. We must, then, recognize and properly allow for, in all fine measurements, two classes of film; the relatively thick film of lubrication which must be taken into account, and the holding film which is so thin as to be negligible. The first facilitates movement of the parts upon each other; the second prevents it.

The Holding Film as a Detector of Irregularities

An excellent way to detect slight irregularities, such as high spots, depressions, bell-mouth, etc., in a lapped hole is by means of this film. The inner surface of the ring is first coated with castor oil, after which it is wiped perfectly dry and allowed to stand for several hours; during which time a coating of fine particles will be deposited from the air. A plug now entered and rotated within the ring so prepared develops a very thin brownish colored film of the same nature as the film that causes the gage blocks to adhere. The color is due to the deposit from the air.

In an imperfect hole this colored film will be distributed quite unevenly and it is this unevenness that reveals the errors. In some parts of the film pattern, patches of the steel color may be seen to continue unbroken for quite an appreciable distance; showing where the metal of the plug jaws has been in contact with the metal of the ring. Then a fringe of dark film may appear, disclosing a hollow spot where the metal does not touch.

Prussian blue makes an excellent indicating film for testing lapped surfaces. Only a very small amount—nothing like the amount generally used—is necessary. A coating of the blue is first applied to the ring by the fingers and then almost entirely wiped off with a clean cloth. The rotating of the plug in the ring causes it to pick up a holding film of blue, causing a very pronounced holding or wringing effect, which is further distributed in the manner described; disclosing any variation in the contact between the two surfaces.

Interference Colors Produced in a Ring

When the lapped surface of a ring gage and the adjustable plug are covered with castor oil and the plug put in the ring, rotated, and then drawn straight out, a cylindrical film of oil has been distributed over the surface of the ring. A ring so treated when viewed by reflected light, either daylight or diffused electric light, will show interference colors; perhaps a series of colored fringes including the straw color, brown, red and blue will be discernible.

These colors are due to the interference of light waves reflected from the highly polished surface of the ring with those reflected from the surface of the oil film. It

is obvious that the more perfect the surface of the ring the more uniform will be these colored bands.

The mere fact that the colors exist does not indicate perfection for it is well known that they may be produced by an imperfectly fitting ring and plug; but with the imperfect contact the surfaces of both plug and ring are distorted and the colors will appear as mere blotches instead of well defined bands.

Similar colors can be produced between two flat surfaces; films sometimes being obtained that are surprisingly uniform and give rise to the straight interference bands indicating an absolutely flat surface.

With the plug and ring shown in Fig. 4 the colors take the form of straight bands running around the hole parallel to the edge of the ring. These bands would not be even with the edge if the hole were not round.

A Perfect Plug Will Enter a Perfect Hole of the Same Size

Without question a perfect 2-in. plug will enter a perfect 2-in. hole—a perfect fit when it is clean and dry—without the aid of a lubricant. The different opinions heretofore existing as to the allowance necessary to permit the plug to enter have resulted from the fact that no one has succeeded in making the perfect plug and the perfect hole.

With a solid plug that fills the hole we have been working under adverse conditions. It has been impossible with the solid plug to detect the lack of roundness because the solid plug distorts the ring and makes it conform to itself, and, if the plug is larger than the ring, expands the latter to allow it to enter.

Also if a ring were considerably out of round it might not, even though the circumference of the hole were greater than that of the plug, allow the latter to enter, and because until the plug was entered there would be no way of detecting the defect in the ring in regard to roundness, the ring would be considered too small and lapping would be continued until the plug did enter and the discovery would be made that the ring had been spoiled.

The time may be said to have passed when it is necessary to neglect unknown errors in the lapping of holes. The new system of internal measurement permits the operator to know at all times not only the actual size of the hole he is lapping but also its condition in respect to roundness, parallelism, bell-mouth, etc. That which has been the greatest problem has now become the least.

Babbitt Bearings on Rolling Mills

By A. Searles

To supplement the article by James Ellis on the subject of "Babbitt Bearings for Lathe Spindles," published on page 844 of the *American Machinist*, the writer would offer a few observations from his own experience with brass and babbitt bearings as applied on rolling mills.

In this case the application was on small rolling mills such as are used for cold rolling of strip steel and other metals. The original installation of mills purchased from the manufacturer of this class of equipment were fitted with brass or bronze roll bearings, which gave trouble from the start.

After relieving the bearings at the sides to prevent side pinching, and carefully scraping them to insure as nearly a perfect bearing as possible, we were able to operate with a certain grade of oil as a lubricant, although scoring of the roll necks occurred during the wearing-in period. This scoring did not, however, interfere with the operation of the mills and came to be considered as a necessary evil, although considerable difficulty was still experienced from heating.

The bearings were finally drilled for water channels and circulating water applied in addition to the circulation of water through the center of the rolls, which served to dissipate the heat generated by the work and maintain a uniform roll shape, which is quite important, particularly in the case of light gages. This water cooling of the bearings prevented further heating, but scoring of roll necks still persisted and caused excessive power loss.

At this stage tests were made to determine the pressures required to roll metal and incidentally it was found that the bearing pressures amounted to about 2,500 lb. per square inch, with a bearing speed of 45 ft. per minute, operating for continuous periods twenty-four hours a day.

Notwithstanding the fact that these pressures would seem to be excessive for babbitt, a number of babbitt and lead bearing metal linings were applied by using worn brass bearings lined with a thin filler of the softer metal. As was to be expected, we had failures, but success finally rewarded our efforts in cases where hard and high grade materials were used.

These experiments resulted in the general application of babbitt lined shells, which were then made of cast iron, thus reducing the initial cost as compared with solid brass bearings and affording a material saving in bearing renewal, since the cast-iron shells could be relined repeatedly while the original practice of using brass bearings necessitated the scrapping of an expensive bearing each time.

In the case of the babbitt lined cast-iron shells a limited amount of water cooling was retained, amounting to about 50 per cent of that applied to the brass bearings; but it is doubtful if even that is required as no heating has been experienced, although the roll speeds were increased in subsequent mills.

The babbitt linings eliminated the neck scoring, thus prolonging the life of the roll, which in being reground on the bodies, as is occasionally necessary, must also have the scores on the necks ground off. It was also necessary to rebore the brasses as a scored neck could not otherwise be refitted to its bearing after removal from the mill.

Scleroscope tests of the roll necks indicated a range in hardness of from thirty to sixty points. It is possible that a careful selection of brass or bronze of suitable composition might have eliminated considerable of the difficulty; however, the fact remains that replacements are more cheaply made with soft linings and the latter give fully as good if not better service insofar as wearing qualities are concerned.

In addition to the advantages outlined, the lubrication problem was greatly simplified, as a much wider range of lubricants could be used. Originally suitable lubrication was accomplished only by using an oil so heavy that in cold weather the viscosity increased to such an extent that it was difficult to feed the oil to the bearings, resulting in great waste of oil as well as aggravating the heating and neck scoring. The application of babbitt linings permitted the use of a lighter oil as well as grease; which has certain advantages not relevant to the bearing problem.



A Modern Multi-Storied Shop For Building Machine Tools

By FRED H. COLVIN
Editor, *American Machinist*

Five-Story Building of Reinforced Concrete—Lighting, Heating and Ventilating Carefully Planned—Novel Method of Handling Chips

THERE are differences of opinion as to the relative advantages of single- and multi-storied shops. Very frequently the conditions leave no choice, as if it is necessary to build in a congested district, the multi-storied shop is the only alternative. It must not, however, be understood that all those who build multi-storied shops do so because of necessity. Many believe that the concentration of a plant on a small ground area has advantages over the single-story shop, which must cover a large acreage and which involves problems of its own in regard to the handling of materials and in the communication between departments. There are many factors to be considered in building a large shop, and these vary according to the business and shipping facilities, so that many points must be carefully considered before deciding as to the type of building best suited to a particular business.

This article shows the way in which the American Tool Works Co., Cincinnati, Ohio, has developed the multi-storied shop building to fit its needs. The building shows very careful planning, both as to its construction and the arrangement of departments in regard to handling material, et cetera.

The building is of somewhat irregular shape, the angular side being necessitated by the direction of the street which contains the railway sidings. The maximum dimensions are approximately 250 ft. each way,

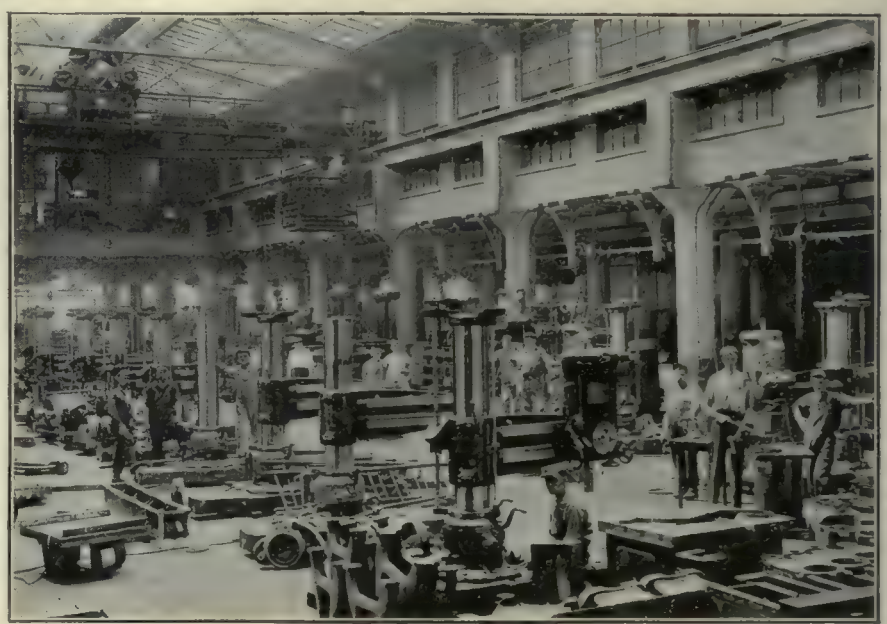


FIG. 1. THE OPEN COURT OF ERECTING BAY ON SECOND FLOOR

which gives a good idea of the size of the building. The building itself is of reinforced concrete, the supporting columns being shown by circles on each floor plan. Its construction required 750 tons of steel, 18,000 bbl. of cement, 12,000 cu.yd. of stone and 6,000 cu.yd. of sand. It is supported on 859 concrete piles of the Simplex type, each pile being designed to support 50 tons. In some cases, the piles had to be driven to a depth of 55 ft. to secure the proper setting, but the average depth was 35 ft. It is interesting to note that the total length of these piles is 33,980 ft., or nearly 6½ miles.

A court 60 ft. wide by 140 ft. long, completely protected by roofing of steel and glass, extends from the second floor to the level of the fifth floor and forms a splendid erecting bay lighted from the skylight above.

Great care has been taken to secure as much light as possible, 80 per cent of the wall area being of glass, amounting to a total of 50,000 sq.ft. The upper halves of the windows are of factory ribbed glass, the ribs being on the inside and running horizontally. The glass in the direct line of vision is clear, but below this is more factory ribbed glass with the ribs on the outside and running vertically.



FIG. 2. AIR VENT IN TOP OF COLUMN

This arrangement is the result of experiment, in which it was found that the horizontal ribs on the upper part of the window diffuse the sun's rays considerably, diverting a large portion of the light rays against the ceiling which in turn reflects it and distributes it in the room beneath. On the other hand, the vertical ribs on the outside break up the light rays and throw them in a different direction, tending to avoid all glare upon the eyes when looking downward. To increase the efficiency and intensity of the reflected lighting, both the walls and the ceiling have been painted white.

For artificial lighting 100-watt Mazda lamps are used, averaging one lamp to every 100 sq.ft. of floor space, or to every block 10 ft. square. These lamps give a light intensity of about 5.6 cp., per square foot. When it is considered that considerably more than 2,400 of these lamps are used, the quantity of the light can be somewhat appreciated.

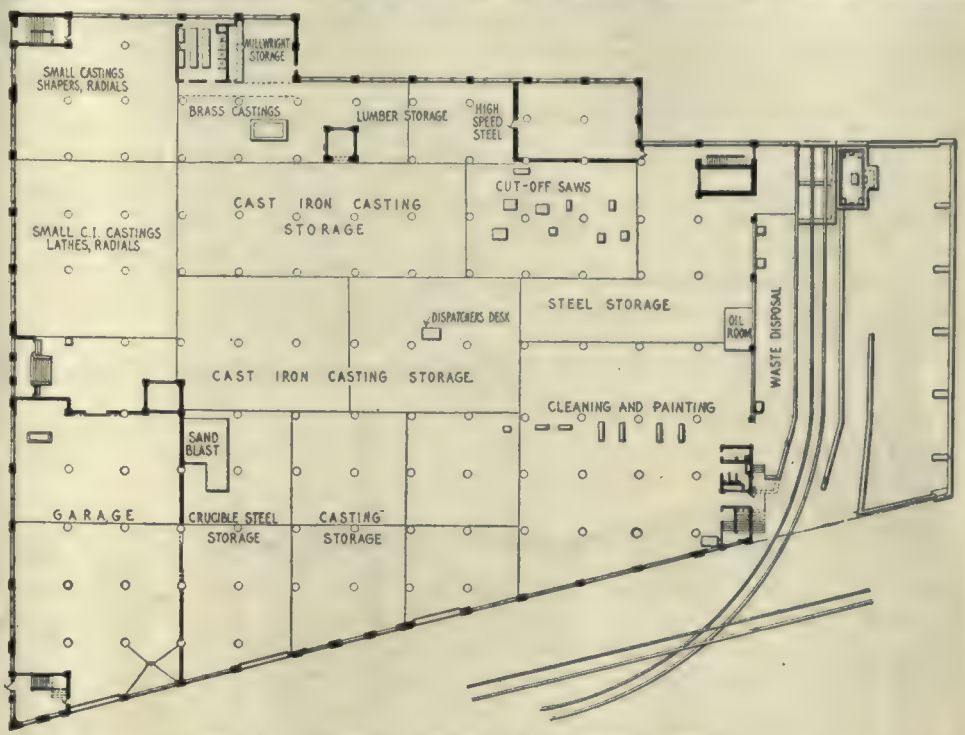


FIG. 3. MATERIAL STORAGE ON FIRST FLOOR

The building is heated by hot air. Two multi-vane fans, each with a capacity of 60,000 cu.ft. per minute, are mounted on the roof and driven by 35-hp. motors. These fans draw a combination of entirely fresh air and air from the interior of the building, through return ducts around the concrete columns. As the air goes to the fans, it enters through 10,752 sq.ft. of 60-in ventro sections or radiators, heated with steam from the boilers. It next passes through a humidifier which brings it to its proper humidity. The air is then forced through distributing ducts to the hollow or ventilating columns of the building. The vents are located in the columns, near the ceiling and face the inclosed portion of the room, thus maintaining a constant circulation of air. One of these vents is shown in Fig. 2, which is a view taken in the vestibule school during the war. Air is supplied in constant quantity, the temperature being controlled by thermostats located in various parts of the building. Although steam is only used for heating, sufficient boiler capacity was installed to make it possible to generate power for the shop should it ever seem desirable to do so.

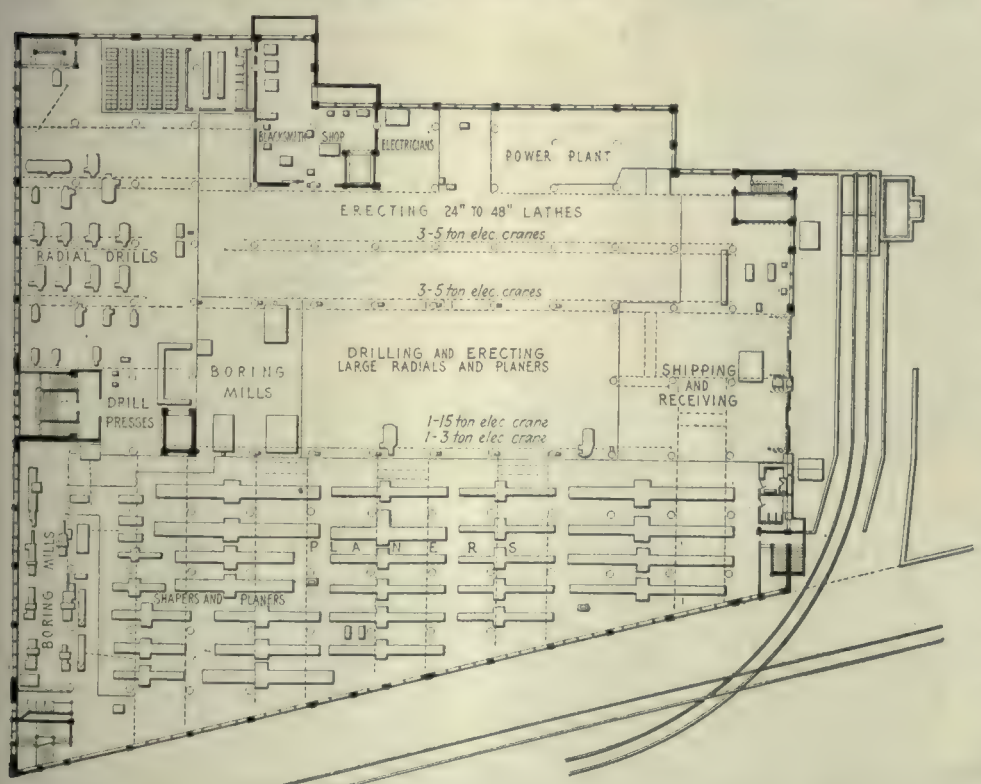


FIG. 4. LAYOUT OF HEAVY MACHINERY ON SECOND FLOOR

Electrical power purchased from a local electric light company is employed throughout the plant; the majority is alternating current, a very small portion being direct current.

Group drives are used in each department, and each lineshaft, controlling about fifteen machines, is driven by an individual motor through a silent chain.

The main switchboard is located on the second floor, and power is distributed to smaller boards on each floor, from which any individual lineshaft can be controlled, the starting compensator being located on the column nearest the motor.

The handling of work from floor to floor is taken care of by three elevators. One of these is 9 x 20 ft. and of the worm-gear type for handling the heaviest work. It is specially counterweighted to minimize slipping under the heaviest loads and runs at 50 ft. per minute. The other two are smaller and are used solely for the lighter work. They are of the traction type and run from 50 to 200 ft. per minute. All the elevators use 220-volt direct current and the shafts are equipped with special Peelle doors. The feature of these doors is that they cannot be opened or closed prematurely or by accident. Instead of closing automatically when the car leaves the floor, they must be closed by hand, and locked, before the car can be started. It is also impossible to open the doors until the car has come to a stop at the floor level.

In the plan of the first floor of the building, which is shown in Fig. 3, the arrangement of raw stores can be readily seen. The various storage departments are designated and it will also be noted that in the center of the floor is the dispatcher's desk; all orders for castings or other raw material coming to that point. From the raw stores the various materials are sent to the departments requiring them, using the elevators provided for that purpose. The plan also shows the extent of the storage yard at the rear and the department of waste disposal which is one of the modern features which make for economy and the prevention of waste.

The garage is 60 x 100 ft. and accommodates the cars of officers and employees, as well as the company trucks. It contains two 10,000-gal. tanks for gasoline and naphtha, as well as other tanks for oils and lubricants. All owners of cars, in either the shop or office, can secure fuel and oil from this large supply at special prices.

The heavy machining is done on the second floor, Fig. 4, the large planing department being shown on the angular side of the building and the boring and radial drilling machines on the front. The planers are not bolted to the floor but merely rest on their foundations. This floor is at the proper level for receiving and shipping material from the spur track at the back. The open court in the center begins on this floor and is used for the erection of the largest machines. Adjoining it is the erection floor for 24- to 48-in. lathes, which is served by three 5-ton electric cranes. The court contains two cranes, one of 15-ton and the other of 3-ton capacity.

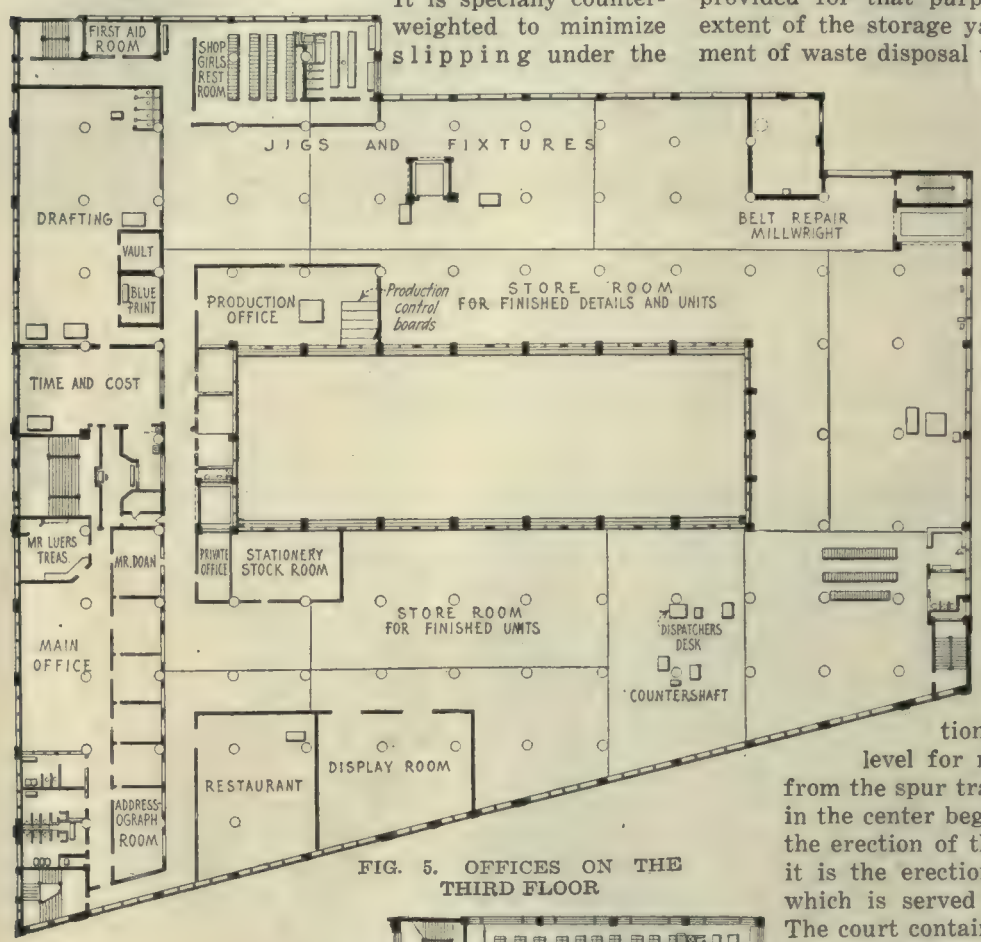


FIG. 5. OFFICES ON THE THIRD FLOOR

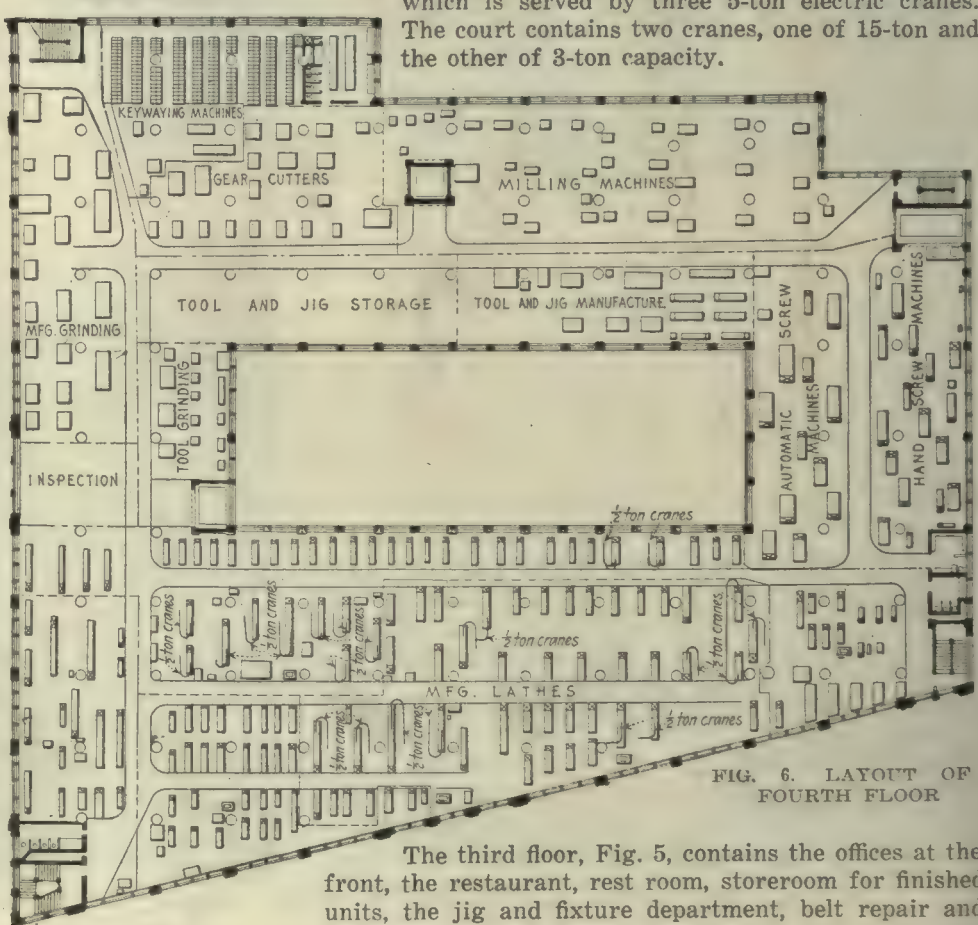


FIG. 6. LAYOUT OF FOURTH FLOOR

The third floor, Fig. 5, contains the offices at the front, the restaurant, rest room, storeroom for finished units, the jig and fixture department, belt repair and

millwrighting departments as well as a room for exhibition or display of machines.

The lighter machine work is done on the fourth floor which is shown in Fig. 6. This floor contains grinding,

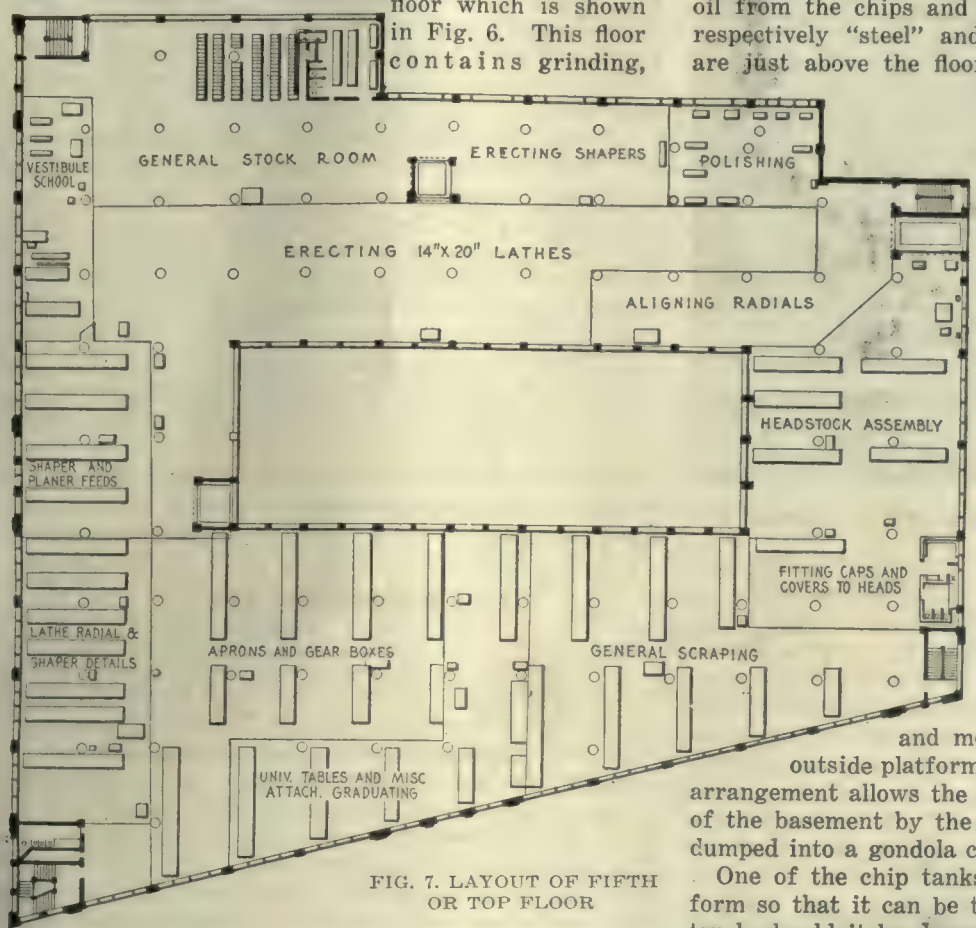


FIG. 7. LAYOUT OF FIFTH OR TOP FLOOR

gear-cutting, milling and screw machines, engine lathes and similar machinery, as well as tool, jig-making and work-inspection departments. The upper, or fifth floor, shown in Fig. 7, is devoted to unit assembly of such details as heads for radial drilling machines, planer rails, aprons, gear boxes, headstocks, turrets and relieving attachments. Here also lathes from 14 to 20 in. are erected, as well as shapers and many of the finishing touches are put on sensitive radial drilling machines.

The method of handling and disposing of chips is very complete and extremely interesting. Fig. 8 was taken at the back of the fourth floor where the greatest quantity of iron and steel chips are produced. This view shows a small separating machine for extracting oil from the chips and also two of the chutes labeled respectively "steel" and "iron." The chute openings are just above the floor and each is provided with a hinged cover which swings down and covers the opening when not in use so as to prevent accidents. These chutes run from the top floor to the chip-storage room on the first floor. In addition there is another chute which extends from the second floor to the basement and is used by the boxing department for conveying shavings and sawdust to the disposal room.

Fig. 9 shows the lower end of the chutes in the basement room. It also shows the sheet-metal tanks used for catching the chips as they come down the chutes, holding them for further disposal. These tanks have trunnions by which they can readily be lifted by the hand traveling crane shown and moved under the opening in the outside platform as indicated in Fig. 10. This arrangement allows the tanks to be readily hoisted out of the basement by the crane in the yard outside and dumped into a gondola car or into a truck.

One of the chip tanks is shown mounted on a platform so that it can be transported by a hand-lift shop truck should it be deemed desirable to move it in that manner. The method of slinging the chip tanks is clearly shown in Figs. 9 and 10. As can be seen from a study of Fig. 3, the entire space beneath the shipping platform is used for chip storage, a sufficient number of tanks being provided to make it easily possible to handle them in an economical manner.



FIG. 8. CHUTES FOR CARRYING CHIPS TO BASEMENT



FIG. 9. CHIP STORAGE TANKS IN BASEMENT

The use of the chutes prevents the crowding of the elevator by the laborers with trucks and wheelbarrows, and permits the laborers to work continuously under the foremen's supervision, thus eliminating many unnecessary men. One man in the waste-disposal room handles all the material and has time for other duties.

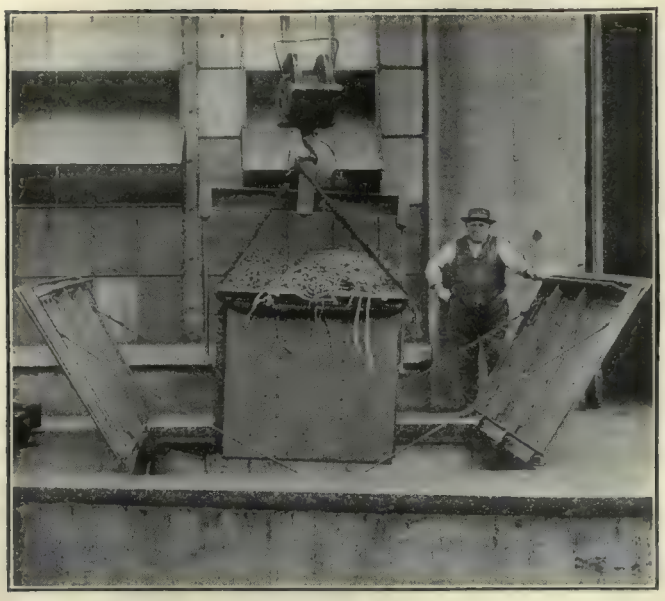


FIG. 10. HOISTING A CHIP TANK OUT OF BASEMENT

The crane shown in Fig. 11 is one of a series used in the various crane bays and is, it will be noted, of the "underslung" type, whereby the crane bridge covers the maximum floor space between the columns of the building. These cranes have longitudinal and cross movements, and are equipped with electric hoists which receive their current from a pair of trolley wires strung parallel to the bridge. There is a wipe contact at the hoist. The trolley wires receive their current from a pair of T-rails attached to the ceiling, and a pair of trolley wheels run on the under faces of the T-rails as shown at *A*.

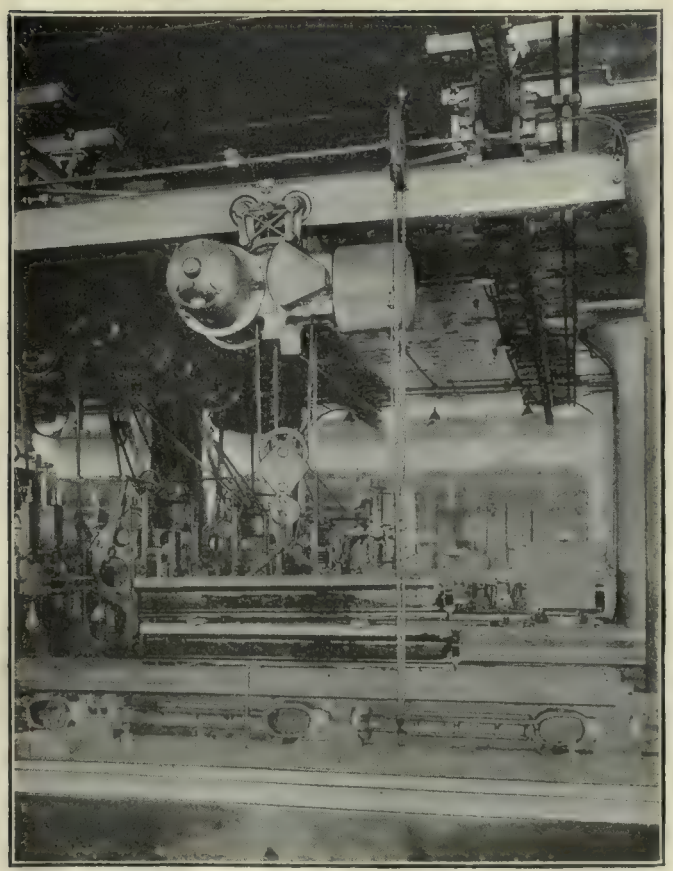


FIG. 11. UNDERSLUNG CRANE IN PLANER DEPARTMENT

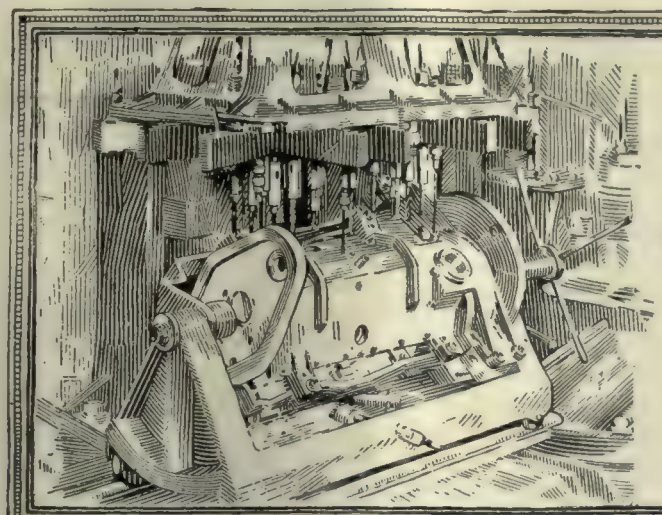
The I-beam tracks which form the crane runway are supported by cast-steel hangers bolted to skids on the ceiling, the skids being held in place by bolts fastened to inserts cast in the slab flooring of the building itself. These cranes were built by the Chisholm & Moore Co., Cleveland, Ohio, from specifications supplied by the American Tool Works, but are now a standard production for similar applications.

This illustration was taken from one end of the bay, over the line of planers and toward the court or light well. It will be noted that the cranes run crosswise of the planer beds and in that way can serve a maximum number of machines with a minimum crane movement. Ample spaces are provided between the planer beds to permit the shop trucks to pass between them so that the necessity for passing work over the entire line of machines is eliminated. The three elevators are controlled by regular operators, while a laborer is provided on each for loading and unloading materials in transportation from floor to floor. As a consequence of this system the mechanics and laborers on each floor have no excuse for leaving their departments to deliver materials to other portions of the shop.

Bearing Metals

By L. L. Thwing

The question of bearing metals is not quite as active as formerly and in practice probably a large percentage of bearings are made of bronze. There is, however, at least one prominent and long established lathe manufacturer who uses babbitt bearings in the headstock. A special and rather expensive babbitt is used and the bearings are carefully scraped to fit the spindle. As his experience of at least 20 years with this type of bearings has been entirely satisfactory, it would seem that they require no further justification. Steel shafts running in cast-iron bearings were formerly more common than they are today. When such bearings were carefully run in so that the cast iron glazed over without scoring, they gave entire satisfaction at low surface speeds which is all the experience I have had with them. Cast iron on cast iron is a combination that is not usually recommended for bearing surfaces, but it is the practice of one company that I know for heavy spindles for their own use, and for at least one spindle of fairly high speed in a machine which it manufactures. In the case of a special lathe with a 12-in.-spindle, both the spindle and headstock bearings were made of cast iron. I had an opportunity to examine the wearing surfaces after 17 years of constant use and they were in perfect condition. This company builds a number of special lathes for its own use with spindles as large as 24 in., and its experience with them has been entirely satisfactory. The same company has for the past 40 years, at least, used a small cast-iron crank shaft about 1¼ in. in diameter which runs in a self-oiling cast-iron bearing. I do not know the actual speed of this shaft but from inspection I should say it is at least 1,200 r.p.m. These shafts are carefully run in before installation, and they must have given satisfaction as they have been made in that way for so long a period. The simplest form of bearing, of a type at least 200 years old, is used by cut-glass makers. It is simply a wheel-shaft pointed at both ends and held on these centers between two wooden uprights. This arrangement gives a very smooth running shaft without the least end play. I have seen it used in two different shops.



Tool Engineering

By
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President and Chief Engineer
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Drill Jig Design Continued—Indexing and Trunnion Jigs—Indexing Requirements—Drilling and Reaming Indexing Fixtures—Four-Sided Jigs for Accurate Work

WHEN a piece of work is to be drilled from three or four sides it may often be desirable to locate it in some form of indexing or trunnion jig. Speaking generally, the necessity for a trunnion jig is indicated when the work is of large size or when the angularity of the holes will not permit the use of a closed jig. It is evident that a large closed jig, say 20 x 18 x 15 in., would be very cumbersome and difficult to handle when turning it over to drill the work from the various sides. Also if the holes in the work were to be so located that the angles did not diverge greatly from each other, it would be practically impossible to drill the holes unless the pieces were located in an index jig of some kind.

The tool engineer in making a decision as to the type of jig to be used for the work must analyze the conditions under which the jig is to be used and must also pay attention to the following points which affect the design.

Points to Be Considered

(1) The ultimate production for which the jig will be required. This is an important factor in the design, as it is evident that it would not be economical to design an indexing jig for a piece of work on which the production is small. It would be better to make several simple and cheap jigs rather than to design one expensive trunnion jig.

(2) The number of sides from which the work must be drilled. It is difficult to give a fixed rule as to when a trunnion jig may be called for and it should be noted that the number of sides from which the work is to be drilled does not, necessarily, settle the matter. We can easily assume that a piece of work having holes in four sides might be of such form or size that it would not need to be handled in an indexing or trunnion jig. On the other hand if the work were very large and difficult to handle it might even be necessary in some cases to design a trunnion jig, even if the holes were drilled from only one side of the piece, in order to facilitate loading and unloading.

(3) The machines on which the various drilling operations will be done. This factor is an important one and must always be given early consideration. There are many cases where multiple spindle drilling machines can be used in connection with trunnion and indexing jigs, provided the holes are more or less uniform in size. There may be other conditions which would indicate that a radial drilling machine must be used. There may also be cases where a light sensitive drilling machine with only one spindle or with several spindles carrying drills of different diameters arranged in gang-form may be necessary.

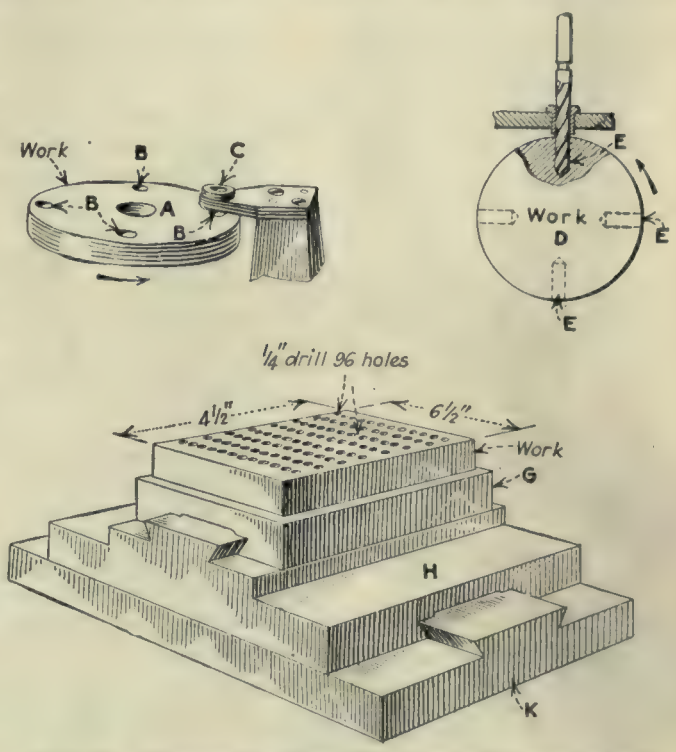


FIG. 83. SEVERAL EXAMPLES OF WORK REQUIRING INDEXING JIGS

(4) Loading and unloading: In placing the work in the jig and removing it after it has been drilled attention must be paid to the convenience of operation. If the work is heavy it is evident that the operator must be considered to some extent so that he will not be obliged to load the work from an awkward position. For the sole purpose of making the method of loading

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and unloading as easy as possible, it is often desirable to make a trunnion jig with a special locating position. When the work is small such provision is not necessary in the majority of cases. It is sometimes a great convenience to the operator if the jig is provided with ejectors of some form and when this is done care must

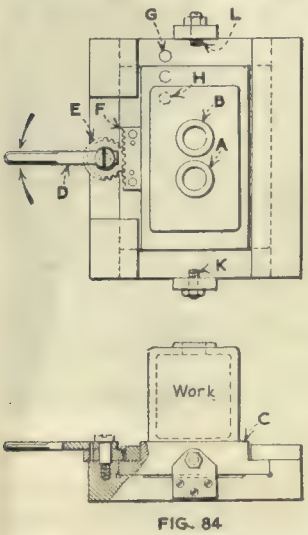


FIG. 84.

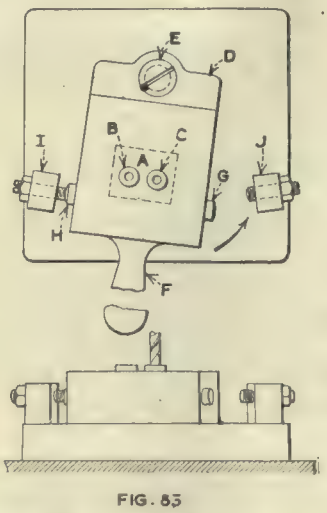


FIG. 85.

FIG. 84. INDEXING JIG FOR BORING AND REAMING
FIG. 85. SWIVEL INDEXING JIG

be taken that the pressure of the ejectors is exerted in such a direction that there is no possibility of a cramping action when in operation.

(5) Locating and clamping: In the location of the work and in the clamping thereof the weight of the work which is to be drilled is an important factor. For very heavy and large castings the matter of leverage which must be exerted on the work to force it into a correct position must be carefully thought out by the tool designer. Cam levers, handwheels, bayonet lock plugs and other devices may often be necessary to insure the correct location. In clamping the work in a large trunnion jig the clamps should be so proportioned that when they are set up they will not cause distortion and thus interfere with the proper working of the jig.

(6) Clearance when indexing. This is an important point which is likely not to be given the consideration which it requires. When large work is being handled on a trunnion jig it may often be found desirable to clamp the jig to the table of the drilling machine. It is evident that when the jig is indexed it should not interfere with the setting of the machine spindles, nor should it strike the column of the machine. The writers know of a large trunnion jig, designed to be used on a heavy drilling machine with a special multiple drill head, which when swung interfered with the column of the machine. It was found necessary to provide a special mounting for the base of the jig so that it could be moved away from the column each time it was indexed. Such mistakes can be avoided if the tool designer will provide himself with data showing the various clearances on the machine to be used for the work.

Having considered the various points mentioned in connection with the design of indexing and trunnion jigs let us now proceed to a discussion of the design of various types of jigs which come under this heading. We may have (a) a number of holes which are drilled so close together that it is not possible to arrange the spindles of a drilling machine to drill all of the holes at the same time; (b) a number of holes in a circular plate at the same distance from the center; (c) several holes in line with each other which must be drilled separately on account of the spindle spacing on the drilling machine; (d) a number of holes equally spaced in the periphery of a cylinder; (e) angular holes arranged in various ways.

Indexing Requirements

It is obvious that both the shape of the work and the relation of the various drilled holes to each other are factors important in determining the type of indexing jig most suitable for a given piece of work. There are given in Fig. 83 several examples of work showing a variety of conditions: *A* is a circular plate having four holes *B* equally spaced and at the same distance from the center. There are several ways in which this piece of work can be drilled. One way is to make a drill jig with four bushings and move it about on the table of the drilling machine so as to bring each bushing under the spindle. Another way is to use the same jig, drilling with a four-spindle head. Still another way is to make an indexing jig, a suggestion for which is given in the illustration. A drill bushing of the proper size would be fixed as shown at *C* and the work would be placed on an indexing table or disk.

At *D* there is shown a drum in which four holes *E* are to be drilled. This operation can be done in either an ordinary four-sided jig or an indexing jig.

The plate *F* offers the rather exceptional problem of drilling 96 holes, $\frac{1}{4}$ in. in diameter and $\frac{1}{2}$ in. c. to c. in each direction, a problem with which we had to deal quite recently. It would be impossible to arrange a series of drill spindles close enough together to drill all the holes at the same time, but it would be entirely practicable to drill alternate holes in one or two lines at the same time. Hence the logical method is to mount the work so that it can be indexed in two directions in a horizontal plane. Suitable provision for carrying the bushings would be made in the jig and the required stops or indexing points on the two slides *G* and *H* would give the various positions. The piece *K* would be clamped to the table of the machine.

A number of combinations of drill spindles could be made when drilling a piece of this character. If the machines were to be multiple-spindle drilling machines,

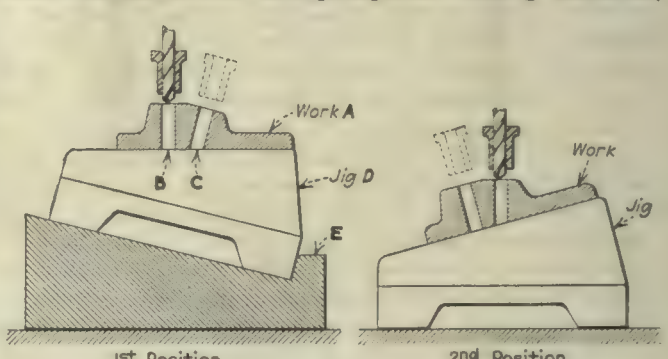


FIG. 86. ANGULAR PLATE USED IN CONNECTION WITH A SIMPLE JIG

the heads could be spaced to drill alternate holes in the first line and the corresponding holes in the third line. The plate could be indexed in one direction only so that the intermediate holes could be drilled. Several indexing operations all in one direction would complete half of the drilling. After this the other slide operating in the

other direction could be indexed progressively to complete the work. It is possible to handle a piece of work of this kind by means of automatic attachments through which the indexing mechanism is operated by the action of the drill head when it is lifted from the work.

Index Boring and Reaming Jig

In Fig. 84 is shown an example of an indexing jig in which the two holes *A* and *B* are to be bored and reamed without removing the work. Bushings could be carried on the sliding member *C* or a permanent bushing could be supported on the column of the machine. The work is of large size and as a consequence indexing is done by means of lever *D* which operates pinion *E* meshing with rack *F* on the sliding member *C* of the fixture. Location bushings are provided at *G* and *H*. The slide is shown in the neutral position. Attention is called to the adjustable stops *K* and *L* which approximate the location as the slide is indexed from one position to the other, thus making it easier for the operator to insert a pin in the location bushings. This example is not intended to show details of construction but rather the application of a principle.

be found very useful. A rapid indexing device could be used and various modifications made to suit particular conditions.

It frequently happens that a piece of work similar to that shown at *A* in Fig. 86 is to be drilled at two or more points such as *B* and *C*, the holes to have an angular relation to each other. When the two holes are to be close together and drilled from the same side of the piece, it would not always be advisable to build an indexing jig, on account of the cost. Assuming then that the holes are to be drilled in a simple jig having the form shown at *D*, it would not be difficult to make up a special angular plate such as shown at *E*, on which the jig could be located at the proper angle for drilling the hole *B*; after this hole had been drilled the jig could be taken from the plate and placed on the drill table to drill hole *C*, as shown in the second position.

If the production required on the work were considerable the angular plate could be clamped under one spindle of a two-spindle machine for drilling one hole and the jig could be transferred rapidly to a position on the machine table under the second spindle for drilling the second hole. Occasionally on very large work an

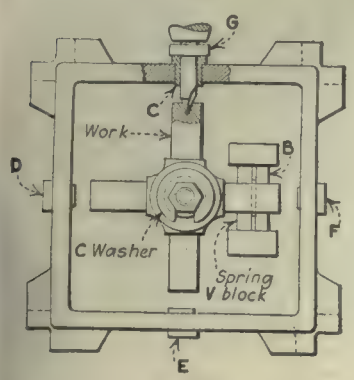


FIG. 87

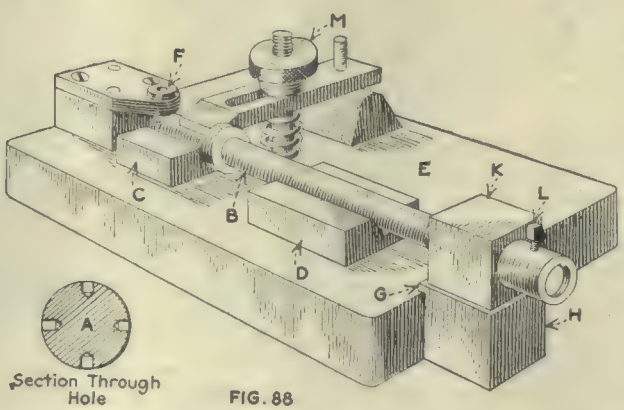


FIG. 88

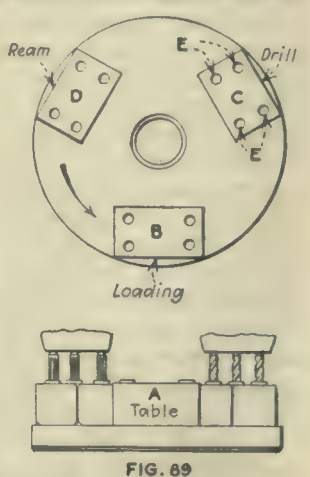


FIG. 89

FIG. 87. FOUR-SIDED JIG FOR ACCURATE WORK. FIG. 88. SIMPLE INDEXING JIG. FIG. 89. INDEX DRILLING AND REAMING

In designing a jig of this character it is advisable to make the lever *D* long enough to afford easy operation. Care must be taken that the pinion *E* is large enough to index the work without too great radial motion of the lever. If the holes *A* and *B* are spaced so far apart that a very large pinion would be required it is better to make the pinion small and provide the lever with a reversible ratchet. Both ratchet and pinion should as a rule be covered to exclude chips.

Swivel Index Jig

A simple form of indexing jig is indicated in Fig. 85, in which the work *A* has two holes at *B* and *C*. The jig itself consists of a box *D* pivoted at the point *E*. It is indexed by means of the handle *F*. Hardened studs *G* and *H* are provided to bear against the adjustable stops *I* and *J*. Bushings could be provided to give more accurate location, but for light work the method shown would give good results.

The same principle could be applied if there were three holes instead of two, but another method of indexing would be required. It would be necessary to find the common center for the three holes and pivot the swinging member at that point in order that the bushings would come directly under the drill spindle. There are certain isolated cases where such a jig would

angular plate, such as that shown, will save the cost of a trunion or indexing jig.

The requirements of certain classes of work are such that it is not always desirable to use an indexing jig or fixture, especially when great accuracy is necessary. In the majority of cases an indexing jig will give results well within the limits of accuracy necessary, but there are occasional instances when some other method may be preferred. There is always the possibility of a slight inaccuracy resulting from the use of any indexing mechanism, caused by chips or dirt working into the indexing members or by wear, misuse or neglect.

An example of very excellent construction to be used when great accuracy is required is shown in Fig. 87, the piece of work *A* being a cross which carries four gears on the arms. It is important, not only that these arms be at right angles but that the locations of the center-holes in the ends of the arms should be of the same depth and the same distance from the center hole on which the work is located. The work is located on a center stud and clamped by means of the *C*-washer, one of the arms being located in a spring V-block shown at *B*. The jig is provided on four sides with feet which can be very accurately machined. The bushings *C*, *D*, *E* and *F* also can be located with great accuracy and

can be faced so that they are exactly the same distance from the central locating plug. The depth of the countersinking is determined by the collar *G* which strikes the head of the bushing.

Simple Index Jig

It is sometimes necessary to design a jig for drilling a series of holes which are equally spaced in the periphery of a shaft or some other part of a similar kind. An example is shown in Fig. 88 in which the holes shown in the sectional view at *A* are to be drilled in the shaft *B*. The method illustrated here is not recommended for use except in rare cases; it may be found useful when a single and cheap method is required for a comparatively small number of pieces. The accuracy obtained will be found to be very satisfactory. The work *B* is located in V-blocks at *C* and *D* and the jig *E* is provided with a bushing at *F* located centrally over V-block *C*. The upper surface *G* of a hardened block *H* is ground to a fixed distance below the center line of the V-blocks. A supplementary block *K*, which has been accurately squared up, is clamped to the end of the shaft by means of the setscrew *L*. By loosening the clamp operated by the thumb nut *M* and pushing the clamp back out of the way the shaft can be turned until the block *K* has rested on each of its four sides and the work has been drilled in each of the four positions. The block *K* can be made with three, four, five, six, eight or more sides.

In quantity production it is often desirable to drill a piece of work and ream it in the same jig. Many times when this is to be done slip bushings are employed in the jig and the drill is replaced by a reamer in the drilling machine. A method which can be used is illustrated in diagram form in Fig. 89. Briefly stated the principle employed is that of an index table *A* on which are mounted three jigs that are indexed from loading position *B* to drilling position *C*, to reaming position *D* and back to loading position. A method like this is suitable only for high production. But it will be found to be an advantage in many ways when the nature of the work will permit. Changing from drilling to reaming bushings can be done by pivoting a plate containing four bushings of each kind or it can be done by using an outside bracket for the bushings.

Machine Tool Service—For Nothing

By John R. Godfrey

It isn't Johnson this time although he plays a part in the story. It's a machine-tool builder who is beginning to think that Johnson isn't as crazy as some of those who don't understand him seem to think. I knew Johnson had been doing a lot of planning about improving his methods but I didn't know all the whys and wherefores of his methods. I learned some of them from the afore-mentioned builder of machine tools.

"That Johnson-man you've been telling us about is a queer bird, Godfrey, but I like him. He sure does try to play the game square. Wish the rest of the world had some of his notions. You see, it's this way:

"Johnson sent over blueprints of some of his motor parts for us to estimate as to how long they would take on our machine. Anything that even made a noise like an order got our ears the first crack. You bet he didn't have to ask twice.

"So we spent quite a lot of time on the job, figured out times, planned tools and set-ups, and I took the batch over to Johnson myself, just to get acquainted. He didn't pay much attention to the plans then, but the next day he 'phoned and I went over again.

'That's a fine lot of suggestions, Mr. Walker,' said he. 'Must have taken a lot of your men's time. I didn't expect any such details, but I'm mighty glad to have 'em. But, I didn't find my bill in the bundle. Where do you get off?'

"I allowed as how I'd get mine if he bought a machine or two, and if he didn't—well, it went into overhead. Then he opened fire.

'That's where you're wrong, Walker. I know it's done, but it doesn't sound right to me. I come to you for special information, you dig it up and plan it out for me and give me the benefit of your years of experience. But if I don't buy a machine you lose and have to tack the expense of helping me on the prices of the machines bought by others. 'Tisn't a fair deal at all.

'We've looked this all over and we can use one of your machines. We're going to buy one machine for a few of our jobs. On some of the other jobs we find out present practice is practically as good as you guarantee—so we can't afford to change. But it's worth money to us to know that. You've saved us money by showing us that we need not buy more than one machine. And we're going to pay for that knowledge. We really ought to pay for the other too, because it's also worth money to us to know what to buy as well as what not to buy. But I don't want to give you heart failure and besides I'm not any too flush myself. You fellows have the wrong slant on this service stuff you talk about.

'I believe in service but it ought to be paid for. If I don't feel that my men know everything worth knowing about production and you give me good engineering advice, I'm mighty glad to pay for it. Then you don't have to tack it on the price that we all pay for your machines.

'If someone else knows what he wants, knows your machines are best for his job, he ought not to pay for educating me. When I buy another machine next year I don't want to feel that I'm paying for service which you gave my competitor who is too dern mean to hire a decent shop man. And there's a lot of shops which figure on using your service to keep from paying a decent salary to a good superintendent.

'Suppose I phone over to your shop for a service man to look over our machine when we get it and find that the only difficulty is that someone forgot to oil it. Should you pay for that—or I? If there's any fault in the machine, if anything got past the inspector, as sometimes happens, it's up to you, of course. But not otherwise.

'You machine-tool men have run your idea of service into the ground. It's costing you thousands of dollars that you have to pass along to the man who knows enough to buy your machines without coaching. What you want is backbone enough to get together and charge for service. Have a real service department, devise tools and fixtures for making your machines even more effective in all kinds of work. But put the cost where it belongs. Don't make the innocent bystander the goat.

'And it's also well to remember that your machines will get the best show and do the best work where there are live men who utilize your suggestions.'

"You know, Godfrey, I'm pretty well sold on Johnson's idea. I can't do it alone but if the leading machine builders had the backbone to stick together on the service proposition—it would be better for everybody."

Gleason 37-In. Two-Tool Bevel-Gear Planer

Machine Fully Automatic—Intended for General Work—Tools Cut on Opposite Sides of Tooth—Forms Control Shape of Tooth—Gages Facilitate Setting

SPECIAL CORRESPONDENCE

THE Gleason Works, Rochester, N. Y., has developed a two-tool bevel-gear planer of the form-copying type. In this machine the advantages of the two-tool principle have been applied to the making of large-diameter and coarse-pitch bevel gears. It is essentially a general-purpose, rapid-production machine able to handle a great variety of work; and is stated to greatly increase output and to be as readily set up as any other bevel-gear machine. Difficulties and inaccuracies met with in previous machines of this character are said to have been overcome by the features incorporated in the design.

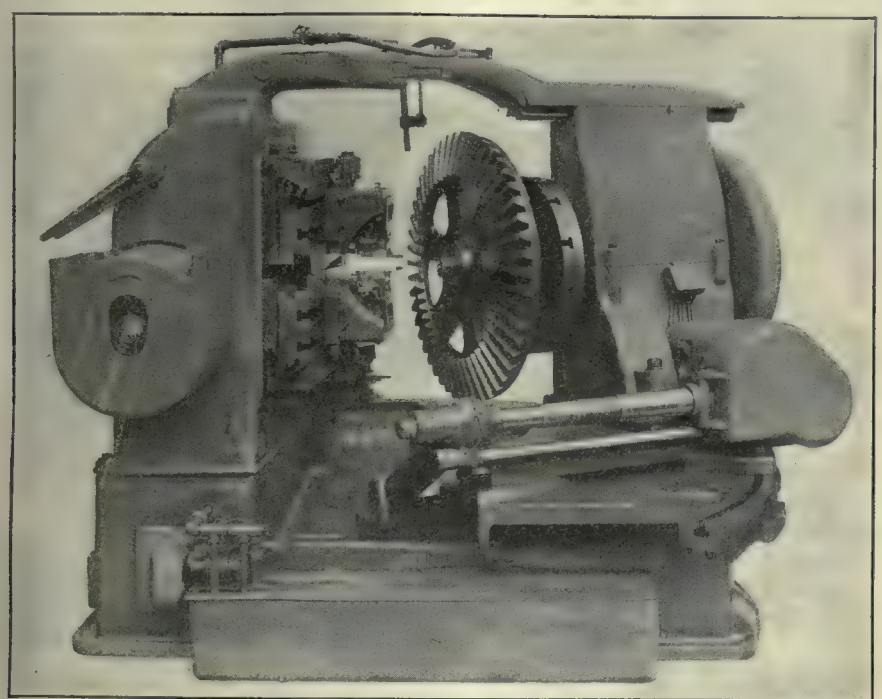


FIG. 1. GLEASON TWO-TOOL BEVEL-GEAR PLANER

The machine has the capacity to cut any gear up to 26-in. cone radius. It will be a crown gear or very high ratio gear 52 in. in diameter, and a miter gear 37 in. in diameter. It should be noted that a 37-in. miter gear and a 52-in. crown gear both have approximately a 26-in. cone radius. The longest face that can be cut is 10 in., and the largest pitch a 1 diametral.

As can be seen in Fig. 1, on the bed of the machine is mounted a pivoted work head and a column carrying the tool heads. This column is stationary and carries the driving pulley, tool speed-change box, crankplate drive, and such parts. On the face of the column are hinged two arms which are free to open and close vertically, shear like, about the center of the machine, which point is the apex of the cone of the gear being cut. Each arm carries reciprocating slides, driven by a rack and pinion which gives the stroke movement to the tools.

On the slides are mounted the tool heads. The cutting tools are held in blocks adjustable about the center of the machine. The tools are tilted slightly for cutting the large gear shown in Fig. 1; in Fig. 2 they are tilted to a greater angle to allow for the cutting of the pinion; and in Fig. 3, taken from the opposite side of the machine, roughing tools are mounted in holders tilted to a still greater amount to bring them into position for roughing a pinion.

The clapping of the tools, or the movement to swing them out of contact with the work during the return stroke, is done mechanically by means of a universal driving connection between the tool holders and a friction gear at the outside of the tool head. This gear is arranged so that the tool block is firmly seated before the cutting stroke starts, and also swings clear of the work on the return stroke.

The tool heads are so constructed that gears can be cut from the center outward, as well as in the usual manner, from the outside toward the center. This is accomplished by transposing the upper and lower tool heads, a change which can be made in a few minutes. Large flat gears, or any gear that is inclined to spring, can be cut to better advantage by reversing the tool blocks and cutting from the center toward the cutside.

A pair of finishing tools and holders are shown lying on the frame of the machine in Fig. 3. These tools are of simple construction, straight pieces of high-speed steel with slightly beveled sides being used. They are also economical, as they are double-ended and can be

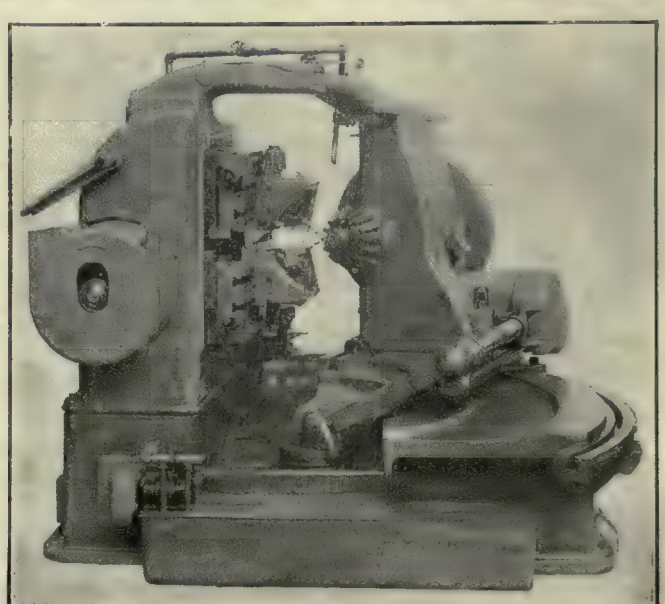


FIG. 2. PLANING A PINION

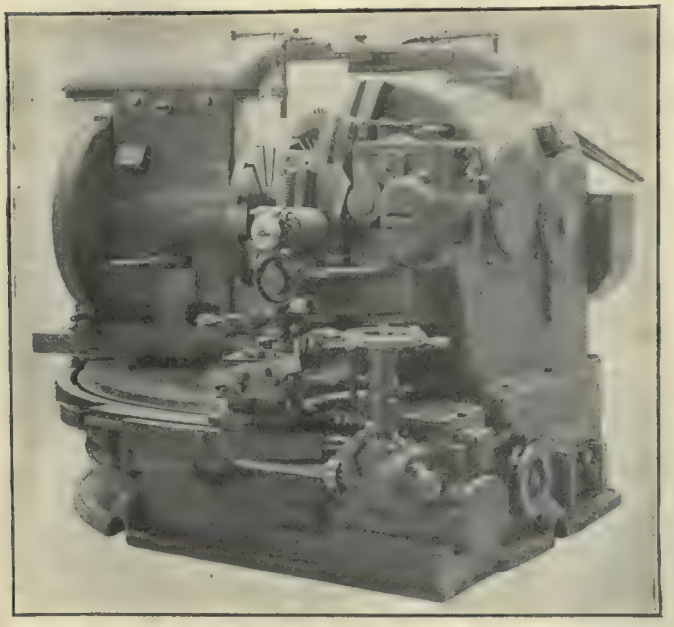


FIG. 3. GEAR PLANER SET UP WITH ROUGHING TOOLS

reversed in the holders. The roughing tools shown in position on the machine are cut from 1¼-in. square stock. Any desired shape or style of tool may be used.

It will be observed that two teeth are roughed simultaneously. The index mechanism, which is of the usual type, is equipped with an extra lever to give double indexing, by means of which two teeth can be brought into cutting position at once. After the gear has been roughed, the lever is moved so that only one tooth is indexed at a time when finish cutting, because in finishing both tools work on the same tooth, although on opposite sides of it.

The machine is equipped with an overhead tie consisting of an arm slidably mounted on the workhead and pivoted about the vertical center line of the machine. A support extending from the column forms a bearing for the arm, thus giving a tie between the workhead and the column, which greatly stiffens the machine and permits of much heavier cutting.

Tool Speeds and Feeds

The machine is provided with four quick changes of tool speed, and a like number of feed changes. Both speed and feed changes are made by sliding gears incased in suitable boxes and running in oil. In addition to the quick-change speeds and feeds, removable change gears can be furnished to give any feed or speed desired. These are used only in making a complete new set-up, as the range of quick-change feeds and speeds is sufficient for all changes required on any one job. The feed sliding gears are engaged by means of a hand-control lever and can be shifted at any time. It has even been found very convenient to change feeds during the cut and considerable time has been saved by doing so, especially on teeth of large pitch. The tool speeds range from 15 to 125 strokes per minute.

A hand feed is also provided, as well as a lever for engaging and disengaging the feed, both located in a position within easy reach of the operator. The feed may be operated by hand through the complete cycle of cutting a tooth, if desired; or the hand feed used to run part way into the work, and then the power feed engaged. This has been found very convenient, especially when roughing or bottoming out a tooth. An interlocking arrangement prevents the feed hand wheel from turning when the power feed is engaged, but automatically brings it into position for operating by hand when the feed is disengaged.

The feeding movement is applied to the work head, and is operated by a segment of a large worm gear attached to the rail at the outer rim of the base. The worm gear, being on the extreme radius of the moving parts, constitutes a very powerful and smooth drive. The feed is actuated by an automatic reversing mechanism. Dogs located on a graduated dial attached to the reverse box are set to trip the reverse, thus governing the depth of tooth. As uniform depth of tooth is essential, special devices are used to insure the reverse mechanism tripping at exactly the same point on each cycle. In addition, a means is provided to give a pause in the feed movement, so that the tools will make one complete stroke after the full cutting depth is reached.

Forms and Means of Operation

One of the most important features of the machine is the method of using the forms or templets which are mounted on and move with the feed rail. The roller is stationary longitudinally, but has a vertical movement, as imparted from the form. The roughing and finishing forms are mounted on a turret, to be seen in the foreground in Figs. 3 and 4, and which can be turned to bring either form into operative position. Only one form is used to control the movement of both arms, this being accomplished by a system of gearing arranged to transfer the shape or profile of the form to both tools simultaneously and to produce the proper tooth shape, the tools moving further apart as they feed in when finishing a tooth.

Provision is made for tilting the forms to any desired angle, a feature of great importance, since without it a different form would be necessary for practically every different gear combination. This tilting feature is better explained as follows. When cutting on opposite sides of a tooth and using two tools, a change develops for bevel gears of different sizes and cone angles in the relation of the tooth contour to the horizontal center line of the machine. The change of contour is due to the different back-cone tooth angles for different gears. This angle, which is the amount that the form should be tilted, may be defined as one-half the angle formed by lines radiating from the center of the back

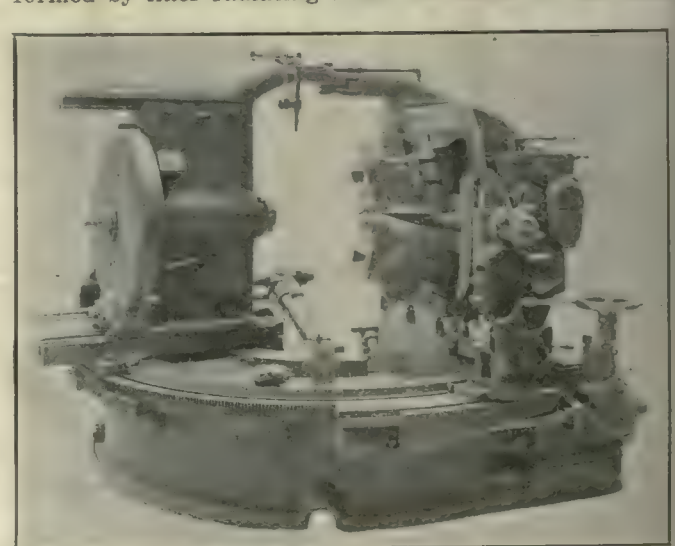


FIG. 4. CONTROL SIDE OF MACHINE

cone to the thickness of tooth at the pitch line. By applying this principle, a set of twenty-five forms is sufficient to take care of all combinations of gears of any given pressure angle. The tooth contour produced is the same as on the Gleason single-tool planers.

Micrometer dials at the end of the arms are used for setting the tooth angle for the thickness of tooth. One dial is graduated in degrees and the other in minutes, insuring a very rapid and accurate adjustment.

Gages for setting the tools are furnished and are made to accommodate both forward and backward cutting. Bench fixtures having accurate gaging points are also made for setting up the tools separately.

Gear and pinion blanks must be carefully located in their correct position for cutting, or otherwise an inferior cutting job is done. To facilitate setting the

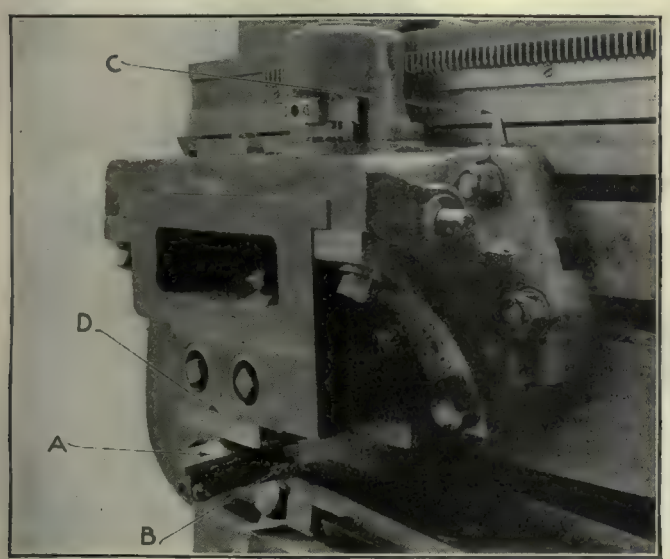


FIG. 5. CONE-DISTANCE GAGE IN PLACE

work, a cone distance gage, shown in Fig. 5, is furnished. It is interesting to note that this gage measures angles as well as cone distance. It fits the clapper block in the same manner as a regular tool holder and carries a vernier block *A*, which is attached to an indicating pointer *B*. The vernier on block *A* is used to give pitch depth; and with the reading set to a given depth, the gear blank, mounted on the work head and set to the proper pitch angle, is moved up until the face of the blank touches block *A* and the indicator stands at zero.

Cone distance is found as follows. Graduations in even inches are marked on the upper arm and a pointer, shown at *C*, is set on the tool head. The gage is graduated to fractional parts of an inch and a zero mark placed on the clapper block, as shown at *D*. Thus, direct readings can be made by setting the head and gage to any given cone distance.

Another feature of the gage is the fact that any inaccuracy in the turning of the gear or pinion can be readily checked. If a correctly turned gear is set up by the vernier block reading, the proper cone distance should be recorded on the scales *C* and *D*. However, if the diameter or the face angle of the blank is incorrect, the cone distance and angular reading will not check.

An interesting feature is a safety shear pin interposed in the feed train, which will shear in case of accident before injury is done to the machine. A safety throwout is provided which automatically disengages the feed before the arms can close together.

Maintaining Harmony in the Shop

By R. A. Schultz
Vice-president, R. A. Schultz Manufacturing Co.

We have in the past used many false methods when employing men, and these in many cases prevented our getting the best that was in them. In too many instances after a man was hired and put to work everybody looked on him as an enemy and many stumbling blocks were thrown in his way. This was especially true if he was a first-class workman, as he was then considered the worst kind of a competitor by the foreman. The foreman frequently watched him like a hawk and the least mistake, often caused by a misunderstanding, would bring the foreman's wrath down on the new man.

The result was that the man did not feel at home and that his antagonism was aroused. He soon came to look on the shop almost in the light of a penitentiary and sought the first opportunity of getting another position. Under these conditions his mind was not on his work and he could not produce anywhere near his full quota of first-class work.

Sometimes the proprietor would hear of the new man's good qualities, perhaps through the office boy, but he seldom took enough interest to get direct information concerning the new man's capabilities. He left altogether too much to the foreman.

After the good man had left, being virtually driven out by the foreman who feared a competitor, the proprietor might sometime inquire of the foreman concerning it. The foreman's alibi was usually that he was too independent and not amenable to discipline. The proprietor had lost a good producer because of a foreman's jealousy.

How to Remedy Conditions

It has been my experience that practically all men are conscientious and will act fairly if given an opportunity. This means a square deal on both sides. The executive must play the game fairly and squarely and prevent so far as possible the presence of misunderstandings and sectional hatred in the shop.

Too many personal questions should not be asked when hiring a new man. Few of us have such a completely clean record that we can be proud of every detail. If a man is hired with the belief that he will make good, and confidence is placed in him, he will usually strive very hard to live up to it. He will have a much better feeling toward the firm and will try to make good.

When the new man comes into the shop he should be welcomed as a friend and made to feel at home. The foreman should have his job already picked out for him, show him his clothes locker, introduce him to his immediate associates and explain any details concerning the work which may be necessary. He should be left alone as much as possible and not closely watched as is too often the case.

The first mistake should be treated as leniently as possible and everything should be done to make him feel at home. Under these conditions he will be much more apt to make good.

There is no royal road to successful manufacturing or successful handling of men, but if they are treated as human beings and with absolute fairness, it is my belief that most of the so-called labor troubles will disappear.

Special Work and Tools at the Puget Sound Navy Yard

Ingenious Special Tools for Shipyard Work—A Square Hole Drilling Attachment—Hydraulic Jack for Close Quarters—Making Lead Hammers

By FRED H. COLVIN
Editor, *American Machinist*

ONE of the interesting jobs is that of turning crankpins, a special device being made for this purpose and used in the 120-in. lathe shown in Fig. 1. The pin turning attachment is shown at *A*, surrounding the crankpin *B*. The method of stiffening the crankshaft while it is in the lathe is of interest, the distance pieces or thimbles *C* and *D* and the clamps *E* and *F* affording an easy and positive method of preventing spring in the shaft while it is in the lathe.

The details of this crankpin turning device, as shown in Fig. 2, are of considerable interest and the design may easily be modified for other applications.

The main casting *A* is fastened to the lathe carriage. This casting and the mating piece *B* have beveled bearing surfaces as at *C*, which form the bearings for the tool carrier *D* and *E*, and guide it as it is revolved around the crankpin. The tool carrier is also made in two parts *D* and *E*, so as to be easily separated for placing around the crankpin, after which the piece *B* is bolted in position, forming a complete guide for the rotary tool carrier which revolves inside of it.

The outside of the tool carrier has gear teeth by which it is driven, and it will be noted that each of its ends overlap in order to provide a continuous gear

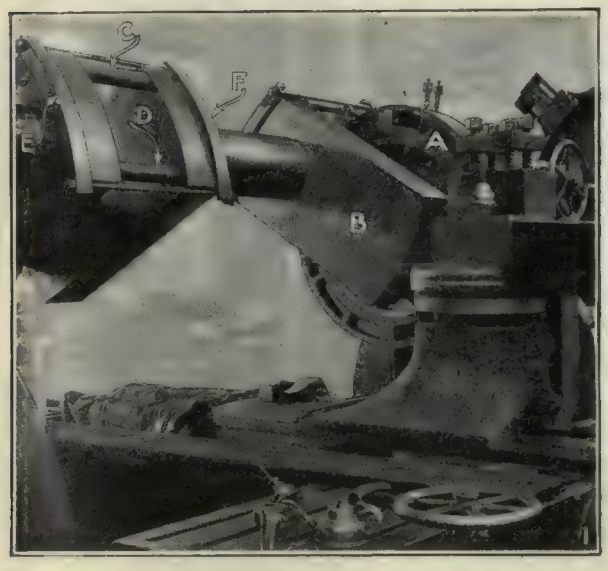
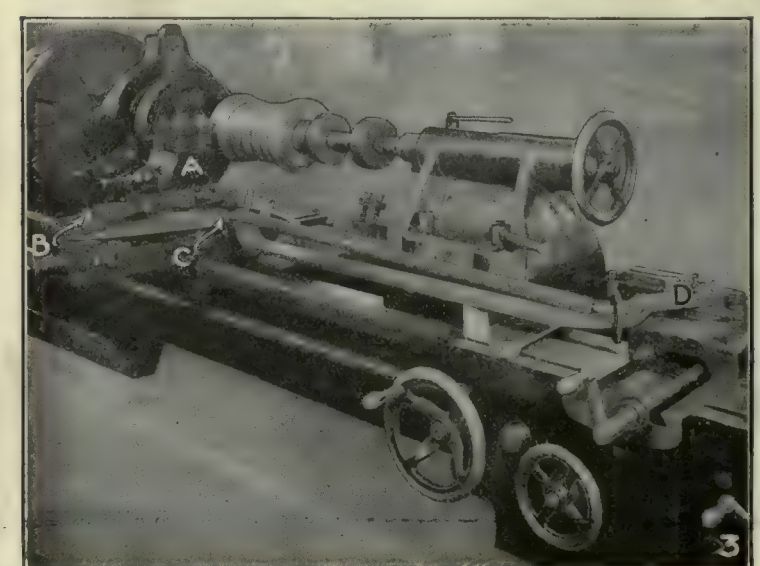




FIG. 1. TURNING A LARGE CRANKPIN. FIG. 2. DETAILS OF THE CRANKPIN TURNER



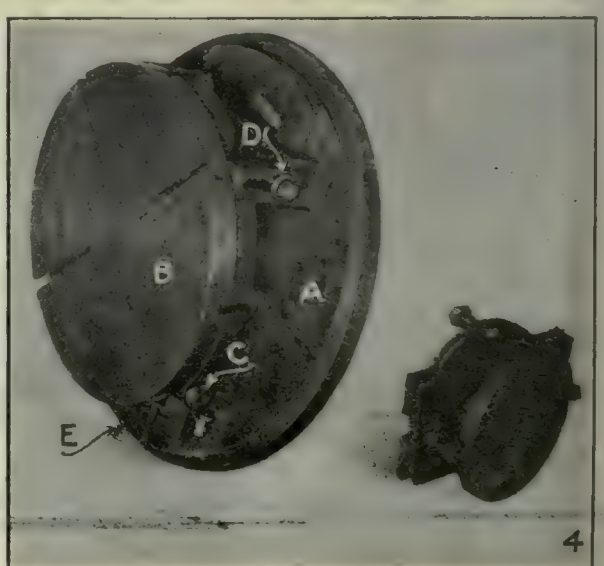
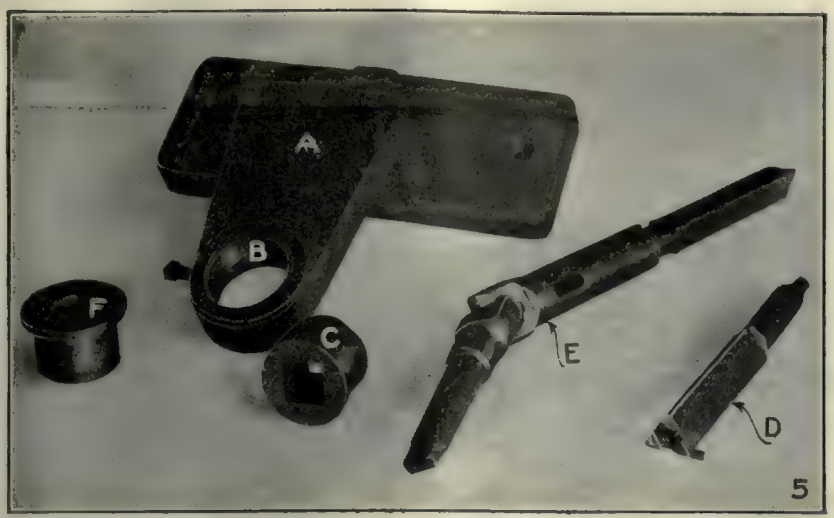


FIG. 3. ATTACHMENT FOR CUTTING HINDLEY WORMS. FIG. 4. ADJUSTABLE ANGULAR FACEPLATE FOR GATE VALVES



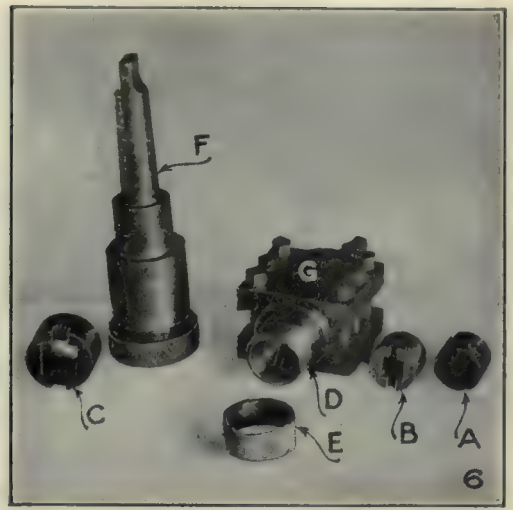


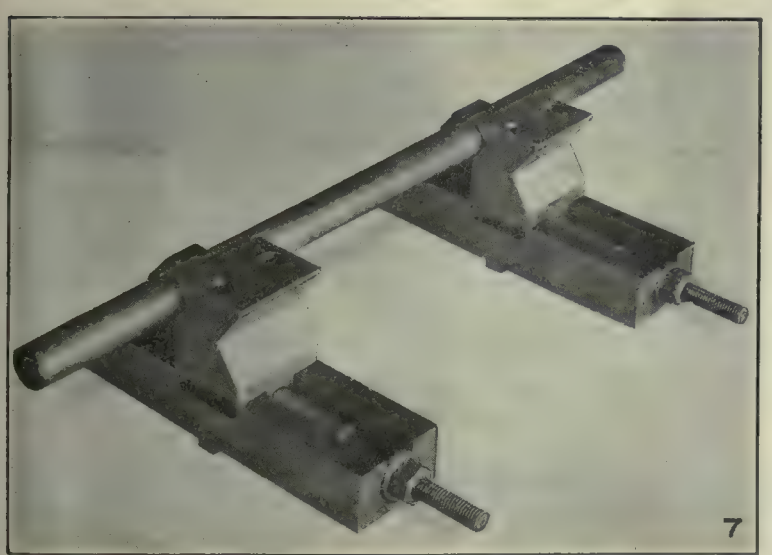
FIG. 5. ATTACHMENT FOR DRILLING SQUARE HOLES. FIG. 6. MACHINE TAP DRIVERS AND CLAMP

for the driving pinion *F*, so as to effectually prevent any tendency of "chatter" on the crankpin being turned. With the halves of the carrier fitted in place around the shaft and carefully bolted together, the outer bearing *B* bolted into place, the device is then ready for use, as in Fig. 1. Power is supplied by the air motor *G*, which drives the tapered shank on *F*. The pinion shown is so mounted in the casting *A* as to mesh with the gear on *D* at *H*.

With this device properly assembled on the lathe, and clamped to the bent bar at the end, as shown in the cut.

The carriage supporting the toolblock is clamped in its proper position on the lathe bed, midway of the length of the worm to be threaded. The carriage at the right is engaged with the lead screw so as to travel at the proper relative speed. As this carriage moves it communicates motion to the block carrying the tool by means of the rack and the gear segment.

This motion swings the cutting tool past the face of the worm so that it can be threaded at the proper rate



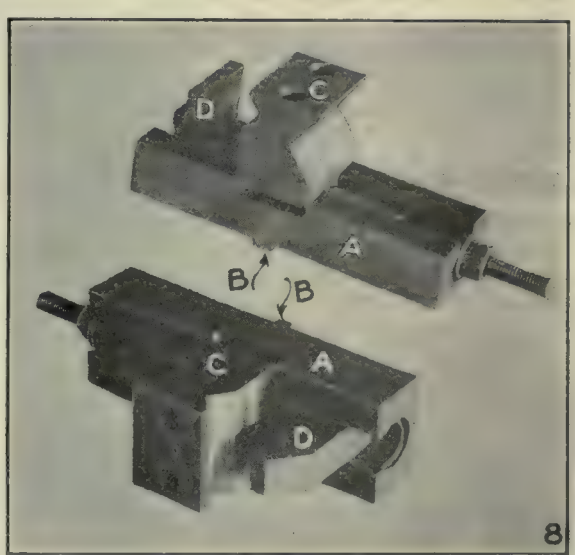


FIG. 7. V-BLOCKS FOR HOLDING ROUND STOCK. FIG. 8. HOW THE BLOCKS ARE MADE

one or more of the tools shown at *I* clamped firmly in position, it is an easy matter to turn the crankpin without difficulty and to be very sure that it is round and true when it is done.

Away back in 1916 it became necessary to make a new Hindley worm for an anchor winch of the U. S. S. *Supply*. In order to make a satisfactory job the attachment shown in Fig. 3 was made by the men at the yard to go on a regular lathe having two carriages. The toolblock *A* was mounted on a swinging slide pivoted at *B*. The end of the lower portion of the slide was cut to form the segment of a gear which meshes with the rack shown at *C*. The rack is connected to the second lathe carriage at *D* by means of the bar shown. The upper bar is simply for stiffening and is and in the proper arc, to conform to the hour glass shape. It makes a very interesting attachment and the results were highly satisfactory.

The making of gate valves of the wedge seat type led to the making of the adjustable angle faceplates shown in Fig. 4. The plate *A* screws on the nose of the spindle and forms a base for the tilting plate *B* which is hinged at *C*. The wedge-shaped seat to be turned is fastened to the plate *B* and adjusted to the proper angle by means of the clamps *D*. The tilting plate is also adjustable across the main plate by means of the screw *E*, making this an extremely flexible attachment for this kind of work. A smaller attachment of the same kind for smaller work is shown at *F*, and is, of course, more easily handled on that account.

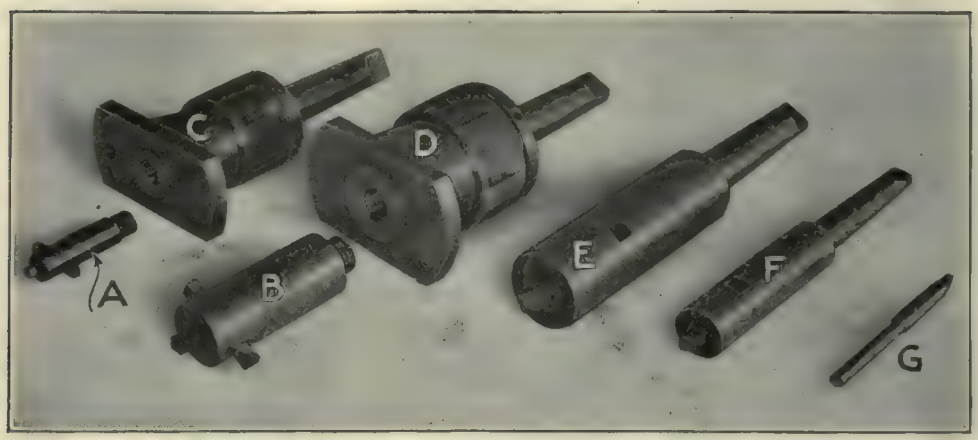


FIG. 9. TOOLS FOR BACK- AND SPOT-FACING

An attachment for drilling square holes is shown in Fig. 5. The bracket *A* clamps to the drilling machine table so that the opening *B* comes over the hole to be drilled. The bushing *C* fits in this hole and the three-cornered drill shown at *D*, revolving (one might almost say "wobbling") in the square hole, cuts a hole of similar shape in the work beneath the bushing. The drill is driven by the universal joint arrangement shown at *E*, one of the three-cornered drills also being shown in place. The bushing *F* is for the drill which takes out a core of the metal before the three-cornered drill is put to work. There are special cases where this has been found very satisfactory, even more so than broaching where the desired output is comparatively small.

Driving taps in the spindle of a drilling machine has not always proved good for the machine itself. To avoid damage to the spindle the drivers and clamps shown in Fig. 6 were designed some time ago and have obviated trouble in this direction. Three sizes of tap drivers are shown at *A*, *B* and *C*. These fit in the sleeve or collet *D* being held in position by the nut *E*. The slot shown across the face of the drivers fits over a key at the bottom of the collet *D* so as to insure positive driving. The driver *F* is put in place in the drilling machine spindle and the clamp *G* is then slipped over it and clamped to the spindle nose. This holds the whole tap driving mechanism solidly to the nose of the spindle and prevents the twisting off of tangs and similar damage.

A convenient vise for holding round bars is shown in Figs. 7 and 8. This is made particularly for milling machine work but can, of course, be adapted to other uses without difficulty. Its construction is perhaps shown to better advantage in Fig. 8, where it will be seen that the body *A* carries the tongue *B*, which is a snug fit, in the slot of the milling machine table and also has the central block or anvil *C* securely fastened in the approximate center of the base. The sliding jaw *D* is in reality a sort of hook bolt which can be reversed when desired.

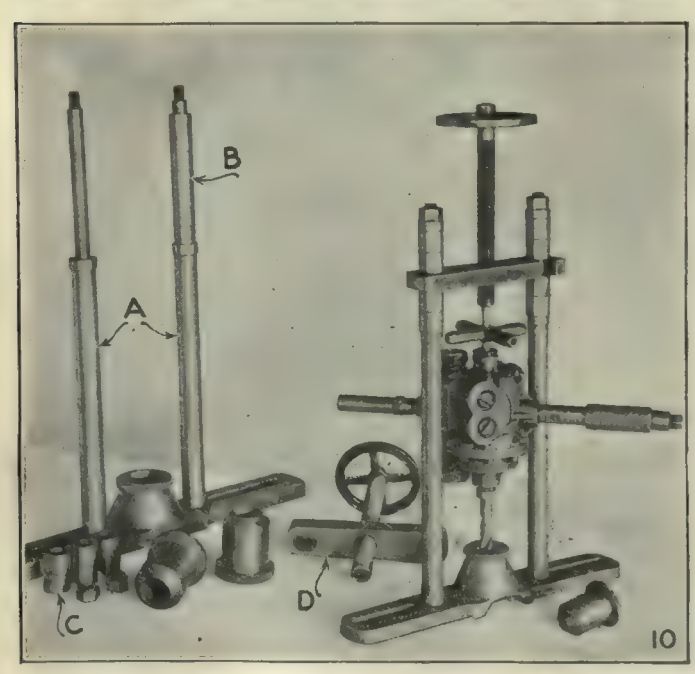
The block *C* has a small *V* planed in one side near the top and a much larger *V* on the opposite side.

It will be noted that the height of the jaw *D* is just sufficient to come well above the center of the small *V*. This leaves a considerable portion of the round bar free for milling or other machining operations, as can be seen in Fig. 7. Reversing the jaw *D* places it opposite the large *V* and enables large pieces of round work to be easily held.

Back-facing cutters and spot-facing tools are shown in Fig. 9, where *A* and *B* are two of the back-facing bars, carrying double ended cutters which are held in position by the setscrews shown. These bars screw into the end of the driving spindles which run inside the holders *C* and *D*.

Three sizes of spot-facing tools are shown at *E*, *F*, and *G*, these being made up to suit different classes of work which sometimes turn up. Altogether the special tool equipment is not only efficient but shows that a real interest is taken in the work by those in charge of the tool department.

An interesting device is the portable drilling rig



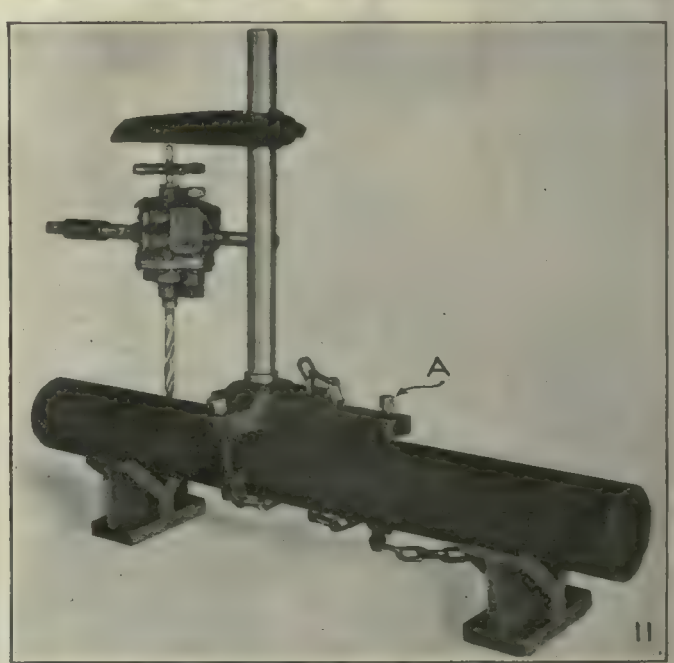


FIG. 10. PORTABLE DRILL JIG AND BUSHINGS. FIG. 11. AN ADJUSTABLE "OLD MAN"

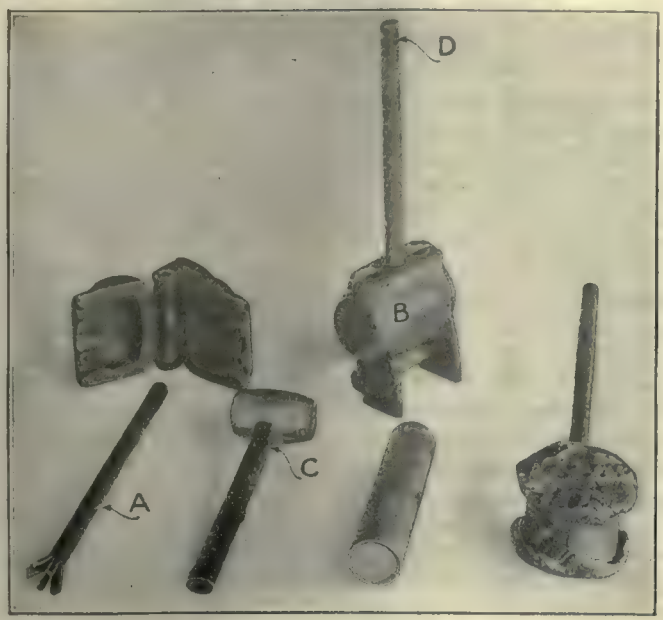


FIG. 12. MOLDS FOR LEAD HAMMERS

shown in Fig. 10. This is shown in two sizes, which cover a large variety of work, and it is an easy matter to make the uprights *A* of different lengths to suit

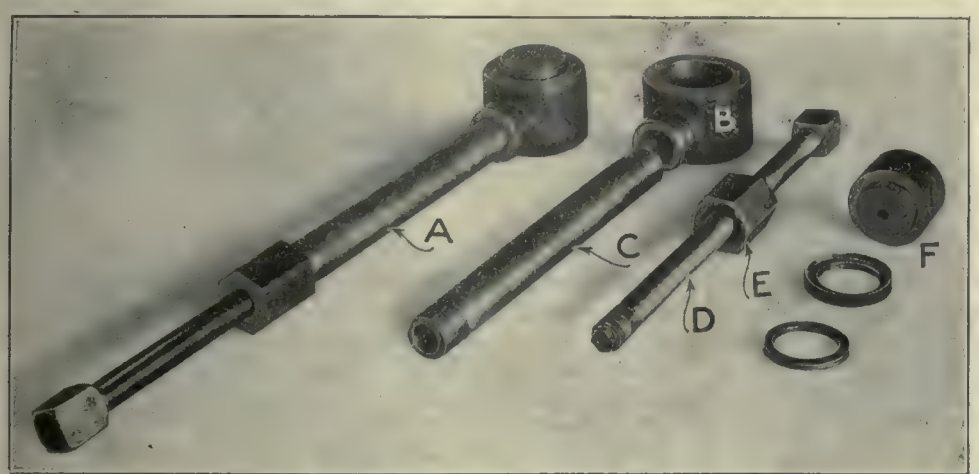


FIG. 13. COMPACT 50-TON JACK

special conditions. The upper ends of these uprights are turned smaller than the main portions and the various collars shown at *B* and *C* allow the feeding screw and its crossplate *D* to be placed in any desired position on them.

One end of this plate has a solid hole and the other is slotted on one side so as to allow it to be easily

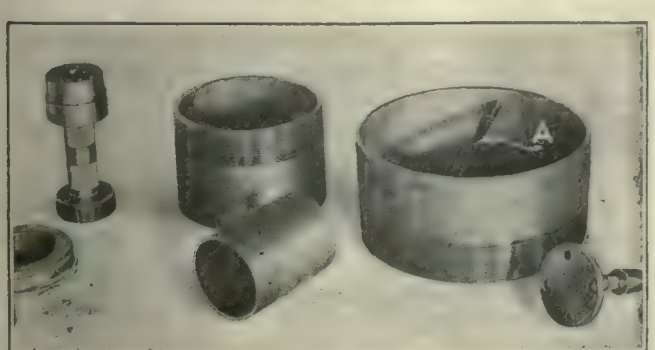


FIG. 14. GAGES FOR LARGE PIPE

swung out of the way when necessary to remove the drill from the work. The two uprights prevent the drill motor from turning, the space in which these are fastened being bolted or otherwise held in position on the work to be drilled. Bushings of various sizes are provided so that the drill is guided clear up to the point where it is at work, as in standard drilling fixtures.

A very convenient "old man" is shown in Fig. 11. It is provided with the usual base, which in this case is held to the work by means of the chain shown. The special feature of this particular old man is the adjustment of the base at *A* which enables the drill to be

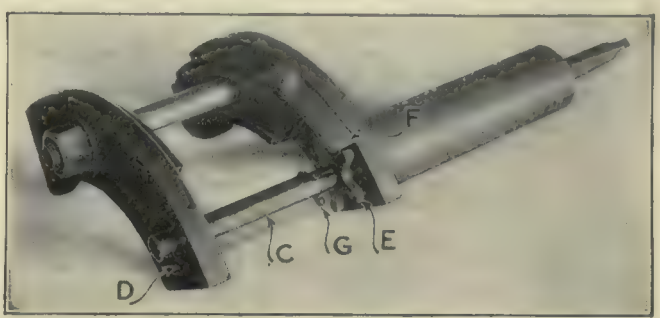


FIG. 15. TAPER HOLE BORING BAR ASSEMBLED

more easily squared with the work, as the column carrying the arm can be easily swung in either direction.

The method of making lead hammers is shown in Fig. 12. The handle *A* is a piece of common pipe with the end split so as to act as a retainer for the lead. This split end is placed in the mold, but not far enough to touch the opposite side. The mold is then closed, as shown at *B*, two legs being provided so that it will stand upright. The melted lead is then poured into the mold through either or both of the

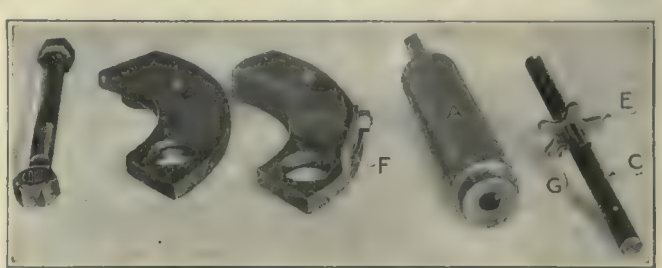


FIG. 16. PARTS OF TAPER HOLE BORING BAR

gates shown, a completed hammer being seen at *C*. It will also be noted that the pipe handle is flattened so as to be more conveniently handled. A hole is sometimes drilled in the end, as at *D*, when it is desired to hang the hammer up instead of letting it lie on the bench.

A very compact and powerful hydraulic jack is shown in Fig. 13. A completed jack is shown at *A*, while the component parts at the right are the forged steel head *B*, the barrel *C*, the plunger and nut *D* and *E*, and the ram and its packing at *F*. It will also be noted that

there is a substantial packing washer on the end of the screw at *E* to prevent leakage up around the threads.

This is for use in forcing out pins or parts, such as piston rods out of crossheads or other places where it is necessary to exert considerable pressure, but where

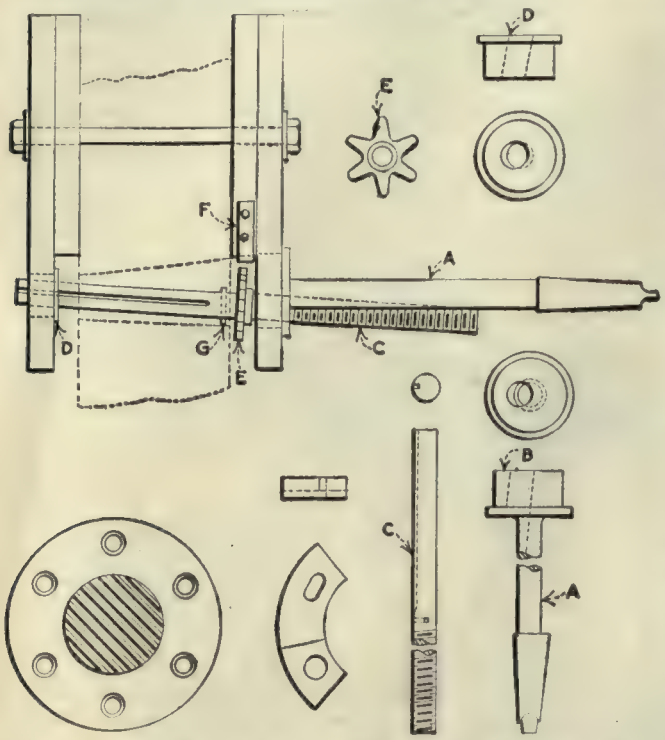


FIG. 17. DETAILS OF TAPER HOLE BORING BAR

there is not room for the regular size jack. This is designed to exert a pressure of 50 tons, using oil in the barrel for this purpose.

A few of the gages used are shown in Fig. 14, the use of tubing for this purpose being the feature of particular interest. This makes a very light gage for large sizes, and by inserting the pin as at *A* it can be very easily handled. The other gages are more of the usual type and require no special mention.

Taper Hole Boring Bar

Another interesting tool developed at the Puget Sound Navy Yard is illustrated herewith. This is a taper hole boring bar which is shown assembled in Fig. 15, disassembled in Fig. 16, and in detail in Fig. 17. This bar was designed especially for taper bolt holes in coupling flanges as shown at the bottom of Fig. 17. This requires a special driving bar *A* for every new taper. The hole *B*, through which the boring bar *C* works, is off center and also at the proper angle for the taper to be bored. The other end of the boring bar is carried in the bushing *D*, which has a feather or sliding key, so as to turn with the boring bar and at the same time allow it to slide freely as it is fed through the hole.

With the boring bar in the position shown in Fig. 17, the driving bar *A* is revolved by any power which may be available, either a horizontal or vertical machine, or porttable motor, as the case may be. The driving bar revolves the star wheel *E*, which strikes the stop *F* at each revolution and feeds the toolbar *C*, carrying the tool *G* down through the hole. This device has proved very satisfactory and bores the hole to within about 0.005 in. of the correct diameter. The holes are then reamed to the correct size.

Organizing Welfare Work

By Oscar E. Perrigo
Librarian, The Pratt & Whitney Co.

On page 331 of *American Machinist*, W. D. Forbes writes a very interesting story of the works manager's problem, and shows up the manufacturer's side of the so-called welfare work in a very forcible and practical manner. It must in all fairness be said that it is a truthful picture in many cases.

But is it always true? Is there any good and sufficient reason why the manufacturer should invest so much money and realize so little practical benefit to the business and to employees? Has there not been some point overlooked that would have saved the situation and brought about that much-hoped-for condition of confidence and unity between the employer and the employees which all plans are intended and expected to produce? Has there not frequently been a mistaken conception of the employees' attitude in relation to these matters from the beginning that has neutralized the good intentions of the management and brought all its well meaning plans to naught?

The fact that in numerous plants that might be mentioned, a great diversity of welfare work has been successful, as has been recorded by many writers whose accuracy cannot be doubted, shows that success along these lines is practical as well as possible. Let us look for a moment into the reasons why in one case they are a success and in another a failure.

Is it not true that the mental attitude of the two parties, the employer and the employees, in their relation to each other, has a great deal to do with the results of any plan for welfare work? And is not the attitude or condition of mind of the employees a very important factor in the matter?

The Independence of the American Mechanic

The real American mechanic is an independent man and he asks for nothing but that which he honestly earns. He has an excellent reputation for honesty and square dealing and he is more or less jealous of his rights. He expects to pay for what he gets and he does not ask or expect something for nothing. Consequently when he is offered something without money and without price he is suspicious that there is a string to it of some kind; he does not know just what, but he fights shy of it.

Reading from Mr. Forbes' article it seems evident that the welfare work he describes was formulated and carried on almost entirely by the management without previous consultation with the men, or even the foremen, on the proposed plan of welfare work. This plan will always cause suspicion among the workmen who take the questioning attitude of "what is behind all this?" Either consciously or unconsciously this will bring the employees to look upon it with disfavor; certainly they will not co-operate with the plan heartily enough to insure its success.

We read that when the works manager came to the conclusion that the welfare plans were a failure and he wanted to go back to a nine-hour day and piece work, he says that he talked with many of the men and he proceeds in considerable detail to give their views on a return to old conditions. The question naturally suggests itself, why did he not consult the men on the question of welfare work when that was organized in the first instance? Possibly this eleventh-hour method of

consulting the men gave them the idea that the management was thereby acknowledging its failure and now appealed to them to help them out of a hole.

The writer has served in the shop since he was seventeen years old and all the way from an apprentice to superintendent, and consequently has had considerable experience in organizing and systematizing work, and feels that he can fairly interpret the attitude of the employees. And of two conditions he is assured by observation and experience; in the language of the shop "you can't take snap judgment on the men," and, second, "you can't shove things down their throats." While these may not be very refined and academic phrases they mean a great deal to the real shop man. In such things as concern them personally they should be consulted; not always personally, perhaps, but through their foremen or natural shop leaders in such a manner as to permit them to express themselves on the subject in question.

When a general welfare policy is proposed to be inaugurated the plan may be outlined at a private meeting of department heads, who will give the management their personal opinions as to how the plan is likely to be received by the employees. The department heads with such others who may be good diplomats will then talk up the matter with the men and ascertain their attitude; explain the proposed plan to the doubtful ones, encourage suggestions and assure all of them that the management has no axe to grind and is not trying to put something over on them. The success of the plan will depend very much on how well these men do their work.

And right here it should be said that the success of these men will depend to a great extent upon how much they are imbued with the *human* view of their subject and their tact and forcefulness in presenting it *to* the men and *for* the men as a practical proposition. If the hearty support of the men can be assured the plan will very likely succeed; but if they persist in taking a hostile attitude on the subject the matter had as well be dropped before any money is spent upon it.

A regularly organized shop association of the employees is of great assistance in carrying along welfare work; but, to insure success the matter must be well canvassed by men who have shown themselves to be expert organizers and before actual welfare work is started and money spent a solid and smooth working organization of a large majority of the employees must be got together. This is not such a difficult undertaking if it is proceeded with on practical and businesslike principles and in a manner similar to organizations among business men. It will not do to post a notice on the bulletin boards that on such a day and hour "the men will meet to form a shop association, adopt a constitution and bylaws and transact such other business as may properly come before the meeting, including the election of such officers as the meeting shall determine." We all know the old familiar formula. There has been a great deal said about "shop politics," but here is a case where the practice of the ward politician will not usually succeed or long endure.

The decision of the manufacturer to start a welfare campaign is a secondary matter. His willingness to spend money is a comparatively easy question to decide. The strong and active working of the employee organization is the all-important force and until we have that it is useless to formulate a welfare plan or to spend money. The real leaders in this plan, or any other plan for the benefit of the shop workers, are to be found in the shop; not the office.

For instance: when Mr. Martin "put in metal lockers for the men's clothes," he probably wanted the men to keep their street clothes in them by day and their shop clothes in them at night. Very likely the greasy shop clothes transferred a disagreeable odor to the street clothes, which was not agreeable to the men. Also, that when he "threw the eating room open to all who wanted to come there evenings to read or write" he forgot the frequently expressed attitude of the men, "We get enough shop during the day and we want to go somewhere else in the evening": and so on through the whole series of well-meant improvements for the benefit of the men.

It reminds the writer that when he was a superintendent in a shop where the men washed up in a long wooden sink filled with water half an hour before quitting time at noon and night, he had a perforated pipe placed above the washing sink by which small streams of clean water were available for rinsing hands and washing the faces of the men. It was an innovation not of their devising or suggesting and in a few days they took it down and washed faces as well as hands in the same water used by all the other men. The mistake was that they had not been consulted in the matter. With the much improved sanitary knowledge of today such a resentment would not now be exhibited, but something quite as positive is just as likely to happen.

From these and similar experiences we deduce these facts: Welfare work can be made of great assistance to the management and to the men, but remember these things; whatever is done in welfare work, in shop associations and any similar plans for the mutual benefit of the employers and the employees, don't begin by planning to spend money. First get an organization among the men going in solid fashion. Have something solid behind your welfare work and let that something be the men.

A patriotic public speaker once said: "The young American is the most independent thing on earth; if he really believes in the righteousness of a cause you can *lead* him up to the cannon's mouth; but you can't *drive* him to buy ice cream at five cents a barrel if he does not want it." He is the most loyal man on earth, and when he is treated as a normal human being he is always on the square.



Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

A Simple and Effective Reversing Dog

By Milton Wright

The device shown in the illustration herewith is a part of the table reversing mechanism of a large special grinding machine built by Curtis & Marble, of Worcester, Mass., for use in their own shop. It is one of many such movements applied in that shop wherever a table is to be reversed quickly and accurately to a predetermined point.

In the movable dog *A* is a spring plunger *B* lying parallel to the line of travel of the table; the plunger normally being thrown forward by its spring until further movement is stopped by the nut *C* in contact with the dog. The chamber in which the plunger moves is counterbored nearly through and the plunger itself is shouldered; thus leaving a cell for the coil spring surrounding its smaller diameter.

The levers of the reversing mechanism are quite heavy and the spring, though comparatively stiff, cannot of itself overcome the inertia; therefore, as the table advances the spring is compressed until the dog itself

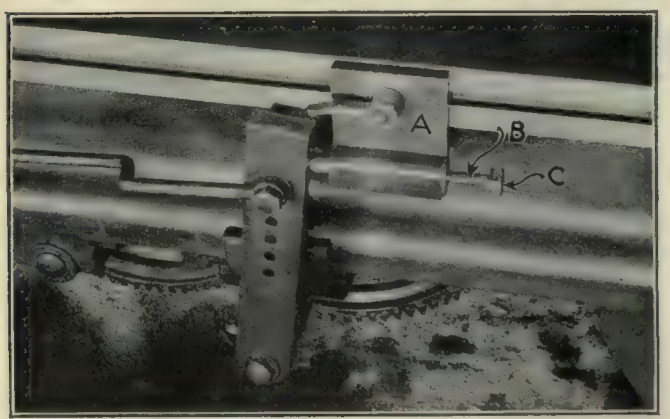


TABLE REVERSING DOG

strikes the lever and sets it in motion, whereupon the spring shoots the plunger forward and quickly completes the reversal.

The device is simple and effective, accomplishing its object with greater precision than most table reversing mechanisms. It has all the good features of the ordinary device except the by-pass (which easily could be added) and few of its disadvantages.

Making an Oil Can Spout

By Robert Mawson

Many readers of the *American Machinist*, when waiting for the 5.15 or some other train, have seen the engineer oiling various parts of the locomotive, using an oil can with an extra long spout. In this article the operations followed by Peter Gray & Sons, East Cambridge, Mass., in the manufacture of oil-can spouts, are shown and described.

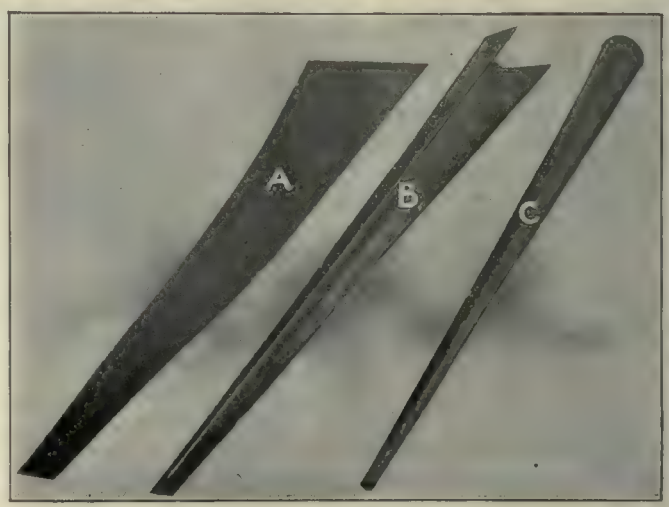


FIG. 1. STAGES IN MAKING THE SPOUT

Fig. 1 shows the stages through which the material passes in making the spout. The blank is laid out on the sheet by means of a templet and cut out with shears, one of the cut-out blanks being shown at *A*. The blank is then bent to a U-shape as shown at *B*, and finally closed to the form illustrated at *C*. The joint is soldered if the material used is tin, but if sheet iron is used the joint is welded either by the acetylene or electric method. The die used for forming the spout is shown in Fig. 2. The spout blank is placed under the forming bar *A* and located by means of two pins *B* and a pin at the opposite end of the blank. The handle *C* is then pushed toward the rear, depressing the spring *D* so that the forming arbor *A* can be pressed down onto the spout blank under it.

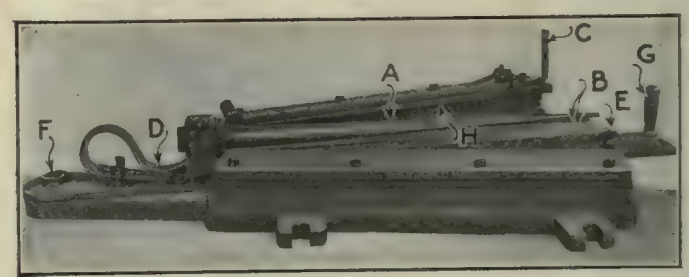


FIG. 2. THE DIE FOR FORMING THE SPOUT

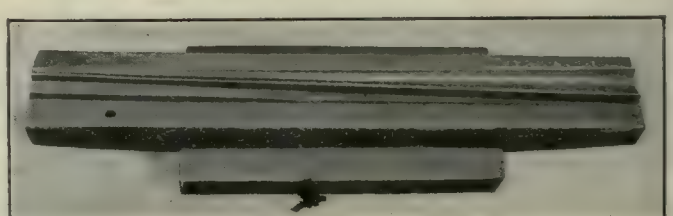


FIG. 3. THE CURLING PUNCH

As the punch, shown in Fig. 3, descends the arbor and also the blank under it are forced down. The blank is therefore forced into a circular depression which causes it to assume a U-shape as illustrated at *B* in Fig. 1.

The index pin *E*, Fig. 2, is now removed and the portion of the die that holds the blank can be moved around the stud *F*. After the index pin has been removed the operator pushes over the movable portion by means of the handle *G* until the forming arbor slides under the shelf *H*.

This action bends over the portion of the blank projecting above the forming arbor on one side, the material being forced on the arbor by means of the shelf.

Fig. 4 shows the die after the operation just described has been performed. Under the shelf and over the forming arbbr may be observed the narrow opening along which the blank rests after being bent over in this operation.

The sliding member of the die is now pulled in the reverse direction when the forming arbor slides under the shelf on the opposite side and bends over the other projecting edge of the blank.

The sliding member is now returned to its normal position, as shown in Fig. 2, and the punch is again forced onto the blank which gives it the final form and

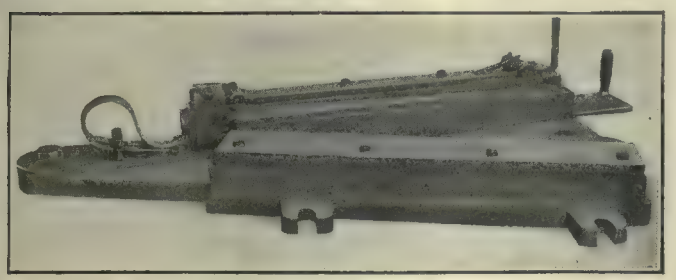


FIG. 4. BENDING THE SIDES

closes the joint along the entire length. It is then ready for soldering or welding as desired.

With the use of this tool several handlings of the blank are avoided. After the blank has been located in the die there is very little chance of error on the part of the operator as the index pin locates the tool in the correct position for both the first and final operations.

Welding a Broken Bell Rod

By L. I. Griwell

A cylindrical-shaped, cast-steel bell rod, varying in diameter from 7 to 11 in. and in wall thickness from about 1 to 2 in., which was to be used in operating the upper hopper for feeding in ore at the top of a blast furnace, while waiting to be installed in the steel plant of the Wharton Steel Co., Wharton, N. J., had one of its cylindrical halves fractured by the accidental falling of a heavy casting on it. In addition, the fractured half was also found to be bent at a point some distance from the fracture.

In repairing the bell rod the two half cylinders were lined up together in the position shown in Fig. 1, the lower, unbroken half acting as a templet for the upper fractured half. The upper half was thermit welded in this position in the usual manner.

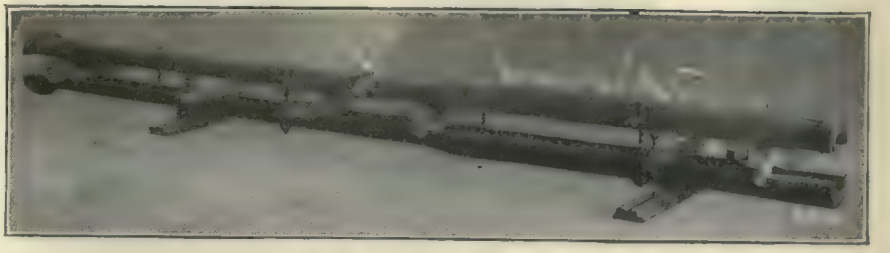


FIG. 1. BELL ROD, SHOWING WELD

Finally in order to obtain accurate lateral alignment between the lower half and its slightly bent mate, the blocks between the two halves were removed, leaving the halves faced together. In this position the welded

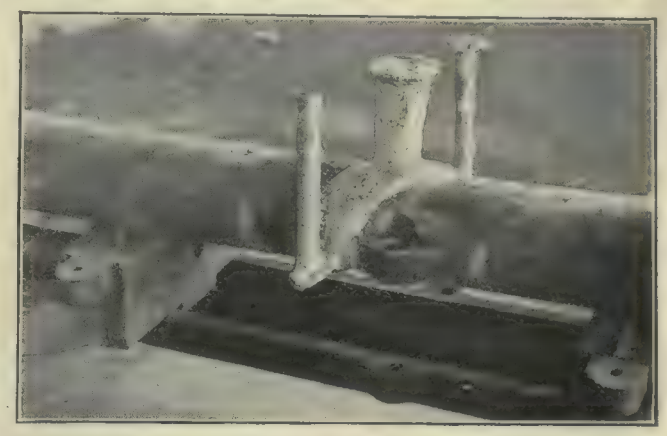


FIG. 2. WELD BEFORE REMOVING GATE AND RISERS

zone was reheated. When sufficiently hot, the top half was straightened and dowel pins inserted in the bolt holes. On cooling, both halves were found to be perfectly aligned and the assembled bell rod was later installed in its blast furnace.

Finishing Bores of Motor Cylinders by Burnishing

By F. C. Mason

Some makers of internal combustion engines have adopted as a means of finishing cylinder bores the tool and process herein illustrated and described; the object being to reduce the cost of production and at the same time to produce a satisfactory finish. If the rolling tool is properly constructed it will accomplish both results.

I have never seen the tool illustrated except by photographs and I believe that a drawing of it will be of interest to readers of the *American Machinist*.

By this method, cylinder bores are usually finished in the following sequence of operations: rough-boring, finish-boring, and rolling, leaving from 0.005 to 0.007 in. for the latter operation. As the parts will wear, the

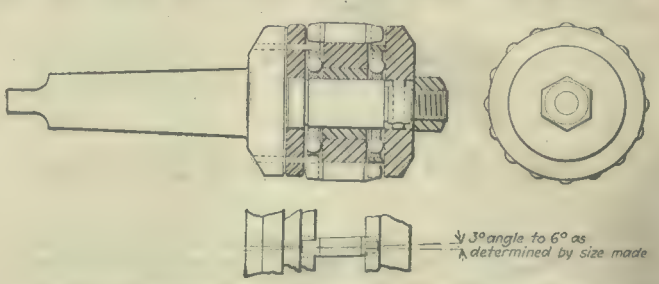


FIG. 1. ASSEMBLY DRAWING OF ROLLING TOOL

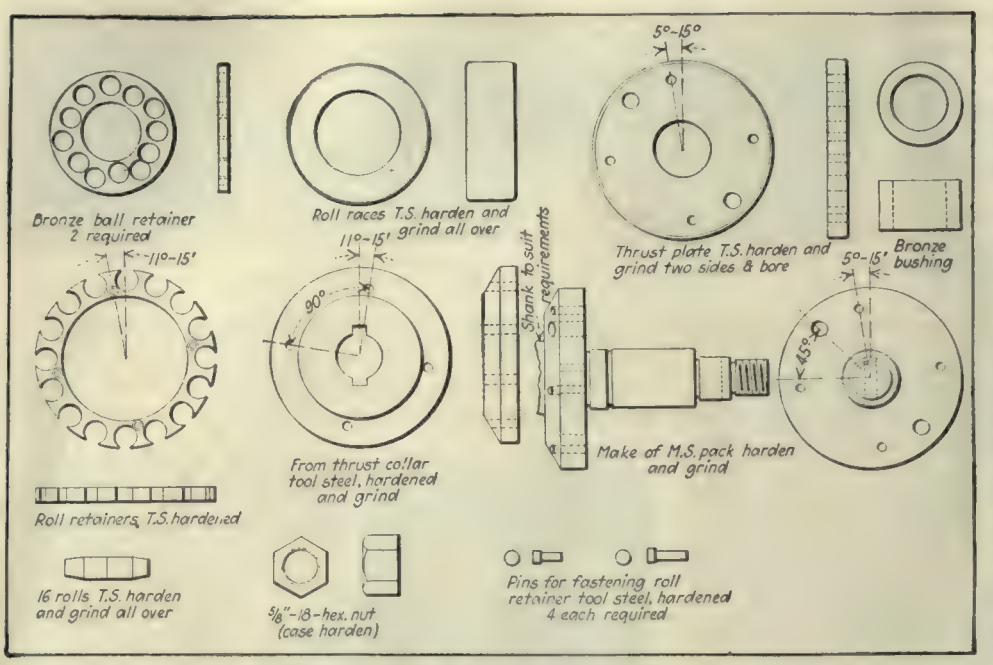


FIG. 2. DETAILS OF ROLLING TOOL

rolls are usually made in step sizes and are changed as the rolling advances to bring the bore to the required size.

The rolling tool acts as a burnisher, rolling the metal in and making it more dense, thereby producing a more lasting surface. On a six-cylinder block one boring machine with six spindles will easily produce fifty blocks in eight hours.

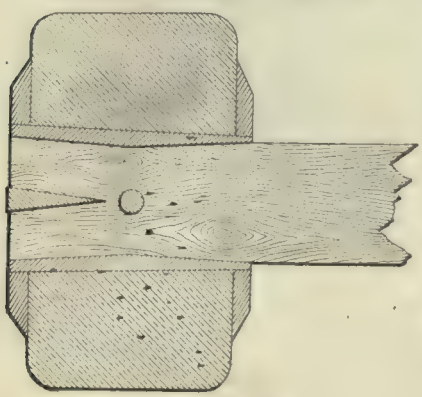
Fig. 1 shows the assembly drawing and Fig. 2 the details. The tool must be made in a very careful manner, with first-class material and workmanship.

A Soft Hammer

By J. H. Maguire

The illustration shows a hammer that can be made with either a rawhide or a wooden face.

The features of it are that the bushing in the head is tapered on the outside to prevent it from slipping out of the head, and the hole in the bushing is tapered to take up the part of the handle displaced by the wedge and so prevent the handle from pulling out. The pin is to make it impossible for the head to turn on the handle. Two years of service in the Westfield Boys' Trade School have proved that this hammer is cheap and serviceable.



A SOFT HAMMER

Using the Chasing Dial of the Lathe

By John P. Wheeler

It is surprising to me how few mechanics realize the possibilties of the chasing dial which is to be found on many lathes. Many lathe hands refuse to use it at all, and others use it only to "drop in" and save reversing. Recently I had some six-start worms of ¾-in. lead to cut. The pitch was therefore ⅛ in. The lead screw was six threads per inch and the wormwheel on the dial had 24 teeth. A little consideration will show that one revolution of the dial means 4 in. travel of the carriage, and each long line (there were four) one inch.

I take the first cut on line No. 1 on the dial and run the carriage back and drop in on line No. 3. This means a 2-in. movement of the carriage. The third cut is taken on No. 1 again, 2 in. more movement, giving three spacings of the worm. I then move the compound slide, which has been set parallel with the ways, ⅛ in. and repeat the operation, No. 1, No. 3, and then No. 1 again. This gives the other three divisions.

I then start another cut by moving the stop the required amount; cut three teeth again, and go back to the first three and cut them. In this manner I cut the whole six teeth of the worm without stopping the lathe except to replace the roughing tool by the finishing tool. Multiple worms can often be cut in this manner with a great saving of time and trouble. Another example was some four-start worms of 1½-in. lead. I ignored the lines on the dial altogether and made new ones with chalk as shown in the sketch—three long ones equally spaced with three shorter ones in between each of the long ones.



MARK THE DIAL THUS

I found that dropping in on any No. 1 gave the first thread, any No. 2 the second, any No. 3 the third and any No. 4 the fourth. I finished these worms (they were of steel about 1½ in. in diameter) in from 40 to 45 min. each on a 12-in. lathe.

The great advantages of this system are uninterrupted operation, speed of output, and, above all, the satisfying assurance that all leads of the worm are alike.

A Useful Setting-Up Tool

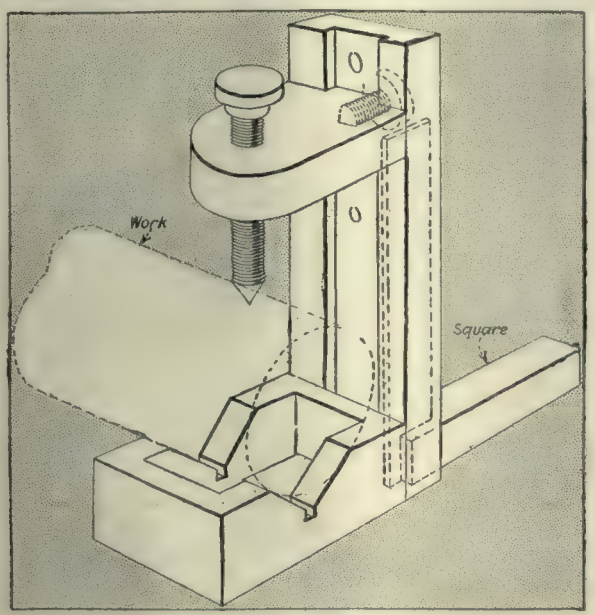
By R. H. Kasper

When drilling on the diameter of round stock, the tool shown in the sketch has been found useful in setting up the work on the drill press, making for quicker and more accurate results.

The sketch shows clearly the construction of the tool. The block carrying the screw is keyed to the grooved upright bar, and is held in position by a screw at the back. A number of holes are provided so that the block may be set to suit work of various diameters. The

screw is located so that its point falls directly over the center of the V-block, and is parallel with the grooved upright bar. The V-block is hollowed out to reduce its weight.

The piece to be drilled is marked with a center punch, and is supported on V-blocks (not shown) on the drill



A USEFUL SETTING-UP TOOL

press table in the usual manner. The tool is then placed over the work, and the screw is set into the center punch mark with just enough tension to hold it in position. The work is then turned until the back of the upright bar is brought square with the drill press table. The work is then clamped firmly, and the tool removed. This brings the punch mark so that the drill will pass through the exact center of the work.

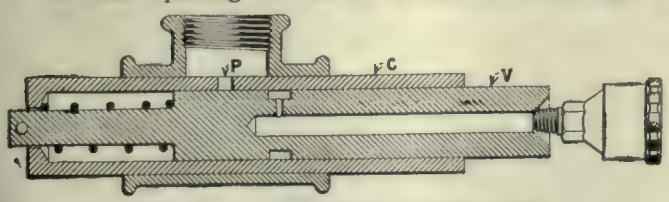
Device for Rapidly Filling Grease Cups

By H. W. Johnson

A firm which daily assembles hundreds of small pressed steel grease cups into its product was confronted with the need for some method for quickly and completely filling them. For this purpose I devised the automatic valve shown in the accompanying sketch.

It consists primarily of a hollow piston valve *V* sliding in a cylinder *C*. This cylinder is forced tightly into a ¾-in. tee.

The side opening of the tee is attached through a



DEVICE FOR FILLING GREASE CUPS

small pipe to a large reservoir containing grease under pressure. In the normal position as shown by the sketch the grease under pressure flows as far as the port *P* when further flow is cut off by the piston valve. When a grease cup is to be filled, the threaded end of the cup is pressed against the countersunk end of the valve *V*. Further pressure forces the valve against spring pressure until the groove in the piston registers with the port *P* at which time the grease is free to flow through the hollow piston and into the grease cup. There is very little leakage between the grease cup and the valve, due to the spring pressure. The air in the grease cup escapes through the threads between the shank and cap. When the grease cup is taken away, the spring instantly closes the valve.

With this rig it is possible to completely fill the grease cups just as fast as a man can pick them up.

Blowpipe vs. Air Chisel for Chamfering

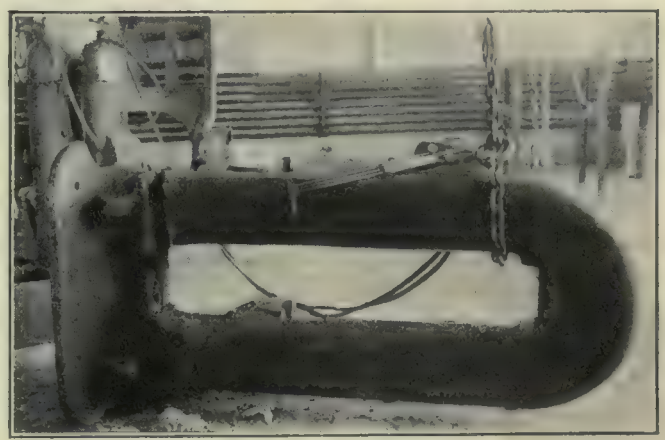
By A. Johnson

In preparing broken castings for repair by welding, the fractured surfaces are chamfered to permit thorough penetration of the flame, as it is necessary to provide a complete bonding of the molten metal in every portion of the joint if the weld is to be as strong as the original metal.

The usual practice has been to chip out the chamfer or "V" with some form of mechanical cutting tool. In heavy work, where filing, grinding, or chipping with cold chisel has been extensively employed, at best it has always been a slow and laborious operation.

The job herewith illustrated and described would seem to point to an entirely new and much more effective and economical way of cutting the chamfers in cast iron.

The accompanying illustration shows a cast-iron punch press frame, weighing 2,800 lb. One leg of this frame measuring 9 in. square in cross section was cracked entirely through. To weld this job it was necessary to "V" out the metal, and as is the practice where it can be done, two "Vs" were made; that is, one on either



CRACK IN PUNCH PRESS FRAME CHAMFERED WITH BLOWPIPE

side with the vertices meeting at the center. The chamfers were 3½ in. in width at the top and each, of course, 4½ in. deep.

To do this job with an air chisel would undoubtedly require at least 12 hours' labor. The entire operation was completed in 40 minutes, however, the tool used being an Oxweld Type C-6 Cutting Blowpipe. It will be noted that the sides compare very favorably, as to evenness, with work done with the air chisel, and as the chamfers can be cut in about 1/18 the time commonly required, the saving in time is obvious. On checking up the acetylene and oxygen consumption, while the cost of the gases tends to equalize the actual cost with that of chamfering with the air chisel, the saving in time alone is a valuable consideration.

IN THIS ISSUE

ONE of the editorials on page 1137 is a very good introduction to the first article "How Should the Engineer Be Educated?" so that little need be said relative to it on this page. We do want to emphasize the fact that the opinion of the several writers is unanimous that engineering education must be very broad in scope and must not fail to establish a strong groundwork of fundamentals. Other interesting points brought out are the differences between the general engineer and the theoretical engineer who in turn is not the same as the pure scientist; also that the scientifically trained man is now coming into his own. It will be remembered that the scientifically trained engineer was accepted with a great deal of diffidence, and that he has had a hard road to hoe. The war helped him not a little and the subject of engineering education is now being studied with renewed attention. Just as an example to indicate the present trend of thought, consider what Dean Bishop of the School of Engineering, University of Pittsburgh, says in his part of the article: "I believe it essential that every man should be trained broadly for his duties as a citizen, as well as specifically for his work as an engineer. Every engineer should be a gentleman and a scholar in the broadest sense of the word. His culture should not be inferior to that of the minister or of the lawyer. His knowledge of present-day affairs should be comparable with the importance which the engineering profession occupies at the present time in the multifarious activities of the world, and this is known as the Engineering Age."

John Bath in "New Light on Internal Measurements," page 1110, considers the old question "Will a two-inch plug enter a two-inch hole?" He says that it will, qualifying his statement, however, with the word perfect; in other words, he says that a perfect two-inch plug will enter a perfect two-inch hole. His article is not confined to dissertations upon this one question. He includes a description of various forms of contacts for measuring cylindrical surfaces, facts relative to the use of oil, and descriptions of some of the Bath micrometers.

A short time ago, we ran a description of the Lodge & Shipley monitor type shop as the first of a group of articles by Colvin devoted to the description of types of plants. In this issue, beginning on page 1114, is the second article, dealing with the multi-storied shop of the American Tool Works Co. Colvin has very thoroughly described this five-story building of reinforced concrete, has furnished illustrations sufficient to show the unusual features and has supplied drawings of the layout of the five floors. Observe carefully the method of ventilating through the columns, the open court to give light to the erecting floor and the method of carrying chips to the basement, storing them there, and removing them.

We have nearly reached the end of the drill jig design section of "Tool Engineering." The current installment, page 1119, takes up indexing and trunnion jigs, drilling and reaming indexing fixtures, and four-sided jigs for accurate work. An interesting and important division of drill jig design is that of indexing.

The fully automatic Gleason 37-in. two-tool bevel-gear planer is described, beginning on page 1123. This machine was designed for general work, its two tools cut on the opposite sides of the tooth, forms control the tooth shape, and a carefully worked out system of gages facilitates setting up the machine.

The second of the articles on the Puget Sound Navy Yard describes some ingenious special tools for ship-yard work, among them a square hole drilling attachment and a cylindrical jack for use in close quarters. There are other articles on the Puget Sound Navy Yard to come. Page 1126.

Some of the things that John R. Godfrey gets off are not so good, and then again some are excellent. We feel perfectly justified in calling your attention to his article this week, page 1122, "Machine Tool Services—For Nothing," which looks like pretty good stuff.

It isn't often that we find space to mention the short articles but we know that they are receiving their share of attention from our readers. On pages 1109, 1113, and 1130 there are brief articles on applying machine shop methods to building construction, babbitt bearings on rolling mills, and organizing welfare work. The practical letter section of four pages beginning on 1132 and the Shop Equipment News on 1138.

Coming Features

Next week will see the last of the "Foreman and His Job." It has been a popular series, as indicated by the facts that many have written us concerning it and that parts of it have been reprinted in other publications. It has to finish, of course, and we feel that we have plenty of good material waiting to take its place.

A new series will begin in the next issue, under the title "Manufacturing With Special Machines vs. Standard Equipment." The articles will deal with the manufacture of recuperators for 240 mm. howitzers. The authors are Col. G. F. Jenks, Chief of Artillery Division, Ordnance Department, U. S. A., and H. Christopherson, General Works Manager of the Otis Elevator Company.

There are several complete articles scheduled for the next issue but they are subject to change, so that we shall content ourselves with mentioning the series articles, "Metal Cutting Tools," "A History of Post War Crises" and "Tool Engineering."

EDITORIALS

Educating the Engineer

AT THIS time of the year when our technical schools and engineering colleges are turning loose a flood of young engineers to make their way in the world, many men are led to pause and wonder about the value of engineering education. The more thoughtful of the graduates themselves are probably the ones most concerned over what they have been able to get out of their years of study. Most of them are faced with the problem of earning a living at once and perhaps this fact leads some of them to attach undue importance to the so-called practical subjects, their knowledge of which can be turned to immediate account. They are not in a position to get a broad view of life's tasks and are too often obsessed with an exaggerated idea of their own worth.

But there are two other classes of men to whom the engineering education problem is a vital one, the members of the engineering faculties and the employers of engineers. The work of the engineering instructor is stimulating to one whose altruistic characteristics are strongly developed but it also has its disappointments. And at this time when he is sending out the finished product of four or more years of endeavor he is quite apt to wonder whether he has given the boy the best equipment for his life-work. He is under pressure from all sorts of theorists and practical enthusiasts to include this or that specialty in his curriculum and many of the suggestions are good. Unfortunately he is only too well aware of the limitations of the human mind and particularly as to how much engineering education can be absorbed.

The employer is always on the lookout for bright young men to grow up with his business and into the important positions as time goes on. He is in an excellent position to determine just what the embryo engineer should know when he starts in on a real job. He also knows the value of character, judgment and ability to get along with people.

Co-operation between engineering educators and employers cannot be too close and it is an encouraging fact that it is growing in intimacy in several directions. Not only is this true of individuals but also of graduate organizations which have at heart not only the advancement of their own *alma mater* but also the good of all engineering education.

Our first article this week is an attempt to put before the men of the machinery industry the opinions of some of the big men both among the educators and among the employers. We commend it to employers, engineers and all those who hope that their sons may help themselves and their country by following the engineering profession.

Looking at the subject from a different angle let it be remembered that engineering is a profession much better recognized now than formerly, due to the vital war work performed by engineers. Engineering societies are encouraging this recognition and the whole is going to react favorably to the man just leaving school.

The Need for Landing Fields

THE recent airplane disaster near Washington, in which seven men lost their lives, will doubtless be the cause of much unthinking comment on the dangers of flying. But according to expert opinion the accident could have been avoided had a possible landing field been available.

The air pilot of today, facing the problems of widely scattered landing fields and almost complete absence of radio direction finding apparatus and air light-houses, is little better off than the ancient navigator caught in a Northeast gale off the Jersey coast between New York and Delaware Bay. There is this difference. Not much can be done toward building safe harbors in the Jersey sands, while the location and clearing of adequate landing fields can be accomplished at moderate expense almost anywhere in this country except in the mountains.

At the recent meeting of the Society of Automotive Engineers, one of the speakers at the aëronautical session compared our present situation to the famous conundrum as to which came first, the hen or the egg. Some people are confident that rapid development of commercial aviation will follow the establishment of a continuous chain of landing fields. Others maintain that when successful commercial airplanes are built it will be easy to persuade chambers of commerce to provide the necessary funds for the landing fields.

Undoubtedly both parties are correct, but in the meantime development of aviation is practically at a standstill. Sooner or later some man, some corporation or some political group with sufficient vision to grasp the beneficial possibilities of aërial supremacy must rise to meet the situation. It will certainly cost a lot of money to place aviation on a profitable basis but there is no doubt that it can be done.

There is precedent for Government aid such as France is extending to her airplane builders and operators, in the land grants to our early railroads and the national maintenance of our harbors, coast guard, lighthouse service and highway projects. The present is perhaps not the best possible time for securing funds for such a project but it must be given careful consideration very soon if we are not to be hopelessly distanced in the march of aërial progress.

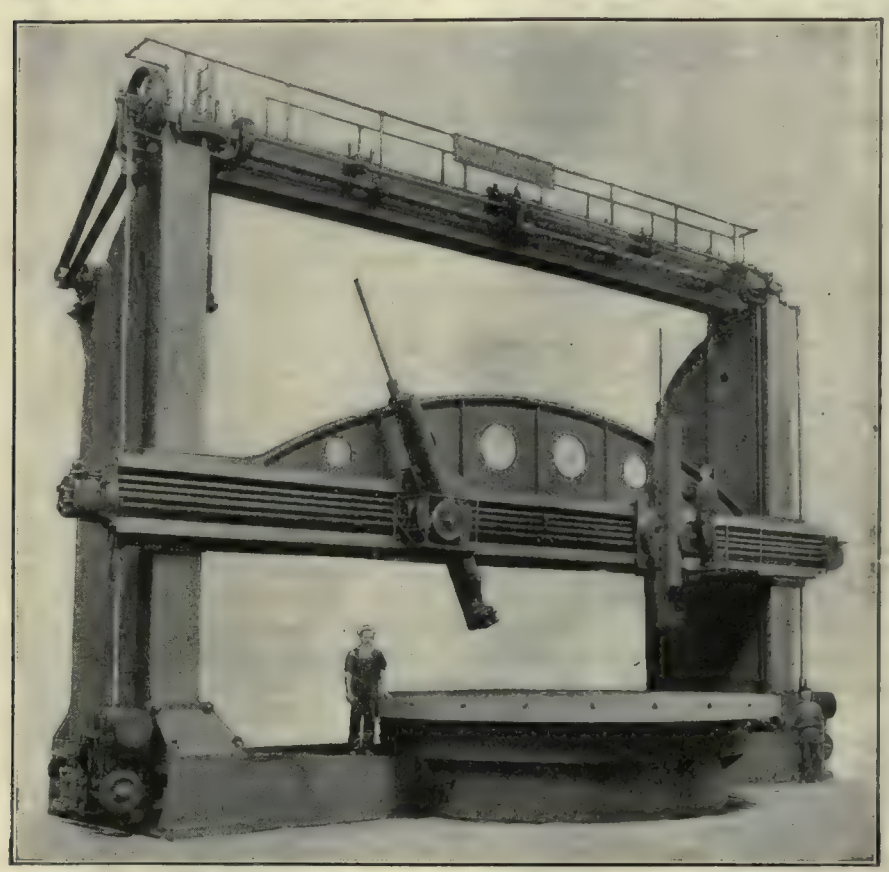
We must not lose sight of the fact that intellectual as well as material supremacy has always fallen to the lot of those possessing the best means of transportation. Our position now is most favorable but we shall be hard put to maintain it if we allow others to develop transportation facilities superior to ours.

The first thing to do is to make a concerted effort to secure landing fields everywhere. Their cost would be so widely distributed that the individual burden would be very light compared to the potential benefits sure to be received. Cities and towns which provide landing fields of the regulation size and shape will be the first to secure the benefits of air transportation. Why not start work for one in your own city? Think it over!

Shop Equipment News

Sellers 35-Foot Boring Mill

The illustration shows a boring and turning mill recently completed by William Sellers & Co., Inc., Philadelphia, Pa., for machining the castings used in large hydro-electric power units. It is probably the largest machine of its type ever built, measuring 35 ft. between the uprights and 18 ft. between the table top and the tools when the crossrail is in its highest position. An idea of the size can be obtained by the relative size of the men shown on the machine.



SELLERS 35-FT. BORING MILL

The bed of the machine weighs about 50 tons. To enable shipping, it is made in two pieces, one piece extending from one upright to the other, and the other piece being bolted and doweled to it and extending forward so as to provide a portion of the bearing for the table. The over-all dimensions of the assembled bed are 19 ft. 9 in. in width, 39 ft. in length and 2 ft. 8½ in. in depth.

The table is supported on two annular bearings on which it slides when the machine is running. These bearings are supplied with oil under pressure, a pump being provided for this purpose. The table, complete with the driving-gear ring and the center spindle, weighs about 40 tons, and is 19 ft. 10 in. in diameter and 2 ft. 3 in. thick. It is provided with radial T-slots for clamping bolts. It is made in two semicircular sections, securely bolted and keyed together. The driving-gear ring is a separate casting 16 ft. 2½ in. in diameter, centered and bolted on the table. The table is provided with a large taper spindle 20 in. in diameter and extending vertically through the bed. A split bushing fits into the central hole in the bed, and is used for adjustment. The spindle bearing is lubricated by the return oil from the inside annular bearing. The uprights are very heavy box castings 24 ft. 8 in. high and 12 ft. deep, the faces being 24 in. wide. They are bolted and doweled to the upper portion of the bed and the upper ends are tied together by a cast-iron crossgirt of heavy box construction. The crossgirt carries the lifting and traverse machinery drives and is accessible to the operator by a ladder carried on the inside of one of the uprights. A wooden platform with safety guard rails is provided to enable the operator to pass safely from one side of the machine to the other at the top.

The machine is driven through a 50-hp. adjustable-speed motor with a variation of 3 to 1, and a speed regulating mechanism with four gear changes, giving a total range of 0.19 to 6 revolutions of the table per minute. The gears are all of large proportion with cut teeth. One feature of the drive which is worthy of mention is the short length of the shafts which are used throughout, in order to eliminate, as far as possible, the shaft deflections which may cause chatter.

The feed mechanism for the power feed of the saddles along the crossrail and for the toolbars in the saddles, is located on the sides of the machine at the base of the uprights. A separate mechanism is provided for each saddle, with an additional feed change on the left-hand side of the machine for changing the feeds from the low range for roughing, to a high range for finishing. This feed motion is driven from the main drive, and runs at a positive relation to the table speeds. The total feed range is from $\frac{1}{64}$ to 1½ in. per revolution of the table.

In place of the ordinary curved-back crossrail extending between the uprights, the back of the crossrail extends its full depth from upright to upright and is clamped to the inner side of the upright at the back edge, in addition to the usual clamp at the front and outer edge. This construction provides a continuous strut between the uprights, immediately above the work and increases the rigidity of both the uprights and the crossrail, in addition to giving greater torsional stiffness to the rail. In order to prevent undue deflection of the crossrail, a cast-iron arched girder is bolted to the upper side of the crossrail. Adjustable wedges at the ends of this reinforcing beam can be manipulated to

bring the crossrail to a practically perfect level. The rail is said to show a variation in its whole length of less than one-thousandth inch. From the face to the back it is 5 ft. 5 in. for the whole distance between the uprights. The face of the crossrail together with the reinforcing beam or arched girder gives a vertical depth to the crossrail of 7 ft. 10 in. at the center.

Two saddles are mounted on the crossrail, in the usual fashion, with taper shoes sliding on square guides. The toolbars or rams are made with heavy rectangular guiding surfaces reinforced torsionally and longitudinally by a tubular section in front of the guiding surfaces.

There are no counterweights required for the toolbars. The taking up of the lost motion in the vertical feed screw is performed by a split spring nut. The spring is calibrated to sustain the weight of the toolbar and boring or turning tools, and maintains contact on both sides of the screw thread in the nut at all times.

Each saddle is supplied with a wooden platform for an operator, and control levers located at the saddle, together with push-button control of the traversing motor give the operator complete control of every movement from the platforms. The controls are duplicated at the ends of the crossrail, so that the point of operation is optional. The mechanism on the end of the crossrail receives its power from two sources through vertical shafts, one of which drives from the feed box at the base of the machine and the other from the traversing mechanism at the top. Tumbler gears in the mechanism on the end of the crossrail interlock the feed and traverse, so that they cannot be engaged at the same time. The horizontal and vertical travel of the saddle are interlocked in the same manner.

The lifting mechanism, as well as the traverse mechanism, is driven by a 20-hp. motor carried on the back of the left-hand upright and driving through a belt to the traverse shaft running the full length of the machine. The drive is from the traverse shaft through a positive clutch connection at the middle of the machine, giving equal torsional deflection to the driving shafts when lifting the crossrail. The lifting screws for the crossrail are set in a recess on the inside of the uprights at a position in back of the face of the uprights, which approximates very closely the center of gravity of the assembled crosshead, saddles and mechanisms.

Instead of the general method of providing ordinary bolts and nuts for clamping the crossrail to the uprights, this work is done by pneumatic cylinders located at the four points of clamping; that is, on the outside and inside of each upright. Each cylinder clamps two bolts. In this pneumatic clamping device, each piston is connected to an upper clamp and each cylinder connected to and supported by a lower clamp, so that, in opening or closing, each clamp is used as an abutment for operating the one either above or below it. The four cylinders are connected by flexible hose and pipe to an operating valve within easy reach of the operator. After the crossrail has been clamped the air pressure may be released by the valve, as the clamps will not loosen until air is applied in the reverse direction. This feature is essential because the length of time consumed on a single job may cover a period during which there is no air pressure to maintain the clamp. The use of the pneumatically operated clamps controlled from one point is almost a necessity, because without them it would be necessary for the operator to move to all parts of the machine to tighten the clamps manually.

Landis No. 4-A Special Grinding Machine

The grinding machine shown by the accompanying illustrations is a late product of the Landis Tool Co., Waynesboro, Pa.

The machine, Fig. 1, is intended for regrinding all parts of automotive engines (except cylinders cast en

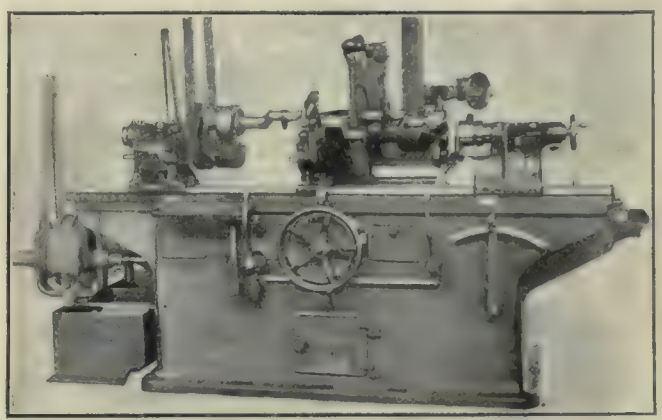


FIG. 1. LANDIS NO. 4-A SPECIAL GRINDING MACHINE

bloc) and as shown is set up for grinding crankshafts.

The driving end of the crank carrying fixture is shown in Fig. 2. It was designed for ease in handling crankshafts, and all loose attachments such as chucks, dogs, blocks and so called throwblocks have been eliminated. Work carrying parts which are a part of the headstock and the footstock are equipped with three-jaw universal chucks, to grip each end of the crankshaft. Bushings are not necessary. An indexing dial for locating the chucks for the different strokes of crankshafts and which is operated by a small crank, is furnished with the machine. The work carrying heads

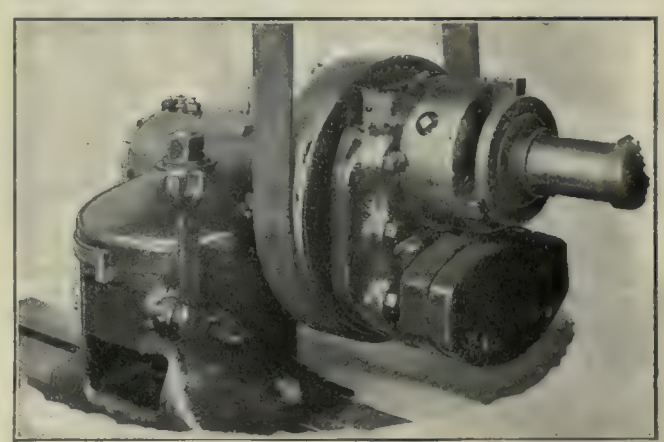


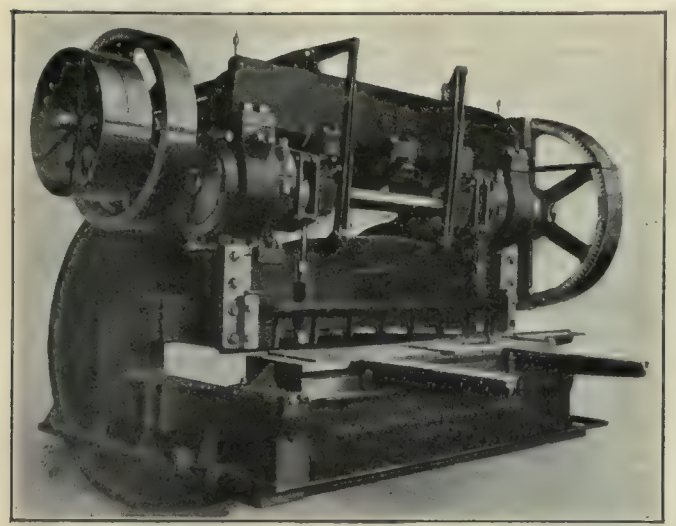
FIG. 2. ATTACHMENT FOR GRINDING CRANKSHAFTS

are centered and brought in line by use of the locating pins after which the machine is ready to receive the work.

The shaft is placed in the three-jaw chucks, brought in line and trued by use of a truing device located on the top of the work rest. The chuck jaws are then drawn up fairly tight, not however, as tight as is necessary for lathe work. The truing device is then removed and the work of regrinding proceeds. The wheel carriage has power feed, and all traverse speed changes are controlled by one lever. The machine is designed to carry a 24-in. diameter wheel with 5-in. belt for driving it. The machine is driven with a small countershaft and requires 5 hp. to operate.

Niagara No. 8-H Power Squaring Shear

The illustration shows a power-driven squaring shear recently placed on the market by the Niagara Machine & Tool Works, 639 Northland Ave., Buffalo, N. Y.



NIAGARA NO. 8-H PLATE-SQUARING SHEAR

Specifications: Capacity in mild steel, $\frac{5}{8}$ in. Nominal cutting length, 96 in. Hp. required, 30. Geared ratio, 15:1. Flywheel: size, 62x9 in.; weight, 2,300 lb. Pulleys: size, 36x9 in.; speed, 240 r.p.m. Floor space overall: front to back, 132 in.; right to left, 197 in. Height overall, 123 in. Weight: with 24-in. gap, 54,000 lb.; with 36-in. gap, 61,000 pounds.

It is designated as the No. 8-H shear, and is designed especially for use in tank manufacture for accurately cutting and squaring steel plates up to $\frac{5}{8}$ or even $\frac{3}{4}$ in. thickness.

The crosshead is of heavy box section, has large guides, and is counterbalanced. The mainshaft and eccentrics are forged in one piece. The clutch block is made of a hammered steel forging and is equipped with hardened and ground removable striking jaws, as well as with hardened backlash jaws. The clutch wheel is bronze bushed, and provided with hardened and ground removable striking faces and with a backlash pin. The cam and throw-out rollers for clutch disengagement are both of hardened steel.

The center bearings for the mainshaft are two in number and are placed as close as possible to the eccentrics and hold-down cams, so as to give sufficient support. The cams for the hold-down are so arranged as to lift it positively, as well as to hold it down positively. They bear against hardened steel rollers lubricated through hollow pins. The hold-down rods are provided with springs so as to compensate for various thicknesses of plates. Brakes lined with asbestos fiber are furnished, each brake being made in hinged halves and equipped with an automatic spring take-up for wear.

The crown is of box section and bolted and doweled in place. The bed is wide and heavy, and is screwed and doweled to the housings. The knife chuck is provided with pockets, so as to enable knife bolts to be easily removed from the top, and is provided with T-slots on top for gages, and on the front for front-gage brackets. The knife chuck is provided on each end with a screw and setscrew to facilitate easy adjustment. The housings are of heavy construction and do not require stay rods for cutting at the maximum rated capacity, so that stay rods and stay-rod lugs are furnished on special order only.

The gears are all machine cut and are equipped with guards, while the pinions are made of hammered steel. The driving mechanism is overhead and out of the way of the operator. The pressure of the cutter bar toward the back is taken up by solid metal, and not by gibs. All movable parts are protected by metal guards. The counterbalance rods are placed outside of the housings, so as not to interfere with work being passed between the housings. The counterbalance weights are regularly carried below the floor line, to comply with safety codes used in many states. A complete set of gages, including a front, side, bevel and slitting gage, and the company's automatic, screw-adjusting back gage, are provide

Landis No. 5 Cylinder Grinding Machine

The Landis Tool Co., Waynesboro, Pa., has lately placed on the market the cylinder grinding machine shown in Fig. 1.

This machine is intended for regrinding automobile cylinders and its range of work capacity includes all makes and types of automobile cylinders cast en bloc as well as a variety of irregular castings.

The work carrying fixture shown in Fig. 2 is an open angle plate with two adjustable work clamping bars. The work to be ground is securely clamped to the bars by two heavy machine clamps of ample capacity. A distinctive feature of this fixture is the arrangement

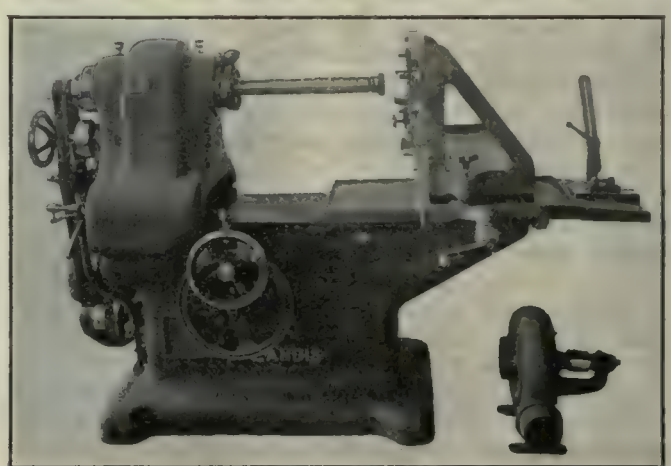


FIG. 1. LANDIS NO. 5 CYLINDER GRINDING MACHINE

for quickly and accurately aligning the work in vertical position in relation to the center of spindle rotation. A centering bar fits neatly into two slots milled in the frame of the work carrying fixture and carries two adjustable centering brackets. Before clamping the work, the centering brackets are inserted in the holes to be ground and adjusted to their sizes. The bar is then inserted in its position on the work carrying fixture. The work is lifted to the machine and fitted over the brackets of the aligning bar, and securely clamped to the carrying fixture. After the work is securely clamped in position the aligning bar is removed. If the work is not absolutely aligned minor adjustment can be made by a screw in front of the fixture which permits it to be raised or lowered as required.

Cross-slide movement of the work carrying fixture is actuated by a screw and nut. A dial on the screw, graduated in thousandths of an inch insures accurate movement when changing from one hole to another. The work carrying fixture is mounted on a traveling

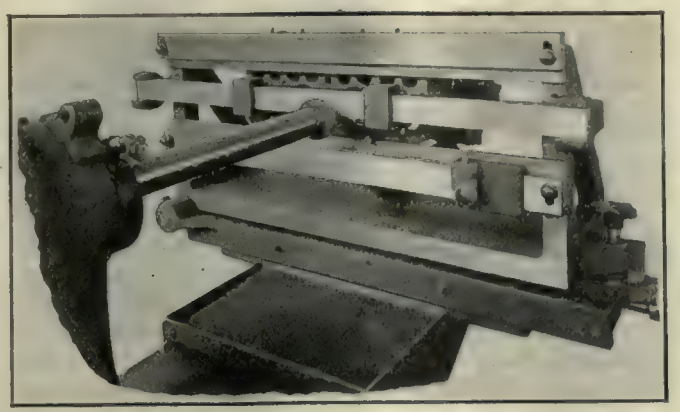


FIG. 2. WORK HOLDING FIXTURE WITH ALIGNING BAR AND BRACKETS

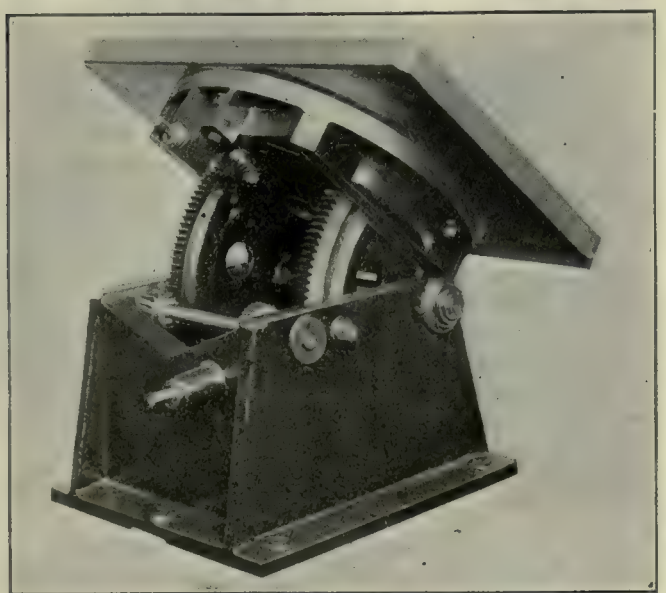
Specifications: Wheel spindle: eccentric adjustment, $\frac{1}{16}$ to $1\frac{1}{16}$ in.; height above work carriage, 10 in. Will grind hole 15 in. in depth; $5\frac{5}{8}$ in. in diameter with $3\frac{1}{2}$-in. wheel. Wheels regularly furnished: $2\frac{1}{2}$ and $3\frac{1}{2}$ in. in diameter. Extra spindles for grinding holes 22 in. deep or larger than 6 in. can be furnished. Work carriage: cross movement, $27\frac{1}{2}$ in.; traverse movement, $31\frac{1}{2}$ in.; traverse speed, 10 in. per minute. Drive: either motor or belt. Motor: 3 hp., 1,150 r.p.m. Floor space, 88 x 88 in. Net weight, 2,900 pounds.

carriage which operates on one flat and one dovetail guide. Lubrication of these guides is assured by rollers running in pockets filled with oil. Traverse movement of the work carriage is automatic and reversing action is obtained by two self-locking adjustable dogs, permitting grinding close to shoulders.

The outside eccentric spindle which carries the wheel spindle eccentric sleeve, runs in two wide capped bearings, and liners afford a correct running fit. The lower half of the bearing is cast as a part of the head which makes it very rigid.

Pawling and Harnischfeger Universal Tilting and Rotary Table

A work table for use with floor-type boring, drilling and milling machines and known as the universal tilting and rotary table, has been recently put on the market by the Pawling & Harnischfeger Co., Milwaukee, Wis., This accessory makes it possible to perform machining operations on five sides of a piece and at an angle with but one set-up. The illustration shows the table tilted. It can be swung to the vertical position, and can be revolved full 360 deg. whether horizontal or elevated.



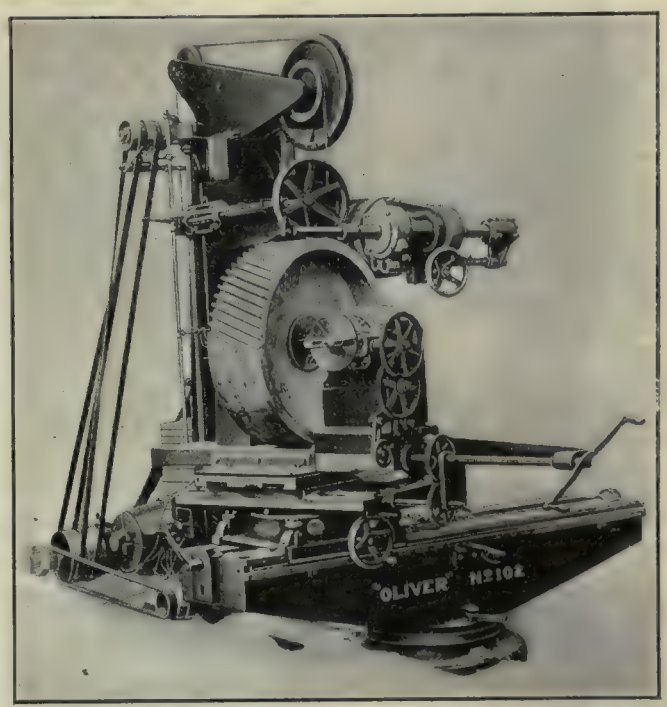
P & H UNIVERSAL TILTING AND ROTARY TABLE

To enable the operator to accurately locate the work there is a graduated dial. The table top is elevated by means of two coarse-pitch spur-gear segments driven through a worm and pinions; and it is revolved independently through a bevel gear and pinion. One revolution of the handle revolves the table 30 deg. and one revolution of the handle elevates the top $2\frac{1}{2}$ deg. Adjustment along the bedplate parallel to the spindle travel is accomplished by means of rack and pinion.

The T-slots or table edges are used to locate work and the top is provided with a trough to catch cutting compound. The table is 40 x 51 in. in size, and is $31\frac{1}{2}$ in. above the floor when in its horizontal position. The T-slots are $\frac{7}{8}$ in. in width. The net weight is 3,900 pounds.

Gear Cutting Attachment for Oliver Pattern Milling Machine

The Oliver Machinery Co., Grand Rapids, Mich., has recently placed on the market a gear-cutting attachment for use on the No. 102 pattern-milling machine



OLIVER PATTERN MILLING MACHINE WITH GEAR CUTTING ATTACHMENT IN USE

made by the concern and on which it is shown in the accompanying illustration. The attachment, known as No. 733, consists of a complete set of appliances for cutting spur, helical, bevel and worm gears. The outfit includes a 14 in. universal dividing head with tailstock, index plate, index chart, two faceplates, set of raising blocks, recessing change gears, quadrants and the connecting mechanism between the table and dividing head.

The machine is so arranged that in turning helical gears the gear pattern rotates according to the helix angle as the cutting progresses from the back to the front edge. The apparatus can be arranged to cut bevel gears. The chief features which the maker emphasizes are the adaptability of the machine, the speed of its operation and the accuracy of the work produced.

Baker Series C Industrial Tractor and Truck

A line of electric industrial trucks and tractors, known as Series C, has been placed on the market by the Baker R. and L. Co., Cleveland, Ohio. The tractor



FIG. 1. BAKER SERIES C TRACTOR UNDER TEST

is shown in Fig. 1 being subjected to an impact test, while in Fig. 2 the elevating platform truck is shown hauling a load.

The tractor can be furnished with either three or four wheels. A spring seat is provided for the driver, and the controls are all within easy reach. Heavy plate bumpers are provided at both the front and rear, so as to properly protect the battery and working mechanism. Both the tractor and the truck are said to be very easy of operation, because of the easy handling of the controls and of the steering.

The chief feature of the truck lies in the method of suspension of the frame on the power axle. The duplex compensating suspension, as it is called, is intended to care for the thrust due to driving and braking, the axle unit being connected to the frame through two yokes which pivot on the frame and are attached to the axle through ball-and-socket joints. The horizontal yoke on the top of the axle transmits the driving strain, while



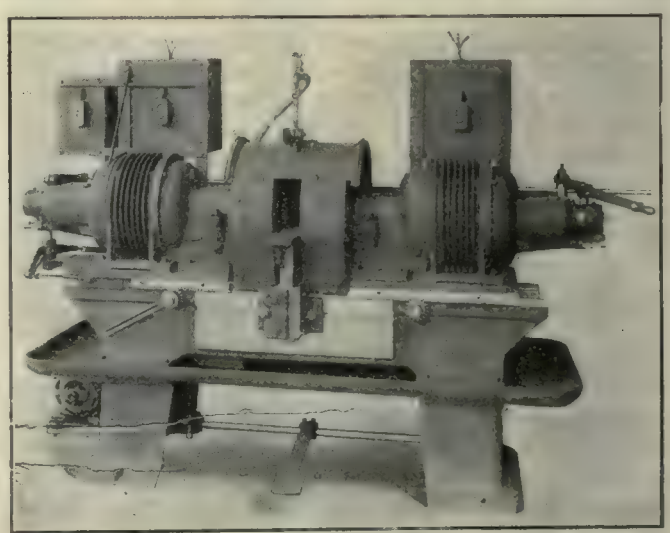
FIG. 2. BAKER SERIES C LIFT TRUCK

the vertical yoke on the side of the axle prevents it from rotating. The weight of the frame is carried on helical springs. The construction is said to provide great flexibility to the axle assembly.

Besly Type-I Two-Spindle Grinding Machine

The illustration shows the heavy-pattern direct-motor-driven, type-I, two-spindle, ring-wheel grinding machine recently placed on the market by Charles H. Besly & Co., Chicago, Ill. The machine is of the regular two-spindle type, for grinding two parallel sides of a piece simultaneously. It is equipped with two 7½-hp., 900 r.p.m., a.c., fully enclosed motors. The motors are fitted with specially designed end casings and large ring-oiling bearings. Push-button control is employed for starting and stopping. The starters are attached directly to the motor frame and are mounted in sheet-metal, dust-proof cases equipped with hinged doors, for access to the working parts.

The motors are mounted on bed plates, and the two inner end casings or bearing supports have footings on the plates machined on the same plane with the motor feet. The motors and plates can be moved along the bed of the machine by means of racks and pinions to accommodate different widths of work. This movement is necessary only to change from one width of work to another, as both spindles themselves slide endwise



BESLY TWO-SPINDLE GRINDING MACHINE

through the bearings in order to feed the wheels to the work.

The spindle feed movement is obtained through racks and pinions to which both hand and foot levers are attached, and it is actuated on both spindles through a connecting rod attached to a lever at the rear of the machine. When desired, the connecting rod can be disconnected and the right-hand spindle locked in a stationary position, while the left-hand spindle can be operated through the foot-lever movement. After the spindles have been moved forward to the work, a spring returns them to their starting position when the foot or hand lever is released. Endwise movement of the wheels is controlled by micrometer stop screws attached to each of the outer bearings. The bearings are phosphor bronze, the thrust being taken on flanges of large area. The flanges bear upon hardened steel thrust collars, and the thrust bearing is automatically oiled from the ring-oiling bearings. All bearings on the machine are dust-proof.

The bed plates of the motors slide on V's planed on the bed. The left-hand plate is equipped with an adjustment feature, which makes it possible to keep the grind-

ing wheels in alignment. The bed of the machine is composed of four parts; namely, two legs, to which are bolted a cast-iron pan, into which is attached the main bed. The bed has a T-slotted pad on the front for attaching work rests and fixtures of all descriptions. There are also two machined strips on the rear of the bed for attaching work rests or brackets.

The hood is centrally located on the bed, the end casings being attached to the motor heads, so as to remain close to the grinding wheels at all times. The top section of the hood is hinged and can be thrown back out of the way, to permit adjusting or changing the grinding wheels.

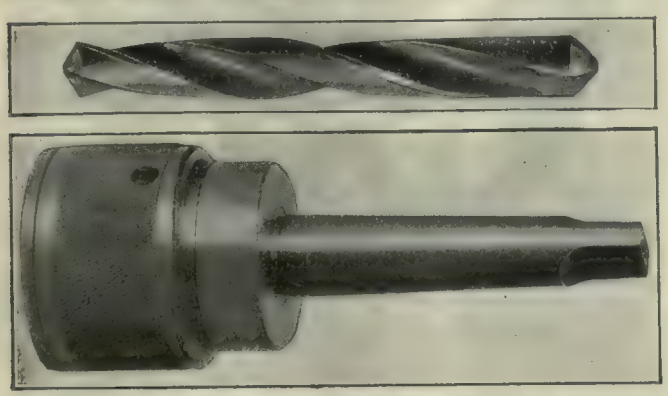
The machine is shown with a plain workrest. Various types, such as rocking, swinging and sliding ones can be used, the sliding type generally being controlled and moved by means of a rack and pinion. The machine as illustrated is equipped for wet grinding. A direct-connected motor-driven pump unit is used, being attached to the leg of the machine directly under the water pan. The starting apparatus for this pump unit is of the push-button type. The pump is of the rotary type and is connected to a three-compartment settling tank located at the rear of the machine.

The machine carries two pressed-steel ring-wheel chucks, into which can be set ring wheels 18 in. in diameter with grinding faces varying from 1½ to 4½ in. in width. Disk wheels 20 in. in diameter can be used if desired. The maximum opening between the ring wheels is 10 in., the height from the floor to the center of spindle is 39 in., and the floor space occupied is 50 x 96 in.

Wayne Chuck for Holding Broken Twist Drills

The Wayne Tool Manufacturing Co., Waynesboro, Pa., is placing on the market a chuck for holding twist drills which have been broken at the shank. The chuck shown in the illustration is said to be very simple and composed of only the shank, casing, two pawls, two screws and a casing plate.

The drill, shown at the top of the illustration, is ground to a 60-deg. point at the broken, or right-hand, end. This allows the drill to automatically center itself on a 60-deg. recess in the shank; and on turning the casing the drill is locked in place by the two pawls

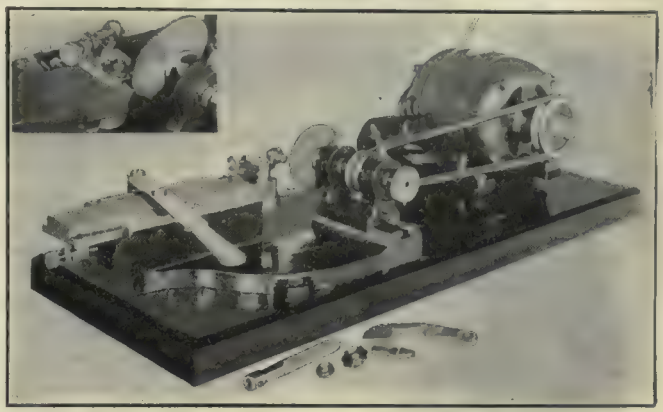


WAYNE BROKEN-DRILL CHUCK

gripping it in the grooves. No wrench is required to tighten or release the chuck. Since the chuck enables the use of broken drills which would otherwise be discarded, it is suitable especially to shops where twist drills are used in large quantities on production work.

Anderson Small Gear-Cutter Grinding Machine

The Anderson Die Machine Co., Iranistan Ave. and Admiral St., Bridgeport, Conn., has recently placed on the market a machine for grinding the teeth of small gear cutters, such as those used in automatic pinion-



ANDERSON GRINDING MACHINE FOR SMALL GEAR CUTTERS

cutting machines for clock work. The chief feature of the machine is the fact that the indexing for each tooth is done with reference to the form of the tooth, rather than by equal spacing. It is claimed that errors due to hardening may thus be corrected in grinding, so that each tooth does the same amount of work.

The accompanying illustration shows the machine mounted on a base, together with a motor and switch. In the view of the complete machine the diamond is shown mounted for dressing the wheel, while the portional view at the top of the illustration shows the manner of mounting a cutter for grinding. The cutter is mounted upon a stud secured to a bracket by two adjusting screws and carrying a finger. By means of the adjusting screws, the finger can be so adjusted that it will bear upon the tooth to be ground close to the face or edge that is to be sharpened.

Mounted on the lower end of the stud is a worm wheel operated by means of a knurled handle to which a worm is secured. This mechanism is for the purpose of feeding or positioning the tooth for the amount to be removed by the grinding wheel. For the purpose of positioning the grinding wheel so that the face of the tooth will always be radial with the center, the gage in front of the machine is used. The gage fits on the upper end of the stud, and the grinding head is adjusted until the two edges of the wheel come in contact with the two straight faces of the gage. The wheel head is then not disturbed for the purpose of removing more stock from the tooth, the whole fixture which supports the cutter being rotated about the stud.

The wheel truing device is also adjusted to and from the wheel by means of the knurled knob. Should it be necessary to form the edge of the wheel, the handle shown in front of the machine is used for holding the diamond. The spindle of the grinding head is hardened and ground and runs on ball bearings. The chuck for holding the wheel is a standard Webster-Whitcomb watch-lathe collet, and the base of the head casting is machined so as to be interchangeable with the head of the Webster-Whitcomb jewelers' lathe. The cutter is moved toward the wheel by means of a hand lever, and a micrometer stop is provided.

Oliver Twist Drill Grinding Machine

A drill grinding machine which is said to involve a number of radical features in handling its class of work is made by the Oliver Instrument Co., Adrian, Mich. The machine as shown in the illustration will handle the work automatically after the drill has been placed in position, thus avoiding variations of grinding due to the personal equation of the operator. The grinding wheel is mounted on an arbor supported by an arm arranged to give it an oscillating motion. The drill is held in a spindle mounted on a bracket on the arm at the right of the machine and is arranged so that a rotating motion is imparted to it at the proper time. The drill is fed forward until it comes up to the face of the wheel; after that all operations are automatic. The grinding wheel arbor revolves in ball bearings, and is mounted on an oscillating cradle. This cradle also has an axial movement, controlled by a cam in the body of the machine and the movements are so related that the wheel traverses the cutting lip of the drill until its periphery approaches the point, the drill remaining stationary during this movement. At this point the drill revolves automatically and the wheel moves forward. The effect of this movement is twofold, it increases the lip clearance toward the center of the drill and forms the heel clearance. The motion is arranged so that the wheel also cuts out the metal in front of that part of the chisel point where the drill lip usually drags.



OLIVER AUTOMATIC DRILL GRINDING MACHINE

The drill holder consists of a rotating spindle with a taper hole adapted to receive standard taper drill sleeves. In order to care for straight shank drills the nose of the spindle is threaded to receive a chuck for holding drills up to 1½ in. in size. The machine will grind two-, three-, or four-lip drills, and the only adjustment required for making the change is to shift the lever, shown on the front of the machine, to one of the three stations indicated on the segment. No adjustment is required for grinding various sizes of drills, and it is stated that grinding is done rapidly without danger of drawing the temper of the drill. The drill point is in full view of the operator.

The motions of the machine are all obtained by simple mechanism contained in an oil-tight case, which protects all parts from grit and insures the thorough oiling of all bearings. Either belt-driven or individual motor-driven machines can be furnished. The countershaft and driving pulleys for the belt-driven machines are bolted to the pedestal. The motor is housed in a dust-proof compartment in the base of the pedestal.

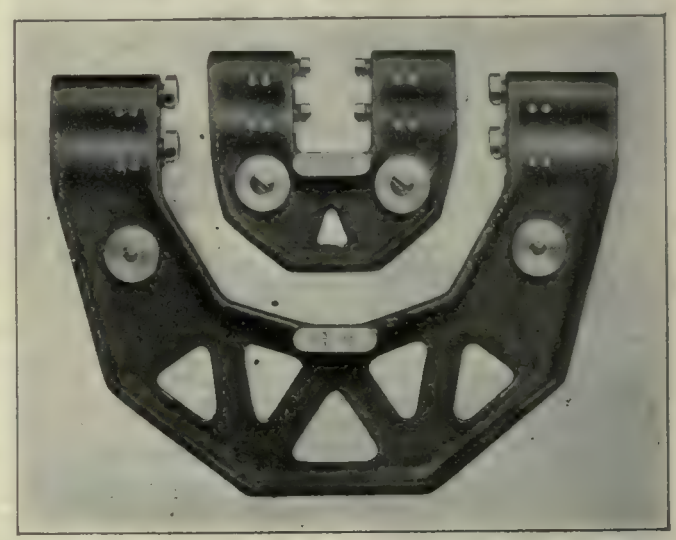
Specifications: Floor space, 20x32 in.; height, 52 in.; capacity; all sizes of taper shank drills; straight shank drills up to 1½ in. Weight; net, 550 lb.; shipping, 650 lb. Speed; countershaft, 1,000 r.p.m.; motor, 1,750 r.p.m.

Pratt & Whitney Adjustable Limit Snap Gage

The Pratt & Whitney Co., Hartford, Conn., has placed on the market a new adjustable-limit snap gage the frame of which, as shown by the illustration, is made in the form of a truss with the members so disposed as to secure great rigidity with a minimum weight of metal.

The gaging anvils are of tool steel, glass hard, with the gaging end of each anvil lapped accurately square with the axis and to a smooth, highly polished surface. The anvils are adjustable to any size within the limits of each gage, and the "go" and "no go" anvils may be set to any amount of tolerance desired. Each anvil is held in position by two opposed setscrews between which it is securely locked against accidental movement; and means are provided by which the gage, once set, may be sealed, so that the adjustment may not be disturbed without leaving evidence. The anvils are made with large heads to allow the gage to be used close to a shoulder.

Two separable buttons of brass, the parts of which are held together and to the frame by a single small screw, are furnished with each gage for stamping sizes, tolerances, tool symbols, and shop or job numbers, thus enabling the user to put a permanent marking upon his gage without striking or subjecting it to any treatment that might cause it to become distorted. The buttons are set into cored holes in the frame, and each part has a small shoulder that will not pass through the hole, so that when the two parts are screwed together they are permanently fastened to the frame and cannot be lost. Markings may quickly be changed by changing the buttons.



PRATT & WHITNEY ADJUSTABLE LIMIT SNAP GAGE

The gage is made in fifteen sizes, to gage from 0 to 12 in., the possible adjustment of each gage overlapping the next size in either direction.



NEWS SECTION

Annual Meeting of American Society for Testing Materials

The twenty-fourth annual meeting of the American Society for Testing Materials was held at the New Monterey Hotel, Asbury Park, June 20 to 24. The meeting was well attended, the early comers being particularly well represented. The report of the executive committee contained much of interest. The net increase in membership for the year was 154, about two-thirds of the previous year, due to business conditions.

A feature gratifying to the members is the increasing use of the society's specifications and methods of tests for materials. This is evidenced both by the increasing sale of the Book of A.S.T.M. Standards and by the increased use of the standards by engineers and architects in their specifications, particularly in municipal, state and federal government work and by public service bodies. Their use is also increasing in connection with export trade. Copies are now available in Spanish-English and editions of French and French-English are also in press. Complimentary copies are sent to all commercial attachés in foreign countries.

The development of engineering education shows a trend toward a distinct class of material engineers. This has led to the appointment of a Committee on Material Engineering Education, which is to include not only teachers but practising engineers so that the practical as well as the theoretical side will receive due attention.

Co-operation with other bodies is also a feature, the American Bureau of Welding, formed as a research bureau of the American Welding Society having F. M. Farmer as the representative of the A.S.T.M. The society also continues its work with the A.S.M.E., on the specification of materials for its boiler Code.

The greater part of the papers presented bear on subjects outside the field of the mechanical engineer, being devoted to preservative coatings and textiles, cement and concrete, road materials, ceramics and petroleum products. The last sessions were however, devoted to steel, wrought iron, cast iron and non-ferrous metals.

A special committee presented a lengthy report on steel, which contained recommendations affecting standards and tentative standards. These included track bolts, steel for buildings, for locomotive rails, ships, cars, pipe and automobile steels. Another committee on the heat treatment of iron and steel brought in a preliminary report which contained definitions and suggestions that will be referred to later.

A paper on "Impact Tests on Cast Steel" by F. C. Langenburg gave a number of tests to determine the effect of phosphorus on cast steel; the effect of different carbon and manganese contents; and the effect of heat treatment on acid open hearth cast steel. There were also reports on comparative results of impact tests on forgings and castings.

The paper by R. S. MacPherran on "Tests of Steel at High Temperatures" dealt with the effect of different alloys for the purpose of securing information as to the best material for use with temperature ranging from 600 to 1,000 deg. Fahrenheit. This included nickel, chromium, manganese, etc. The tests, though not conclusive are interesting and indicate which forms of carbides tend to strengthen steels at high temperatures.. These investigations should be studied by builders and designers of internal combustion engines.

C. E. Margerum presented a very interesting paper on testing the shock strength of hardened steel. This paper needs to be studied to secure the information it contains. It indicates, however, that hardness, as indicated by Brinell tests, is not a measure of ability to resist impact. The impact strength seems to increase as the Brinell hardness declines until about the 550 point. Then impact strength drops a little until 500, after which it falls off more rapidly than the drop in hardness, down to the point of annealing.

The wrought iron committee report covered wrought iron pipe, boiler tubes, bolt iron, chain, staybolts, etc.

New Method of Manufacturing Cast Iron and Steel in France

(By Paul H. Cram, Consul, Nancy)

It is reported that the Basset Steel Works (Aciéries Basset) have recently discovered a new method of manufacturing cast iron and steel. Lucien Basset states that, after having obtained satisfactory results in a furnace of 25 tons capacity, he has recently made conclusive experiments in a 100-ton furnace resulting in the manufacture of steel at a cost of 110 francs a ton. This is less than the average pre-war cost. Mr. Basset has also stated that his company will soon begin the construction of 12 furnaces having a total daily capacity of 3,000 tons of steel. He estimates the total cost at 30,000,000 francs.

According to this method the coal which is consumed in the furnaces enters into the manufacture of metallurgical products simply as an element producing heat and as an element which throws out gases acting on the raw material. It appears that the application of these principles results not only in an important economy of fuel but also eliminates the necessity of utilizing coke. Consequently the discovery of this process is of considerable importance to France.

New Detinning Plant

In order to handle more satisfactorily its growing detinning business in the West, the Metal & Thermit Corporation has constructed and will shortly place in operation in South San Francisco, Cal., a large new plant for the production of detinned billets, in addition to the detinning plants already operated by this company for several years at Chrome, N. J., and East Chicago, Ind.

The new South San Francisco plant has also been equipped with a large welding shop containing excellent equipment and facilities for undertaking repairing by the thermit process. With this new equipment at its disposal the company is exceptionally well prepared to render prompt and efficient service. The new plant will be in charge of Ed Kardos, superintendent. The cost of the plant is estimated in the neighborhood of $800,000. The former offices of the company located at 329-333 Folsom Street, San Francisco, have been moved to the South San Francisco plant.

Aluminum Solders

All tests on recent aluminum solder at the Bureau of Standards have been completed and Circular 78, "Solders for Aluminum," will now be revised to include these tests. In spite of claims made by those interested, no solder for aluminum has yet been found which will withstand the corrosion test, although the fused zinc chloride solders withstand corrosion for the greatest length of time.

The British Iron and Steel Situation

By WILBUR J. PAGE
(Trade Commissioner, London)

With the absolute stagnation in the engineering trade brought about by the coal strike, the improvement in the British iron and and steel trade that was noted early in April has entirely disappeared, with the result that now there are practically no bids for either foreign or domestic business. To find a blast furnace still in operation is a rarity today. British makers' difficulty when the strike is over will be to obtain orders to set their plants working again, unless they can afford to sell at considerably lower prices than they are now quoting. In many cases the present prices are at a level below actual cost of production. Therefore it is evident that British iron and steel producers can not possibly hope to lower their selling prices much more unless they can appreciably lower their costs.

During the week a further reduction of 20s. per ton was announced in the price of hematite iron for home trade. The home and export prices for East Coast mixed numbers now stand at the same figure, at least so far as official quotations are concerned, at 160s. per ton, but in actual practice export business is a matter of negotiation and 155s. per ton is probably nearer the market figure. It is generally believed as far as home trade is concerned, that a further reduction will be necessary before there is any revival in demand. Production in Cleveland iron is practically at an end with the exception of a limited quantity produced by two furnaces which are on slack blast. The quantities of No. 3 G. M. B. Cleveland iron in stock have rapidly diminished, and makers who have any for sale are effecting an advance of 10s. per ton above the official minimum.

Because of the shortage of coal to keep the coke ovens heated, there is danger that a majority of the coke ovens in the country will have to be allowed to go cold within the next week. This will be disastrous to any early resumption in the iron and steel trade, even when the coal strike is settled, owing to the length of time which it will take to reheat these coke ovens.

Perfect Air Service

For the first time in its history, the Air Mail Service last week had 100% performance on all divisions, including the transcontinental route from New York to San Francisco. Second Assistant Postmaster General Shaughnessy has sent out a bulletin of congratulations to all the field forces for this splendid showing.

Changes in the Air Mail Service, which become effective July 1, involve the discontinuance of the route from Chicago to Minneapolis, and the route from Chicago to St. Louis. The aviation fields at College Park, Maryland, Bustleton, Pennslyvania, Newark, New Jersey, St. Louis, Missouri, Minneapolis, Minnesota and La Crosse, Wisconsin, will be abandoned shortly after.

The transcontinental route from New York to San Francisco will be continued as usual under appropriation made by Congress. It has been necessary to abandon the lateral routes because Congress has not appropriated any money for the operation of these routes during the next year. The aviators and other men on these discontinued routes will be transferred to the transcontinental route and as far as possible utilized on regular work or on the reserve list, as will the equipment.

Business Conditions as the Big Banks of the Country See Them

National City Bank of Chicago Declares Business Structure Is Stronger—Increased Gold Reserves Improve Banking Situation

The problems of the present situation in the market for international exchanges as seen by A. H. Baldwin, assistant manager, International Trade Department, Guaranty Trust Company of New York, are of such extreme complexity that it is difficult to find a parallel for them in any former period. The world has never before seen such an intricate and highly developed system of international trade and finance torn and disorganized by the epochal events of the last seven years. Notwithstanding the exceptional difficulties that perplex even the keenest professional skill, there is to be observed a very considerable volume of speculation in foreign currencies by American investors who base their transactions upon all sorts of rumors, theories, or impressions as to the future movement of sterling, francs, marks, lire, or other currencies, rather than upon a close study of the principles that apply in this field of financial operations.

There are such principles, which in normal times afford a reasonably firm foundation upon which to construct a policy of operation designed to minimize the risks in exchange transactions, although they have never eliminated them. But, today, the new factors which have been introduced as a result of the war are so many and have so complicated the situation that the risks are greater than ever before. The professional exchange operator finds them extremely difficult to analyze, while the layman is almost completely at their mercy. The most careful calculations are likely to be upset at any moment by unexpected developments in the political, financial or economic situation abroad. The former preponderant influence of trade balances and gold reserves upon exchange is greatly modified, and psychological factors have become important to a far greater degree than ever before.

At present, when one seeks for a prophet who will fortell the future of exchange, one seeks in vain. The question is so interwoven with doubtful factors that no answer is forthcoming and a day-to-day policy is the only one practical, even for an expert trader. Gold is used to restrain fluctuations in European currencies within fixed limits, but, today, international debts are upon a scale that precludes any settlement of balances through the shipment of gold, even if nations have suffered no depletion of their stocks of this metal.

In pre-war days one could assume political stability as reasonably assured and the approximate balancing of expenditures and income by governments. Now, even the most casual study of the budgets of European nations, their vast issues of paper money and their political disorders discloses how uncertain and unpredictable are these factors in a number of countries. These are at present influences materially affecting the future movements of exchange.

It is recognized that, lacking gold, the only method of payment of foreign debts open to the nations abroad is through the export of goods. Who is there at this time who can foretell with any clear vision the future of industry and markets? At the moment, the entire machinery of international trade is seriously dislocated. Primary markets throughout the world, normally sources of raw materials and food for Europe, find their purchasing power too weak to permit the absorption of the customary volume of imports, and exporting markets, in turn, are unable to buy the manufactured products of industrial Europe on the pre-war scale. This condition renders estimates of production and consumption and the movement of commodities between nations extremely problematical.

The productive capacity of many countries, the United States among them, has been tremendously stimulated by the war and it is at present extremely difficult to see where the markets are to be found for all this great total of commodities.

Another factor that is seriously influencing the judgment of observers of exchange conditions is the morale of the laboring class in various countries. A gospel of restriction of production has been preached for many years by leaders of labor. It has already had disastrous results in Great Britain. Is this fallacy to persist? If it is to continue to influence the British worker, what will be the future of industry in that nation, which is so completely dependent upon her ability to compete for trade in overseas markets? Can she ever hope to rehabilitate her finances unless her labor costs are brought into reasonable relation with similar costs in Germany, Belgium, Japan, or even the United States? The coal strike of the last two months has already dealt a heavy blow to her trade position, and this is undoubtedly reflected in the present rate of sterling.

The crippling of British industries through lack of coal has had its immediate effect upon her exports, and every week of reduced production that elapses weakens further the competitive position of the nation and renders the task of rehabilitating her finances more difficult. Similar problems as to the probable trend of what we may term industrial morale are found, also, in Belgium, France, Italy, Spain, and other countries, and they add to the perplexities which confront the observer of the movements of exchange rates. The increase of export trade to the fullest possible volume is now so vital to the countries in question that any element which hampers its progress assumes an importance in connection with exchange far greater than in normal periods, and causes fluctuations in rates that would have seemed most extreme in pre-war days.

It can readily be seen from these brief references to but a small percentage of the many phases of the present exchange problem that its stable elements are few and that all are now especially subject to the influence of the unexpected. How sensitive the exchange rates are in this respect has recently been shown by the effect of the payment in part of the German indemnity upon sterling and francs. Germany was undoubtedly in a position to throw large amounts of British and French funds on the market for the purchase of dollar credits, and no outsider could have made any estimate of the probable development of the negotiations which preceded this incident, nor been conversant with the methods Germany might use to effect these payments. As future settlements are made, no doubt other rates may be influenced, depending upon the credits which German trade has established in different foreign countries.

With exchanges so unstable as we find them, it is evident that only by a most intensive study of foreign conditions and the closest analysis of the known political, industrial and economical situation in each country can even tentative conclusions be reached as to their probable trend. Haphazard operations in this field are as completely speculative today as can be imagined.

It can be affirmed, however, that the careful student should be qualified to recognize currently those developments that promise definite improvement. When industries are again active, when economy is seen in government expenditures and their budgets once more approximate a balance, when labor is efficient and productive, when paper currency is reduced in volume and exports are large, it can then safely be concluded that matters are definitely on the road to recovery and that exchange rates will also strengthen.

Slow but Steady Improvement Seen by the First National Bank of Boston

Slow but steady improvement in the business situation is taking place month by month. Fear of a financial collapse has entirely vanished and has given way to a feeling of quiet confidence that our industries, taken as a whole, are gradually bettering their position. The existing credit strain is gradually relaxing. Speaking generally, New England member banks have reduced their borrowings from the Reserve Bank to reasonable amounts. This is very significant, inasmuch as this section a year ago, having experienced first the shock of deflation, was obliged to rediscount most heavily. Similarly it is now well along the road toward its normal financial balance and strength. This objective has been reached by the great progress which has been realized in liquidating inventories, coupled with the sub-normal volume of business now being done.

In reviewing the past eighteen months, it is now strikingly apparent that a vast amount of constructive and co-operative effort between banks and industrial concerns has been accomplished, which has resulted in averting countless failures and in saving enterprises which possessed merit but which were prostrated for the time being by an unprecedented world condition. Each day sees some situation in the industrial fabric mended and thereby continually the foundation for better business later on is being broadened and strengthened. Business, although small in amount and in many lines on a sub-normal profit basis, is gaining in health. It is true that deflation is far from its end and that we cannot expect free and active business until the values in the various commodities are nearer a parity.

The metal shops, utilizing specially steel, are finding business difficult, as is to be expected when the steel industry is operating at about one-fourth capacity. Automobiles, pianos and higher priced goods are encountering severe sales resistance, although general retail trade is reported as excellent. The encouraging factor in this connection is the generally favorable crop prospect throughout the world and the report that food rationing is practically at an end, which was a necessary forerunner to a demand from abroad for our raw materials and manufactures.

The demand for iron and steel has fallen off further during the past month and the steel industry now is experiencing a full measure of depression such as it has not felt in many years. Operations of furnaces and mills have continued to decline until, at this writing, operations are averaging less than 30 per cent of capacity. Pig iron output in May amounted to about 1,215,000 tons, which is the smallest for any full month in thirteen years. Steel ingot production also has been at a low rate, amounting in May to 1,265,850 tons, an increase of about 50,000 tons over April. Working at capacity the country could produce close to 4,000,000 tons per month. Both pig iron and finished steel prices have continued to decline, with price cutting retarded principally by lack of inquiries on which to quote.

In New England there is more activity in cotton, in woolens and in the hide, leather and shoe industries. Except in wool the raw material situation has measurably improved.

The most noteworthy price change of recent weeks was a reduction of $5 on wire products by the leading interest, which was the first deviation by that interest from its April 13th price list. This reduction did not stimulate wire business. Reports have not been particularly encouraging in any direction. Railroad businees has been almost negligible, although a fair volume of repair work is expected shortly. The automobile industry appears to have provided for its immediate needs. The machinery trade is extremely quiet. Agricultural implement makers are not active. Steel jobbers have been buying extremely cautiously. Exporters are taking little material. The demand for wrought pipe has been dull, due to slackening of oil field development resulting from the slump in the oil industry. Anticipated buying of cast iron pipe by municipalities has not yet materialized to any great extent and prices for this product are weak. One of the most encouraging signs in the steel situation is the increase in small building jobs requiring small amounts of structural steel.

Commission on Industrial Waste

A federal commission to study waste elimination in industry is proposed in a bill which has been introduced by Senator Calder. The bill is intended to continue and to amplify the survey made by the Federal Engineering Societies at the instigation of Herbert Hoover, who at that time was president of the organization.

Senator Calder's bill provides that the Commission is to be known as the United States Industrial Waste Commission. It is to be composed of seven commissioners "of iminent attainment." The members are to be appointed by the President. The bill specifies that the Secretary of Commerce is to be chairman of the Commission.

The Commission is directed by the bill to make a final report on or before Sept. 21, 1922. The report to cover waste in "timber, power, transportation, oil, coal, essential minerals and other basic raw materials." The Commission is specifically instructed to recommend improved methods and means of eliminating intermittent and seasonal production. The commissioners are to serve without salary.

There is reason to believe that the Committee on Commerce, to which the bill has been referred, will take prompt and favorable action on it. The attention of the committee has been called to the fact that needless waste in industry is levying a heavy toll on business and on the public. It is emphasized that no regulation is contemplated in this legislation and that there is not to be a suggestion of interference with private initiative.

The Basic Causes of Waste

It is believed that such a commission will be able to draw public attention to some of the basic causes of waste and to practical methods by which they may be checked.

Irregularity of employment is recognized as one of the matters to which the commission would have to give much attention. The Committee on Commerce, in considering the bill, has before it information to the effect that the shoemaker is idle 35 per cent of his time. The clothing worker is idle 31 per cent of his time. In other industries conditions are even more unfavorable. Data before the committee show that labor, directly and indirectly, is responsible for 88 per cent of the total cost of building. This high labor cost is due, in part, to the fact that even in normal years, building labor is idle one-third of its time.

The Super Power Survey is cited as an effort to eliminate waste. In the Boston-Washington industrial area some 17,000,000 horsepower is being produced. Of this, only 10,000,000 horsepower is actually productive. The remaining 7,000,000 horsepower either is wasted or is used to transport the fuel for the 10,000,000 horsepower actually effective.

Interlocking Electrical Transmission

The Super Power Survey is expected to show that the gradual development of an interlocking system of electrical transmission between super-power plants, to which coal could be transported economically, and a gradual development of hydro-electrical plants would result in saving most of this 7,000,000 horsepower. In addition, by-products could be saved and the transportation system correspondingly relieved. This has been cited to the committee as one example of what may be possible along the line of waste elimination.

In addition, the committee has been furnished with data showing that there is great waste resulting from lack of co-ordination of railways, waterways, coastwise shipping, which, among other things, would relieve the rail lines of much of their burden of low grade, unprofitable freight. Specific instances of waste in coal production, petroleum production, lumber manufacture and many other activities have been pointed out the committee.

Aviation School Planned for Bolivia

There is a project on foot which has the approval of the Bolivian Government for the foundation in that country of an aviation school for the purpose of developing commercial flying and improving communication with the adjoining countries. Included in the equipment of the proposed school will be hangars, mechanics' shops, photographic workshops and other supplies. The names of the interested parties are obtainable from the Latin American Division of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

A. S. M. E. 1922 Meeting

The next spring meeting of the American Society of Mechanical Engineers will be held in Atlanta, Ga., May 8 to 11, 1922.

Lower Steel Prices

The steel companies, both large and small, are said to be no longer adhering to the price schedule established last April. Prices have been shaded for some time by the smaller plants and recent announcement of lower prices has precipitated a general reduction with indications of still lower prices in the near future.

Railroad Equipment Needs Repairs

Thirteen per cent of the open-top equipment of the railroads in the United States is in bad order. Due to their financial condition, most carriers are in no position to undertake the repair of this equipment at present. Should the demand for this equipment increase rapidly this fall, this fact will have an important bearing on the car supply, since the rapid repair of steel cars is impossible. Only a very small percentage of railroad shops are equipped to repair steel cars.

Ruling Scale by Light Waves

It is interesting to note that it is now possible to construct scales for the measurement of length directly from the fundamental wave lengths of light without the use of any intermediary standard. As an example of work of this sort which is now being regularly carried out, it may be mentioned that the Bureau recently completed the rulings on a 6 in. scale using light waves from a tube containing Neon (wave length 5800 to 6600 A) as the length standard. The work was done for and the scale has been delivered to the Brown & Sharpe Manufacturing Co.

Window Displays to Promote Sales

Window displays of machine and other manufactured products are being used in various cities to attract attention and stimulate sales. In some cases these are the products of a single company, as was recently the case in Harrisburg, Pa., where the "farmotor," Harrisburg steam engines, steam turbines and textile machinery were displayed by the Harrisburg Corporation at the plant of the Harrisburg Foundry and Machine Works of that city. In other cases the various manufacturers make combined displays in the various store windows in town of products manufactured locally.

Indianapolis Firms Interested in Export Trade

Several Indianapolis firms interested in export trade in Latin-American countries and particularly in Colombia and Venezuela held a meeting recently at which P. L. Bell, trade expert of the Department of Commerce told the executives how it might be done. The companies represented were the International Machine Co., the Diamond Chain Manufacturing Co., the Swan-Myers Co., the Van Camp Hardware Co., the Wheeler-Schebler Co., Nordyke & Marmon, the Jackson Manufacturing Co. and the C. J. Walker Co. Mr. Bell declared business will be slow in general lines in these countries for some time and what most was needed was the right sort of representation. He said it took personal contact and friendship.

Welding Results in Annual Saving of Millions of Dollars

In a recent visit to one of our large industrial plants a prominent member of the American Welding Society made a careful estimate of the enormous savings that resulted from the use of welding at this plant. This estimate proved conclusively that millions of dollars were saved by the company in the reclamation of defective castings and the repair of broken, worn and incorrectly machined parts. Complicated structures such as gear housings, pulley wheels, tanks, etc., were being constructed entirely by the use of welding. New applications were found daily. This company is using automatic machines and both gas and electric hand welding; a total equivalent of some 60 welders.

Trade Organizations and the Law

The attitude of the federal administration toward the trade organizations of the various industries has been made clear by recent announcements by the Secretary of Commerce and by the Attorney-General. The Attorney-General has given notice that he will push a test case against one of the open-price associations. There will be no dragnet thrown over all the associations and there will be no wholesale indictments, Attorney-General Daugherty declared. Secretary Hoover authorized the following statement:

"The relation of trade associations and trade institutes to the anti-trust laws have been discussed at great length in the administration. Of the many thousands of such organizations there are a small minority who have degenerated into ways that make for restraint of trade.

"All are agreed that the purposes and actions of the vast majority of national associations are a constructive contribution to public welfare. Their activity in promotion of better practices, advancement of technical processes, simplification of production, standardization of quality, extension of foreign trade, commercial arbitration, ets.—all make for more efficient industry and business. Many of them collect information as to the production, stocks of raw and other material, percentage of industry in active operation, total orders in hand—all of which when available to the public, contribute both to stability and the increasing efficiency of industry and to the protection both of the smaller manufacturer and the consumer. The Department of Commerce wishes to co-operate and assist with all of this sort of effort.

"A smaller number of such associations have been engaged in the collection of data on the prices for the exclusive use of their members. Some of these associations have been charged with delimiting areas of commodity distribution among their members and other misuse of information.

"Whether these latter practices constitute a violation of the national anti-trust laws must be determined by the courts, and this the Attorney-General is vigorously proceeding to find out.

"All this raises anew the question of the authority of the Federal Trade Commission. The original conception of the Trade Commission was that it should among other things, advise business men as to what constituted a violation of the restraint of trade laws, but these powers were struck out in the course of original legislation. It seems to me that the seven years' experience with the Commission should now enable a reconsideration of its powers with a view to giving it a more constructive function, subject, say, to review by the Attorney-General, by which it could remove the uncertainties from the mind of business men as to the line between the field of co-operation for promotion of production and trade in public interest and the field of practices against public interest. There is nothing so destructive of business as uncertainty, and business has inherently enough uncertainty to deal with without this one.

Alcohol as Locomotive Fuel in Brazil

Consul C. R. Cameron, of Pernambuco, reports that there are in his district approximately 80 modern cane-sugar factories, which have about 800 miles of railway of from 0.75 to 1 meter gauge, operated at present by wood-burning locomotives. The fuel problem, however, is becoming a serious one and as a result the sugar-mill operators are turning their attention to the matter of reducing wood consumption and finding substitutes. Consequently great interest is being shown in the substitution of alcohol, which is produced in large quantities on the sugar plantations from the molasses finals. Pernambuco has recently adopted the use of alcohol to which 5 per cent gasoline has been added as an automobile fuel (see *Commerce Reports*, March 15, 1921). The manufacturers are, therefore, naturally interested in using their own inexpensive product for their railways. The current price of alcohol is about $0.22 per gallon, but the cost to the producer is much less. It is suggested that American manufacturers of locomotives capable of burning alcohol communicate with the Pernambuco sugar mills, a list of which may be obtained from the Latin American Division of the Bureau of Foreign and Domestic Commerce or from any of the district or co-operative offices by referring to file No. L.A.-12012.

Detailed Statistics Concerning the Manufacture of Machine Tools in the U. S.

A preliminary statement of the general results of the 1920 census of manufactures has been issued by the Bureau of the Census, Department of Commerce, furnishing statistics concerning the value of machine tools manufactured during the year 1919. Reports were received from 403 establishments engaged principally in the manufacture of this class of machinery. The products for the year were valued at $212,225,000.

Of these establishments, 102 were located in Ohio, 46 in Massachusetts, 33 in Connecticut, 32 in Pennsylvania, 31 in Michigan, 29 in New York, 28 in Illinois, 24 in Wisconsin, 15 in Indiana, 14 in New Jersey, 13 in Rhode Island, 7 in Kentucky, 6 in Vermont, 5 each in Minnesota and Missouri, 3 each in Maine and New Hampshire, 2 in California, and 1 each in Delaware, Iowa, Kansas, Maryland and Washington.

The statistics are summarized in the following statement. The figures shown are preliminary and subject to such change and correction as may become necessary from a further examination of the report.

SUMMARY OF STATISTICS FOR THE MANUFACTURE OF MACHINE TOOLS—1919

Number of establishments		403
Value of products		$212,225,000
Lathes:		
Engine	$22,630,000	
Turret	10,141,000	
Bench and other	4,094,000	36,865,000
Milling machines:		
Plain	$6,470,000	
Universal	66,025,000	
Vertical	2,370,000	
Automatic	1,232,000	
Other	2,776,000	18,873,000
Grinding machines:		
Plain	$11,600,000	
Universal	2,066,000	
Other	1,725,000	15,391,000
Drilling machines:		
Radial	$5,702,000	
Multiple spindle	1,999,000	
Sensitive	1,975,000	
Upright	1,754,000	11,430,000
Screw machines:		
Automatic	$7,076,000	
Hand	3,159,000	10,235,000
Boring machines:		
Horizontal	$4,438,000	
Vertical	4,330,000	8,768,000
Planers		8,129,000
Presses:		
Punching	$5,400,000	
Other	957,000	6,357,000
Gear cutting machines		6,257,000
Hammers:		
Pneumatic	$3,070,000	
Other	1,882,000	4,952,000
Shapers		4,231,000
Pipe machines		3,178,000
Shears		1,566,000
Broaching machines		1,395,000
Bending machines		942,000
Portable tools		10,908,000
All other machine tools		26,075,000
All other products		36,673,000

Now It's a Decimal System

A bill (S. 565) has been introduced into the Senate to establish a standard *decimal* system of weights and measures. Because of its novelty we reproduce the bill in full. Agitation and change seem to be in the air, nothing else could excuse such a proposition. It takes away the present inch, which is the basis of all machine measurements, and substitutes the foot, which is as bad as the meter, so far as machine building is concerned. The bill has been referred to the Committee on Agriculture and Forestry, which probably means that it will be plowed under or lost in the woods. It should also be noted that the author fondly asked for it to go into effect on Jan. 1, 1922, but it is not compulsory.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that the primary linear standard for the weights and measures of the United States shall be the English foot as commonly used and established as a measure of length in the United States of America and in the United Kingdom of Great Britain and Ireland.

The standard decimal graduations of the foot shall be the tenth, which shall be denoted the decimal inch; the hundredth, which shall be denoted the line; and the thousandth, which shall be denoted the point.

The square of the foot shall be denoted the square; the square of the decimal inch shall be denoted the decimal square; the square of the line shall be denoted the line square; and the square of the point shall be denoted the point square.

The cube of the foot shall be denoted the cube; the cube of the decimal inch shall be denoted the decimal cube; the cube of the line shall be denoted the line cube; and the cube of the point shall be denoted the point cube.

The standard weight shall be the ounce, which is the weight of the decimal cube of water at maximum density. The mill is the thousandth part of the ounce. The bushel is the weight of one thousand ounces, or of the cube of water at maximum density.

Sec. 2. That the American centimeter, or ameter, is the third part of the decimal inch and may be designated am.; the American cubic centimeter, or acube, is the twenty-seventh part of the decimal cube and may be designated ac.; the American gram, or agram, is the twenty-seventh part of the ounce and may be designated ag.; and the American liter, or aliter, is the volume of one thousand acubes and may be designated al.

Sec. 3. That the standard measure for commodities shall be the keg, which is the volume of the cube. The common divisions of the keg are the half, which shall be denoted the half keg; the quarter, which shall be denoted the peck; the eighth, which shall be denoted the gallon; the sixteenth, which shall be denoted the pot; and the thirty-second, which shall be denoted the quart.

The fluid ounce is the volume of the decimal cube, the dram is the tenth part of the fluid ounce, and the pint is ten fluid ounces or the volume of ten decimal cubes.

The capacity of all containers in which either liquid or dry commodities are packed for measure or sale shall be indicated for liquids in kegs, pints, or fluid ounces, and for dry commodities in kegs, decimal cubes, or ounces.

Sec. 4. That the water flow unit is the flow of one cube of water in one second of time.

The work unit is the work required to raise one ounce the height of one foot.

The power unit is the power required to raise one ounce the height of one foot in one second of time.

The thermal unit is the heat required to raise one ounce of water one degree of the scale of the Fahrenheit thermometer.

The pressure unit is the pressure of one ounce upon the surface of one decimal square.

The units hereafter used by the Bureau of Standards shall be the units established by this Act.

Sec. 5. That the common inch is the twelfth part of the foot; the yard is three feet; the fathom is six feet; the rod sixteen and one-half feet; the furlong is forty rods; and the mile is three hundred and twenty rods.

The acre is one hundred and sixty square rods.

The pound is sixteen ounces; the ton is two thousand pounds, or thirty-two bushels; the quarter is five hundred pounds, or eight bushels.

The enumeration of the foregoing common measures shall not be construed to forbid the use of other common measures not defined in this Act.

Sec. 6. That section 3569 of the Revised Statutes is hereby repealed.

Sec. 7. That this Act shall take effect on January 1, 1922.

The best thing about the bill is that it evidently hasn't a chance of being passed. In most ways the metric system is preferable as this upsets the unit of measurement for all machine building, which is the inch and not the foot. The adoption of an entirely new system of measurement is unthinkable at this stage of the world's development.

EXPORTS OF METAL WORKING MACHINERY CONTINUED TO DECLINE DURING MAY, ACCORDING TO RETURNS TO THE BUREAU OF FOREIGN AND DOMESTIC COMMERCE. THE COMPILATIONS OF THAT BUREAU, TAKEN FROM SHIPS' MANIFESTS, SHOW THAT THE EXPORTS DURING MAY, 1921, WERE VALUED AT $1,275,971. THIS COMPARES WITH $2,055,422 IN APRIL, 1921, AND $4,566,390 IN MAY, 1920. THE DETAILED RETURNS ARE AS FOLLOWS:

	May, 1920	May, 1921
Metal-working machinery—		
Lathes	$829,434	$269,835
Other machine tools	1,318,478	254,326
Sharpening and grinding machines	276,057	82,183
All other	2,142,421	669,627
Total metal-working machinery	4,566,390	1,275,971
Exported to—		
Belgium	208,021	8,349
France	609,006	385,908
Italy	309,156	3,840
Norway	13,149	469
Spain	113,184	13,667
Sweden	43,298	5,667
United Kingdom	1,366,341	180,365
Canada	689,442	99,596
Mexico	45,046	66,936
Cuba	76,740	20,926
Brazil	38,295	2,297
Chile	5,239	9,826
China	71,676	28,609
British India	175,517	132,707
Japan	415,030	88,073
Australia	57,288	23,620
Other countries	329,962	200,166

Business Items

The foundry of the New England Steel Casting Co., at East Longmeadow near Springfield, Mass., was recently destroyed by fire.

The Hoffman-Benedict Tool and Die Co. has been incorporated with $35,000 capital stock by J. Fly and William Fritsche.

The Baltimore, Md., Board of Trade reports the Seaboard Steel & Iron Corp., manufacturers of metal goods, as among the six new concerns established in that city in May.

The Midland Barge Co., Midland, Pa., has been incorporated with $100,000 capital stock by B. W. Hunsicker, S. N. Craig and A. K. Hamilton.

The Dayton Disc Wheel Co., incorporated for $100,000, will erect a plant during the next year for making disc wheels for automobiles. George F. Deady is president.

James Cunningham, Son & Co., builders of automobiles in Rochester, N. Y., have increased their capitalization from $1,200,000 to $3,200,000.

The Pacific Machine & Blacksmith Co. has been organized at Astoria, Oregon, to own and operate a machine shop. The incorporators are Alex Brenner, Walter Christofferson and Harry P. Olsen.

The Service Clock Co. has been organized to manufacture automatic clocks, time recorders, etc., at Albany, N. Y. The directors are F. H. Butchem, Thomas Halle, James L. Watson, H. B. Holland and Hannon E. Norris, all of New York.

The Sharon Pressed Steel Co., Sharon, Pa., has been reorganized and has added to its equipment. The new president is H. W. Torney, while Arthur W. Swan is general manager. The plant has a capacity of 1,500 car and truck frames per day.

The Naval Operating Base Air Station, Hampton Roads, Va., is securing estimates for a new machine shop 46 x 80 feet with two wings 50 x 144 feet as well as a carpenter shop 80 x 180 feet.

The Boston and Albany Railroad Co., recently completed a new brick, concrete and steel constructed machine shop building at the Pittsfield, Mass., yards of the company.

The Builders' Iron Foundry, Inc., 9 Codding St., Providence, R. I., has recently completed the erection of a one-story brick and steel machine shop building on Kinsley and Sims Ave., which will give approximately 12,000 sq. ft. additional floor space.

The Platt Iron Works, Dayton, O., announce a $50,000 addition to their plant, which will practically double its capacity for the manufacture of machinery as in the past. This firm was formerly known as the Smith, Vail, Stilwell and Pierce Co.

B. F. Avery and Sons have opened a plant is Louisville, Ky., for the manufacture of the Champion line of harvesting machinery. This line was originally made in Springfield, Ohio, but it was deemed best to open a plant further south owing to the growth of diversified farming in the southern part of the country. The plant is to employ about 500 men.

The Scoville Manufacturing Co., Waterbury, Conn., recently completed an addition to the brass mill plant on Bridge St., Waterbury. The addition is of brick, concrete and steel construction and is modern in every way. It is one story high and gives a floor space of approximately 25,000 square feet.

The office of the Aetna Machinery Corporation after July 1 will be located in the Merchants Bldg., 156 Market St., and the yard and warehouse at 45-47-49 Greene St., Newark, N. J. The company will continue to handle both new and used machine tools.

The Adell Manufacturing Co., Inc., of Orange, Mass., has recently been incorporated with a capital stock of $90,000 to engage in the machinery manufacturing business. The officers are John A. Adell, president, Orange; Carl C. Harris, treasurer, Orange.

The Zina Goodell Corp., of Salem, Mass., has been organized and incorporated with a capital stock of $125,000 to manufacture hardware, tools, etc. The officers of the concern are Oliver W. Goodell,, president; Edward R. Fallon, of Swampscott, Mass., treasurer; and with Harry H. Steinle, and Messrs. Goodell and Fallon, form the board of directors.

The Economy Tool Company has been formed at Warsaw, Ind., with a capital stock of $150,000. The men interested in the new company are A. C. McDonald, A. T. Anderson, C. E. Artman, W. S. Felkner, C. O. Dickey, E. A. Gast and E. M. Butterbaugh, all of Warsaw.

The E. J. Shanahan Co. of Bridgeport, Conn., was recently incorporated under the laws of Connecticut, to engage as dealers in the tools and machinery business. The capital stock of the company is $50,000 and the incorporators are Edward J. Shanahan; George A. Bradford, Bridgeport; and E. H. Byrnes, Bridgeport.

The Cortland Grinding Wheel Corp., Chester, Mass., formerly of Cortland, N. Y., has been incorporated under the laws of the State of Massachusetts, to manufacture grinding wheels, etc. The capital is divided into 8,000 shares of stock with no par value. The Cortland Company recently combined with the Maxf Grinding Wheel Corp., of Chester, Mass.

The Link-Belt Company has acquired all of the capital stock of the H. W. Caldwell & Son Company, and Frank C. Caldwell has been elected a director of the Link-Belt Company. The H. W. Caldwell & Son Company's plant will continue to operate under separate corporate existence and under its present name.

Agreements for the merger of the Lamson-Sessions Co., Cleveland, and the Falls Rivet Company have been entered into it was announced this week by George S. Case, general manager of the Lamson-Sessions Co. Both are old and established firms and the purpose of consolidation is for expansion.

Although complete details have not been worked out the consolidated companies will have an authorized capital of $3,000,000. At present the Falls Rivet Company has a capital of $600,000, while that of the Lamson-Sessions Co. is $1,450,000. It has not been definitely settled what the name of the new company will be.

The Falls Rivet Company was established in 1880 while Lamson-Sessions has been in operation since 1866. Roy H. Smith, president of the Falls Co., has been elected a vice president of the Lamson-Sessions Co. but will continue in charge of the Kent plant. Officers of Lamson-Sessions Company are: F. C. Case, president; J. G. Jennings, vice president and treasurer; I. L. Jennings, secretary, and George S. Case, general manager.

At a meeting of the board of directors of the Commercial Shearing and Stamping Co., Youngstown, O., George C. Tinsley was made general manager. For the past ten years he has been connected with the Youngstown Sheet and Tube Co. and the Sharon Steel Hoop Company, Sharon, Pa. Officers re-elected at this meeting are Robert Carnick, president; R. V. Proctor, vice president, and Jacob Carnick, treasurer.

At the annual meeting this week of the Reliance Wheel Co., Reliance, O., the following officers were elected: President, N. H. Van Sicklen; vice president, Charles T. Gaither, secretary-treasurer, L. B. McKelvey and director of sales, J. M. Crenan. Other directors aside from the officers are Fred Tod, H. H. Hull, T. E. Milliken, S. W. Goldcamp and J. W. Darr.

The Atlas Die-Casting Co. Inc., 29 to 41 Jackson St., Worcester, Mass., has been incorporated under the laws of Massachusetts for $250,000. The officers are A. M. Brewster, president, Harry Smith, general manager, Nathan Lester, engineer, and M. F. MacNeil, secretary and treasurer. The concern has a casting machine of its own design covered by patents, and will soon be prepared to furnish castings in any standard alloy that can be cast in a machine. It will start casting about July 15 to Aug. 1.

The Olson-Boettger Electric Manufacturing Co., 103 E. 3d St., St. Paul, Minn., has announced its entrance into the jobbing field. The company has reorganized and has increased the capital stock from $75,000 to $250,000. The name of the new corporation is to be Olson-Boettger Electric Company. H. S. Olson is the president and treasurer, J. O. Nelson secretary, and R. P. Young, vice-president and manager. The corporation will maintain a first-class and up-to-date repair shop for the rebuilding of motors and generators.

Proposed consolidation of the plants of the Central Steel Co., the Massillon Rolling Mills Co. and the National Pressed Steel has been agreed to by officers and stock holders, it was announced this week. The combined capitalization is $18,000,000. At a meeting of stockholders to be held July 7, the merger will be ratified. They are all known as Geiger-Jones properties. Each of the three companies will continue their present lines of manufacture and virtually the same management will govern under the merging of interests as existed when the plants operated separately. R. E. Bebb of Canton, who has headed the three companies for the past five years, will remain in charge as chief executive officer. This is the second large merger within the past few months in the Canton steel district, the first being consolidation of the United Alloy Steel Corporation, the Berger Manufacturing Co. and the United Furnace Company.

The U. S. Department of Commerce have issued six Booklets of standard specifications with the text in both English and French. These were prepared under the supervision of the Bureau of Standards and adopted by the American Society for Testing Materials. The booklets are known as Industrial Standards Nos. 104, 112, 113, 132, 134 and 136 and refer to Low Carbon Steel Splice Bars; Carbon Steel Bars for Railway Springs; Carbon Steel Car and Tender Axles; Wrought Iron Plates; Cast Iron Locomotive Cylinders and Medium Hard Drawn Copper Wire, respectively.

Vacancy in Standards Bureau

No selection has been made for the important Bureau of Standards post made vacant recently by the death of Dr. E. B. Rosa. It is not improbable that the work in electrical physics and electrical engineering may be conducted in the future by separate chiefs. It is recognized that it will be very difficult to secure a man of Dr. Rosa's capabilities for a salary of $4,800 The problem will be simplified, it is believed, by placing the two sections of the electrical division under separate directors.

Increasing Patent Office Salaries

The bill providing for an increase of force and salaries in the Patent Office has been reported out by the House committee on patents with the recommendation that it be passed at the earliest possible date.

The bill as reported is substantially the same as the one which passed the House at the last session except that the section authorizing the Federal Trade Commission to administer patents for Government employees has been eliminated.

The bill increases the salaries of the principal examiners in the Patent Office from $2,700 to $3,900 per year. Assistant examiners are allowed increase ranging from $150 per year to $900 per year. It is generally recognized that the salary of the principal examiners is the most important feature of the entire bill. Representative Lampert of Wisconsin, the chairman of the committee, expresses the opinion that the salary of the principal examiners should be much higher than the $3,900 provided in the bill but that the committee had agreed on that figure in the hope that it would not be questioned and the bill passed as an emergency measure. He calls attention to the fact that the American Patent Law Association after a referendum vote expressed the opinion that the principal examiners should receive $5,000. The National Research Council placed the salary at $4,200 but with the idea of naming a figure that would pass at a time when Congress is emphasizing the need of retrenchment. In the Lehlbach reclassification bill the salaries of these examiners are placed at $5,040.

The bill also increases the commissioners salary from $5,000 to $6,000; that of the first assistant commissioner from $4,500 to $5,500; that of the second assistant commissioner from $3,500 to $5,000; that of chief clerk from $3,000 to $4,000; that of one solicitor from $2,750 to $5,000; that of five law examiners from $2,750 to $4,000; that of two examiners of interferences from $2,700 to $5,000. Five members of the board of examiners in chief who are appointed by the President and who under the statute must have both scientific and legal training, will be allowed an increase by this bill from $3,500 to $5,000.

The demoralized condition of the Patent office may be understood when it is known that there are now 46,472 applications awaiting attention. The number of pending applications is increasing all the time. In a little over a year, 110 examiners—one-fourth of the total examining force—have resigned. These men were experienced examiners, with from 2 to 20 years training. Their places have been taken by young men just out of college—the only ones apparently to whom the salaries appeal. The difficulty is, Mr. Lampert points out, that they have no patent experience, and cannot act in intricate technical cases as rapidly as can those who have spent years in the Patent Office working with those subjects.

New Publications

Standard Parts. General Motors Corporation. Tables of specifications and sketches, describing many of the G. M. C. parts which have been standardized. The pages are 4¼ x 7¼ in. and are punched to fit a loose-leaf note book.

Handbook of Standard Details. By Charles H. Hughes. Three hundred four 5 x 7-in. pages, numerous illustrations. Published by D. Appleton & Co., New York.

A book, compiled particularly for engineers and draftsmen, including drawings, tables and formulas of standard details for use in designing. It is divided into sections on drawing, fastening (bolts, nuts, screws, keys, cotters, etc.), power transmission (shafting, couplings, clutches, collars, bearings, pulleys, belting, gearing, etc.), pipe, tubes and fittings, miscellaneous details (handles, knobs, wrenches, spanners, springs, taper pins, etc., structural details and useful tables (weights and measures, strength of materials, etc.).

The Modern Foreman. By Robert Grimshaw. 190 pages, 5½ x 8½ in. Published by Biddle Business Publications, New York.

The author is well known in mechanical circles and has had a wide experience in many sections of the globe. He sees a real danger in the absence of efficiency in our production methods due to lack of co-operation between employer and employee. The main theme of his talks to foremen is to remedy this condition, and we all know this is sadly needed.

The book is divided into twenty-six chapters which discuss such subjects as efficiency; the kinds of foremen; factors in production; the workers and their welfare; the art of handling men; foremen's duties; eliminating wastes; modern factory methods and the training of foremen. It is a book that can be read with profit by both the foreman and his employer.

Thermal Expansion of Copper and Its Important Industrial Alloys. Scientific Paper No. 410 published by the United States Bureau of Standards, Washington, D. C. One hundred fifty-nine 6½ x 10-in. pages, illustrated with 43 halftones and line drawings and 41 tables.

This publication contains data on the thermal expansion of 128 samples of copper and alloys of various compositions containing from 56 to 100 per cent copper. The specimens used were prepared in various ways—cast, cold-rolled, extruded, extruded and cold-worked, hot rolled and cold worked. Descriptions of the apparatus and the preparations of the samples are given, and practically all available information on the thermal expansion of copper and its alloys is briefly reviewed.

This publication is now ready for distribution and anyone interested may obtain a copy by addressing the Bureau.

Progress Report of National Screw Thread Commission. Miscellaneous publication, No. 42 of the Bureau of Standards, Washington, D. C. For sale by the Superintendent of Documents at 15 cents per copy.

In this report the following fundamentals have been established:

(1) Definitions of screw thread elements and all terms entering into screw thread standardization; (2) Standard thread form, thread angle—60 deg., flat at crest = ⅛ pitch; (3) an adequate system of screw threads consisting of a coarse thread series and a fine thread series; (4) four kinds or classes of fit with allowances and tolerances for 3 of the 4 classes established; (5) an adequate gaging system for inspecting the manufactured product.

Explanations, excerpts and criticisms have been and will be published in the *American Machinist* from time to time.

Some Properties of White Metal Bearing Alloys at Elevated Temperatures. Technologic Paper No. 188, Bureau of Standards, Washington, D. C., prepared by John R. Freeman, Jr., and R. W. Woodward, of the Bureau.

An apparatus is described for determining the yield point and ultimate strength of white metal bearing alloys at temperatures up to 100 deg. C. The results of compression tests and Brinell hardness at temperatures to 100 deg. C. are given for five typical white metal bearing alloys including three tin base alloys, one lead base alloy and one intermediate alloy, which show that the tin base alloys maintain their properties better at elevated temperatures than the lead-containing alloys. The yield point of tin base alloys is not affected by heating for six weeks at about 100 deg. C. but the yield point is lowered in the lead base alloy by heating for two weeks at about 100 deg. C.

Technologic Paper No. 185. By Alexander I. Krynitsky, associate physicist, Bureau of Standards, U. S. Department of Commerce.

This paper covers the results of a series of experiments on copper crusher cylinders, two main points are emphasized in the report: (1) For cases where pre-compression is necessary, a pre-compression of the cylinders at a pressure of at least 8,000 lb. per square inch below the expected maximum pressure can be employed without impairing the ability of the pre-compressed cylinders to register the maximum pressure in as reliable a manner as would an uncompressed cylinder. (2) It is probable also that aging at temperatures within 0 deg.—100 deg. C.—makes the compressed copper rather softer. Copis may be procured by addressing a request to the Bureau.

Mineral Resources of the United States—Part I. Metals. By the United States Geological Survey, Washington, D. C. Cloth covers, 6 x 9 in. 969 pages.

The volume is devoted largely to statistics concerning the various metals. They include figures on production, prices, imports and exports, and demand and supply. Information is given as to the sources of metals, their producers, where found, character and uses. There are included several valuable maps and a table showing the quantities and value of the mineral products of the United States by years from 1908 to 1917, and the total value of the mineral product from 1880 to 1907. There are chapters on The Economic Limits to Domestic Independence in Minerals, by George Otis Smith; International Control of Minerals, by C. K. Leith; and Mineral Production of the United States, by H. D. McCaskey and M. B. Clark.

Employee Training. By John Van Liew Morris, Ph.D. First Edition, 311 5½ x 8 in. p., cloth board covers. Published by McGraw-Hill Book Co., Inc., 370 Seveth Ave., New York, N. Y.

The book contains the data obtained by a thorough study of the educational and training methods used by industrial concerns. The vocational programs existing in 35 manufacturing plants, each employing from 500 to 50,000 men, are outlined. The subject of apprenticeship receives particular attention, although special training, Americanization, foreman training and similar topics are covered. The book may serve as a reference volume, since it is largely a compilation of methods of employee training. It should both aid the manufacturer in formulating a plan for training his employees, since it shows what has been accomplished, and also give to the educator a knowledge of what industry is doing to train its workers. The latter part of the book is of particular value, as it summarizes the conditions existing in industry with regard to training and education of employees, and it points out the means of development for the future.

The principal divisions of the book are, "Comprehensive programs for apprenticeship and special training," dealing with some programs found in the electrical-manufacturing, rubber, automibile and other industries; "Programs emphasizing apprenticeship," covering apprenticeship courses of various sorts in industries of all types, including shipbuilding and machine-tool manufacture; "Programs emphasizing special training," which describes many unusual educational features; "Programs of primarily technical instruction" and "A review of apprenticeship and industrial training" dealing with the relative scope and advantages of such topics as apprenticeship part-time schools, night schools, foreman training and civic instruction. The corporation as a vocational educational unit it discussed.

Gasoline Automobiles. By James A. Moyer, Director of University Extension, Massachusetts Department of Education. Cloth covers 5 x 8 in., 256 pages, 212 line drawings. Published by the McGraw Hill Book Co. Inc., 370 Seventh Ave., New York, N. Y.

A clear, brief and instructive presentation of the essential principles of automobile construction and operation. The author has well carried out the purpose of the book, which is to give such information about the construction and maintenance of automobiles that inexpert drivers and owners can make the simpler adjustments and repairs intelligently and economically. The book is not a catalog of details, but is devoted to essentials only, underlying principles being thoroughly explained.

Chapter headings: Automobile Types and Parts; Automobile Engines; Gasoline and Substitutes; Gasoline Carbureters; Automobile Ignition; Magnetos and Ignition Testing; Electric Starters; Clutches, Transmissions and Differentials; Lubrication and Cooling Systems; Automobile Troubles and Noises.

Export Trade Directory, 1921-22. Compiled under the supervision of B. Olney Hough, Editor, "American Exporter." One thousand thirty-six 6 x 9-in. pages, cloth boards. Published by American Exporter (Johnston Export Publishing Co.) 370 Seventh Ave., New York City.

A directory of the U. S. export merchants, export agents, etc. Information is given relative to date of establishment, names of officers, if a corporation or partnership, address and telephone number, departments, foreign connections, markets covered and products dealt in. In many instances a rating is given indicating the comparative importance of export business done. The several divisions of the book are: Export Merchants in the U. the book are: Export Merchants in the U. S.; Manufacturers' Export Agents, Managers of Export Departments and Export Brokers; Leading Bankers Engaged in Foreign Exchange Business; Foreign Exchange Brokers; Marine Insurance Companies in New York City; Foreign Freight Forwarders; Some Export Trucking and Export Packing Concerns in New York City; Steamship Services to Foreign Ports; How to Ship to Foreign Markets; Consuls of Foreign Countries in the U. S.; American Consular and Commercial Representatives Abroad; and Organizations for the Promotion of Export Trade. There are also lists of foreign chambers of commerce in N. Y.; buying offices of foreign concerns; foreign connections of American export merchants, N. Y.; export merchants classified by addresses; export merchants classified by markets cultivated; and export merchants classified according to goods shipped. A map of the export district of N. Y. City has been included.

Trading with the new countries of Central Europe. By Oscar P. Austin, statistician, the National City Bank of New York and secretary, the National Geographic Society. Sixty-six 6 x 9-in. pages.

The sixth of a comprehensive series published by the National City Bank of New York, covering the foreign commerce of the United States and Central Europe. The book is divided into chapters covering twenty-one countries, or provinces, in Central Europe. The economic, financial, political and industrial policies of these countries are analyzed. Some of the newer provinces mentioned are Austria, Czecho-Slovakia, Danzig, Esthonia, Fiume, Hungary, Jugo-Slavia, Latvia, Lithuania, Poland, Ukrania and the German colonies. Maps showing the new geographic position and area of the countries mentioned are included, as well as tables showing the date of independence, form of government, racial stock and whether newly established or readjusted political units.

The book is full of authentic information for the business man and contains a wealth of valuable data for anyone interested in the present commercial growth of Europe.

Lubricating and Allied Oils. By Elliot A. Evans, F.C.S., A.M.I., P.T., Chief Chemist to C. C. Wakefield & Co., Ltd., with foreword by Sir Charles Cheers Wakefield. Bart., C.B.E., D.L., J.P., etc. One hundred and twenty-eight 5½ x 8½-in. pages, with 25 photographs and line drawings. Published by E. P. Dutton & Co., 681 Fifth Ave., New York, N. Y.

This volume deals with the origin, preparation and uses of both mineral and vegetable oils, with several chapters devoted to the fundamental considerations in the selection of a lubricant. Both the methods and apparatus used for testing oils are described in a manner calculated to make it possible for the average chemist or engineer to learn to test oils correctly and to pass on their relative merits. The subject matter has been drawn from the author's experience and close association with the science of lubrication both in the workshop and in the laboratory, also from numerous technical journals, papers and books. The following chapter titles indicate the contents of the work: History of Petroleum; Oil Refining; Occurrence of Fatty Oils; Physical Tests; Chemical Tests; Oxidation of Petroleum; Oleography; Selection of Lubricants; Oils Employed.

Personals

Louis Stout has been elected president of the Boos Machine Co., St. Marys, O.

Roy G. Owens, vice president in charge of sales of the Lakewood Engineering Co., Cleveland, O., has resigned.

A. H. Adams has resigned as chief engineer of the North Electric Manufacturing Co., Galion, O. He will locate in New York.

C. E. Davies has been appointed managing editor of "Mechanical Engineering" succeeding the late L. G. French.

N. J. Whitehurst has been elected to the presidency of the Virginia Mechanics Institute for the thirty-first time.

C. G. Beardslee, who resigned as supervisor of labor at the Southington, Conn., plant of the Peck, Stow & Wilcox Co., has left for Los Angeles, where he will study.

Arthur B. Babbitt, secretary and general manager of the Kent Machine Company, Kent, O., has been elected a director and a member of the corporation of Wentworth institute, Boston, Mass.

J. T. Dougherty has tendered his resignation as superintendent of the Mercer works of the American Sheet and Tinplate Company, Farrell, Pa. He has held the position since 1915.

Lionel A. Wharrard, director and technical adviser of the British Needle Co., Ltd., Redditch, England, is visiting this country with a view to enlarging the firms business connections here.

Harry R. Jones, president of the United Alloy Steel Co., Canton, Ohio, has been made a director of the Midland Bank, Cleveland, Ohio.

B. M. W. Hanson is now president of The Hanson-Whitney Machine Company, Hartford, Conn. He was formerly vice-president and general manager of Colt's Patent Fire Arms Mfg. Co.

S. C. Spaulding, chief metallurgist of the Halcomb Steel Co., Syracuse, N. Y., spoke on the subject, "Why Did It Break?" before the Worcester, Mass., chapter of the American Society for Steel Treating, May 19.

Charles W. Holtzer, president of the Holtzer-Cabot Electric Co., Boston, Mass., has been elected a director of the National Association of Manufacturers to represent Massachusetts on the board.

H. R. Setz, consulting engineer of the Manitowoc Ship Building Corporation, Manitowoc, Wis., has been appointed the American representative of the Franco Tosi Società Anonima, Leguano, Italy.

Hugh Rockwell, Plainville, Conn., who was president and general manager of the Standard Steel & Bearings Co., Inc., is to move to Lincoln, Neb., where he will be associated with the Harding-Zuck-Poole Co., builder of airplanes.

P. R. Letts has been appointed Office Manager of the Industrial Bearings Division of the Hyatt Roller Bearing Company, New York, succeeding G. J. Traendly, who is now Office Manager, General Motors Corporation, New York.

E. G. Shaeffer has been appointed general traffic manager for the Keystone Steel & Wire Co., Peoria, Ill. Emil P. Kastien formerly assistant, has been appointed purchasing agent to succeed Mr. Schaeffer who will devote his entire time to traffic.

Hubert Chauncey Hart, Unionville, Conn., for more than 40 years a marker of cutlery, has just passed his 77th year. He is the oldest member of the Connecticut house of representatives. Mr. Hart is the inventor of the roller chain and was also a pioneer in roller bearings.

D. S. Cole, formerly production manager of the Leece-Neville Co., Cleveland, has been made general manager of the Martel Packings Company, Inc., Elyria, O. A. H. Krugman is superintendent in charge of manufacturing operations and C. R. Jenks, formerly of the Turbine Air Cooled Tool Co., Cleveland, is production manager.

William H. Moore, who until recently was assigned to the Chicago territory, now has charge of the Southern territory of the Metal and Thermit Corporation. Mr. Moore has had a thorough practical experience in all forms of thermit welding.

Crannell Morgan, vice-president of the Hardware and Supply Co., Akron, Ohio, has been re-elected president of the National Supply and Machinery Dealers Association. Mr. Morgan is also treasurer of the Wise Furnace Co., Akron, Ohio.

Robert E. Belt, secretary-treasurer, American Malleable Castings Association, Cleveland, Ohio, and Addison Boren, manager work accounting bureau, Yale and Towne Mfg. Co., Stamford, Conn., has been appointed to the national board of directors of the Industrial Cost Association, Pittsburgh, Pa.

J. O. G. Gibbons, formerly with Westinghouse, Church Kerr & Co. and now engaged in private practice, has joined forces with C. E. Brown, who for the past few years has been a U. S. Ordnance Engineer, forming a partnership under the name of Gibbons & Brown, Consulting Engineers, specializing on power plants and industrial problems, with offices in the Ordway Building, Newark, N. J.

William Aldrich, who joined the former Goldschmidt Thermit Company in 1909, has been transferred from the Southern to the Western territory of this company. Mr. Aldrich will travel extensively in the States of California, Oregon, Washington, Idaho, Nevada, Utah and Arizona, and will make his headquarters at the new South San Francisco office of the Metal and Thermit Corporation.

M. D. Troyer, assistant to J. J. Lumm, sales manager of the Clyde Iron Works, Duluth, Minn., has been appointed manager of the Cincinnati district of the company with headquarters in the Union Central Building. The Cincinnati district comprises the states of Ohio, Indiana, Kentucky, Tennessee, West Virginia, Virginia, North Carolina, Pennsylvania and Georgia. Mr. Troyer succeeded W. C. Champion, who has been appointed Pacific Coast sales manager with the headquarters at Seattle, Wash.

Charles Copeland, assistant treasurer, has been elected a member of the board of directors and secretary of E. I. duPont de Nemours & Co., to fill the vacancies caused by the death of Alexis I. duPont. Mr. Copeland has been assistant treasurer of the company for 18 years. His connection with the explosives industry began several years earlier when he became assistant to J. A. Haskell, then president of the Laflin & Rand Powder Co. He served also as assistant treasurer of the Eastern Dynamite Co. and of the Lake Superior Powder Co. On the consolidation of these companies with the DuPont Co., he assumed the position which he is now leaving for his new work as secretary of the company.

Presentation of Medals

The John Fritz Gold Medal goes to Sir Robert Hadfield (for 1921) and Eugene Schneider, head of the Creusot Works (for 1922). The presentations are to be made in both London and Paris by a deputation of thirteen engineers representing American engineering societies.

The Graphite Industry in the Far East

In the island of Ceylon graphite is found in greater abundance than in any similar sized area in the world. The soil and rocks of Ceylon are almost everywhere impregnated with graphite, so that it may be seen covering the surface in the drains after a rain. The supply is practically inexhaustible. The peculiarity of Ceylon graphite is its remarkable purity.

The principal mines in Chosen are in North Pyengan, North and South Choo-Chung, North Kyungsang, Kwangwon, and South Hamkyung, Provinces. The graphite found in Chosen is classified as scaly, fibrous, foliated, earthly, the first two classifications containing over 90 per cent of carbon.

In China graphite is found in Hunan, on the Upper Mekong, and it also exists near Wenchow (Chekiang) and in Kwangtung. In 1900 it was officially reported that graphite was discovered in Kaotzu, west of Chingkiang in Kiangsu, but no mining has been done on any scale so far, reports *Finance and Commerce.*

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A firm of merchants in Mexico desires to purchase general hardware, shelf hardware, cutlery, etc. Quotations should be given f.o.b. New York or San Francisco and c.i.f. Mexican port. Correspondence and catalogues are requested in Spanish. Reference. No. 34982.

The representative of a group of manufacturers in China is in the United States and desires to form direct connections with manufacturers of machinery for flour, paper, cotton and silk-spinning mills, machine works, mining and electric power plants, transmission equipment, telephone equipment, locomotives and railway appliances, motor cars and trucks, structural steel, galvanized sheets and wires, tin plate, hardware, paints, building materials, leather, chemicals and dyestuffs. Quotations should be given f.o.b. American port. Payment: Cash against documents. Catalogues, price lists and full information are requested. Reference. No. 34983.

A firm of manufacturers' agents in India desires to import sewing machines, cycles, oil, crude oil, steam engines, ice plants, sugar mills, flour mills and other secondhand machinery of all sorts and printing machines. Reference. No. 34988.

The industrial representative in the United States of a European country desires to secure catalogues and quotations from manufacturers of electrical machinery, apparatus, supplies, and insulating materials; machine tools, transportation equipment; and labor-saving devices. Reference No. 34999.

A merchant in Spain desires to secure an agency for the sale of moderate priced automobiles. Quotations should be given c. i. f. Vigo or Corunna and f. o. b. New York. Payment to be made againt documents at Spanish port, or at New York. Correspondence should be in Spanish. Reference No. 35003.

A commercial agent in Germany desires to secure the representation of manufacturers and exporters for the sale of American goods. Reference No. 35006.

A merchant in the Straits Settlements desires to purchase American standard 42-gallon oil barrels, in quantities of about 3,000 monthly. Reference No. 35009.

A merchant in India desires to purchase electrical goods and appliances, such as bulbs, shades, lamps, and fans. Quotations should be given c. i. f. Calcutta. Reference. No. 35025.

Obituary

William G. LeCount, a well-known manufacturer of machinists' tools, died at his residence, Norwalk, Conn., on June 11, as the result of a stroke of apoplexy. Mr. LeCount was born at East Norwalk, March 6, 1865. After attending public school he entered the Norwalk Iron Works Company's shop as an apprentice, serving for four years. He then joined his father, the late C. W. LeCount, proprietor of a machine shop, who was a pioneer in the manufacture of lathe dogs as commercial articles. Upon the death of the elder LeCount, William succeeded to the business of which he was the active head at the time of his death. Mr. LeCount is survived by a widow, two daughters and a son.

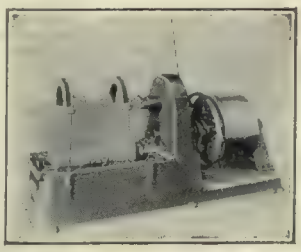
Forthcoming Meetings

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

Condensed-Clipping Index of Equipment

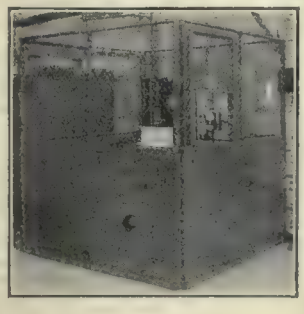
Patented Aug. 20, 1918

Burning-In and Running-In Machine, Gas-Engine Bearing
Detroit Garage and Equipment Co., 268 Jefferson Ave., Detroit, Mich.
"American Machinist," March 31, 1921



The machine serves both for burning-in bearings and for a running-in test, the illustration showing it set up for burning-in the bearings of a Fordson tractor engine. After the bearings have been burnt-in, the engine is turned over and connected for the running-in test. The machine has two spindles geared in train with the main-drive shaft. The upper spindle is used for the burning-in operation and is geared to run at 200 r.p.m. The lower spindle is connected to the crankshaft for running-in and runs at 600 r.p.m. The motor is mounted on a saddle that fits in the bed of the machine, this saddle being special for each size and make of motor handled.

Booth, Metal, Time-Keepers'
Lyon Metallic Manufacturing Co., Aurora, Ill.
"American Machinist," March 31, 1921



This booth is for use by factory timekeepers, department foremen and those requiring an inclosed space in the shop. It is built from standardized sectional panels, is provided with a sliding window and can be furnished with practically any arrangement required in the way of drawers, compartments and the like.

Boring and Drilling Machine, Horizontal, No. 217-H
Baker Bros., Toledo, Ohio.
"American Machinist," March 31, 1921



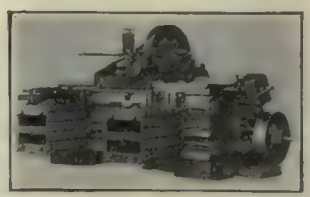
This machine is of an extra-heavy pattern, being intended primarily for the machining of crankcases, large transmission-cases, rear-axle housing and other work of the heavier class. It is built to drive a 2-in. high-speed drill in steel. Speed and feed changes are obtained by change gears. A vertical adjustment is provided to take care of any discrepancy in castings or fixtures. The table is 75 in. long and the spindle will feed 16 in. The machine is 11 ft. 4 in. long overall by 25¼ in. wide, and weighs 4,750 lb.

Sanding Machine, Disk, Type D-2.
Syracuse Sander Manufacturing Co., Inc., Syracuse, N. Y.
"American Machinist," March 31, 1921



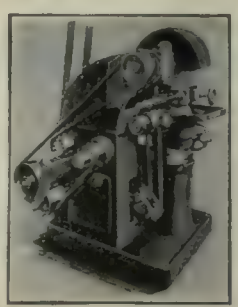
The machine is intended for use in wood shops, although it may also be used for disk-grinding small metal parts, especially brass and aluminum. Garnet paper disks are used when working on wood, and Aloxite or emery-cloth disks for metal grinding. The disk is 15 in. in diameter. By means of a vacuum system, the dust is carried to the floor through the post of the pedestal. The table, which has an angle gage graduated in degrees, may be tilted to either 35 deg. down or 10 deg. up. The motor is totally inclosed. The overall dimensions of the machine are 25 x 25 x 47 in., and the weight 300 lb.

Shaper, Traverse-Head, Putnam, 26-in.
Manning, Maxwell & Moore, Inc., 119 West 40th St., New York, N. Y.
"American Machinist," March 31, 1921



The principal features of the machine are its generally heavy proportions and ability to transmit the power required for heavy cuts at high speeds. The head is gibbed for taking up wear and wipers keep the surfaces in contact free from dirt. Power feed is provided for moving the head along the bed and a split nut in the head provides means for disengagement from the feed screw. The ram is operated by the McCord quick-return motion. The tables are mounted on individual saddles and can be adjusted both vertically and longitudinally. Speed changes are obtainable through a selective-type gear box. The machine with an 8-ft. bed weighs 18,000 lb.

Grinding Machine, Centerless, Heavy-Duty, No. 4.
Detroit Machine Tool Co., 6545 St. Antoine St., Detroit, Mich.
"American Machinist," March 31, 1921



Two abrasive wheels are used in the machine, the upper one for grinding and the lower one for rotating and feeding the work. The work is rotated by placing it on top of the rotating wheel, which when swung around at a slight angle also feeds the work past the grinding wheel. The rotating wheel has three speeds available through a cone pulley. Work from ¼ to 3 in. in diameter and from ¼ to 16 in. in length can be ground, and cuts from 0.0001 to 0.015 in. deep can be taken. A wheel-truing device is furnished. The grinding wheel is driven by a 4-in. belt from a jack shaft at the rear of the machine, and the rotating wheel receives power though a small gear box.

Grinding Machine, Face and Shear Blade
Springfield Manufacturing Co., Bridgeport, Conn.
"American Machinist," March 31, 1921



The machine is entirely self-contained and is operated by three motors, one of 15-hp. for driving the wheel, one variable-speed 5-hp. reversing motor for driving the table-traversing mechanism, and one ½-hp. motor for driving the pump. Table speeds of from 7 to 27 ft. per minute may be obtained, and the reversing feature of the motor dispenses with all belting. The operation of the machine is controlled from either front or rear by mechanical means, push buttons being provided for controlling the motors. The machines are made in different sizes, to handle work varying in lengths from 6 to 17 ft. The weight of a machine of 12 ft. capacity is 14,750 pounds.

Lathe, Tire-Turning, Double, Putnam, 54 In.
Manning, Maxwell & Moore, Inc., 119 West 40th St., New York, N. Y.
"American Machinist," March 31, 1921



The machine has a capacity for turning car and engine truck wheels from 30 to 52 in. in diameter, and can be adjusted to take wheels for narrow-gage tracks. The combination toolslide carries both roughing and finishing tools, so arranged that when once set they do not have to be removed except for grinding. The tailstock is moved along the bed by power, either an auxiliary 7½-hp. motor or an individual countershaft being used. The spindles and faceplates are made in one piece. The maximum distance between the faceplates is 10 ft. 9⅞ in. The bed of the machine is 23 ft. 3 in. long, 6 ft. 6½ in. wide, and has a solid top. The machine weighs 86,000 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Mass., Revere—The Eastern Mach. Wks., (machine shops)—
One grinder for elbows.
One No. 41 Bliss or equivalent press.
One small bench press.
One bench lathe similar to Dalton.

Mass., Springfield—J. Karagozian, 191 Walnut St.—one No. 5 punch press.

N. Y., Brooklyn—Davis & Quick, 315 St. Marks Ave. (Dyers and Cleaners)—one No. 304 A pipe threading machine.

N. Y., New York—The West Virginia Pulp & Paper Co., 200 5th Ave.—one 4 in. pipe threading machine.

Ky., Praise—The Elkhorn Table & Mfg. Co.—sanders, table leg lathes, band saw, shaper, belting shafting and hangers.

La., New Orleans—The Crystal Mfg. Repair Shop, O. J. Pivert, Prop.—welding machinery equipment, 12 in. lathe with 24 in. swing (new or used).

La., New Orleans—The Federal Machine & Fdry. Co., Inc., 706 North Rampart St., F. Michon, Mgr.—complete foundry equipment, No. 4 milling machine, 12 in. lathe, welding machines.

N. C., Statesville—J. C. Steele & Sons, manufacturers of brick-making and clay-working machinery, C. M. Steele, Purch. Agt.—one 24 in. traverse head shaper (used).

S. C., Rock Hill—W. M. Padgett & Co.—bar bender to bend 1¼ in. square bars and small pile driver.

S. C., Sumter—O. L. Williams Veneer Co.—48 x 54 in. triple drum sander (used).

Tenn., Knoxville—J. G. Duncan Co., 101 East Jackson St., manufacturers of machinery, J. G. Duncan, Purch Agt.—rebuild sash and door machines, top and side heads with attachments for grooving and boring sash stiles, used or rebuilt Little Wonder Wood Worker.

W. Va., Logan—The Guyan Mach. Shops, manufacturers of machinery, B. Shell, Mgr.
One bending roll for plate ¼ x 48 in.
One slitting shear and punch for ½ in. plate.
One Universal tool grinder.
One keyseating machine.
One 15-16 in. and two 15-16 in. shaft hangers, roller or ball bearing.

O., Cincinnati—The Cincinnati Authorized Ford Dealers Co., 1426 Sycamore St., H. G. Ragor, Mgr.—equipment for rebuilding Ford cars.

Wis., Barron—Barron Co., E. Gleason, County Hwy. Comr.—equipment for machine shop.

Wis., Jackson—The Jackson Light Co.—lathes.

Wis., Milwaukee—Joe's Garage, 684 Third Ave.—drill press.

Wis., Milwaukee—The Redel Candy Corp., 319 East Water St., J. L. Redel, Purch. Agt.—one power band saw.

Wis., Racine—The Sterling Metal Products Co., 16th and Junction Aves.—stamping presses.

Ark., Little Rock—The Model Mach. Wks., 401 Rector Ave.—piston turning lathe, automobile crank shaft grinding machine, automobile and tractor cylinder grinding equipment.

Machinery Wanted

Ala., Northport—The Modern Lumber Co., R.R. Johnston Purch Agt.—gang saw trimmer to trim lumber from 6 to 20 ft. to be operated by foot pedals.

Fla., Arcadia—The Tropics Products Co., (fruit products), J. R. Payne, Secy.—bottling machinery, for citrus fruit products, machinery for citrus fruit plant.

N. C., Mount Airy—J. F. and O. H. Yokley, J. F. Yokley, Purch. Agt.—complete machinery for the manufacture of chairs, steam blower and dry kiln equipment.

O., Columbus—The North Columbus Ice & Coal Co., Hudson and Pennsylvania Aves., R. R. Smith, owner—two light ice manufacturing machines.

Kan., Leavenworth—The U. S. Government, c/o C. E. Taylor—necessary machinery to manufacture and repair gasoline motors.

Mo., Cape Girardeau—The Perfection Furniture Mfg. Co., L. H. Landgrof, Purch. Agt.—machine to manufacture twisted tenso porch swing chains, capacity, 400 to 500 or more chains per day.

Tex., Wichita Falls—The W. K. Knutson Mill & Mfg. Co., 1903 Burnett St., W. K. Knutson, Purch. Agt.—machinery for the manufacture of vacuum refrigerators, planing mill equipment.

N. Y., Buffalo—S. B. Turner, 54 Fulton St.—one 9 hammer Morgan nailing machine with side arm (used).

Metal Working Shops

NEW ENGLAND STATES

Mass., Brockton—The Brockton Produce Co., 65 Lincoln St., has awarded the contract for the construction of a 1 story, 99 x 112 ft garage.

Mass., Springfield—E. T. Davis, 398 Bridge St., has awarded the contract for the construction of a 2 story, 72 x 182 ft. garage on Chestnut and Taylor Sts. Estimated cost $120,000.

Conn., Hartford — Cohn & Feinsilber, Prospect St., will soon award the contract for the construction of a 1 story, 50 x 90 ft. addition to garage on Prospect St. Estimated cost $20,000. B. A. Sellew, 721 Main St., Archt.

Mass., Cambridge—S. Fishman has had plans prepared for the construction of a 1 story, 57 x 100 ft. garage on Tremont St. Estimated cost $25,000. J. A. Tuck, 34 School St., Boston, Archt.

Mass., North Adams—Loss & Chornack, 21 State St., will soon award the contract for the construction of a 1 story, 40 x 100 ft. garage, on Ashland St. Estimated cost $20,000. Private plans.

Mass., Springfield—W. Sacks, 47 Churchill St., has awarded the contract for the construction of a 2 story, 95 x 100 ft. garage, etc., on Liberty and Sharon Sts. Estimated cost $65,000.

Mass., Somerville — Herlihy Bros., 556 Rutherford Ave., Charlestown, has awarded the contract for the construction of a 1 and part 2 story, 40 x 110 ft. garage and milk station on Washington and Myrtle Sts. Estimated cost $35,000.

MIDDLE ATLANTIC STATES

N. Y., Brooklyn—M. Koeppel, 361 Stone Ave., had plans prepared for the construction of a 1 story, 75 x 100 ft. garage on Pennsylvania Ave. and Fulton St. Estimated cost $15,000. Koohn Bros., 361 Stone Ave., Archts.

N. Y., Brooklyn—Shapiro Bros., 130 Smith St., will soon award the contract for the construction of a 1 story, 80 x 100 ft. top addition to their garage at 259-65 Pacific St. Estimated cost $25,000.

N. Y., New York—Cuneo & Podesta, 541 West Bway., is having revised plans prepared for the construction of a 6 story, 52 x 96 ft. garage at 75 Washington Pl. Estimated cost $80,000. F. E. Vitola, 56 West 45th St., Archt.

N. Y., New York—The Dorsma Garage Corp., 1016 St. Nicholas Ave., will soon award the contract for altering and extending present 1 story garage. Estimated cost $20,000. F. J. Schefeik, 4168 Park Ave., Archt.

N. Y., New York—The Excel Garage Co., 163 East 84th St., will soon award the contract for altering 4 story, 48 x 71 ft. garage. Estimated cost $15,000. S. Cohen, 32 Union Sq., Archt.

N. Y., New York—J. Hoffman Brewing Co., 213 East 55th St. is altering its 2 story, 52 x 150 ft. garage. Estimated cost $75,000.

N. Y., New York—F. Hogan, 35 East 169th St., will soon award the contract for the construction of a 1 story, 50 x 74 ft. garage on 145th St. L. A. Sheinart, 194 Bowery, Archt.

N. Y., New York—The 138th St. Garage, Inc., c/o L. A. Sheinart, Archt. and Engr., 194 Bowery, is having plans prepared for the construction of a 1 story, 175 x 200 ft. garage on 138th St. near Alexander Ave. Estimated cost $60,000.

N. Y., New York—The Inter-City Fuel Co., 17 Battery Pl., is having plans prepared for the construction of a 2 story, 50 x 100 ft. garage at 410 East 30th St. Estimated cost $400,000. Parsons, Klapp & Brinkerhoff, 84 Pine St., Engrs.

N. Y., New York—The M. G. W. Realty Corp., 277 Bway., will soon award the contract for the construction of a 2 story, 92 x 100 ft. garage at 448 West 19th St. Estimated cost $50,000. Springstein & Goldhammer, 32 Union Sq., Archts.

N. Y., New York—The Estate of J. Bimack, 250 Bway., is building a 1 story, 75 x 98 ft. garage at 21 West 37th St. Estimated cost $25,000.

N. Y., New York—J. Sabia, 4208 Park Ave., is building a 1 story, 56 x 119 ft. garage. Estimated cost $18,500.

N. Y., New York—R. Hartshorne, 63 Wall St., is building a 2 story, 98 x 175 ft. garage at 550 West 25th St.

THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$26.00
Northern Basic	25.52
Southern Ohio No. 2	25.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	32.26
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	26.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	*24.50
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern, sil 2.25@2.75	28.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	24.96
Basic	23.46
Bessemer	24.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.23	$3.33	$3.09	$3.23
Soft steel bars	3.13	3.23	2.99	3.13
Soft steel bar shapes	3.13	3.23	3.48	3.13
Soft steel bands	4.18	4.28	6.25	
Tank plates	3.23	3.33	3.78	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	4.25	3.85	4.13
No. 12	3.15	4.30	3.90	4.18
No. 14	3.20	4.35	3.95	4.23
No. 16	3.30	4.45	4.05	4.33
Black				
Nos. 17 and 21	3.75	4.80	4.55	5.20
Nos. 22 and 24	3.85	4.85	4.60	5.25
No. 25 and 26	3.90	4.90	4.65	5.30
No. 28	4.00	5.00	4.75	5.40
Galvanized				
No. 10 and 11	4.00	4.75	4.75	5.70
No. 12 to 14	4.10	4.85	4.85	5.80
Nos. 17 and 21	4.40	5.15	5.15	6.10
Nos. 22 and 24	4.55	5.30	5.30	6.25
No. 26	4.70	5.45	5.45	6.30
No. 28	5.00	5.75	5.75	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$4.73	$4.63	$4.25
Flats, squares and hexagons, per 100 lb.	5.23	4.63	4.75

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 3/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.50	8.00	8.25
Spring steel (light)	8.00	7.00	10.50
Coppered Bessemer rods(base)	8.00	8.00	6.20
Hoop steel	3.64	3.69	3.83
Cold rolled strip steel	8.00	8.25	7.90
Floor plates	5.30	3.09@3.40	5.78

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of April 13, 1921:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	62½	50	¼	33½	18½
			1 to 1½	35½	20½

LAP WELD

2	54½	41	2	30½	16½
2½ to 6	58½	45	2½ to 4	34½	22½
7 to 12	54½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	60½	49	1 to 1½	35½	21½
2 to 3	61½	50			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	52½	41	2	31½	19½
2½ to 4	56½	45	2½ to 4	34½	22½
4½ to 6	55½	44	4½ to 6	33½	21½
7 to 8	50½	37	7 to 8	24½	12½
9 to 12	45½	32	9 to 12	19½	7½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13.75
Tin in 5-ton lots	29.80
Lead	4.75
Zinc	5.75
ST. LOUIS	
Lead	4.85
Zinc	5.35

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	21.25	22.00	23.50
Copper wire (carload lots)	16.00	17.50	20.00
Brass sheets	16.25	20.00	20.75
Brass pipe	19.00	22.00	24.50
Solder (half and half) (case lots)	20.00	23.50	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	14.25
Cleveland	16.00
Chicago	18.75

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	41
Electrolytic	43

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots..... 10.00

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.00
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	$10.00
Copper, heavy, and wire	9.00	9.50	9.00
Copper, light, and bottoms	8.00	7.50	8.00
Lead, heavy	3.25	3.50	3.75
Lead, tea	2.00	2.50	2.75
Brass, heavy	6.00	5.50	9.00
Brass, light	4.50	4.00	5.00
No. 1 yellow brass turnings	5.00	4.50	5.00
Zinc	3.00	2.50	3.50

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.4	25.50@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.75
Chicago	20.50
Cleveland	22.50

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	41.00	35.00
Commercial	30.00	14.75	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

This market is very soft, and our quotations for the present are useful only as a guide.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$2.25	1.60
Hot pressed hexagon	List	2.25	1.60
Cold punches hexagon	List	2.25	1.60
Cold punched square	List	2.25	1.60

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	50%
Cleveland	80%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50-10%	60-10%	50%
1¼ and 1½ in. by 3 in. up to 12 in	50%	50-5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $4.50 Chicago..... $4.00
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $3.75 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅜ by 6 in. and smaller	40%	60%	40%
Larger and longer up to 1 in. by 30 in.	40%	50-10%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	50%	60-10%	45%
Tinned	45%	60-10%	30%

Structural, ⅜, ½, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.65 Cleveland...$4.25 Chicago....$4.88 Pittsburgh..$3.70
Boiler, same sizes:
New York...$4.75 Cleveland...$4.35 Chicago....$4.98 Pittsburgh..$3.80

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	21.00	25.00	25.50
Brass	19.00	23.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ⅛-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$7.00 per 100 lb.; New York price is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	9.00@12.00	12.00	14.25
Colored mixed	6.50@ 9.50	9.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$3.00@$3.25
Prompt foundry	4.00@ 4.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.80	$0.88	$0.87
5-gal. cans	.83*	1.03	1.12

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount. Business is good in white lead.

N. Y., New York—The Shamrock Towing Co., 662 West 50th St., has awarded the contract for the construction of a 2 story, 85 x 100 ft. garage at 663 West 50th St. Estimated cost $25,000.

N. Y., Rochester—The Mayer Coating Machines Co., 205-213 St. Paul St., plans to build a new factory.

N. J., Belleville—B. P. Stine, 1 Washington Ave., is building a 1 story, 50 x 100 ft. garage on Mill St. Estimated cost $12,000.

N. J., Hilton (Newark P. O.) E. Brenner and F. J. Walker, Archt., 738 Broad St., Newark, will soon award the contract for the construction of a 1 story, 47 x 90 ft. garage on Springfield Ave. Estimated cost $10,000.

Pa., Harrisburg—State of Pennsylvania Dept. of Pub. Grounds & Bldgs., Capitol Bldg., will soon receive bids for the construction of a 2 story, 100 x 200 ft. garage on North and Cameron Sts. Estimated cost $150,000. Private plans.

Pa., Lancaster—L. A. Apeidel, 520 North Queen St., had plans prepared for the construction of a 2 story garage on West Orange St. near Mulberry St. Estimated cost $20,000. G. C. Snyder, 28 North Mary St., Archt.

Pa., Monongahela—Downer & Dias, c/o The Keystone Garage, has had plans prepared for the construction of a 2 story, 60 x 180 ft. garage. Estimated cost $50,000. G. K. Downer, c/o Owner, Archt.

Pa., Philadelphia—C. E. Abel, c/o Phila. Housing Corp., Commonwealth Bldg., has awarded the contract for the construction of a 1 and 2 story, 150 x 250 ft. garage, on 56th and Walnut Sts. Estimated cost $100,000. Private plans.

Pa., Philadelphia—The Cramp Ship & Engine Co., Richmond and Norris Sts., will soon award the contract for the construction of a 1 story garage and repair shop on Wildey and Fletcher Sts. Estimated cost $30,000. Private plans.

Pa., Philadelphia — L. Elikofsky, 3201 Montgomery Ave., has awarded the contract for the construction of a 1 and 2 story, 100 x 130 ft. garage and slaughter house, on 30th and Page Sts. Estimated cost $30,000.

Pa., Philadelphia—H. E. Greenberg, 511 South 63d St., is having plans prepared for the construction of a 1 story, 50 x 100 ft. garage, on 12th and Parrish Sts. B. Brown, Denckla Bldg., Archt.

Pa., Philadelphia—M. Roseman, 433-35 Moore St., has awarded the contract for altering and building a 1 story, 40 x 48 ft. addition to his garage.

Pa., Philadelphia—L. Rubin, c/o Neubauer & Supowitz, Archts., 929 Chestnut St., will soon award the contract for the costruction of a 1 story, 97 x 200 ft. garage on 41st and Poplar Sts.

Pa., Scranton—L. Reisman, Archt, Miller Bldg., is receiving bids for the construction of a 1 story, 50 x 81 ft. garage at 729 Cedar Ave., for M. Gruber, 729 Cedar Ave. Estimated cost $18,000.

Pa., Wilkes-Barre—The Smith & Clarke Co., Water and Tannery Sts., has awarded the contract for the construction of a 1 story, 50 x 100 ft. garage on Waver and Tannery Sts. Estimated cost $20,000.

SOUTHERN STATES

Va., Hampton Roads—The Bureau of Yards & Docks, Navy Dept., Wash., D. C. will soon award the contract for the construction of a machine and carpenter shop at the Naval Operating Base, here. Noted March 17.

W. Va., Morgantown—The Romisch Mfg. Co. will soon receive bids for the construction of a 2 story, 35 x 150 ft. machine shop on Beechurst Ave. Estimated cost $20,000. Austin Co., 16122 Euclid Ave., Cleveland, O., Archt. A. Romisch, Engr.

MIDDLE WEST STATES

Ill., Chicago—M. H. Spades, c/o D. S. Klafter, Archt., 64 West Randolph St., is receiving bids for the construction of a 1 story, 70 x 125 ft. auto sales and service building on Bway. and Berwyn Ave. Estimated cost $80,000.

Ill., Mt. Morris—The Paragon Fdry. Co., Oregon, Ill., is having plans prepared for the construction of a 1 story, 100 x 200 ft. foundry here. Estimated cost $50,000. N. E. Buser, Mt. Morris, Archt.

Wis., Manitowoc—The Dicke Motor Co., c/o W. C. Dicke, Franklin and 11th Sts., has awarded the contract for the construction of a 2 story, 60 x 120 ft. garage, machine shop and salesroom on 8th St. Estimated cost $75,000. Noted April 7.

Wis., Milwaukee—The Milwaukee-Western Fuel Co., 120 Wisconsin St. will soon award the contract for the construction of a 1 and 2 story, 125 x 200 ft. garage on South Pierce St. Estimated cost $80,000. Klug & Smith, 69 Wisconsin St., Archts. and Engrs.

Wis., Oshkosh—The Hollister Auto Co., 33 Algoma St., has awarded the contract for the construction of a 2 story, 80 x 116 ft. garage. Estimated cost $60,000. Noted April 14.

WEST OF THE MISSISSIPPI

Kan., Leavenworth—The U. S. Government, c/o C. E. Taylor, will receive bids until July 5, for the construction of a 1 story, 250 x 1,000 ft. school and motor repair shop. Estimated cost $500,000. Private plans.

Minn., Winona—The New Owatonna Mfg. Co., manufacturer of implements, is having plans prepared for the construction of a factory on West 5th St. Estimated cost $50,000. Architect not announced.

General Manufacturing

MIDDLE ATLANTIC STATES

N. Y., Buffalo—F. L. Ball Co., 2381 Fillmore Ave., is building a bakery. Estimated cost $150,000.

N. Y., Elmhurst—S. Augstein & Co., 352 4th Ave., New York, has awarded the contract for the construction of a 3 story, 80 x 150 ft. factory on Laurel Blvd., for the manufacture of knitted goods. Estimated cost $100,000.

N. J., Atlantic City — Abbott Alderney Dairy, 31st and Chestnut Sts., Philadelphia, has awarded the contract for altering a 3 story dairy here.

SOUTHERN STATES

Va., Lynchburg—Sta.-Kleen Bakery Co., Inc., is receiving bids for altering and building an addition to its plant, at 1218-22 Park Ave. Estimated cost $40,000. C. M. Bartberger & Son, Westinghouse Bldg., Pittsburgh, Archts.

MIDDLE WEST STATES

Ill., Chicago—Hinckley & Schmitt, 420 West Ontario St., plans to build a 7 story, 75 x 100 ft. ice cream factory, on Ohio and Orleans Sts. Estimated cost $150,000. Architect not announced.

Ind., Elkhart—The Reid Furniture Co. is having plans prepared for the construction of a 2 story, 50 x 200 ft. furniture factory. Estimated cost $100,000. E. H. Turnock, Elkhart, Archt.

Ind., Indianapolis—The Bookwalter Ball Co., Century Bldg., plans to build a 1 story, 50 x 100 ft. addition to its printing plant at 1520 North Capitol Ave. Estimated cost $50,000. Private plans.

Ind., South Bend—The India Rubber Corp., 310 West Ewing St., is having plans prepared for the construction of a 2 story, addition to its rubber factory. Estimated cost $50,000. W. W. Schneider, 120 South Main St., Archt.

O., Cleveland—The Austin Co., Genl. Contractors, 16112 Euclid Ave., has purchased site and plans to build 1 and 2 story, factories on East 200th St. and St. Clair Ave. Estimated cost $75,000. Private plans.

Wis., Milwaukee—The Eagle Lye Wks., 32 Erie St., has awarded the contract for the construction of a 3 story, 50 x 60 ft. addition to its factory. Estimated cost $40,000.

Wis., Milwaukee—The Milwaukee Bag Mfg. Co., 206 South Water St., manufacturer of burlap bags, etc., is having plans prepared for the construction of a 3 story, 40 x 85 ft., addition to its present factory on South Water St. Estimated cost $50,000. Federal Eng. Co., Stephenson Bldg., Engrs.

Wis., Milwaukee—The Quality Products Co., 638 Arthur Ave., has awarded the contract for the construction of a 2 story, 50 x 65 ft. cold storage plant on Arthur Ave. Estimated cost $40,000.

WEST OF THE MISSISSIPPI

Okla., Bartlesville—P. K. Locke & Son are building a 2 story, 54 x 120 ft., flour and feed mill on Keeler Ave. Estimated cost $28,000.

Minn., Minneapolis—The Sanitary Mattress Mfg. Co., 511 1st Ave., N. E., has awarded the contract for the construction of a 2 story, 65 x 157 ft. factory on Bway. and Tyler St., N. E. Estimated cost $40,000. Noted April 21.

Col., Denver—The U. S. Government c/o Constr. Quartermaster, Fitzsimmons Genl. Hospital, will soon award the contract for the construction of 1 administration building, 8 com. officers quarters, 12 non-com. officers quarters, 7 warehouses, 1 pump house and reservoir, 2 stables, 2 wagon sheds, 1 hayshed, extension of 7 wards, laundry and dry cleaning building, boiler house, refrigerator, 2 warehouses, etc.

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